Appendix A

Implementing Ordinance Template

February 2020

MODEL IMPLEMENTING ORDINANCE
ORDINANCE NO. _____

AN ORDINANCE OF THE [*BOARD OF SUPERVISORS OF THE COUNTY OF PLACER/CITY COUNCIL OF THE CITY OF LINCOLN*] ADDING [*TITLE/CHAPTER #*] TO THE [*COUNTY OF PLACER/CITY OF LINCOLN*] CODE

WHEREAS, the County of Placer ("County"), the City of Lincoln ("City"), the Placer County Water Agency ("PCWA"), and the South Placer Regional Transportation Authority ("SPARTA") developed the Western Placer County Habitat Conservation Plan/Natural Communities Conservation Plan ("HCP/NCCP") and the Western Placer County Aquatic Resource Program ("CARP").

WHEREAS, the County developed the Placer County In-Lieu Fee Program ("In-Lieu Fee Program").

WHEREAS, the HCP/NCCP, the CARP, and the In-Lieu Fee Program collectively comprise the Placer County Conservation Program ("PCCP").

WHEREAS, the HCP/NCCP has been developed to:

- preserve the ecosystems of the western portion of Placer County ("Plan Area"), which include the [*County of Placer/City of Lincoln*];
- conserve and prevent further endangerment of the species that are dependent upon those ecosystems;
- comply with federal and state laws that protect such species; and
- obtain long-term authorized Take coverage through permits from the U.S. Fish and Wildlife Service ("USFWS"), the National Marine Fisheries Service ("NMFS"), and the California Department of Fish and Wildlife ("CDFW") for the activities of the County, the City, the PCWA, and SPARTA and to extend such authorized Take coverage to private project applicants under the County's or City's jurisdiction and to participating special entities.

WHEREAS, the CARP has been developed to:

- protect Aquatic Resources of Placer County and to preserve and enhance their aquatic functions and values;
- comply with federal laws that protect Waters of the United States and state laws that protect Waters of the State;
- support the issuance of permits from the U.S. Corps of Engineers ("USACE") and the Central Valley Regional Water Quality Control Board ("CVRWQCB") authorizing minimal impacts to such waters for the activities of the County, the City, the PCWA, and SPARTA and to private project applicants under the County's or City's jurisdiction; and

- support abbreviated federal procedures for the USACE's issuance of permits authorizing impacts to Waters of the United States that are more than minimal for the activities of the County, the City, PCWA, SPARTA and private project applicants.

WHEREAS, the In-Lieu Fee Program has been developed to:

- provide an effective regional compensatory mitigation program in western Placer County for impacts to aquatic resources authorized by the USACE in Clean Water Act Section 404 permits;
- comply with the USACE and U.S. Environmental Protection Agency ("USEPA") Compensatory Mitigation Rule requirements for compensatory mitigation projects for impacts to Waters of the United States;
- allow project proponents to fulfill compensatory mitigation requirements for impacts to Waters of the United States by payment of a fee; and
- consolidate funding for compensatory mitigation projects in western Placer County to implement larger, more comprehensive, more efficient, and more beneficial mitigation projects compared to project-by-project mitigation.

WHEREAS, the HCP/NCCP and the CARP were developed by the County, the City, the PCWA, and SPRTA in cooperation with the USFWS, NMFS, CDFW, the USACE, the USEPA, and the CVRWQCB, and in consultation with stakeholder groups and the general public.

WHEREAS, the In-Lieu Fee Program was developed by the County, in cooperation with the City, the USACE, the USEPA and the CVRWQCB, and in consultation with stakeholder groups and the general public.

WHEREAS, the Placer County Board of Supervisors approved the In-Lieu Fee Program and authorized the County Executive Officer to sign the In-Lieu Fee Program Enabling Instrument on _____, 201_, copies of which are on file in the County's Community Development Resource Agency.

WHEREAS, on _____, 201_, the [*Board/Council*] certified the Environmental Impact Report for the HCP/NCCP and CARP projects and made appropriate findings pursuant the California Environmental Quality Act ("CEQA") (Public Resources Code § 21000 et seq.), under Clearinghouse No. _____.

WHEREAS, the [*Board/Council*] approved the HCP/NCCP and the CARP, and authorized the [*Board Chair/City Manager*] to sign the HCP/NCCP Implementing Agreement and the Joint Exercise of Powers Agreement Creating the Placer Conservation Authority, on _____, 201_, copies of which are on file with the [*Clerk of Board/City Clerk*] and the [*e.g., Community Development Resource Agency*).

WHEREAS, as a result of the adoption of the HCP/NCCP by the [*County/City*], the [*County/City*] received long-term endangered species permits/authorized Take coverage from the USFWS, the NMFS, and the CDFW. The Take authorizations cover the [County/City's] own activities and, in addition to coverage of its own public projects, the [*County/City*] will be able to extend authorized Take coverage to private Project Applicants under its jurisdiction. Rather than separately permitting and mitigating individual projects, the HCP/NCCP evaluates natural resource impacts and mitigation requirements comprehensively in a manner that is more efficient and effective for at-risk species and their essential habitats. The USFWS, NMFS, and CDFW Take authorizations also provide assurances that no further commitments of funds, land, or water from covered public and private projects will be required to address impacts on Covered Species beyond that described in the HCP/NCCP, as long as the HCP/NCCP is properly implemented.

WHEREAS, as a result of the adoption of the CARP by the [*County/City*], the [*County/City*] USACE [*has issued/will issue*] a permit that covers certain projects that will have minimal impacts to Waters of the United States. The wetland permit [*covers/will cover*] the [*County/City's*] own activities and, in addition to coverage of its own public projects, the [*County/City*] will be able to extend wetland permit coverage to private Project Applicants and public agencies under its jurisdiction. Rather than separately permitting and mitigating individual projects, the CARP evaluates aquatic resource impacts and mitigation requirements comprehensively in a manner that is more efficient and effective for Aquatic Resources of Placer County and their aquatic functions and values.

WHEREAS, as a result of the approval of the In-Lieu Fee Program, the County [*received/will receive*] approval from the USACE to create mitigation "credits" that can be used to fulfill Clean Water Act Section 404 compensatory mitigation requirements for development projects in western Placer County. The PCA will implement the In-Lieu Fee Program on behalf of the County. The In-Lieu Fee Program does not include procedures or requirements for development projects. Rather, it enables the PCA to create mitigation credits under Clean Water Act Section 404 by protecting, enhancing and restoring aquatic resources.

The HCP/NCCP, CARP and In-Lieu Fee Program are complementary programs that will be jointly implemented using the land acquisition, protection, management, enhancement, and restoration actions set forth in the HCP/NCCP.

WHEREAS, the PCCP incorporates the HCP/NCCP, CARP and In-Lieu Fee Program into a comprehensive local program that strengthens local control over land use and natural resource protection and more efficiently protects natural resources by creating new reserves that will be larger in scale, more ecologically and hydrologically viable, and easier to manage than the individual mitigation sites created under the current individual project-by-project approach. The PCCP is intended to protect the existing character of the [*County/City*] and the region through the implementation of a system of reserves which will provide for permanent open space, habitat conservation for species covered by the HCP/NCCP, and protection for Aquatic Resources of Placer County.

WHEREAS, the PCCP provides a more efficient and streamlined approach for complying with state and federal environmental laws for both public and private projects that is intended to:

- reduce the time and resources previously required to obtain state and federal permits;
- preserve the ability of affected property owners to make reasonable use of their land consistent with the requirements of applicable laws, which include but are not limited to the National Environmental Policy Act ("NEPA") (42 U.S.C. §§ 4321-4347), the California Environmental Quality Act ("CEQA") (Public Resources Code § 21000 et seq.), the Federal Endangered Species Act ("ESA") (16 U.S.C. §§ 1531-1544), the California Endangered Species Act ("CESA") (Fish & Game Code § 2050 et seq.), the California Natural Community Conservation Planning Act ("NCCPA") (Fish & Game Code §§ 2800-2835); the Clean Water Act ("CWA") (33 U.S.C. §§1251-1387), and the Porter Cologne Water Quality Control Act (California Water Code section 13000 et seq.; and
- maintain economic development within the [*County/City*] by providing a streamlined environmental review and permitting process from which development can proceed in an orderly manner.

WHEREAS, the County and the City formed the Placer Conservation Authority ("PCA"), a joint powers agency, to administer and implement the HCP/NCCP, the CARP and the In-Lieu Fee Program.

WHEREAS, the purpose and intent of this Placer County Conservation Program Ordinance is to:

- protect vegetation communities and natural areas in western Placer County that are known to support threatened, endangered, or key sensitive populations of fish and wildlife species;
- protect Aquatic Resources of Placer County, which include Waters of the United States and Waters of the State, and to preserve their aquatic functions and values;
- help to achieve the goals set forth in the HCP/NCCP, the CARP, and the In-Lieu Fee Program;
- protect the existing character of the [*County/City*] and the region by creating a system of reserves that will provide for permanent open space, habitat conservation for species covered by the HCP/NCCP, and aquatic resource protection for Aquatic Resources of Placer County;
- preserve the ability of affected property owners to make reasonable use of their land consistent with the requirements of applicable laws, which include but are not limited to the CEQA, NEPA, ESA, CESA, NCCPA, CWA, and the Porter Cologne Water Quality Control Act;

- insure the collection of PCCP development fees to support implementation of the PCCP; and
- maintain economic development within the [*County/City*] by providing a streamlined environmental review and permitting process from which development can proceed in an orderly manner.

WHEREAS, the [*County/City*] General Plan, adopted by the [*Board/Council*] on [*Date*], ("General Plan"), includes land use, open space, and conservation goals, policies, standards and programs that anticipate, support, and complement the PCCP.

WHEREAS, Article 11, Section 7 of the California Constitution authorizes the [*County/City*] to enact measures that protect the health, safety, and welfare of its citizens.

WHEREAS, the Mitigation Fee Act, Government Code Section 66000 et seq. authorizes the [*County/City*] to impose fees and other exactions to provide necessary funding for public facilities required to mitigate the negative effect of new development projects within the Plan Area.

WHEREAS, a public hearing to consider this Ordinance was noticed in accordance with State law and, on [*date*], the [*Board of Supervisors/City Council*] held the public hearing.

WHEREAS, the [*County/City*] has considered the General Plan, the HCP/NCCP, the CARP, the In-Lieu Fee Program, and the EIR/EIS, and all written material and oral testimony presented before and during the public hearing, and desires to establish development fees as described in Chapter 9 of the HCP/NCCP.

NOW, THEREFORE, THE [*BOARD/COUNCIL*] OF THE [*COUNTY OF PLACER/CITY OF LINCOLN*] DOES HEREBY ORDAIN AS FOLLOWS:

SECTION 1. FINDINGS

The [*Board of Supervisors/City Council*] finds and determines as follows:

A. The foregoing recitals are true and correct and are incorporated herein by reference.

B. There is a need to establish a comprehensive framework to protect and conserve species, Aquatic Resources of Placer County, natural communities and ecosystems in [*western Placer County/the City of Lincoln*], while improving and streamlining the environmental permitting process for impacts of future development on rare, threatened, and endangered species and Aquatic Resources.

C. The PCCP, including the HCP/NCCP, the CARP, and the In-Lieu Fee Program, implemented in accordance with the Implementing Agreement, will:

1. provide comprehensive species, Aquatic Resources of Placer County, and ecosystem conservation and contribute to the recovery of endangered species within [*western Placer County/the City of Lincoln]*;

2. provide a balance between open space, agriculture, habitat, and all forms of development;

3. reduce the cost and increase the clarity and consistency of federal and state permitting;

4. consolidate and streamline these processes into one, locally controlled process;

5. ensure the efficient and timely development of public facilities and related services;

6. encourage, where appropriate, multiple uses of protected areas;

7. share the costs and benefits of the PCCP as widely and equitably as possible; and

8. protect the rights of private property owners.

D. Adoption and implementation of this Ordinance will enable the [*County/City]* to promote the health, safety and welfare of all of its residents by helping to achieve the goals set forth in the General Plan, HCP/NCCP, the CARP, and the In-Lieu Fee Program, and to preserve the ability of affected property owners to make reasonable use of their land consistent with the General Plan, NEPA, CEQA, ESA, CESA, NCCPA, CWA, and the Porter Cologne Water Quality Control Act and other applicable laws.

SECTION 2. PLACER COUNTY CONSERVATION PROGRAM IMPLEMENTATION ORDINANCE

[*Title/Chapter*] _____ is hereby added to the [*County of Placer/City of Lincoln*] Code to read as follows:

CHAPTER _____
PLACER COUNTY CONSERVATION PROGRAM IMPLEMENTATION ORDINANCE

Sections:

_____ **Summary**
_____ **Definitions**
_____ **Purpose**
_____ **Incorporation of HCP/NCCP and CARP by Reference**
_____ **Applicability**
_____ **Responsibility for Administration**

_____ Land Conversion Authorization Requirements
_____ Application Requirements
_____ PCCP Development Fees
_____ Authorization of Take and Impacts to Aquatic Resources of Placer County
_____ Enforcement

[*Section*] Summary

This article provides for the adoption of procedures to implement the Placer County Conservation Program, the adoption of requirements for development to avoid or minimize impacts to natural resources, and the adoption of fees to be used for the conservation of natural resources in mitigation of the impacts of development in [*western Placer County/the City of Lincoln*].

[*Section*] Definitions

The definitions set forth in this section shall govern the application and interpretation of this Ordinance. Words and phrases not defined in this section shall be interpreted so as to give this Ordinance its most reasonable application.

A. "Aquatic Resources of Placer County" include Waters of the U.S.; Waters of the State; Stream Systems, and constituent habitats for Aquatic/Wetland Complex, Vernal Pool Complex and Riverine/Riparian Complex within the Stream System.

B. "Building Permit" means a permit for the construction, assembly, or installation of a structure that requires attachment to the ground.

C. "County Aquatic Resource Program" or "CARP" means the Western Placer County Aquatic Resource Program adopted by the [*County/City*] on _____, 201_, and any amendments thereto.

D. "Covered Activity" means a covered activity under the HCP/NCCP, as provided in Chapter 2 of the HCP/NCCP.

E. "Covered Species" means the species, listed and non-listed, whose conservation and management are provided for in the HCP/NCCP and for which incidental Take is authorized by the Wildlife Agencies pursuant to the Take Permits: [*list species here.*]

F. "Development Project" means any project or activity within the [*County/City*] that requires a Land Conversion Authorization.

G. "Habitat Conservation Plan/Natural Communities Conservation Plan" or "HCP/NCCP" means the Western Placer County Habitat Conservation Plan/Natural Communities Conservation Plan adopted by the [*County/City*] on _____, 201_, and any amendments thereto.

H. "Implementing Agreement" means that agreement made and entered into by and among [*identify signatories*] that defines the parties' respective roles and responsibilities and provides a common understanding of actions that will be undertaken to implement the HCP/NCCP.

I. "In-Lieu Fee Program" means the Placer County In-Lieu Fee Program approved by the Placer County Board of Supervisors on _____, 201_, and any amendments thereto.

J. "Land Conversion Authorization" means any permit or approval that authorizes a ground disturbing activity, including, but not limited to, [*list County's/City's applicable land use approvals here, such as tentative map, parcel map, conditional use permit, site development permit, planned development permit, or special use permit*].

K. "Ordinance" means this [*title/chapter*].

L. "PCCP Development Fees" or "Fees" means the fees adopted by the [*County/City*] in accordance with Chapter 9, Section 9.4 of the HCP/NCCP, and the Fee Study in support thereof, and any amendments and adjustments to those fees. PCCP Development Fees consist of the following types of fees:

1. Land Conversion Fee;

2. Special Habitat Fees; and

3. Temporary Effect Fee.

M. "Placer Conservation Authority" or "PCA" means the joint exercise of powers agency formed on _____, 201_, by and among the County and the City pursuant to the Joint Powers Act, Gov. Code § 6500 et seq.

N. "Applicant" means any person or entity *who applies* for a Land Conversion Authorization for a Covered Activity.

O. "Reserve System" means the Reserve System that will be assembled through the HCP/NCCP and the CARP to provide for the conservation of Covered Species and Aquatic Resources of Placer County.

P. According to the federal ESA (16 USC 1532 [19]), "Take" is broadly defined to include any actions that harm the species, including "habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering" (50 CFR § 17.3). According to California Fish and Game Code (California Fish and Game Code Section 86), take means to hunt, pursue, catch, capture, or kill, or to attempt to hunt, pursue, catch, capture, or kill

"Take" and "Taking" have the same meaning provided by the Federal Endangered Species Act ("ESA") (16 U.S.C. §§ 1531-1544) and its implementing regulations with regard to activities subject to the ESA, and also have the same meaning provided in section 86 of the California Fish and Game Code with regard to activities subject to the California Endangered Species Act ("CESA") (Fish & Game Code § 2050 et seq.), and the California Natural Community Conservation Planning Act ("NCCPA") (Fish & Game Code §§ 2800-2835).

Q. "Take Permits" means the federal incidental Take permits issued by United States Fish and Wildlife Service and the National Marine Fisheries Service pursuant to Section 10(a)(1)(B) of the ESA, and the state Take authorization issued by CDFW pursuant to Section 2835 of the California Fish and Game Code, to the Placer Conservation Authority, the County of Placer, the City of Lincoln, the Placer County Water Agency and the South Placer Regional Transit Authority.

[*Section*] Purpose

The purpose of this [*Title/Chapter*] is to implement the Placer County Conservation Program in order to provide a regulatory framework for promoting the protection and recovery of natural resources, including Covered Species and Aquatic Resources of Placer County, while streamlining the permitting process for both publicly funded and privately funded planned development in the [*County of Placer/City of Lincoln*]. The Placer County Conservation Program includes the Western Placer County Habitat Conservation Plan and Natural Community Conservation Plan ("HCP/NCCP"), the Western Placer County Aquatic Resource Program ("CARP"), and the Placer County In-Lieu Fee Program. The HCP/NCCP was developed by the County, the City, PCWA, and SPRTA, in cooperation with the USFWS, the NMFS, and the CDFW, and in consultation with stakeholder groups and the general public. The CARP was developed by the County, the City, PCWA, and SPRTA in cooperation with the USACE, the USEPA, and the CVRWQCB, and in consultation with stakeholder groups and the general public. The In-Lieu Fee Program was developed by the County in association with the USACE, the USEPA, and the CVRWQCB, and in consultation with stakeholder groups and the general public.

[*Section*] Incorporation of HCP/NCCP and CARP by Reference

The HCP/NCCP and CARP are incorporated by reference as though fully set forth herein. Complete copies of the HCP/NCCP and CARP are available for inspection at the Office of the [*County/City*] Clerk and the [*administering department, e.g., Community Development Resource Agency*], and on the [*County's/City's*] website.

[*Section*] Applicability

A. This Ordinance shall apply to all Development Projects within the HCP/NCCP Plan Area, consisting of Plan Area A and Plan Area B, as further defined and described Chapter 3 of the HCP/NCCP, except for the following:

1. Any Development Project that is not a Covered Activity under the HCP/NCCP, as set forth in Chapter 2, Section 2;

2. Development Projects that the [*administrator*] determines are entirely within managed water or urban land cover types, as defined in the HCP/NCCP;

3. Development Projects in Plan Area B and in the Valley Subarea of Plan Area A that are constructed on parcels equal to or less than 20,000 square feet at the time of Plan adoption;

4. Improvements of less than 5,000 square feet of new impervious surface to existing improved sites, regardless of parcel size, including new structural improvements and installation of roads, sidewalks, hardscape and other impervious surfaces;

5. Development Projects for which project-specific state and federal take authorizations have been issued under the ESA and CESA;

6. Development Projects for which USFWS, NMFS, and CDFW provide written confirmation to the PCA that ESA and CESA permits are not necessary or that compliance with the ESA and CESA has been achieved by other means; and

7. Development Projects that have obtained vested [*County/City*] entitlements prior to the adoption of this Ordinance, unless post-Ordinance adoption (a) the Development Project entitlements are subsequently amended through the discretionary review process, or (b) the Development Project entitlements' term expires, or (c) a Project Applicant with such vested entitlements elects to participate in the program set forth in this Ordinance.

B. This Chapter establishes requirements and application procedures whereby Project Applicants may receive authorization for the incidental take of Covered Species under state and federal law and authorization for impacts to Aquatic Resources of Placer County, subject to the Applicants' compliance with all of the terms and conditions required by this Chapter, including compliance with

applicable terms and conditions of the HCP/NCCP, the Implementing Agreement, and the CARP.

[*Section*] Responsibility for Administration

The [*identify administrator, the Community Development Resource Agency Director, for example.*] shall administer and apply the provisions of this Chapter for the [*County/City*].

[*Section*] Land Conversion Authorization Requirements

All Project Applicants for Development Projects that are subject to this Ordinance shall comply with the conditions on Covered Activities in Chapter 6 of the HCP/NCCP and Section 6 of the CARP. Applicable conditions on Covered Activities from Chapter 6 of the HCP/NCCP and Section 6 of the CARP, as determined by the [*administrator*], shall be included in each Land Conversion Authorization approval for such Development Projects.

[*Section*] Application Requirements

A. Each Land Conversion Authorization application for a Development Project that is subject to this Ordinance shall include details, in the form and manner required by the [*administrator*], of the methods and timing by which the project will comply with the HCP/NCCP and the CARP. Every such application shall be accompanied by a completed HCP/NCCP participation package, as set forth in Chapter 6, Section 6.2, of the HCP/NCCP and shall include any additional contents and requirements set forth by the [*administrator*] for implementation of this Ordinance.

B. The [*administrator*] shall review HCP/NCCP participation packages for completeness. The HCP/NCCP participation package for a Development Project must be reviewed and approved for completeness before the Land Conversion Authorization application for the Project can be deemed complete.

[*Section*] PCCP Development Fees

A. The PCCP Development Fees are hereby adopted in accordance with Chapter 9 of the HCP/NCCP for the purpose of mitigating impacts to open space, to habitat and species covered by the HCP/NCCP, and to aquatic resources covered by the CARP. PCCP Development Fee revenues will be used to fund the acquisition of land that does or could provide habitat for covered species, the management and enhancement of such land and habitat, the protection and enhancement of aquatic resources on such land, and the administrative actions necessary to accomplish these tasks, as more particularly set forth in the HCP/NCCP and CARP. Because the tasks and actions set forth in the HCP/NCCP encompass the tasks and actions set forth in the CARP, the PCCP Development Fees set forth in the HCP/NCCP will fund both HCP/NCCP and CARP tasks and actions.

B. The amounts and method of calculating the PCCP Development Fees, including the Land Conversion Fee, the Special Habitat Fees, and the Temporary Effect Fee, shall be adopted by [*Board of Supervisors/City Council*] fee resolution. The amount

of the PCCP Development Fees shall be adjusted periodically based on determinations and assessments by the Placer Conservation Authority in accordance with Chapter 9, Section 9.4.1.7, of the HCP/NCCP. The adjusted PCCP Development Fee amounts shall be adopted by [*Board/Council*] fee resolution.

C. Payment of applicable PCCP Development Fees shall be required for all Development Projects subject to this article. Each Land Conversion Authorization for such Development Projects shall require the Project Applicant to pay such Fees in full to the [*City/County*] according to the payment schedule determined by the [*administrator*]. The [*administrator*] shall determine the PCCP Development Fee payment schedule for each such Development Project as follows:

    1. For Development Projects that are approved as a single-phased project, PCCP Development Fees shall be paid in full prior to the issuance of the first Land Conversion Authorization;

    2. For Development Projects that are approved as phased projects, the PCCP Development Fees shall be paid prior to the issuance of the first Land Conversion Authorization for each phase, in proportion to the extent of land conversion associated with each phase, and prior to any ground-disturbing activities in each phase; and

    3. For Development Projects that require both Land Conversion Authorizations and Building Permits, the [*administrator*] may allow for the splitting of PCCP Development Fee payments, in which an initial payment is made prior to the issuance of the first Land Conversion Authorization, in proportion to the extent of land conversion associated with such Land Conversion Authorization, and subsequent payment(s) are made prior to the issuance of Building Permits, in accordance with Chapter 9.4.1.8 of the HCP/NCCP.

D. If the Placer Conservation Authority authorizes another manner of compensatory mitigation in lieu of some or all of the PCCP Development Fees pursuant to Chapter 9, Section 9.4.1 (e.g., a land donation in lieu of payment of a portion of the PCCP Development Fees), the Project Applicant shall provide the [*City/County*] with written documentation from the Placer Conservation Authority of compliance with such alternative manner of payment and the dollar equivalent amount of such alternative manner of compensatory mitigation, and the amount of the PCCP Development Fees owed for the Development Project shall be reduced accordingly.

E. In the event the [*administrator*] determines that the HCP/NCCP, pursuant to Chapter 9, Section 9.4.1.2, exempts a Development Project from payment of the

PCCP Development Fees, no PCCP Development Fees shall be required for the project.

F. Any fee amounts paid for a Development Project pursuant to [*identify fee ordinances for removal of native trees (oak trees, riparian woodlands, etc.) and open space impacts*] shall be credited against the Land Conversion Fee assessed for the project.

G. All PCCP Development Fees collected shall be transmitted to the Placer Conservation Authority quarterly, within thirty (30) days of the end of the quarter within which the fee was collected, for deposit into a separate account or fund, and for the investment, accounting and expenditure in accordance with the provisions of the this Ordinance and the Mitigation Fee Act.

[*Section*] Authorization of Take and Impacts to Aquatic Resources of Placer County

Upon approval of a Land Conversion Authorization incorporating all applicable HCP/NCCP and CARP conditions of approval, and payment in full of the PCCP Development Fees, the [*administrator*] shall extend the following to the Project Applicant:

- authorized Take coverage for the Development Project in accordance with the terms of the HCP/NCCP and the Implementing Agreement; and
- authorization to impact Aquatic Resources of Placer County in accordance with the terms of the CARP.

[*Section*] Enforcement

The [*City/County*] Planning Director shall be authorized to enforce the provisions of this Chapter by civil or administrative action as permitted by law and [*County/City*] Code.

SECTION 3. SEVERABILITY

If any part of this Ordinance is for any reason held to be invalid by a court of competent jurisdiction, that holding shall not affect the validity or enforceability of the remaining portion of this Ordinance, and the [*Board/Council*] hereby declares that it would have adopted each provision of this Ordinance irrespective of the validity of any other provision.

[*Include agency-specific adoption language and signature block*]

Appendix B

Implementing Agreement

IMPLEMENTING AGREEMENT
FOR THE
WESTERN PLACER COUNTY
HABITAT CONSERVATION PLAN AND
NATURAL COMMUNITY CONSERVATION PLAN

5/13/2020

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AGREEMENT

1. PARTIES

This Implementing Agreement ("**Agreement**"), made and entered into by and among the United States Fish and Wildlife Service ("**USFWS**") of the United States Department of the Interior, the National Marine Fisheries Service ("**NMFS**") of the United States Department of Commerce, the California Department of Fish and Wildlife ("**CDFW**") of the State of California Natural Resources Agency, the Placer Conservation Authority, a joint exercise of powers agency, ("**PCA**"), the County of Placer ("**County**"), the City of Lincoln ("**City**"), the Placer County Water Agency ("**PCWA**"), and the South Placer Regional Transportation Authority ("**SPRTA**"), governs the implementation of the joint habitat conservation plan and natural community conservation plan for western Placer County (the "**Western Placer County Habitat Conservation Plan and Natural Community Conservation Plan**," the "**Plan**," or the "**HCP/NCCP**") as of the Effective Date.

These entities may be referred to collectively as the "**Parties**" and individually as a "**Party**." The USFWS, NMFS and CDFW may be referred to collectively as the "**Wildlife Agencies**." The PCA, County, City, PCWA, and SPRTA, may be referred to collectively as the "**Permittees**" and each individually as a "**Permittee**."

2. RECITALS

The Parties have entered into this Agreement in consideration of the following:

2.1. In 2001, the County, USFWS, NMFS and CDFW entered into a natural community conservation planning agreement pursuant to the California Natural Community Conservation Planning Act (the "**Planning Agreement**"). The Planning Agreement identified guidelines, criteria and procedures for the preparation of a comprehensive joint habitat conservation plan and natural community conservation plan that would provide for the management and conservation of numerous fish and wildlife species. The HCP/NCCP has been prepared according to the process described in the Planning Agreement.

2.2. The HCP/NCCP is a plan to protect and enhance ecological diversity and function in western Placer County, while allowing appropriate and compatible growth and development to occur in accordance with certain environmental laws. The Plan includes measures that provide for the conservation and management of certain "covered" species, and that avoid, minimize, and mitigate impacts on the "covered" species and their habitat resulting from various public and private activities, including urban, suburban, and rural residential growth and a variety of highway, road, water, sewer, and other needed infrastructure construction and maintenance activities. A primary goal of the Plan is to fulfill the requirements of the federal Endangered Species Act and the California Natural Community Conservation Planning Act in order to obtain authorizations for the incidental take of certain covered species that may result from these activities.

2.3. The federal Endangered Species Act ("**FESA**") prohibits the "take" of species listed as endangered or threatened under FESA, as take is defined under federal law. Under Section 10 of FESA, USFWS and NMFS may issue a permit authorizing the incidental take of endangered or threatened species during otherwise lawful activities if certain statutory requirements are met by the applicant and such take will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. To obtain a federal incidental take permit, the applicant must submit a habitat conservation plan describing, among other things, the steps the applicant will take to minimize and mitigate to the maximum extent practicable the impact of such "taking." The Permittees submitted the HCP/NCCP to USFWS and NMFS and applied for federal permits for incidental take of certain "covered" species within the area encompassed by the Plan. The incidental take permits issued by USFWS and NMFS will be issued concurrently with each agency's execution of this Agreement.

2.4. Like FESA, the California Endangered Species Act ("**CESA**") prohibits the take of species listed as endangered, threatened or candidate species under CESA. The Natural Community Conservation Planning Act ("**NCCPA**") allows CDFW to authorize, by permit, the take of any species, whether or not it is listed as an endangered, threatened or candidate species under CESA, where the conservation and management of the species is provided for in a natural community conservation plan approved by CDFW. Because the HCP/NCCP was developed to meet the standards of the NCCPA, it will do more than minimize and mitigate the impacts of the activities covered in the Plan. The Plan will also contribute to the recovery of listed species and help prevent other species from becoming threatened or endangered. The Permittees submitted the HCP/NCCP to CDFW for approval and permitting for take pursuant to NCCPA. CDFW will issue an incidental take permit based on the HCP/NCCP concurrently with its execution of this Agreement.

2.5. All of the Permittees intend to receive coverage under the federal incidental take permits, and the state permit issued pursuant to the NCCPA, for certain "covered" activities that they will implement, including infrastructure projects and operations and maintenance activities. In addition, the County and the City intend to allow land developers, infrastructure project proponents and landowners to receive coverage under the permits for certain development and other activities, subject to the conditions in this Agreement, the HCP/NCCP and the permits. The PCA may also negotiate agreements with other entities to allow certain activities of such entities to be covered by the permits, subject to the conditions in this Agreement, the HCP/NCCP and the permits.

2.6. The USFWS and NMFS acknowledge that the Permittees have agreed to take on the responsibility of developing and implementing the HCP in large part to obtain regulatory assurances as provided for in accordance with "No Surprises" regulations at 50 Code of Federal Regulations section 17.22(b)(5) and section 17.32(b)(5). These regulatory assurances will be applicable to the Permittees once the federal permits are issued, and will remain applicable throughout the permit term so long as the Permittees are in full compliance with the permit, HCP, and this Agreement. Similarly, the Permittees are

agreeing to substantial commitments of land, natural resources, financial resources, human resources and other assets to conserve and manage the "covered" species, their habitats and other natural communities, in exchange for the assurances provided by CDFW in this Agreement pursuant to California Fish and Game Code section 2820, subdivision (f).

3. DEFINITIONS

The following terms as used in this Agreement will have the meanings set forth below. Terms specifically defined in applicable federal or state statutes (e.g., FESA, CESA, etc.) or the regulations adopted by USFWS, NMFS and CDFW under those statutes will have the same meaning as in those statutes and regulations when used in this Agreement.

3.1. **"Agreement"** means this Implementing Agreement, which incorporates the HCP/NCCP and the Permits by reference.

3.2. **"Annual Report"** means the Annual Report prepared by the PCA about implementation of the HCP/NCCP, as provided in Section 12 and further described in Chapter 8.11.

3.3. **"Authorized Take"** means the extent of incidental Take of Covered Species authorized by USFWS and NMFS in the Federal Permits issued to the Permittees pursuant to Section 10(a)(1)(B) of FESA, and the extent of Take of Covered Species authorized by CDFW in the State Permit issued to the Permittees pursuant to California Fish and Game Code section 2835.

3.4. **"CDFW"** means the California Department of Fish and Wildlife, a department of the California Natural Resources Agency.

3.5. **"CEQA"** means the California Environmental Quality Act (Pub. Resources Code §21000 et seq.) and all rules, regulations and guidelines promulgated pursuant to that Act.

3.6. **"CESA"** means the California Endangered Species Act (Fish & G. Code, §2050 et seq.) and all rules, regulations and guidelines promulgated pursuant to that Act.

3.7. **"Changed Circumstances"** means changes in circumstances affecting a Covered Species or the geographic area covered by the HCP/NCCP that can reasonably be anticipated by the Parties and that can reasonably be planned for in the HCP/NCCP. Changed Circumstances and planned responses to Changed Circumstances are more particularly defined in Section 10.4 and Chapter 10. Changed Circumstances do not include Unforeseen Circumstances. (50 CFR 17.3; Fish & G. Code 2805.)

3.8. **"Chapter"** means a chapter or section of the HCP/NCCP.

3.9. **"Conditions"** or **"Conditions on Covered Activities"** means the avoidance and minimization measures described in Chapter 6, and the requirement to pay certain fees, or to provide land in lieu of such fees, described in Chapter 9, which will be incorporated

in Covered Activities, as provided in Section 8.

3.10. **"Conserve," "Conserving,"** or **"Conservation"** means to use, and the use of, methods and procedures within the HCP/NCCP Plan Area that are necessary to bring the federally and state-listed Covered Species to the point at which the measures provided pursuant to FESA and CESA are not necessary, and to maintain or enhance the condition of the non-listed Covered Species so that listing pursuant to FESA and CESA will not become necessary.

3.11. **"Conservation Measure"** means each action described in Chapter 5 of the HCP/NCCP that is a component of the HCP/NCCP conservation strategy described in Chapter 5.

3.12. **"Covered Activities"** means the otherwise lawful activities and projects described in Chapter 2 of the HCP/NCCP that the Permittees or Third Party Participants may implement in the Plan Area for which incidental Take is authorized by the Wildlife Agencies pursuant to the Permits.

3.13. **"Covered Species"** means the species, listed and non-listed, whose conservation and management are provided for in the HCP/NCCP and for which incidental Take is authorized by the Wildlife Agencies pursuant to the Permits. Covered Species are listed in Chapter 1.2.4 of the HCP/NCCP.

3.14. **"Development Fees"** means the Land Conversion Fee, the Special Habitat Fees, and the Temporary Effect Fee.

3.15. **"Effective Date"** means the date after execution of this Agreement by all Parties, issuance of all three of the Permits, and adoption of HCP/NCCP implementation ordinances by the City and the County, as provided in Section 15.1.

3.16. **"Evaluation Checklist"** means the checklist prepared by the PCA to guide the County's and the City's review of HCP/NCCP participation packages submitted by project proponents.

3.17. **"Federal Listed Species"** means the Covered Species that are listed as threatened or endangered species under FESA as of the Effective Date, and the Covered Species that are listed as threatened or endangered pursuant to FESA during the term of the HCP/NCCP as of the date of such listing.

3.18. **"Federal Permits"** means the federal incidental take permits issued by USFWS and NMFS to the Permittees pursuant to Section 10(a)(1)(B) of FESA.

3.19. **"FESA"** means the Federal Endangered Species Act of 1973, as amended (16 U.S.C § 1531 et seq.) and all rules, regulations and guidelines promulgated pursuant to that Act.

3.20. **"Land Conversion Fee"** means the Land Conversion Fee as provided in Section 8.2 and further described in Chapter 9.4.1.

3.21. **"Listed Species"** means a species (including a subspecies, or a distinct population segment of a species) that is listed as an endangered or threatened species under FESA or as an endangered, threatened or candidate species under CESA.

3.22. **"NCCPA"** means the California Natural Community Conservation Planning Act (Fish & G. Code, §2800 et seq.), and all rules, regulations and guidelines promulgated pursuant to that Act.

3.23. **"NEPA"** means the National Environmental Policy Act (42 U.S.C. §4321 et seq.) and all rules, regulations and guidelines promulgated pursuant to that Act.

3.24. "**NMFS**" means the National Marine Fisheries Service, an agency of the Department of Commerce.

3.25. **"Non-listed Species"** means a species (including a subspecies, or a distinct population segment of a species) that is not listed as endangered or threatened under FESA or CESA.

3.26. **"Participating Special Entity"** means an entity that is not subject to the City's or the County's land use or other regulatory authority that has entered into a Participating Special Entity Agreement with the PCA pursuant to Section 9.8 to receive Authorized Take coverage for a project or activity within the Plan Area.

3.27. **"Party"** and **"Parties"** mean the signatories to this Agreement, individually and collectively.

3.28. **"PCA"** means the Placer Conservation Authority, a joint exercise of powers agency pursuant to California Government Code section 6500 et seq., formed by the "Joint Exercise of Powers Agreement Creating the Placer Conservation Authority" between the County and the City.

3.29. "**Permanently Protect**" means to record a perpetual conservation easement or agricultural conservation easement, in a form approved by the Wildlife Agencies, that prevents development, prohibits inconsistent uses, and ensures that habitat for Covered Species is protected and maintained.

3.30. **"Permits"** means the Federal Permits and the State Permit.

3.31. **"Permittees"** means the County, the City, the PCA, the PCWA, and SPRTA.

3.32. **"Plan Area"** means the area within which the Permittees are seeking authorization from the Wildlife Agencies for the Take of Covered Species resulting from Covered Activities. The Plan Area is further described in Chapter 1 and is depicted in Figure 1-2 of the HCP/NCCP.

3.33. **"Planning Agreement"** means the "Natural Community Conservation Planning Agreement" executed in 2001, by the County, USFWS, NMFS and CDFW pursuant to the NCCPA to guide the preparation of the HCP/NCCP.

3.34. **"Private Project Participant"** means a private person or entity that has received Take Authorization coverage from the County or the City pursuant to Section 9.7 for a project or activity within the Plan Area that is subject to the land use or other regulatory authority of the County or the City.

3.35. **"Reserve Management Plan"** means a Reserve Management Plan as provided in Section 7.2 and as further described in Chapter 5.

3.36. **"Reserve System"** means the land acquired and dedicated in perpetuity through either a fee interest or conservation easement intended to meet the preservation, conservation, enhancement and restoration objectives of the HCP/NCCP.

3.37. **"HCP/NCCP"** and **"Plan"** mean the joint habitat conservation plan and natural community conservation plan prepared by the Permittees and approved by the Wildlife Agencies under Section 10 of FESA and Section 2835 of the California Fish and Game Code.

3.38. **"Section"** means a section or subsection of this Agreement.

3.39. **"Special Habitat Fees"** means the Special Habitat Fees as provided in Section 8.2 and further described in Chapter 9.4.1, which include a Vernal Pool Direct Effects Fee, a Vernal Pool Immediate Watershed Effects Fee, an Aquatic/Wetland Fee, Riverine/Riparian Fee, and a Riverine/Riparian Buffer Fee, a Stream System Encroachment Fee, and a Salmonid Stream Channel Fee.

3.40. **"State Listed Species"** means the Covered Species that are listed as threatened or endangered species, or a candidate for such status, under CESA, as of the Effective Date, and the Covered Species that are listed as threatened or endangered, or a candidate for such status pursuant to CESA during the term of the HCP/NCCP, as of the date of such listing.

3.41. **"State Permit"** means the state Take permit issued to the Permittees pursuant to Section 2835 of the California Fish and Game Code.

3.42. **"Take"** and **"Taking"** have the same meaning provided by FESA and its implementing regulations with regard to activities subject to FESA, and also have the same meaning provided in section 86 of the California Fish and Game Code with regard to activities subject to CESA and NCCPA.

3.43. **"Temporary Effect Fee"** means the Temporary Effect Fee provided in Section 8.2 and further described in Chapter 9.4.1.

3.44. **"Third Party Participants"** means Private Project Participants and Participating Special Entities.

3.45. **"Unforeseen Circumstances"** under the Federal Permits means changes in circumstances affecting a Covered Species or geographic area covered by the HCP/NCCP that could not reasonably have been anticipated by the Permittees, USFWS and NMFS at

the time of the HCP/NCCP's negotiation and development, and that result in a substantial and adverse change in the status of a Covered Species. (50 CFR 17.3). **"Unforeseen Circumstances"** under the State Permit means changes affecting one or more species, habitat, natural community, or the geographic area covered by a conservation plan that could not reasonably have been anticipated at the time of plan development, and that result in a substantial adverse change in the status of one or more Covered Species. (Fish & G. Code 2805.)

3.46. **"USFWS"** means the United States Fish and Wildlife Service, an agency of the United States Department of Interior.

3.47. **"Wetlands"** means the wetlands types described in Chapter 3.

3.48. **"Wildlife Agencies"** means USFWS, NMFS and CDFW.

4. PURPOSES OF THIS AGREEMENT

This Agreement defines the Parties' roles and responsibilities and provides a common understanding of actions that will be undertaken to avoid, minimize and mitigate the effects on the Covered Species caused by the Covered Activities within the Plan Area, and to provide for the conservation of the Covered Species within the Plan Area. The provisions of this Agreement, the HCP/NCCP, and permits shall be interpreted to be consistent with and complementary to each other. In the event of any direct contradiction, conflict, or inconsistency between this Agreement, the HCP/NCCP, or the Permits, the terms of the Permits shall control.

5. PLACER COUNTY CONSERVATION PROGRAM

As further described in Chapter 8.1, the Placer County Conservation Program is a comprehensive local natural resource planning effort for western Placer County that addresses native species of fish and wildlife, aquatic resources, and water quality. The HCP/NCCP, along with the Western Placer County Aquatic Resource Program ("**CARP**") and the In-Lieu Fee Program, is a component of the PCCP. The state and federal legal requirements that apply to the CARP and the In-Lieu Fee Program are different than those that apply to the HCP/NCCP. The CARP and In-Lieu Fee Program are intended to meet permit issuance criteria under Sections 404 and 401 of the federal Clean Water Act and the standards of the California Porter-Cologne Water Quality Act, as well as local aquatic resource protection requirements and standards. As a consequence, the state and federal agencies involved with implementation of the HCP/NCCP are different than those involved with implementation of the CARP and In-Lieu Fee Program.

The HCP/NCCP, the CARP, and the In-Lieu Fee Program, are each independently viable and designed to meet relevant state and federal permit issuance criteria fully. However, many, if not most, procedures and conservation measures implemented under the HCP/NCCP will serve to implement all three programs. For example, a measure to restore vernal pools would serve to implement and meet the objectives of the HCP/NCCP (i.e., for vernal pool species and habitat), the CARP, and the In-Lieu Fee Program (i.e., for wetland functions and services and water quality). This overlap of the HCP/NCCP, CARP and In-Lieu Fee Program makes it necessary to coordinate their implementation

among Parties, as well as the United States Army Corps of Engineers and the United States Environmental Protection Agency.

The Parties agree to coordinate implementation of the HCP/NCCP with the implementation of the CARP and the In-Lieu Fee Program, and agree that successful implementation of the HCP/NCCP, CARP, and In-Lieu Fee Program will require coordination among all participating local, state and federal agencies. As further described in Chapter 8.1.4, this coordination will be required in several key areas, including the following:

- Funding;
- Avoidance and minimization requirements;
- Land acquisitions;
- Land management and enhancement; and
- Wetland creation and restoration.

6. IMPLEMENTATION STRUCTURE

The governance or implementation structure for the HCP/NCCP is set forth in Chapter 8.2. The general roles and responsibilities of the Parties for the implementation of the HCP/NCCP are as follows.

6.1. Permittees' Responsibilities

The Permittees will fully and faithfully perform all obligations assigned to them collectively, and to each of them individually, under the Permits, the HCP/NCCP, and this Agreement.

6.2. Wildlife Agency Responsibilities

The Wildlife Agencies will provide guidance to the PCA and other Permittees about the requirements of the Permits. The Wildlife Agencies will monitor Plan compliance and will notify the PCA as soon as possible if the Plan is not being implemented as required in the Permits. The Wildlife Agencies will review and approve proposed Reserve System land acquisitions, draft Reserve Management Plans, monitoring plans and other aspects of Plan implementation, as described in the Plan. The Wildlife Agencies will also assist the PCA in attempting to secure state and federal funding for Plan implementation, such as reviewing grant proposals.

6.3. Responsibilities of the Placer Conservation Authority

The Permittees are collectively responsible for compliance with all applicable terms and conditions of the Permits, the HCP/NCCP, and this Agreement. However, the PCA will have primary responsibility for implementing the HCP/NCCP on behalf of the Permittees. The PCA may delegate the implementation of specific actions to other Parties or qualified third parties, including but not limited to public agencies, private conservation organizations, scientists, and contractors, but the PCA itself will remain responsible for ensuring overall implementation of the HCP/NCCP on behalf of the Permittees in accordance with the Permits, the HCP/NCCP, and this Agreement. The PCA's responsibilities are set forth in Chapter 8.3 and generally include, but are not necessarily limited to, implementation and management of all of the following elements of the HCP/NCCP:

- implementation of conservation measures;
- administration of the HCP/NCCP, including staffing, and providing necessary scientific, legal, and financial expertise and consulting services;
- monitoring, adaptive management and scientific oversight;
- real estate activities;
- grant administration;
- budget preparation;
- GIS/database maintenance;
- annual reporting;
- coordination among the Permittees; and
- public outreach and education.

7. CONSERVATION PROGRAM IMPLEMENTATION

The PCA is primarily responsible for overall and day-to-day implementation of the Plan, including Plan conservation measures (Chapter 5), the Monitoring and Adaptive Management Plan (Chapter 7), and the Plan funding strategy (Chapter 9). The PCA will receive advice from a variety of sources, including the Wildlife Agencies, science advisors, and the public, and will take the advice into consideration to implement the Plan effectively and cost-efficiently.

The Wildlife Agencies will have review and approval authority over certain aspects of implementation, such as Reserve System land acquisitions, restoration project designs, Reserve Management Plans, and substantial changes in the Monitoring and Adaptive Management Program. However, the PCA will ultimately decide how to implement the Plan and how to comply with the Permits, the Implementing Agreement and the HCP/NCCP.

7.1. Establishing the Reserve System

The PCA will establish the Reserve System on behalf of the Permittees as set forth in Chapter 8.4 and Chapter 5.4.1. The Reserve System will be created by permanently protecting land containing certain terrestrial and aquatic land cover types and managing and monitoring them in perpetuity. Lands will be added to the Reserve System at a pace that is roughly proportional to the rate at which Covered Activities are implemented and Authorized Take occurs, as provided in Section 7.1.3 and further described in Chapter 8.4.3.

7.1.1. Permanent Protection of Reserve System Lands

Reserve System lands will be permanently protected. For purposes of the Permits, the HCP/NCCP, and this Agreement, Reserve System lands will be regarded as permanently protected if the biological functions and values on the lands that contribute to meeting the goals and objectives of the HCP/NCCP are protected by a permanent, recorded conservation easement that meets the requirements of this Section and Chapter 8.4.9.

7.1.1.1. Conservation Easements

As further described in Chapter 8.4.9, the PCA will negotiate the specific terms and conditions of conservation easements used to permanently protect Reserve System lands with each landowner on a case-by-case basis, based on site conditions, land uses, and Covered Species and habitat needs. However, the PCA will use either the "Conservation Easement" template in Appendix K of the HCP/NCCP or, for certain agricultural lands, as further described in Chapter 8.4.9.3.2, the "Agricultural Conservation Easement" in Appendix K of the HCP/NCCP**,** as a model for Reserve System lands. Alternatively, for agricultural lands added to the Reserve System as described in Chapter 8.4.9.3.2, where the use of other forms of agricultural conservation easements are required by state or federal agencies, such as conservation easement forms approved by the Department of Conservation for use with its grant programs, the PCA may use such other forms of conservation easements with the concurrence of the Wildlife Agencies. The PCA and the Wildlife Agencies must review and approve any variations from the conservation easement templates, including, but not limited to, the use of other state- or federally- approved forms of agricultural conservation easements.

7.1.2. Wildlife Agency Concurrence

As described in Chapter 8.4.2.4, the concurrence of CDFW and USFWS must be obtained for all land acquisitions counted toward Plan land acquisition commitments for terrestrial Covered Species. The concurrence of NMFS will be required for land acquisitions that support habitat for covered anadromous fish species. The PCA will discuss potential land acquisitions with the Wildlife Agencies early in the land acquisition process and will provide an opportunity for input during site selection when practicable.

The Wildlife Agencies will review all pre-acquisition assessments and provide comments to the PCA within thirty (30) days of receiving such proposals (see Chapter 8.4.2.2, Step 2: Pre-acquisition Assessment, for the typical information in these proposals). The Wildlife Agencies may, within the thirty (30) day period, request additional information or clarification and up to thirty (30) days of additional review time. The PCA will revise the documents based on Wildlife Agency comments, if any, and provide revised drafts to the Wildlife Agencies within fifteen (15) days. These deadlines are established to ensure the timely review and comment on the documents by the Wildlife Agencies and to enable the PCA to complete the land acquisition process expeditiously. If a Wildlife Agency does not, within thirty (30) days, provide either comments or a written request for a maximum of thirty (30) days of additional review time (for a total maximum of sixty (60) days), and the acquisition meets all relevant conditions of the HCP/NCCP, the PCA may proceed with the acquisition, and the acquisition will be credited toward Plan land acquisition commitments.

If the proposed acquisition requires a mineral resources assessment, the Wildlife Agencies may review this additional information when it is available as described in Chapter 8.4.2.6.2, Mineral Resources Assessment.

7.1.3. Stay-Ahead Requirement

As further described in Chapter 8.4.3, the PCA will ensure that lands are added to the Reserve System, and habitat is restored or created, at or faster than the pace at which Covered Activities impact Covered Species and natural communities, which will fulfill the NCCPA's requirement to ensure that implementation of mitigation and conservation measures on a plan basis is roughly proportional in time and extent to the impact on habitat or covered species. (Cal. Fish & G. Code section 2820(b)(9).) This requirement is referred to in the HCP/NCCP as the "stay-ahead" requirement.

7.1.3.1. Stay-Ahead Reporting and Process for Addressing Non-Compliance

As further described in Chapter 8.4.3.6, the PCA will monitor compliance with the stay-ahead requirement and will report the compliance status in each annual report, as provided in Section 12.1, beginning with the third annual report. In addition, the PCA will provide quarterly updates regarding compliance on the PCCP Internet website. The Wildlife Agencies will evaluate compliance with the stay-ahead requirement annually. If the Wildlife Agencies determine that the requirements of Chapter 8.4.3 have not been fulfilled, they will so notify the PCA in writing, and the PCA and Wildlife Agencies will meet to develop a mutually agreeable plan of action that will fulfill such requirements, as further described in Chapter 8.4.3.6. The mutually agreeable plan of action may include, but is not limited to, the examples provided in Chapter 8.4.3.6. If the Wildlife Agencies and the PCA cannot develop such a mutually agreeable plan of action, or if the PCA disagrees with a Wildlife Agency determination that the requirements of Chapter 8.4.3 have not been met, the PCA or any Wildlife Agency may initiate the dispute resolution process in Section 16.2.

The Parties acknowledge that failure to fulfill the requirements of Chapter 8.4.3 would constitute a violation of the Federal and State Permits and that the Wildlife Agencies will take appropriate responsive actions to address any such violation in accordance with FESA and the NCCPA, which could include suspension or revocation of the Permits, in whole or in part.

7.1.3.2. Procedure for Addressing Failure to Maintain Rough Proportionality

In addition to the plan of action described in Section 7.1.3.1 and Chapter 8.4.3.6, the NCCPA requires a specific procedure for responding to a failure to ensure that the implementation of mitigation and conservation measures is "roughly proportional in time and extent to the impact on habitat or Covered Species authorized under the plan" (Cal. Fish & G. Code section 2820(b)(9)). This Section fulfills that requirement. If the Wildlife Agencies determine that the requirements of Chapter 8.4.3 or this Section have not been fulfilled, the PCA will either regain rough proportionality within forty- five (45) days or will enter into an agreement with the Wildlife Agencies within forty-five (45) days, which will set a course of action to expeditiously regain rough proportionality. The agreement may include any of a variety of commitments or adjustments to the PCCP designed to regain rough proportionality, including but not limited to, a plan to acquire, restore, or enhance lands of the appropriate land cover type expeditiously. However, if the PCA and the Wildlife Agencies meet to develop a plan of action, as described above, the agreement will be based on that plan of action. The PCA will provide written notice of the agreement to the other Permittees. Each Permittee will implement all actions set forth in the agreement that apply to the Permittee.

If the PCA does not regain rough proportionality within forty-five (45) days or enter into an agreement with the Wildlife Agencies within forty-five (45) days setting a course of action to regain rough proportionality, the Wildlife Agencies may suspend or revoke the State Permit, in whole or in part. All Parties acknowledge that failure to fulfill the requirements of the HCP/NCCP and the Permits would constitute a violation of the Permits and the Wildlife Agencies will take appropriate responsive actions to address any such violation in accordance with the ESA, NCCPA, and their implementing regulations, which could include suspension or revocation of the Permits, in whole or in part. The partial suspension or revocation may include removal of one or more Covered Species or reduction in the scope of the Take Authorizations. Before suspending or revoking the Permits due to a failure to maintain rough proportionality, CDFW will meet with the Permittees to determine whether mutually agreeable modifications to the HCP/NCCP would obviate a suspension or revocation.

If the NCCPA procedure for addressing a failure to maintain rough proportionality in California Fish and Game Code section 2820 is amended, the new procedure shall supersede the procedure in this Section 7.1.3.2 to the extent they are inconsistent.

7.1.3.3. Dedication of Land in Lieu of Development Fee to Maintain Rough Proportionality

As further described in Chapter 8.4.3.7, if at any time the HCP/NCCP fails to comply with the stay-ahead requirement, or if the PCA concludes there is a reasonable likelihood that the HCP/NCCP will fall out of compliance within one (1) year, the PCA may recommend that the Permittees provide land or implement conservation actions in Chapter 5, and that the County and City encourage Third Party Participants to provide land or implement such conservation actions, in lieu of all or a portion of Development Fees, in accordance with Section 8.2.3 and Section 8.2.4.

The PCA will provide written notice of such recommendation to the other Permittees and the Wildlife Agencies. The PCA's notice will recommend a scope of the land or conservation action in lieu of fee requirement, for example, applying the requirement to Covered Activities that will impact ten (10) acres or more. All Permittees will thereafter apply the recommended requirement to Covered Activities that they implement; the PCA will apply the requirement to Participating Special Entities; and the County and City will consider applying the requirement to Private Party Participants.

The County and City acknowledge that failure to apply the land in lieu of fee requirement to private project proponents when needed to meet the Stay Ahead requirement may result in suspension or revocation of the Permits.

The PCA will terminate the requirement for land dedications or implementation of conservation actions (i.e., it will revert back to a voluntary alternative) as soon as the PCA determines, and the Wildlife Agencies concur, that HCP/NCCP implementation is in compliance with the stay-ahead requirement. Upon making such a determination, the PCA will so notify the other Permittees in writing, and the Permittees may thereafter terminate the requirement with regard to their own Covered Activities and to Private Party Participants.

7.1.4. Mitigation for Activities Not Covered by the PCCP

Land acquired, preserved in perpetuity, and managed for natural resource purposes to mitigate the impacts of projects not covered by the HCP/NCCP may complement and augment conservation achieved by the Plan, if the location and management of the land is consistent with HCP/NCCP goals and objectives. For example, compensatory mitigation for projects in non-participating cities (Roseville, Rocklin, and Auburn) could preserve land in the Plan Area that would not have been preserved under the Plan. Alternatively, mitigation for non-covered projects could help to accomplish conservation objectives of the Plan.

7.1.4.1. Proposals from Proponents of Non-Covered Projects

Proponents of projects in or near the Plan Area that are not covered by the Plan but that affect Covered Species may be interested in using the Plan as a vehicle to implement actions to mitigate the impacts of their projects. These non-covered projects may be required to conduct mitigation or conservation actions under a variety of state and federal laws, including but not limited to ESA, CESA, Clean Water Act, Porter-Cologne Water Quality Act, the National Environmental Policy Act (NEPA), or CEQA. In many cases, using the Plan's conservation strategy to guide the actions will ensure compatibility with the Plan and potentially achieve greater conservation benefits by lowering costs (i.e., accomplishing more with mitigation funds). Costs to mitigate non-covered projects through the Plan are expected to be lower than the project-by-project approach because of the economies of scale realized by the Plan in conducting land acquisition, habitat restoration, land management, and monitoring. The PCA and the Wildlife Agencies will consider proposals from proponents of non-covered projects to use the Plan as a vehicle for project mitigation on a case-by-case basis to determine whether they would contribute to the successful implementation of the HCP/NCCP and whether and how the HCP/NCCP could appropriately be used to fulfill mitigation requirements pertaining to the proposed project.

If the PCA and Wildlife Agencies agree that the HCP/NCCP could appropriately be used to fulfill such mitigation requirements, the PCA will work with the project proponent as agreed to add lands to the Reserve System. Such lands may be added to the Reserve System and counted toward the conservation component (but not the mitigation component) of the Plan's land acquisition commitments (See Chapter 9.4.3.3) if:

- The lands meet the criteria for Reserve System lands;
- A conservation easement in a form substantially similar to the Plan conservation easement template is recorded on the land;
- A Reserve Management Plan is prepared for the lands in accordance with Chapter 5; and
- The project proponent provides the PCA with sufficient funds to manage the lands in perpetuity in accordance with the Habitat Management Plan.

7.1.4.2. Mitigation Proposals that would Impede Plan Implementation

If land acquisitions intended to fulfill mitigation requirements under ESA, CESA, section 1602 of the California Fish and Game Code, or CEQA for a non-covered project is proposed in the Reserve Acquisition Area, the Wildlife Agencies will confer with the PCA to ensure that the acquisition will

not conflict with the Plan or impede the Permittees' ability to meet Plan requirements. For example, CDFW may not be able to make required findings under CESA if issuance of a CESA permit conflicts with the HCP/NCCP. If a land acquisition intended to fulfill mitigation requirements will conflict with the Plan or impede the Permittee's ability to meet Plan requirements, the applicable Wildlife Agency(ies) will work with the applicant to design and implement alternative mitigation measures that will avoid such conflict or impediment. For example, if a land acquisition within the Reserve Acquisition Area is proposed to fulfill mitigation requirements for a non-Covered Activity, and the land proposed for acquisition is needed to fulfill compensatory mitigation requirements for Covered Activities, the applicable Wildlife Agency(ies) will work with the applicant to design and implement alternative mitigation measures. Such alternative mitigation measures may include, but are not limited to:

- Use of Wildlife Agency approved mitigation banks and conservation banks that have a service area boundary that includes the non-Covered activity;
- Compensatory mitigation on lands outside the Plan Area (including lands within the limits of non-participating cities)
- Additional onsite avoidance; and
- Onsite restoration.

7.2. Management and Enhancement of the Reserve System

The PCA, on behalf of the Permittees, will ensure that Reserve System lands are managed as provided in this Section and further described in Chapter 5.4.2. The PCA may delegate management responsibility to other Parties or qualified third parties, including but not limited to public agencies, private conservation organizations, scientists, and contractors. However, the PCA will be responsible for ensuring that the Reserve System lands are managed in perpetuity.

The PCA will coordinate with managers of other protected areas to help form a biologically cohesive network of protected lands in the Plan Area. The PCA will be responsible for directing landscape-level management and enhancement actions (Chapter 5.4.2.4), natural community-level management and enhancement actions (Chapter 5.4.2.5), and species-level management and enhancement actions (Chapter 5.4.2.6). Management measures will include such things as regular patrol, trash removal, fence and gate installation and repair, road maintenance, and other necessary activities.

7.3. Restoration and Creation of Natural Communities and Covered Species Habitat

The PCA, on behalf of the Permittees, will ensure that natural communities and Covered Species habitat is restored and created within the Reserve System, as provided in this Section and further described in Chapter 5.4.3. The PCA will be responsible for natural community-level restoration and creation actions (Chapter 5.4.3.4), and species-specific restoration actions (Chapter 5.4.3.5).

Restoration and creation actions will restore degraded and lost natural communities and habitat for Covered Species to conserve the species, to improve landscape-level ecosystem function, and to mitigate for the direct and indirect effects of Covered Activities.

The PCA may delegate creation and restoration responsibilities to other Parties or qualified third parties, including but not limited to public agencies, private conservation organizations, scientists, and contractors. However, the PCA will be responsible for ensuring that restoration and creation actions are carried out in accordance with the Permits, the Plan, and this Agreement.

7.4. Monitoring and Adaptive Management

The PCA, on behalf of the Permittees, will implement the HCP/NCCP monitoring and adaptive management program as set forth in this Section and further described in Chapter 8.8. The PCA may delegate monitoring responsibilities to other Parties or qualified third parties, including but not limited to public agencies, private conservation organizations, scientists, and contractors. However, the PCA will ultimately determine what actions are appropriate based on input and recommendations provided in the adaptive management program. Decisions made in the adaptive management program will be based primarily on which course of action is most likely to meet the biological goals and objectives of the Plan within budget constraints and while avoiding or minimizing conflicts with other biological goals and objectives. However, the PCA will collect and consider all feedback from the Wildlife Agencies in determining management and monitoring practices, and the Wildlife Agencies' approval will be required for any major changes in management plans.

7.4.1. Role of the Wildlife Agencies

The primary role of the Wildlife Agencies in the adaptive management program will be to provide feedback to the PCA regarding recommended changes to Plan implementation based on the results of research and monitoring and on the recommendations of the science advisors. The Wildlife Agencies will also provide expertise in the biology and conservation of Covered Species and natural communities.

8. CONDITIONS ON COVERED ACTIVITIES

The impacts to Covered Species and natural communities resulting from Covered Activities will be minimized and mitigated by the implementation of the conservation strategy described in Chapter 5, by avoidance and minimization measures for Covered Activities and related application and survey requirements described in Chapter 6, and by the payment of certain fees that will be used to fund implementation of the HCP/NCCP described in Chapter 9. The measures described in Chapter 6 and the fee requirements described in Chapter 9 are referred to herein and in the HCP/NCCP as "**Conditions on Covered Activities**" or "**Conditions.**" Most of these Conditions apply to specific types of Covered Activities; no individual Covered Activity will be required to comply with all Conditions. Instead, each Covered Activity will comply with specific applicable Conditions. The Permittees will ensure that all applicable Conditions are incorporated in Covered Activities, as provided in this Section.

8.1. Avoidance and Minimization of Impacts

As further described in Chapter 6, the HCP/NCCP includes Conditions to avoid or minimize the Take of Covered Species resulting from Covered Activities. These Conditions are designed to form a regional program that will be implemented systematically to: prevent Take of individuals of certain

Covered Species; avoid impacts to Covered Species to the maximum extent practicable; minimize adverse effects on Covered Species and natural communities to the maximum extent practicable; and avoid and minimize direct and indirect impacts on aquatic resources. Each Permittee will incorporate all applicable Conditions within all Covered Activities that it implements. In addition, the County and the City will require all applicable Conditions as conditions of approval for all Private Project Participant Covered Activities, and the PCA will ensure that the Conditions are incorporated in all Participating Special Entity Covered Activities.

8.2. HCP/NCCP Development Fees

As provided in this Section and further described in Chapter 9, the PCA will use revenues generated from certain fees placed on Covered Activities to fund implementation of actions that will provide compensatory mitigation for the impacts of Covered Activities on Covered Species. Such actions include, but are not limited to, administrative costs, creation of the HCP/NCCP Reserve System, management of Reserve Lands, monitoring of and reporting on HCP/NCCP implementation, adaptive management, and responses to Changed Circumstances. These actions, together with the avoidance and minimization measures provided for in Section 8.1, will fulfill all requirements under FESA to minimize and mitigate for the impacts of Covered Activities on Covered Species and natural communities and to help provide for the conservation and management of Covered Species under the NCCPA.

Fee revenues and related mitigation sources of funding (see Table 9-4 in Chapter 9.4) will fully offset the portion of overall HCP/NCCP costs incurred to provide compensatory mitigation for the impacts of Covered Activities, including, but not limited to, endowment contributions to fund management and monitoring of the Reserve System in perpetuity and reimbursement of a portion of Plan preparation costs.

The HCP/NCCP includes three types of fees: the "**Land Conversion Fee**," the "**Special Habitat Fees**," and the "**Temporary Effect Fee**," collectively, the "**Development Fees**." The City and the County will collect fee payments from Private Project Participants and provide the fee revenues to the PCA as soon as reasonably practicable, but in no event later than thirty (30) days after the end of the quarter within which the fee was collected. The PCA will collect all fee revenues, including fee revenues from Private Project Participants provided by the City and the County, fee payments from Participating Special Entities, and, for Covered Activities implemented by the Permittees, fee payments from the Permittees. The PCA will comply with all applicable provisions of the Mitigation Fee Act (Gov. Code §66000, et seq.) as to the deposit, accounting, expenditure and reporting of such fee revenues.

8.2.1. Requirement to Pay Development Fees

The County and the City will make payment of the applicable Development Fees a condition of approval for Private Project Participant Covered Activities; the PCA will require payment of the Development Fees for Participating Special Entity Covered Activities; and the Permittees will each pay the applicable Development Fees for Covered Activities that they implement.

8.2.2. Timing of Development Fee Payment

As further described in Chapter 9.4.1.8, the Special Habitat Fee obligation for a Covered Activity, including any Special Habitat Temporary Effect Fee, will be paid prior to issuance of a land conversion authorization that allows ground disturbance of a special habitat. Applicable Land Conversion and Land Conversion Temporary Effect Fees for each Covered Activity will be paid at the first of the following steps to occur:

- Issuance of a grading permit or plan;
- Approval of an improvement plan;
- Issuance of a building permit; or
- Any other final permit action for a Covered Activity that authorizes ground disturbance.

If a Covered Activity requires a grading permit, grading plan, or improvement plan and, in addition, requires a building permit, then a Private Project Proponent may elect to pay portion of the applicable Development Fees at the grading permit, grading plan, or improvement plan step and the remainder at building permit issuance. In this circumstance, the total fee amount due at grading permit, grading plan, or improvement plan approval, and the total remaining fee amount required, will be determined by the County or City, as applicable, in accordance with Chapter 9.4.1.8. The County or City will also allocate the remaining fee amount required by parcel, and the remaining fee obligation for each parcel will be due when the first building permit is issued for that parcel.

8.2.3. Credit for Land Conversion Fee in Exchange for Dedication of Land

As further described in Chapter 8.4.13 and Chapter 9.4.1.10, the PCA can approve credit for a portion of the Land Conversion Fee in exchange for a dedication of land to be added to the Reserve System. The PCA may allow fee credits for lands provided in lieu of the Land Conversion Fee so long as the PCA has sufficient available or committed funds to manage and monitor the dedicated land during the Permit Term, which may include funds provided by the Permittee, Private Project Participant, or Participating Special Entity seeking the fee credit. The Permittee, Private Project Participant, or Participating Special Entity seeking the fee credit must enter into a land dedication agreement with the PCA in accordance with Chapter 9.4.1.10.1, which must be fully executed before commencement of the Covered Activity to which the credit will be applied.

8.2.3.1. Land Dedication Incentive

If land proposed for dedication is of exceptional conservation value to the Reserve System, the PCA may offer an incentive to the Permittee, Private Project Participant, or Participating Special Entity for the land dedication in accordance with Chapter 9.4.1.10.2. The PCA will determine the conservation value of lands proposed for dedication based on the PCA's analysis of lands needed to fulfill the Plan's land acquisition commitments and the role that the proposed lands will play in meeting those commitments. As further described in Chapter 9.4.1.10.2, the land dedication incentive may include one or both of the following components.

- The PCA may approve a higher amount of credit for the Land Conversion Fee than the minimum credit described in Chapter 9.4.1.10.1.

- The PCA may allow the transfer of credit so that it can be used for Covered Activities other than those specified in the land dedication agreement.

8.2.4. Credit for Special Habitat Fees in Exchange for Restoration or Creation

As further described in Chapter 8.7.2 and Chapter 9.4.1.4.2, the PCA can approve credit for all or a portion of the Special Habitat Fees in exchange for the restoration or creation, management, and monitoring of wetlands, streams, or riparian areas that meets all applicable requirements of Chapter 6 and Chapter 8.4.1 or the purchase of appropriate wetland restoration or creation credits in a conservation bank or mitigation bank approved by the PCA in accordance with Chapter 8.4.7.

The PCA will prepare a written determination of whether a restoration or creation proposal, or a proposal to purchase credits at a conservation bank or wetland mitigation bank, conforms to the HCP/NCCP and is therefore approved by the PCA. The written determination will include the amount of any approved credit for the Special Habitat Fees.

8.2.5. Payment of Fees with a Special Tax or Special Assessment District

As further described in Chapter 9.4.1.9, the PCA, and the County or City, as applicable, may approve the use of special tax or assessment adopted through formation of a financing district, such as a Community Facilities District or a special assessment district, to the extent allowed by the applicable California law, to fulfill in part the requirement to pay Development Fees. The County or City, as applicable, in cooperation with the PCA, will determine whether to allow the use of a financing district for that purpose during the local entitlement process for the Covered Activity. For the County, any use of a financing district would require the approval by the Board of Supervisors in accordance with the Placer County Bond Screening Committee's adopted rules and procedures. If a financing district is used, the portion of the Development Fee obligation funded with an ongoing special tax or assessment must meet the following criteria:

- Must not be greater than fifty percent (50%) of the total Development Fee obligation and thereby limited to funding ongoing operating costs during the term of the Permits;
- Must exclude the shares of the total Development Fee obligation associated with land acquisitions for the Reserve System, post-permit endowment, and Plan preparation costs that would be due pursuant to Chapter 9.4.1.8;
- Must be levied in a substantially equal annual amounts plus adjustments to reflect changes in costs calculated pursuant to Chapter 9.4.1.7;
- Must fully fund the Development Fee obligation prior to the end of the term of the Permits;
- Must be backed by a guarantee by the Permittee with jurisdiction over the Covered Activity to the PCA providing that, if the financing district fails for any reason to fund the Development Fee obligation fully, the Permittee will pay the shortfall upon the failure of the financing district

8.3. Exemptions from Development Fees

Certain Covered Activities will not disturb the ground or will have little measurable impact on Covered Species or natural communities and are exempt from the requirement to pay Development

Fees. These Covered Activities will receive Authorized Take coverage under the Permits. The Permittee responsible for implementing or approving the Covered Activity will determine whether it is exempt from the requirement to pay Development Fees in accordance with this Section 8.3 and Chapters 9.4.1.2 and 6.2.4.

8.4. Adjustment of Fees

As further described in Chapter 9.4.1.7, the Development Fees will be adjusted in two ways to account for increases or decreases in the cost of implementing the HCP/NCCP: by annual adjustments and by periodic assessments and adjustments. The PCA will adjust the Development Fees annually, by March 15 of each year, according to the indices and procedures described in Table 9-8 of the HCP/NCCP, beginning the calendar year following the Effective Date.

In addition, periodically, the PCA will assess the actual accrued costs of implementing the Plan, the assumptions underlying Plan funding, and estimated costs to complete Plan implementation, to evaluate whether fee revenues are likely to be adequate to cover implementation costs, as described in Chapter 9.4.1.7. The PCA will also compare the actual accrued costs of implementing the Plan, including managing and monitoring the Reserve System, to the estimates of those costs from the prior periodic assessment specifically to determine the actual change in all costs, including but not limited to land acquisitions. The PCA will initiate this periodic assessment based on cost data through the end of the PCA's fifth fiscal year following the Effective Date. Thereafter, the periodic assessment will occur at least once every five (5) years.

Based on each periodic assessment, the PCA will determine whether adjustments to the Development Fee amounts are necessary to ensure full funding of the mitigation share of remaining HCP/NCCP implementation costs, including endowment contribution costs and plan preparation costs, as described in Chapter 9.4.1. The Permittees will not be required to increase Development Fees to address shortfalls in other sources of funding or to decrease Development Fees in response to windfalls in other sources of funding. Automatic annual fee adjustments will resume after the periodic fee assessment and will continue until the next periodic assessment.

9. TAKE AUTHORIZATION

As of the Effective Date, the Permittees may Take the Covered Species, provided the Take is incidental to the implementation of Covered Activities in the Plan Area, as authorized by and subject to the conditions of the Permits, the HCP/NCCP, and this Agreement. The Covered Activities are described in Chapter 2.5 of the HCP/NCCP.

The Permittees' Take authority covers all of their respective elected officials, officers, directors, employees, agents, subsidiaries, and contractors who engage in any Covered Activity. Each Permittee will be responsible for supervising compliance with the relevant terms and conditions of the Permits by its own elected officials, officers, etc., and all contracts between a Permittee and any such person or entity regarding the implementation of a Covered Activity will require compliance with the Permits.

9.1. Issuance of the Permits

After satisfaction of all other applicable legal requirements, USFWS and NMFS will each issue the Permittees a permit under Section 10(a)(1)(B) of FESA (the "**Federal Permits"**) and execute this Agreement. The Federal Permits will authorize incidental take of all Federal Listed Covered Species resulting from Covered Activities in the Plan Area. The Federal Permits for incidental take of all Non-listed Covered Species will become effective, upon the listing of such species under FESA.

After satisfaction of all other applicable legal requirements, CDFW will issue the Permittees a permit under Section 2835 of the California Fish and Game Code authorizing Take by the Permittees of each Listed and Non-listed Covered Species resulting from Covered Activities in the Plan Area (the "**State Permit**") and execute this Agreement.

9.2. Permittee Responsibilities

Each Permittee will be responsible for ensuring that Covered Activities that it implements comply with the requirements of the Permits, the HCP/NCCP, and this Agreement, following the evaluation process described in Chapter 6.2.1. The Permits will authorize the County and the City to extend Authorized Take coverage to Third Party Participants for Covered Activities that are subject to the County's or City's land use authority and comply with the requirements of the Plan. The County and the City will each review Participation Packages submitted by project applicants within their jurisdictions in consultation with the PCA and, with PCA concurrence that a Participate Package complies with Plan requirements, determine whether to extend Authorized Take coverage following the process described in Chapter 6.2.2. The County and the City will develop a checklist for evaluating the completeness of Participation Packages within the first six (6) months after the Effective Date.

9.3. PCA Responsibilities

The PCA will have limited responsibilities with regard to the Permittee's use of Authorized Take and extension of Authorized Take to Private Party Participants. The PCA will provide support to the Permittees' for their decisions regarding the use and extension of Authorized Take, such as draft checklists, template planning survey reports, and a fee calculator. The PCA will also advise the City and the County regarding their review of Participation Packages, will review Participation Packages to ensure that they comply with Plan Requirements, and will promote coordination among the Permittees to ensure that Conditions on Covered Activities are implemented and enforced consistently and effectively.

In addition, the PCA will have the following specific responsibilities and authorities related to the Permittees' use of Authorized Take and the extension of Authorized take to Third Party Participants:

- Reviewing applications from Participating Special Entities as provided in Section 9.8 and further described in Chapter 8.9.4, and extending Authorized Take as appropriate;
- Reviewing proposals for credit for the Land Conversion Fee in exchange for the dedication of land as provided in Chapter 9.4.1.10 and further described in Chapter 8.4.13.3, and for credit for the Special Habitat Fees in exchange for restoration or creation of jurisdictional wetlands or riparian habitat as provided in Section 8.2 and further described in Chapter 8.7.2. The Permittees will refer any such proposals to the PCA for review, approval, and calculation of

the required Development Fees. The PCA will review proposals on a case-by-case basis. If the PCA approves a proposal, the terms of the land offer, habitat restoration or creation, and any remaining Development Fee amounts will be forwarded to the appropriate Permittee for incorporation into the Covered Activity's conditions of approval;

- Verifying that proposals to defer fee payment through ongoing assessments, special taxes, or other mechanisms conform to Plan requirements (see Chapter 9). The PCA will review these proposals prior to adoption by the County or the City;
- Approving fee waivers when dedications of land within the Stream System are offered (see Chapter 6.3.3). The PCA must approve these proposals prior to adoption by the County or City;
- Suspending the option for early payment of fees and extension of Authorized Take under certain circumstances, as described in Chapter 9. The PCA will notify all Permittees of any such suspension;
- Recalculating the fees annually and providing the new fee amounts to the Permittees, as described in Chapter 9. The PCA will notify each Permittee of the new fees; and
- Determining mitigation requirements and fees to be paid by Participating Special Entities.

9.4. Wildlife Agency Responsibilities

As of the Effective Date, the Permittees may implement Covered Activities and extend Authorized Take coverage to Third Party Participants in accordance with the Permits, the HCP/NCCP, and this Agreement without the prior approval of the Wildlife Agencies, except as specifically identified in Chapter 8.9.3. As provided in Section 10.5 below, the Parties acknowledge that some Covered Activities may be the subject of federal Section 7 consultations even though they are covered under the Permits (e.g., Covered Activities that require a Clean Water Act Section 404 permit or are funded wholly or in part by the Federal Highway Administration).

As further described in Chapter 8.9.3, the Wildlife Agencies' will monitor implementation of the HCP/NCCP to ensure overall compliance with the Permits, the HCP/NCCP, and this Agreement. To ensure that the Wildlife Agencies are adequately informed about the Permittees' use and extension of Authorized Take coverage, the Permittees will provide copies of any application and supporting information required in Chapter 6 for any Covered Activity upon the request of any Wildlife Agency.

9.5. Authorized Take for Projects and Activities Implemented by Permittees

Each Permittee will, in consultation with the PCA, ensure that all Covered Activities it implements comply with the Permits, the HCP/NCCP, and this Agreement. As further described in Chapter 6, each Permittee will document such compliance and provide a copy of that documentation to the PCA. The PCA will maintain a record of compliance documentation for all Covered Activities implemented by Permittees.

The Permittees will develop a template within six (6) months of the Effective Date to standardize the form in which they document their compliance with the Permits, the HCP/NCCP, and this Agreement. The template will be substantively similar to the "Participation Package" used for Private Project Participants, as described in Section 9.7 and Chapter 6. However, the Permittees may adapt the form of the Participation Package for their use as they deem appropriate.

When one or more Development Fees are required for a Covered Activity implemented by a Permittee, the PCA will calculate the required fee amount, and the Permittee will transfer that amount to the PCA before initiating the Covered Activity. As further described in Chapter 9, Permittees may use any applicable alternative to fee payment allowed in the HCP/NCCP, including, but not limited to, purchasing credits at approved mitigation or conservation banks, obtaining a credit for the Land Conversion Fee as provided in Section 8.2.3, and obtaining credit for Special Habitat Fees as provided in Section 8.2.4. The PCA will prepare a written determination of whether any such credit proposed by a Permittee conforms to the HCP/NCCP and is therefore approved. The written determination will be prepared within forty-five (45) days of receiving a complete written proposal from a Permittee and will include the amount of any approved credit, as described in Chapter 9.

Take Authorization coverage for any Covered Activity implemented by a Permittee will take effect upon the Permittee's delivery to the PCA of its documentation of compliance with the Permits, the HCP/NCCP, and this Agreement, along with any required Development Fee amount, and implementation of any actions supporting a Development Fee credit.

9.6. Extension of Take Authorization to Third Party Participants

As further provided by the Permits, the HCP/NCCP, and this Agreement, Authorized Take coverage may be extended to "**Third Party Participants**," which include "**Private Project Participants**," and "**Participating Special Entities**." The PCA may extend Authorized Take coverage to Participating Special Entities and will be responsible for determining whether applications or requests from potential Participating Special Entities and comply with all applicable terms and conditions of the Permits, the HCP/NCCP, and this Agreement. The County and City may extend Authorized Take coverage to Private Project Participants, will be responsible for determining, in consultation with the PCA, whether Participation Packages from potential Private Project Participants comply with all such terms and conditions, and will make findings supporting such determination before extending Authorized Take coverage.

9.7. Private Project Participants

The County and the City will each require proponents of private projects that are subject to their land use or other regulatory authority and fall within the categories of projects and activities described in Chapter 2.5, to comply with all applicable terms and conditions of the Permits, the HCP/NCCP, and this Agreement, and may extend Authorized Take coverage to such projects, as provided in this Section 9.

9.7.1. HCP/NCCP Application Process

As further described in Chapter 6, the County and the City will require proponents of private projects that are subject to their land use or other regulatory authority and fall within the categories of projects and activities described in Chapter 2.5, to submit a Participation Package as described in Chapter 6.2 and will, in consultation with the PCA, review the Participation Package based on an "**Evaluation Checklist**" that will be prepared by the PCA within six (6) months of the Effective Date.

The County's and City's review of the application package will occur concurrently with the environmental review of the project pursuant to CEQA, for projects subject to CEQA.

Based on its review of each Participation Package and input from the PCA, the County or the City will prepare a written determination regarding whether the private project, as proposed in the Participation Package, includes all applicable terms and conditions in the Permits, the HCP/NCCP, and this Agreement and is therefore consistent with the HCP/NCCP. If the County or City concludes that the project as proposed does not include all applicable terms and conditions, it will explain the deficiency or omission in writing to the private project proponent and will place the Participation Package on hold. If the County or City concludes, and the PCA concurs, that the project as proposed includes all applicable terms and conditions, it will prepare a written determination to that effect (a "**Compliance Determination**").

The County and the City will provide to the PCA a copy of all HCP/NCCP Participation Packages for which they have prepared a Compliance Determination.

Nothing in this Section shall be construed to affect the ability of the County or a City to determine that an application for a private project is incomplete or to deny a private project application for any reason unrelated to the Permits or the HCP/NCCP.

9.7.2. Extension of Authorized Take Coverage to Private Project Participants

If the County or the City prepares a Compliance Determination for a private project following completion of the HCP/NCCP application process, the private project proponent will be eligible for Authorized Take coverage as a Private Project Participant. The County or the City will require the private project proponent to comply with all applicable terms and conditions of the Permits, the HCP/NCCP, and this Agreement. The County or the City may enter into an agreement in which the project's proponent assumes the obligation to comply with such terms and conditions or may require such compliance as a condition of project approval. Once the agreement is entered into or the conditions of approval are imposed, all applicable Development Fees have been paid, as provided in Section 8.2 and further described in Chapter 9, any actions supporting a Development Fee credit as provided in Section 8.2.3 and Section 8.2.4 have been implemented, and the County or the City has otherwise finally approved the project, the County or the City will extend Authorized Take coverage to the project proponent. The project proponent thereafter will have Authorized Take coverage as a Private Project Participant.

Once Authorized Take coverage has been extended to a Private Project Participant, it will remain in effect with regard to the project for as long as the Private Project Participant fully complies with the applicable terms and conditions of the Permits, the HCP/NCCP, and this Agreement, and any additional conditions required by the County or City, as applicable; provided, however, that if any of the Permits is suspended or revoked, the Wildlife Agency that has suspended or revoked the Permit may also suspend or revoke the Private Project Participant's Authorized Take coverage if the Wildlife Agency determines that continued implementation of the Private Project Participant's project would likely jeopardize the continued existence of a Covered Species. Before making such a determination, the Wildlife Agency will meet and confer with the Private Project Participant and the County or the City, as applicable, to discuss the threat of jeopardy and possible ways to avoid it short of suspending

or revoking Authorized Take coverage for the project. In addition, if the County or the City suspends or revokes its final approval of the project, then the County or the City will also suspend or revoke the Authorized Take coverage for the project.

9.7.3. HCP/NCCP Implementation Ordinances

Within one hundred and twenty (120) days after the issuance of all of the Permits, the County and the City will each consider the adoption of an HCP/NCCP implementation ordinance substantively similar to the model ordinance attached to the HCP/NCCP as Appendix A. The implementation ordinance will, among other things, provide for the imposition of Development Fees, as provided in Section 8.2 and further described in Chapter 9, and establish the jurisdiction's requirements for extending Authorized Take coverage to Private Project Participants, as provided in this Section 9.7. The County and the City may extend Authorized Take coverage to Private Project Participants only after adopting an HCP/NCCP implementation ordinance in accordance with this Section.

The model ordinance in Appendix A of the HCP/NCCP is intended to exemplify the necessary substantive terms of a HCP/NCCP implementation ordinance; it is not intended to dictate the precise terms of each such ordinance. The County and the City may each adapt the model ordinance to reflect its independent findings, to maximize administrative efficiency, or for other reasons, provided the substance of the operative terms in the model ordinance is reflected in each implementation ordinance.

9.8. Participating Special Entities

The PCA may extend Authorized Take coverage to public and private entities that are not Permittees, including, but not limited to, school, water, irrigation, transportation, park and other districts and utilities, pursuant to an enforceable agreement that defines all planning, implementation, management, enforcement and funding responsibilities necessary for the entity to comply with the Permits, the HCP/NCCP, and this Agreement (a "**Participating Special Entity Agreement**"). Such entities thereafter will have Authorized Take coverage as Participating Special Entities.

As further described in Chapter 8.9.4, the PCA may at its discretion, and with the Wildlife Agencies' concurrence, enter into a Participating Special Entity Agreement with an entity if certain requirements are met and the entity explains how it will comply with all applicable terms and conditions of the Permits, the HCP/NCCP, and this Agreement in an application satisfying the criteria set forth in Chapter 8.9.4.1. Among other things, the Participating Special Entity Agreement must adequately address the legal and equitable remedies available to the PCA if the public entity fails to perform its contractual obligations. As described in Chapter 8.9.4.1, after execution of a Participating Special Entity Agreement and payment of all fees specified by the PCA, the PCA will issue a "**Certificate of Inclusion**" to the entity that describes the scope of its Authorized Take coverage and sets forth the conservation measures it is required to implement. The entity will thereafter be a Participating Special Entity subject to the terms of the Participating Special Entity Agreement and the Certificate of Inclusion, and the Authorized Take will be deducted from the take limits set forth in the Permits. A Certificate of Inclusion template is attached as **Exhibit A**. The PCA will enforce the terms of the Permits, the HCP/NCCP, and this Agreement with regard to any such Participating Special Entity and will withdraw the Certificate of Inclusion and terminate any Authorized Take coverage

extended to the Participating Special Entity if the Participating Special Entity fails to comply with such terms.

9.8.1. Potential Roseville Annexation Area

Covered Activities within a potential Roseville annexation area ("**Potential Annexation Area**") are eligible for coverage in a Participating Special Entity Agreement in the event the Area is annexed by the City of Roseville, as further described in Chapter 8.9.4.2. Covered Activities within the Potential Annexation Area have been evaluated as part of the potential future growth in the Plan Area and are included as part of the potential Authorized Take under the Permits; and the Projects do not conflict with the HCP/NCCP conservation or the ability of the PCA to meet Plan goals and objectives. The City of Roseville is currently evaluating the possibility of annexing the lands comprising the Potential Annexation Area. Any such annexation would not affect the boundaries of the HCP/NCCP's Potential Future Growth area or Reserve Acquisition Area. In the event the Potential Annexation Area is annexed to the City of Roseville, which is a non-participating city, then the proponent of Covered Activities within the Area will be eligible to secure incidental take coverage as a Participating Special Entity, if the PCA determines that the Covered Activity meets the conditions specified in Chapter 8.9.4.2.

9.9. Placer Vineyards Specific Plan

The Placer County Board of Supervisors approved the Placer Vineyards Specific Plan ("**PVSP**") in 2007 and approved amendments to the PVSP in 2015. PVSP infrastructure includes both on-site and off-site components. The PVSP is the largest planned development in western Placer County.

Implementation of the PVSP within Placer County is a Covered Activity. Portions of some off-site infrastructure facilities related to the PVSP are not within the Plan Area because they are outside of Placer County and are, therefore, not covered by the Plan. With the exception of these out-of-county infrastructure facilities, the Plan included in its analysis the PVSP's projected effects and take of Covered Species. There may be future amendments to the PVSP, which will be covered under the Plan, provided they would not cause the take limits under the permits to be exceeded, the amendment does not result in effects on Covered Species beyond those analyzed for the Plan, and conditions are applied to the PVSP consistent with Appendix N of the Plan.

All PVSP development is required to comply with the "Placer Vineyards Mitigation Strategy" adopted by Placer County in connection with the PVSP (the "**PVSP Mitigation Strategy**"). The PVSP Mitigation Strategy, which was developed in consultations between the Placer Vineyards owners group, the County, the Sacramento Area Council of Governments, various environmental groups and state and federal resource agencies, identifies, among other things, wetland and species-related mitigation standards for development within the PVSP. The PVSP Mitigation Strategy is an integral component of, and was designed to be consistent with, the Plan's conservation strategy.

Because the land plan for the PVSP was finalized while the Plan was still in development, some of the avoidance and minimization measures and conservation requirements in the PVSP Mitigation Strategy differ slightly from the Conditions on Covered Activities in Chapter 6, as described in Appendix N of the Plan. However, all PVSP projects that receive incidental take coverage under the

Plan and permits will be subject to Plan fees, as described in Chapter 9.

Some projects within the PVSP were built before the Effective Date. To comply with the ESA, these interim PVSP projects obtained incidental take authorization in accordance with the Programmatic Biological Opinion issued for the entire PVSP (USFWS, April 1, 2016, *Programmatic Biological Opinion for the Placer Vineyards Specific Plan Project*, Placer County, California [Corps File Number SPK-1999-00737] [Service File Number: 81420-2008-F-0983])(the "**Programmatic BO**"), which incorporates the PVSP Mitigation Strategy. In the Programmatic BO, the USFWS analyzed the PVSP as a whole to ensure that projects receiving incidental take authorization through project-specific biological opinions prior to approval of the Plan are in alignment with the regional conservation strategy for western Placer County. Prior to the issuance of each USACE permit for an interim project, the USFWS reviewed that project's final mitigation plan and appended to the Programmatic BO an incidental take statement for that project.

The projects in the PVSP that did not receive incidental take authorization as described above will obtain take authorization through the Plan under the same terms and conditions as other Covered Activities, except as otherwise provided in Appendix N of the Plan, and will receive the regulatory assurances provided for Covered Activities. The PVSP projects that received incidental take authorization under the Programmatic BO as described above will not receive such regulatory assurances. Any differences between the PVSP-specific conditions described in Appendix N of the Plan and the conditions described in Chapter 6 will only apply to PVSP projects (including covered off-site infrastructure), and will not apply to other, non-PVSP Covered Activities.

As described in Chapter 8.9.5, certain special requirements apply to the PVSP to incorporate lands used for compensatory mitigation for PVSP projects built before the Effective Date into the Reserve System and to account for PVSP effects.

9.10. Coverage Option for Certain Minor Activities

Chapter 2.7 defines "minor activities" not subject to the requirements of the Plan, including activities on parcels existing at the time of Plan adoption equal to or less than 20,000 square feet (0.46 acre), and small additions of less than 5,000 square feet to existing improved properties. Existing lots of this small size and small additions to existing structures are not subject to Plan requirements and are not covered by the Plan or the permits because they are not expected to have adverse effects on Covered Species. However, if a property owner were to find a Covered Species on such a site, he or she may wish to receive Take authorization under the Plan.

The types of activities and projects that may occur on these small sites are the same as those activities and projects already covered by the Plan, so the effects analysis in Chapter 4 has considered relevant potential impacts. Because impacts on such sites would be very small, and this opt-in allowance would be granted very rarely, any resulting Take can be accommodated within the Take limits established under the State and Federal Permits. Therefore, with the advance approval of the PCA, proponents of such minor projects and activities may apply for Take authorization under the Permits in accordance with Chapter 6.2. To receive Take authorization under the Permits, such projects and activities must meet all applicable criteria for Covered Activities in Chapter 2, Covered Activities, and must fulfill all applicable Conditions in Chapter 6. (*See also*, Chapter 8.9.6.)

9.11. Two-Year Take Limit for Advance Acquisition of Vernal Pool Complex Lands

As further described in Chapter 8.4.6, within two (2) years of adopting the implementation ordinances, the PCA will protect vernal pool complex lands containing a minimum of one-hundred sixty (160) acres of vernal pool constituent habitat (23% percent of the total vernal pool constituent habitat commitment), of which at least fifty-three (53) acres will be delineated as vernal pools. No more than 1,800 acres of vernal pool complex and eighty (80) wetted acres of vernal pool-type wetlands (15% of the total Authorized Take) will be authorized for Take under the Plan until the one-hundred sixty (160) acres are protected.

The 3,000 acres of advance acquisition lands are in addition to the Jump Start lands identified in Chapter 8.4.4. This advanced acquisition and Take limit are designed to ensure that more high-quality vernal pools and vernal pool complexes are protected than Taken, ensuring that the PCA exceeds the Stay Ahead requirement early in the term of the Permits.

9.12. Activities Not Covered

Projects and activities that are not Covered Activities will not receive Authorized Take Coverage and are not subject to the terms and conditions of the Permits, the HCP/NCCP, and this Agreement, except as provided in Section 9.10 and Chapter 8.9.6. As further described in Chapter 2.7, projects and activities not covered include, but are not limited to, the following:

- Projects and activities within the current boundaries of non-participating cities that are not undertaken by a Permittee;
- Pesticide and rodenticide application;
- Routine and ongoing agricultural activities;
- Expansion of cultivated agriculture into natural lands;
- Timber harvest operations;
- Quarries and other mining;
- Municipal power generation;
- Projects with their own FESA and CESA permits;
- Rezoning, general plan amendments, or other legislative acts that intensify land use in the Valley or Foothills Conservation and Rural Development components of Plan Area A;
- Private development that the Wildlife Agencies determine does not require coverage under the Plan; and
- Certain minor activities:
    - Activities that do not require a construction permit;
    - Activities on existing non-natural lands;
    - Activities on existing small (20,000 square feet or less) parcels; and
    - Small (less than 5,000 square feet) additions to existing improved properties.

10. REGULATORY ASSURANCES

The Wildlife Agencies acknowledge that the Permittees have agreed to take on the substantial responsibility of developing and implementing the HCP/NCCP in large part to obtain regulatory

assurances, as provided in FESA and the NCCPA and further described in this Section and Chapter 10.

10.1. FESA Regulatory Assurances

Provided that the Permittees have complied with their obligations under the Permits, the HCP/NCCP, and this Agreement, USFWS and NMFS can require a Permittee or Third Party Participant to provide additional mitigation beyond that provided for in the HCP/NCCP only in accordance with the "No Surprises" regulations at 50 Code of Federal Regulations section 17.22(b)(5) and section 17.32(b)(5).

10.2. NCCPA Regulatory Assurances

CDFW will not require any Permittee or Third Party Participant to provide, without its consent, additional land, water or financial compensation, or additional restrictions on the use of land, water, or other natural resources, in connection with any Covered Activity for the purpose of conserving Covered Species, even in the event of Unforeseen Circumstances, provided the Permittees are properly implementing this Agreement, the HCP/NCCP and the terms and conditions of the State Permit. The provisions of this Agreement and the HCP/NCCP that address Changed Circumstances are not Unforeseen Circumstances and therefore are not subject to these assurances. A portion of the HCP/NCCP implementation budget has been allocated for actions in response to Changed Circumstances and, as a result, the Changed Circumstances provisions of the HCP/NCCP are not intended to require modifications to the HCP/NCCP that would require additional funding or to impose significant additional burdens on Permittees or Third Party Participants.

10.3. Changed Circumstances

The PCA will implement responses to Changed Circumstances as provided in this Section and further described in Chapter 10. Changed Circumstances identified and planned for in the HCP/NCCP are contained in Chapter 10.2.1. In the event a Changed Circumstance identified in Chapter 10.2.1 occurs, the PCA will implement the responsive action(s) prescribed in Chapter 10.2.1 for that Changed Circumstance. Neither the PCA nor any other Permittee or Third Party Participant will be required to take any additional action to respond to a Changed Circumstance (i.e., any action not otherwise required by the Permits, the HCP/NCCP, and this Agreement), except as described in Chapter 10.2.1. Changed Circumstances are provided for in the HCP/NCCP and therefore are not Unforeseen Circumstances. The Permittees' responses to Changed Circumstances, as well as the funding to assure that the responses are implemented, are described in the HCP/NCCP. Therefore, Changed Circumstances do not require an Amendment of the Permits or the HCP/NCCP. The Parties agree that Chapter 10.2.1 identifies all Changed Circumstances and describes appropriate and adequate responses for them. Other changes not identified as Changed Circumstances will be treated as Unforeseen Circumstances.

10.4. Initiating Responses to Changed Circumstances

The PCA will notify the Wildlife Agencies within seven (7) days after learning that any of the Changed Circumstances listed in Chapter 10.2.1 has occurred. As soon as practicable after learning of the Changed Circumstances, the PCA will initiate responsive actions in the manner described in Chapter 10.2.1.

If a Wildlife Agency determines that a Changed Circumstance has occurred and that the PCA has not responded as described in Chapter 10.2.1, the Wildlife Agency will so notify the PCA, specifically identifying the Changed Circumstance. As soon as practicable after receiving the Wildlife Agency's notice, the PCA will initiate responsive actions in the manner described in Chapter 10.2.1.

After it has initiated responsive actions to a Changed Circumstance as provided in this Section, the PCA will promptly inform the Wildlife Agencies of its actions. The PCA will continue implementation of any such responsive actions to completion and will describe in its Annual Report for that year the Changed Circumstance and the responsive actions implemented. Subsequent Annual Reports will track the response of the Reserve System and the Covered Species to evaluate whether responsive actions implemented as a result of Changed Circumstances have been effective.

10.5. Section 7 Consultations regarding Covered Activities

Nothing in this Agreement is intended to alter the obligation of a federal agency to consult with USFWS or NMFS pursuant to Section 7 of FESA (16 U.S.C. §1536(a)) (e.g., for Clean Water Act Section 404 permits or Covered Activities funded wholly or in part by the Federal Highways Administration).

Unless otherwise required by law or regulation, in any consultation under Section 7 involving the Permittees or an existing or prospective Third Party Participant and a proposed public or private project in the Plan Area that may adversely affect one or more Covered Species that are Federal Listed Species, USFWS and NMFS will issue a biological opinion for the proposed project that is consistent with the biological opinion issued for the HCP/NCCP and the Federal Permits, provided that the proposed project itself is consistent with the HCP/NCCP and the Federal Permits. The USFWS and NMFS would not impose measures on a Permittee or an existing or prospective Third Party Participant in excess of those that have been or will be required by this Agreement, the HCP/NCCP, and the Permits, unless required by law or regulation. As stated in Chapter 10.4.2, before completing a Section 7 consultation for a Covered Activity in which USFWS or NMFS proposes to require a measure that exceeds the requirements of the Permits, the HCP/NCCP, or this Agreement, USFWS or NMFS will meet and confer with the Permittee with jurisdiction over the affected project to discuss alternatives to the imposition of the measure that would meet the applicable legal or regulatory requirements.

10.6. Consultations by CDFW

Except as otherwise required by law, CDFW will not recommend or otherwise seek to impose in correspondence or consultation with other public agencies, or through permit or agreement terms and conditions, any mitigation, compensation or habitat enhancement requirements regarding impacts of Covered Activities on Covered Species within the Plan Area that are in excess of those that have been or will be required by this Agreement, the HCP/NCCP, and the Permits.

11. Funding Sources and Assurances

The PCA, County, City, PCWA, and SPRTA will ensure that all required mitigation, conservation, monitoring, and reporting measures are adequately funded throughout the term of the Permits, the HCP/NCCP, and this Agreement, and that certain monitoring, reporting and adaptive management

measures are adequately funded in perpetuity. The Permittees do not intend to use funds from their respective general funds to implement the HCP/NCCP; rather they intend to obtain sufficient funds through a comprehensive strategy further described in Chapter 9 that includes: development fees, dedications, special taxes, and ongoing assessments; federal and state grants; private grants; and ongoing conservation efforts by local and state agencies that have a demonstrated record of acquiring and managing lands for recreational and conservation purposes in the Plan Area. The Permittees may use or establish other local funding measures, including, but not limited to, utility surcharges, special taxes or assessments, or bonds, to the extent allowed by law. The Permittees are responsible to seek feasible increases in revenues as necessary to keep pace with rising costs, as described in Chapter 9. Each Permittee will promptly notify the Wildlife Agencies of any material change in the Permittee's financial ability to fulfill its obligations under the Permits, the HCP/NCCP, this Agreement. In addition, the PCA will include in its Annual Report reasonably available financial information to demonstrate the Permittees' collective ability to fulfill their obligations under this Agreement in light of a material change in a Permittee's finances, if any.

11.1. State and Federal Funding

As further described in Chapter 9.4.3, funding may be provided by one or more state and federal programs. Neither state nor federal funds can be guaranteed and the state or federal government may contribute less than the estimates in the HCP/NCCP. Federal funds could only be utilized to assist in meeting the conservation components of the HCP/NCCP, and any state or federal funds are not required to satisfy the issuance criteria for the ESA and NCCPA. The HCP/NCCP has estimated that state and federal funds could be used to acquire 13,905 acres of land and restore 82 acres of vernal pool, aquatic/wetland, and riverine/riparian constituent habitat, which will be administered, managed, and monitored by the PCA, to the Reserve System. This acreage represents 29.4 percent of the total Reserve System.

State and federal funding sources for land acquisition could come from a variety of sources including those identified in Chapter 9.4.3.2. If state and federal funds are unable to contribute to the estimated amounts, the Permittees and the Wildlife Agencies will follow the approach set forth in Section 11.3 below. If necessary or appropriate, the Parties will reevaluate the HCP/NCCP and work together to develop or identify an alternative funding mechanism.

11.2. Funding for Post-Permit Management and Monitoring

The PCA will be solely responsible for funding long-term management and monitoring after the Permits expire. As described in Chapter 9.3.8, funding provided by Development Fee contributions and interest earnings on endowment fund balances during the term of the Permits will increase the endowment sufficiently to fully fund in perpetuity Plan implementation costs after the Permits expire. The periodic assessment and adjustment of fees during the term of the Permits described in Chapter 9.4.1.7 will prevent shortfalls in the endowment. If the endowment does not increase at a sufficient rate to reach its target amount, and revenue from special taxes and ongoing assessments does not make up for the shortfall, the Land Conversion Fee can be increased to make up the shortfall. subject to the requirements of the Mitigation Fee Act (Gov. Code §66000, et seq.). With these safeguards, the Parties expect post-permit funding to be adequate to fully offset post-Permit management and monitoring costs.

11.3. Effect of Inadequate Funding

As described in Chapter 9.4.5, the HCP/NCCP includes conservative assumptions and safeguards intended to ensure adequate funding for implementation, as well as a range of actions that the Permittees can take in the event of a temporary funding shortfall. In the event there is inadequate funding to implement the HCP/NCCP despite these assumptions, safeguards, and actions, the Wildlife Agencies will assess the impact of the funding deficiency on the scope and validity of the Permits. Unless the Permittees exercise the authority to withdraw, as provided in Section 15.5, or the Wildlife Agencies revoke the Permits, in whole or in part, as provided in Section 14, the Parties agree that they will meet and confer to develop a strategy to address the funding shortfall and to undertake all practicable efforts to maintain the level of conservation and Authorized Take coverage afforded by the Permits until the funding deficiency can be remedied.

11.4. Endowment for Post Permit Management and Monitoring

As described in Chapter 9.4.6, the PCA will create an endowment account to generate revenue to cover the costs of managing and monitoring the Reserve System following expiration of the Permits. The PCA may manage and invest funds in the endowment account directly or under contract to either a community foundation or a congressionally chartered foundation as defined in section 65965 of the California Government Code. The Parties agree that, as a public agency formed to implement the HCP/NCCP on behalf of the Permittees, including but limited to implementation of the funding strategy described in Chapter 9, the PCA is qualified to manage the endowment account.

The PCA shall ensure that the endowment is managed, invested, and disbursed in furtherance of the long-term stewardship of the Reserve System by:

- Managing endowment funds efficiently;
- Achieving a reasonable long-term rate of return on investment of endowment funds similar to those of other prudent investors for endowment funds;
- Achieving a long-term rate of return that at a minimum is equal to the capitalization rate of 3.25 percent annually assumed in the Plan, after deducting inflation and fees, and as adjusted by the periodic assessment and adjustment of fees;
- Fully funding the endowment by the end of the term of the Permits based on a schedule that allocates a fixed percentage of each land conversion fee payment to the endowment as adjusted by the periodic assessment and adjustment of fees;
- Managing and investing endowment funds in good faith and with the care an ordinarily prudent person in a like position would exercise under similar circumstances, consistent with the Uniform Prudent Management of Institutional Funds Act (Part 7 (commencing with Section 18501) of Division 9 of the Probate Code);
- Utilizing generally accepted accounting practices as promulgated by either the Financial Accounting Standards Board or any successor entity for nonprofit organizations or the Governmental Accounting Standards Board or any successor entity for public agencies, to the extent those practices do not conflict with any other requirements of law; and
- Disbursing endowment funds on a timely basis and only for the long-term stewardship of the Reserve System.

12. REPORTING AND INFORMATION MANAGEMENT

The PCA, on behalf of the Permittees, will report on and manage information regarding HCP/NCCP implementation as provided in this Section and further described in Chapter 8.10 and Chapter 8.11. The PCA may delegate reporting and information management tasks in this Section and the HCP/NCCP to other Parties or qualified third parties, including universities, scientists and other contractors. However, the PCA will remain solely responsible for ensuring implementation of such tasks on behalf of the Permittees.

12.1. Annual Report

The PCA will prepare an annual report on implementation of the HCP/NCCP (the "**Annual Report**"), as further described in Chapter 8.11. The Annual Report will summarize actions taken to implement the HCP/NCCP during each calendar year and will be submitted to the Wildlife Agencies by March 1 of the following calendar year, beginning the calendar year after the first full calendar year of implementation. The PCA will provide a copy of the Annual Report to all Parties. The PCA will also create and maintain an Internet website for the public distribution of information regarding HCP/NCCP implementation and will post each Annual Report on the website.

12.2. Compliance Tracking

As further described in Chapter 8.10.1, the PCA will be responsible for tracking compliance with the Permits. To track compliance, the PCA will maintain baseline data for the purpose of tracking the amount of Take that has been authorized, the amount of Authorized Take that has occurred, and the PCA's progress toward achieving the HCP/NCCP's goals and objectives for Covered Species.

12.3. HCP/NCCP Data Repository

Within one (1) year after the adoption of the first implementation ordinance as provided in Section 9.7.3, the PCA will develop and maintain a comprehensive HCP/NCCP data repository for information regarding Permit compliance and all other information regarding HCP/NCCP implementation for which reporting is required, as further described in Chapter 8.10.2.

12.4. Information Sharing

The PCA will make the HCP/NCCP data repository accessible to the Parties. The Parties will keep confidential sensitive species information to the extent permitted by the Freedom of Information Act and the California Public Records Act. The PCA will oversee and control access to the HCP/NCCP data repository as necessary to ensure the integrity of the repository and data therein. Subject to the California Public Records Act, the PCA may determine in its sole discretion whether, and under what conditions, to grant access to the data repository to third parties, including Third Party Participants.

Within the time periods prescribed in the California Public Records Act, the PCA will respond to a written request from any Party and will, in its sole discretion, determine whether documents that are responsive to the request exist, are within its possession and control, and are subject to disclosure, including the following:

- Non-confidential and non-proprietary databases that track Covered Activities or Reserve System land acquisitions;
- GIS data relevant to HCP/NCCP implementation in the format in which it is stored, including land cover data, the location of Covered Activities, and the boundaries of the Reserve System; and
- Non-confidential and non-proprietary financial data regarding the PCA, in the format in which it is stored.

13. MODIFICATIONS AND AMENDMENTS

The Parties may from time to time modify or amend the Permits, the HCP/NCCP, and this Agreement, in accordance with this Section and the requirements of FESA, the NCCPA, NEPA and CEQA, Chapter 10.5, and this Agreement.

13.1. Ordinary HCP/NCCP Administration

The Parties understand that ordinary administration and implementation of the HCP/NCCP will require minor variations or administrative changes in the way certain conservation actions are implemented. Such administrative changes will not require modification or amendment of the Permits, the HCP/NCCP, and this Agreement, and will not require the prior approval of the Wildlife Agencies. The PCA will summarize any such administrative changes in its Annual Report. Such administrative changes may include, but are not limited to, the examples provided in Chapter 10.5.1.

13.2. Minor Modifications of the HCP/NCCP

The PCA may propose minor modifications to the HCP/NCCP, as defined in Chapter 10.5.2, by providing written notice to all of the other Parties. Such notice will include a statement of the reason for the proposed modification and an analysis of its environmental effects, if any, including any effects on Covered Species. The Wildlife Agencies will each approve or disapprove proposed modifications within sixty (60) days of receipt of such notice or will explain in writing to the PCA why such approval or disapproval cannot be provided within sixty (60) days and will specify when such approval or disapproval will be provided. Proposed modifications will become effective upon the Wildlife Agencies' written approval. The Wildlife Agencies will not approve minor modifications to the HCP/NCCP if they determine that such modifications would result in adverse effects on Covered Species or natural communities under the HCP/NCCP that are significantly different from those analyzed in the HCP/NCCP or would result in additional Take of Covered Species not analyzed in the HCP/NCCP. If any Wildlife Agency disapproves a proposed modification, it may be proposed as an amendment of that Wildlife Agency's Permit as provided in Section 13.4.

Minor modifications of the HCP/NCCP that may be approved pursuant to this Section include, but are not limited to, the examples of minor modifications described in Chapter 10.5.2.

13.3. Amendment of this Agreement

This Agreement may be amended only with the written agreement of all Parties; provided, however, that any amendment or portion thereof pertaining to Private Project Participants, implementing ordinances under Section 9.7 or any other provision of this Agreement pertaining to the land use or

other regulatory decisions of the City or County will not require the consent of the PCWA, SPRTA, or OSA.

13.4. Amendment of the HCP/NCCP and the Permits

The Permittees may substantially revise the HCP/NCCP or apply to amend the Permits by obtaining the applicable Wildlife Agency's approval of an amendment to one or more of the Permits as provided in this Section and in accordance with all applicable laws and regulations, including but not limited to FESA, NEPA, NCCPA and CEQA. The PCA will provide written notice to all of the other Parties of any proposed Permit amendment. Such notice will include a copy of any required application for the proposed amendment, a statement of the reason for the amendment and an analysis of its environmental effects, if any, including any effects on Covered Species. The Wildlife Agency will review and approve or disapprove the proposed Permit amendment in an expeditious manner, commensurate with the level of environmental review appropriate to the magnitude of the proposed amendment. However, the Wildlife Agency will use its best efforts to approve or disapprove any proposed Permit amendment within one hundred eighty (180) days after receipt of an application to amend the HCP/NCCP, except where a longer period of time is required by law. Unless and until CDFW adopts regulations that set forth specific requirements for the amendment of NCCPA take authorizations, for purposes of proposed amendments to the State Permit, CDFW will accept an application for a Permit amendment that meets the requirements of this Section and FESA requirements for an application for an amendment of an incidental take permit; provided, however, that CDFW's approval or disapproval of the proposed Permit amendment will be based on the requirements of the NCCPA and CEQA and not on the requirements of FESA.

Revisions of the HCP/NCCP that would require an amendment of one or more of the Permits include, but are not limited to, the examples described in Chapter 10.5.3.

13.5. General Land Use and Regulatory Authority of the County and City

The Parties acknowledge that the adoption and amendment of general plans, specific plans, community plans, area plans, zoning ordinances and other land use and regulatory ordinances, and the granting of land use entitlements, ministerial permits, or other regulatory permits by the County or City are matters within the sole discretion of the County or City and will not require amendments to this Agreement, the HCP/NCCP, or the Permits, or the approval of other Parties to this Agreement. However, no such action by the County or City will alter or diminish their obligations under this Agreement, the HCP/NCCP or the Permits.

14. REMEDIES AND ENFORCEMENT

Each Party will have all of the remedies available in equity (including specific performance and injunctive relief) and at law to enforce the terms of the Permits, the HCP/NCCP, and this Agreement, and to seek redress for any breach or violation thereof; except that none of the Parties will be liable in damages to any other Party or to any other person or entity for any breach of this Agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this Agreement, or any other cause of action arising from this Agreement. The Parties acknowledge that the Covered Species are unique and that their loss as species would be irreparable and that therefore

injunctive and temporary relief may be appropriate in certain instances involving a breach of this Agreement. Nothing in this Agreement is intended to limit the authority of the Federal and State governments to seek civil or criminal penalties or otherwise fulfill its enforcement responsibilities under FESA, CESA or other applicable law.

14.1. Suspension or Revocation of Federal Permit

USFWS or NMFS may suspend the Federal Permit it issued, in whole or in part, for cause in accordance with the laws and regulations in force at the time of the suspension. The regulations governing permit suspension and revocation are currently codified at 50 Code of Federal Regulations section 13.27 (suspension) and 13.28, 17.22(b)(8) and 17.32(b)(8)(revocation).

14.2. Reinstatement of Suspended Federal Permit

In the event USFWS or NMFS suspends a Federal Permit, in whole or in part, as soon as possible, USFWS or NMFS, as applicable, will meet and confer with the Permittees concerning how the suspension can be ended. At the conclusion of any such conference, USFWS/NMFS will identify reasonable, specific actions, if any, necessary to effectively redress the suspension. In making this determination, USFWS/NMFS will consider the requirements of FESA and its regulations, the conservation needs of the Covered Species, the terms of the Federal Permits and of this Agreement and any comments or recommendations received during the meet and confer process. As soon as possible, but not later than thirty (30) days after the conference, USFWS/NMFS will send the Permittees written notice of any available, reasonable actions necessary to effectively redress the deficiencies giving rise to the suspension. Upon performance or completion, as appropriate, of such actions, USFWS/NMFS will immediately reinstate the Federal Permit. It is the intent of the Parties that in the event of any total or partial suspension of the Federal Permit, all Parties will act expeditiously and cooperatively to reinstate the Federal Permit.

14.3. Suspension of the State Permit

In the event of any material violation of the State Permit or material breach of this Agreement by the Permittees, CDFW may suspend the State Permit in whole or in part; provided, however, that it will not suspend the State Permit without first (1) attempting to resolve any disagreements regarding the implementation or interpretation of the HCP/NCCP or this Agreement in accordance with Section 16.2, (2) requesting the Permittees to take appropriate remedial actions when such remedial actions are reasonable and available, and (3) providing the Permittees with written notice of the facts or conduct which may warrant the suspension and an adequate and reasonable opportunity for the Permittees to demonstrate why suspension is not warranted or to take steps necessary to cure the violation or breach.

14.4. Failure to Maintain Rough Proportionality

As provided in Section 7.1.3.2, in the event that CDFW has determined that the Permittees have failed to meet the stay-ahead requirement as provided in Section 7.1.3, and if the Permittees have failed to cure the default or entered into an agreement to do so within forty-five (45) days of the written notice of such determination, CDFW will suspend the State Permit in whole or in part in accordance with California Fish and Game Code section 2820.

14.5. Reinstatement of Suspended State Permit

In the event CDFW suspends the State Permit, as soon as possible but no later than ten (10) days after such suspension, CDFW will confer with the Permittees concerning how the violation or breach that led to the suspension can be remedied. At the conclusion of any such conference, CDFW will identify reasonable, specific actions necessary to effectively redress the violation or breach. In making this determination, CDFW will consider the requirements of NCCPA, the conservation needs of the Covered Species, the terms of the State Permit and this Agreement and any comments or recommendations received during the meet and confer process. As soon as possible, but not later than thirty (30) days after the conference, CDFW will send the Permittees written notice of the reasonable actions necessary to effectively redress the violation or breach. Upon performance of such actions, CDFW will immediately reinstate the State Permit. It is the intent of the Parties that in the event of any suspension of the State Permit, all Parties will act expeditiously and cooperatively to reinstate the State Permit.

14.6. Revocation of State Permit

CDFW may revoke or terminate the State Permit for a material violation of the State Permit or material breach of this Agreement by the Permittees if the CDFW determines in writing that (1) such violation or breach cannot be effectively redressed by other remedies or enforcement action, or (2) revocation or termination is required to avoid jeopardizing the continued existence of a Covered Species and to fulfill a legal obligation of the CDFW under the NCCPA.

CDFW agrees that it will not revoke or terminate the State Permit without first (1) attempting to resolve any disagreements regarding the implementation or interpretation of the HCP/NCCP or this Agreement in accordance with Section 16.2, (2) requesting that the Permittees take appropriate remedial action, and (3) providing the Permittees with notice in writing of the facts or conduct which warrant the revocation or termination and a reasonable opportunity (not less than forty-five (45) days) to demonstrate or achieve compliance with NCCPA, the State Permit and this Agreement.

However, in the event that CDFW has determined that the Permittees have failed to meet the rough proportionality standard provided in Section 7.1.3, and if the Permittees have failed to cure the default or to enter into an agreement to do so within forty-five (45) days of the written notice of such determination, CDFW will revoke the State Permit in whole or in part in accordance with California Fish and Game Code section 2820.

14.7. Inspections by Wildlife Agencies

The Wildlife Agencies may conduct inspections and monitoring of the site of any Covered Activity, and may inspect any data or records required by this Agreement, the HCP/NCCP or the Permits, in accordance with applicable law and regulations. The PCA will also provide the Wildlife Agencies reasonable access to conduct inspections of the Reserve System.

15. TERM OF AGREEMENT

15.1. Effective Date

This Agreement will be effective on the date after all of the following have occurred:

- execution by all Parties;
- issuance of all three of the Permits; and
- adoption of an HCP/NCCP implementation ordinance by each of the City and the County.

15.2. Term of the Agreement

This Agreement will run for a term of fifty (50) years from the Effective Date, unless extended pursuant to Section 15.4, or unless all of the Permits are permanently terminated pursuant to Section 14, in which case this Agreement will automatically terminate. This Agreement may also be terminated by mutual written agreement of the Parties.

15.3. Term of the Permits

The Permits will have a term of fifty (50) years from the Effective Date unless terminated as provided in this Agreement.

15.4. Extension of the Permits

Upon agreement of the Parties and in compliance with all applicable laws and regulations in force at the time, the Wildlife Agencies may, with respect to the Permits under their respective jurisdictions, extend the Permits beyond their initial terms. If the Permittees desire to extend the Permits, they will so notify the Wildlife Agencies at least six (6) months before the then-current term is scheduled to expire. Extension of the Permits constitutes extension of the HCP/NCCP and this Agreement for the same amount of time, subject to any modifications agreed to by the Parties at the time of extension.

15.5. Withdrawal by a Permittee

Upon ninety (90) days written notice to the Wildlife Agencies, the PCA and all other Permittees, any Permittee except for the PCA may unilaterally withdraw from this Agreement. As a condition of withdrawal, the Permittee will remain obligated to ensure implementation of all existing and outstanding minimization and mitigation measures required under the Permits, the HCP/NCCP, and this Agreement for any Authorized Take that the Permittee itself caused and any Authorized Take by Private Project Participants for which the Permittee extended Authorized Take coverage prior to withdrawal. If a Permittee withdraws before causing or extending any Authorized Take coverage under the Permits, the Permittee will have no obligation to ensure implementation of any minimization or mitigation measures. Such withdrawal of a Permittee from this Agreement will be deemed to constitute a surrender of the Permittee's Authorized Take coverage under the Permits.

Withdrawal by a Permittee will not diminish or otherwise affect the obligations of the remaining Permittees under the Permits, the HCP/NCCP, and this Agreement. The Permittees acknowledge that if one or more Permittees withdraws from this Agreement and, as a result of the withdrawal, it is no

longer feasible or practicable to implement the Permits and the HCP/NCCP successfully, it may be necessary to modify the HCP/NCCP or to amend the Permits, or both, in response to the withdrawal.

Within forty-five (45) days after receiving written notice of withdrawal from a Permittee, the Wildlife Agencies, the PCA and all Permittees will meet to discuss and evaluate whether the HCP/NCCP can be successfully implemented without the participation of the withdrawing Permittee. Relevant factors in this evaluation include but are not limited to whether, without the participation of the withdrawing Permittee, HCP/NCCP implementation will continue to be adequately funded, whether the Permittees can continue to comply with the stay-ahead requirement, whether all required conservation actions can be implemented, and whether the overall HCP/NCCP conservation strategy can be implemented consistent with the HCP/NCCP. Based on this meeting or meetings, and based on any other relevant information provided by the PCA or the remaining Permittees, the Parties will determine whether it is necessary to modify the HCP/NCCP or amend the Permits, or both, in response to the withdrawal.

Upon ninety (90) days written notice to the Wildlife Agencies, the Permittees collectively may withdraw from this Agreement. As a condition of such withdrawal, the Permittees will be obligated to ensure implementation of all existing and outstanding minimization and mitigation measures required under the Permits, the HCP/NCCP, and this Agreement for any Authorized Take that occurred prior to such withdrawal until the Wildlife Agencies reasonably determine that all Authorized Take of Covered Species that occurred under the Permits has been mitigated to the maximum extent practicable in accordance with the HCP/NCCP, which determination the Wildlife Agencies will make as soon as reasonably possible.

If the Permittees collectively notify USFWS or NMFS in writing that they plan to withdraw from this Agreement or to discontinue the Covered Activities, they will surrender the Federal Permit issued by that agency pursuant to the requirements of 50 Code of Federal Regulations Part 13.26.

Regardless of withdrawal and surrender of the Permits, the Permittees acknowledge that lands dedicated to the Reserve System must be protected, managed and monitored in perpetuity.

16. MISCELLANEOUS PROVISIONS

16.1. Collaboration among the Parties

The Parties agree that successful collaboration among them is important to the success of the HCP/NCCP. Notwithstanding any other Section of this Agreement or Chapter of the HCP/NCCP, each Party will make a reasonable effort to: meet and confer with any other Party upon the request of that Party to address matters pertaining to the HCP/NCCP, the Permits, or this Agreement; provide relevant, non-proprietary, non-confidential information pertaining to the HCP/NCCP upon the request of any Party; and provide timely responses to requests from any Party for advice, concurrence, or review and comment on reports, surveys or other documents, regarding matters pertaining to the HCP/NCCP, the Permits, or this Agreement.

16.2. Dispute Resolution

The Parties recognize that disputes concerning implementation, compliance with, or termination of

the Permits, the HCP/NCCP, and this Agreement may arise from time to time. The Parties intend to resolve most disputes at the staff or field personnel level. However, the Parties recognize that some disputes might not be resolved at the staff or field personnel level. The Parties agree to work together in good faith to resolve such disputes using the informal dispute resolution procedure set forth in this Section. No Party shall be required to use the informal dispute resolution procedure before seeking any other remedy available at law or in equity if the Party concludes, in its discretion, that circumstances so warrant. However, unless the Parties agree upon another dispute resolution process, or unless a Party has initiated administrative proceedings or litigation related to the subject of the dispute in federal or state court, the Parties agree to use the following procedures to attempt to resolve disputes.

16.2.1. Notice of Dispute; Meet and Confer

If a Party objects to any action or inaction by any other Party on the basis that the action or inaction is inconsistent with the Permits, the HCP/NCCP, and this Agreement, it will provide a written notice explaining the basis of the objection to such other Party, the PCA, and any other Parties whose involvement is necessary to resolve the dispute. The Party that is the subject of the written notice will respond to the notice in writing within thirty (30) days of receiving it, stating what actions it proposes to take to resolve the objection or, alternatively, explaining why the objection is unfounded. If the response resolves the objection to the satisfaction of the objecting Party, the objecting Party will so notify all involved Parties, and the responding Party will ensure implementation of the actions, if any, proposed in the response. If the response does not resolve the objection to the satisfaction of the objecting Party, the objecting Party will so notify all involved Parties and request that all involved Parties meet and confer to attempt to resolve the dispute. The meeting will occur within thirty (30) days after the involved Parties receive the notice and meeting request from the objecting Party, or at such later time as the objecting Party may agree to. A representative of the PCA will take notes at the meeting, summarize the outcome, and distribute meeting notes to each Party in attendance.

16.2.2. Elevation of Dispute

If the Parties do not resolve a dispute after completing the dispute resolution procedure in Section 16.2.1, any one of the Parties may elevate the dispute to a meeting of the chief executives of the involved Parties. For purposes of this provision, "chief executive" means the County Executive of the County, the City Manager of the City, the Chief Executive Officer of the PCWA, the Executive Director of the SPRTA, the executive director of the PCA, the CDFW Regional Manager, the USFWS Field Supervisor, and NMFS' Assistant Regional Administrator for Protected Resources, Southwest Region. Each Party will be represented by its chief executive in person or by telephone at the meeting, and the meeting will occur within forty-five (45) days of a request by any Party following completion of the dispute resolution procedure.

16.3. Calendar Days

Throughout this Agreement and the HCP/NCCP, the use of the term "day" or "days" means calendar days, unless otherwise specified

16.4. Response Times

Except as otherwise set forth herein or as statutorily required by CEQA, NEPA, CESA, FESA, NCCPA or any other laws or regulations, the Wildlife Agencies and the Permittees will use reasonable efforts to respond to written requests from a Party within a forty-five (45) day time period. The Parties acknowledge that the City and the County are subject to the Permit Streamlining Act and that nothing in this Agreement will be construed to require them to violate that Act. In addition, the Wildlife Agencies will provide timely review of proposals for Covered Activities to be implemented directly by the Permittees, where such review is required by this Agreement, the HCP/NCCP, or the Permits Review of Third Party Participant Applications.

16.5. Notices

The PCA will maintain a list of individuals responsible for ensuring HCP/NCCP compliance for each of the Parties, along with addresses at which those individuals may be notified ("**Notice List**"). The Notice List as of the Effective Date is provided below. Each Party will report any changes of names or addresses to the PCA and the other Parties in writing.

Any notice permitted or required by this Agreement will be in writing, and delivered personally, by overnight mail, or by United States mail, postage prepaid. Notices may be delivered by facsimile or electronic mail, provided they are also delivered by one of the means listed above. Delivery will be to the name and address of the individual responsible for each of the Parties, as stated on the most current Notice List.

Notices will be transmitted so that they are received within deadlines specified in this Agreement, where any such deadlines are specified. Notices delivered personally will be deemed received on the date they are delivered. Notices delivered via overnight delivery will be deemed received on the next business day after deposit with the overnight mail delivery service. Notices delivered via non-certified mail will be deemed received seven (7) days after deposit in the United States mail. Notices delivered by facsimile or other electronic means will be deemed received on the date they are received.

The following Notice List contains the names and notification addresses for the individuals currently responsible for overseeing and coordinating HCP/NCCP compliance:

[Names and addresses]

16.6. Entire Agreement

This Agreement, together with the HCP/NCCP and the Permits, constitutes the entire agreement among the Parties. This Agreement supersedes any and all other agreements, either oral or in writing, among the Parties with respect to the subject matter hereof and contains all of the covenants and agreements among them with respect to said matters, and each Party acknowledges that no representation, inducement, promise of agreement, oral or otherwise, has been made by any other Party or anyone acting on behalf of any other Party that is not embodied herein.

16.7. Defense

Upon request, CDFW will, to the extent authorized by California law, cooperate with the Permittees in defending, consistent with the terms of the HCP/NCCP, lawsuits arising out of the Permittees' adoption of this Agreement and the HCP/NCCP.

16.8. Attorneys' Fees

If any action at law or equity, including any action for declaratory relief, is brought to enforce or interpret the provisions of this Agreement, each Party to the litigation will bear its own attorneys' fees and costs, provided that attorneys' fees and costs recoverable against the United States will be governed by applicable federal law.

16.9. Elected Officials Not to Benefit

No member of, or delegate to, the California State Legislature, the United States Congress, the County Board of Supervisors, the City Council of the City, or the governing boards of the other Permittees will be entitled to any share or part of this Agreement or to any benefit that may arise from it.

16.10. Availability of Funds

Implementation of this Agreement and the HCP/NCCP by USFWS and NMFS is subject to the requirements of the Anti-Deficiency Act, 31 U.S.C. 1341, and the availability of appropriated funds. Nothing in this Agreement will be construed by the Parties to require the obligation, appropriation, or expenditure of any money from the United States Treasury. The Parties acknowledge and agree that USFWS and NMFS will not be required under this Agreement to expend any federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing.

Implementation of this Agreement and the HCP/NCCP by CDFW is subject to the availability of appropriated funds. Nothing in this Agreement will be construed by the Parties to require the obligation, appropriation, or expenditure of any money from the Treasury of the State of California. The Parties acknowledge and agree that CDFW will not be required under this Agreement to expend any state appropriated funds unless and until an authorized official of that agency affirmatively acts to commit such expenditure as evidenced in writing.

Implementation of this Agreement and the HCP/NCCP by the Permittees is subject to the availability of their respective appropriated funds, including but not limited to the special purpose revenues dedicated to implement the HCP/NCCP. Nothing in this Agreement will be construed to require the obligation, appropriation, or expenditure of any money without express authorization by the County Board of Supervisors, the City Council of the City, and/or governing boards of the PCA, PCWA, and SPRTA. Notwithstanding these requirements and limitations, the Permittees are required to fund their respective obligations under this Agreement, the HCP/NCCP and the Permits as provided in Section 11. The Parties acknowledge that if the Permittees fail to provide adequate funding for their respective obligations under this Agreement, the HCP/NCCP and the Permits, the Permits may be suspended or revoked as provided in Section 14.

16.11. Governing Law

This Agreement will be governed by and construed in accordance with the laws of the United States and the State of California, as applicable.

16.12. Duplicate Originals

This Agreement may be executed in any number of duplicate originals. A complete original of this Agreement will be maintained in the official records of each of the Parties hereto.

16.13. Relationship to the FESA, CESA, NCCPA and Other Authorities

The terms of this Agreement are consistent with and will be governed by and construed in accordance with FESA, CESA, NCCPA and other applicable state and federal laws. In particular, nothing in this Agreement is intended to limit the authority of USFWS, NMFS or CDFW to seek penalties or otherwise fulfill its responsibilities under FESA, CESA and NCCPA. Moreover, nothing in this Agreement is intended to limit or diminish the legal obligations and responsibilities of USFWS or NMFS as agencies of the federal government or CDFW as an agency of the State of California.

16.14. No Third Party Beneficiaries

Without limiting the applicability of rights expressly granted to the public pursuant to the ESA, CESA, NCCPA or other applicable law, this Agreement does not create any right or interest in the public, or any member thereof, as a third party beneficiary thereof, nor will it authorize anyone not a Party to this Agreement to maintain a suit for personal injuries or property damages under the provisions of this Agreement. The duties, obligations, and responsibilities of the Parties to this Agreement with respect to third party beneficiaries will remain as imposed under existing state and federal law.

16.15. References to Regulations

Any reference in the Permits, the HCP/NCCP, or this Agreement to any regulation or rule of the Wildlife Agencies will be deemed to be a reference to such regulation or rule in existence at the time an action is taken.

16.16. Applicable Laws

All activities undertaken pursuant to the Permits, the HCP/NCCP, or this Agreement must be in compliance with all applicable local, state and federal laws and regulations.

16.17. Severability

In the event one or more of the provisions contained in this Agreement is held to be invalid, illegal or unenforceable by any court of competent jurisdiction, such portion will be deemed severed from this Agreement and the remaining parts of this Agreement will remain in full force and effect as though such invalid, illegal, or unenforceable portion had never been a part of this Agreement. The Permits are severable such that revocation of one of the Federal or State Permits does not automatically cause revocation of the other. For example, if CDFW revokes the State Permit, it does not automatically cause revocation of a Federal Permit.

16.18. Due Authorization

Each Party represents and warrants that (1) the execution and delivery of this Agreement has been duly authorized and approved by all requisite action, (2) no other authorization or approval, whether of governmental bodies or otherwise, will be necessary in order to enable it to enter into and comply with the terms of this Agreement, and (3) the person executing this Agreement on behalf of each Party has the authority to bind that Party.

16.19. Assignment

Except as otherwise provided herein, the Parties will not assign their rights or obligations under the Permits, the HCP/NCCP, or this Agreement to any other individual or entity.

16.20. Headings

Headings are used in this Agreement for convenience only and do not affect or define the Agreement's terms and conditions.

16.21. Legal Authority of USFWS and NMFS

USFWS and NMFS enter into this Agreement pursuant to FESA, the Fish and Wildlife Coordination Act, and the Fish and Wildlife Act of 1956. Section 10(a)(2)(B) of FESA expressly authorizes USFWS and NMFS to issue Section 10(a) Permits to allow the incidental Take of species listed as threatened or endangered under FESA. The legislative history of Section 10(a)(1)(B) clearly indicates that Congress also contemplated that USFWS and NMFS would approve habitat conservation plans that protect non-listed species as if they were listed under FESA, and that in doing so, USFWS and NMFS would provide assurances for such non-listed species.

16.22. Legal Authority of CDFW

CDFW enters into this Agreement pursuant to the NCCPA.

16.23. No Limitation on the Police Power of the City or the County

Nothing in this Agreement, the HCP/NCCP or Permits limits the exercise of or in any way surrenders the police power of the City or the County.

16.24. Agreement with USFWS not an Enforceable Contract

Notwithstanding any language to the contrary in this Agreement, this Agreement is not intended to create, and shall not be construed to create an enforceable contract between the USFWS and the Permittees (individually or collectively) under law with regard to the Permit or otherwise and no Party to this Agreement shall be liable in damages to the other Party or any other third party or person for any performance or failure to perform any obligation identified in this Agreement. The sole purposes of this Agreement as between the USFWS and Permittees are to clarify the provisions of the HCP and the processes the Parties intend to follow to ensure the successful implementation of the HCP and use of the Take Authorization in accordance with the Permit and applicable Federal law.

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Implementing Agreement.

UNITED STATES FISH & WILDLIFE SERVICE

Dated: _____ By: _____

NATIONAL MARINE FISHERIES SERVICE

Dated: _____ By: _____

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

Dated: _____ By: _____

PLACER CONSERVATION AUTHORITY

Dated: _____ By: _____

COUNTY OF PLACER

Dated: _____ By: _____

CITY OF LINCOLN

Dated: _____ By: _____

PLACER COUNTY WATER AGENCY

Dated: _____ By: _____

SOUTH PLACER REGIONAL TRANSPORTATION AGENCY

Dated: _____ By: _____

EXHIBIT A

[DATE]

[NAME]
[COMPANY]
[STREET ADDRESS]
[CITY, STATE, ZIP]

Re: Certificate of Inclusion for [PROJECT APPLICANT NAME AND PROJECT TITLE] Project

Dear [NAME]:

The United States Fish and Wildlife Service, the National Marine Fisheries Service, and the California Department of Fish and Game have issued Permits pursuant to the federal Endangered Species Act and the California Natural Community Conservation Planning Act (collectively "Permits") authorizing "Take" of certain species in accordance with the terms and conditions of the Permits, the Western Placer County Habitat Conservation Plan/Natural Community Conservation Plan ("HCP/NCCP") and the Implementing Agreement for the HCP/NCCP ("Implementing Agreement"). Under the Permits, certain activities by [SPECIAL ENTITY NAME] are authorized to "Take" certain species, provided all applicable terms and conditions of the [DATE] Participating Special Entity Agreement Between the Placer Conservation Authority and [SPECIAL ENTITY NAME] ("PSE Agreement"), Permits, the HCP/NCCP and the Implementing Agreement are met.

As the owner/operator of the property depicted in the PSE Agreement, [SPECIAL ENTITY NAME] is entitled to coverage under the Permits for the proposed activities which are described in the PSE Agreement, with respect to any Take of Covered Species identified in the HCP/NCCP. Take authorization under the Permits applies only to the uses of the property described in the PSE Agreement and is subject to the conditions set forth in the PSE Agreement. If [SPECIAL ENTITY NAME] does not fully comply with the PSE Agreement, take authorization under the Permits will thereby be invalidated and can be temporarily or permanently revoked by the Placer Conservation Authority. The take authorization and conditions and limitations that apply to the take authorization are generally described in the Permits, the HCP/NCCP, and the Implementing Agreement. This Certification of Inclusion does not increase the state and federal agencies regulatory authority over [SPECIAL ENTITY NAME] but instead ensures compliance with the federal Endangered Species Act (including 50 CFR section 13.25(d), the California Natural Community Conservation Planning Act, and the California Endangered Species Act.

Coverage under the Permits will become effective immediately. In the event that the activities covered by the PSE Agreement are sold or leased, the buyer or lessee must execute a new PSE Agreement Implementing the HCP/NCCP and Granting Take Authorization.

If you should have any questions, please call me at [telephone number].

Sincerely,

[Name]
Executive Director
Placer Conservation Authority

Appendix C

Evaluation of Special-Status for Coverage in Placer County

Table C-1. Species Considered but Not Recommended

Species	Status[a]			Criteria[b]				Notes
	State	Placer Legacy	Federal	Range	Status	Impact	Data	
Invertebrates								
California linderiella *Linderiella occidentalis*	-	C3	-	Y	N	Y	Y	Very common in plan area. Several records from west Placer including Sun City, Roseville, Wildlands Sheridan Mitigation Bank, Wildlands Orchard Mitigation Bank, and West Park Property. About 40 occurrences have been recorded (CNDDB 2015).
Johnson's hairstreak *Callophrys (Mitoura) johnsoni*	-	CC	-	Y	N	Y	Y	Recorded in Placer County; no specific location data provided (Opler et. al 1995). Known to occur in study area.
Lindsey's skipper *Hesperia lindseyi*	-	CC	-	Y	N	Y	Y	Recorded in Placer County; no specific location data provided (Opler et. al 1995).
Sonoran blue *Philotes sonorensis*	-	CC	-	Y	N	Y	Y	Recorded in Placer County; no specific location data provided (Opler et. al 1995). Known to occur in study area.
Western cloudywing *Thorybes diversus*	-	CC	-	Y	N	Y	Y	Recorded in Placer County; no specific location data provided (Opler et. al 1995).
California dogace butterfly *Zerene eurydice*	-	CC	-	Y	N	Y	Y	Recorded in Placer County but no specific location data provided (Opler et. al 1995). Known to occur in the plan area.
Kings Canyon cryptochian caddisfly *Cryptochia excella*	-	C1	-	Y	N	Y	Y	Recorded in Placer County; no specific location data provided (Erman and Erman 1995).
Spiny rhyacophila caddisfly *Rhyacophila spinata*	-	C3	-	Y	N	Y	Y	Known to occur in Lady's Canyon, Placer County on the Middle Fork of the American River (Erman and Nagano, 1992).

Species	Status[a]			Criteria[b]				Notes
	State	Placer Legacy	Federal	Range	Status	Impact	Data	
Mammals								
Pallid bat *Antrozous pallidus*	SSC	C4	FS, LS	Y	Y	Y	N	Within species' known distribution (Verner and Boss 1980; Zeiner et al. 1990), but no documented records found in CNDDB, MVZ, or UCD.
Townsend's big-eared bat *Corynorhinus townsendii*	SSC	C4	FS, LS	Y	Y	N	Y	Within species' known distribution (Verner and Boss 1980; Zeiner et al. 1990); specimen record from San Juan Ridge (SFAS) and one recent record from west of Newcastle (CNDDB 2015).
Spotted bat *Euderma maculatum*	SSC	C4	LS	Y	Y	Y	N	Within species' known distribution (Verner and Boss 1980; Zeiner et al. 1990), but no documented records found in CNDDB, MVZ, or UCD.
Western mastiff bat *Eumops perotis californicus*	SSC	C4	LS	N	Y	Y	N	Near species' known distribution (Verner and Boss 1980; Zeiner et al. 1990), but no documented records found in CNDDB, MVZ, or UCD.
Western small-footed myotis *Myotis ciliolabrum*	-	C4	LS	Y	N	Y	N	Within species' known distribution (Verner and Boss 1980; Zeiner et al. 1990), but no documented records found in CNDDB, MVZ, or UCD; taxon included on species list for Spenceville Wildlife Area, so probably occurs in Placer County.
Long-eared myotis *Myotis evotis*	-	C4	LS	N	N	Y	N	Specimen records from near Independence Lake and Sagehen Creek, Nevada County; no documented records from Placer County (MVZ 2003).
Fringed myotis *Myotis thysanodes*	-	C4	FS, LS	Y	N	Y	N	Within species' known distribution (Verner and Boss 1980; Zeiner et al. 1990), but no documented records found in CNDDB, MVZ, or UCD.
Long-legged myotis *Myotis volans*	-	C4	-	Y	N	Y	Y	A single specimen record from 1912 near Dutch Flat (MVZ 2003).
Yuma myotis *Myotis yumanensis*	-	C4	LS	N	N	Y	N	Specimen records from attic of a private residence near Hobart Mills, Nevada County; no documented records from Placer County (MVZ 2003).

Species	Status[a]			Criteria[b]				Notes
	State	Placer Legacy	Federal	Range	Status	Impact	Data	
Ring-tailed cat *Bassariscus astutus*	FP	C3	-	Y	N	Y	Y	Within species' known distribution (Verner and Boss 1980; Zeiner et al. 1990); no MVZ or CNDDB records, but suitable habitat exists along several foothill creeks such as Coon Creek and Auburn Ravine Creek (ICF file data). It is known to occur at Coon Creek.
American badger *Taxidea taxus*	SSC	C3	-	Y	N	Y	Y	Within species' known distribution (Verner and Boss 1980; Zeiner et al. 1990), but no documented records found in CNDDB, MVZ, or UCD; active burrows observed in headwaters basin of North Fork American River since the 1970s (T. Beedy pers. obs.).
Fish								
Hardhead *Mylopharodon conocephalus*	SSC	C3	FS	Y	N	Y	Y	Inhabits larger tributaries of the Sacramento River, including American (North and Middle Forks) and Bear Rivers and possibly lower reaches of Rubicon River; Auburn Ravine and Coon Creek (ICF file data).
Reptiles								
Coast horned lizard *Phrynosoma blainvillii*	SSC	C3	LS	Y	Y	N	Y	Within species' range. Three occurrences recorded in the Colfax area (CNDDB 2015).
Amphibians								
California tiger salamander – Central Valley Distinct Population Segment *Ambystoma californiense*	ST	C2	FT	N	Y	Y	Y	CDFW does not consider this species to occur in Placer County (CDFG 2010; Figure 6), but suitable habitat occurs in the western part of the County.
Western spadefoot *Spea hammondii*	SSC	-	LS	Y	N	Y	N	Five occurrences in the non-participating cities; multiple observations near the intersection of Moore Road and North Dowd Road that have been submitted to CNDDB in 2019 (pers. comm. Jackson Shedd). Suitable habitat occurs in the western part of the County.
Birds								
Redhead (nesting) *Aythya americana*	SSC	C3	MBTA	Y	N	Y	Y	Probably a rare breeder in the Plan area.

Species	Status[a]			Criteria[b]				Notes
	State	Placer Legacy	Federal	Range	Status	Impact	Data	
American white pelican (nesting colony) *Pelecanus erythrorhynchos*	SSC	C3	MBTA	N	N	Y	Y	Not known to nest in the Plan area.
Great blue heron (nesting colony) *Ardea herodias*	CDF-S	C3	MBTA	Y	N	Y	Y	Common in the Plan area, rookery sites known to occur.
White-faced ibis (nesting colony) *Plegadis chihi*	-	C3	MBTA	Y	N	Y	Y	Suitable nesting habitat is present Frequent in the western part of the Plan area, especially in winter.
Sharp-shinned hawk (nesting) *Accipiter striatus*	-	-	MBTA	Y	N	Y	Y	Unlikely to nest in the plan area; however, numerous observations the plan area (eBird Data 2013).
Golden eagle (nesting & wintering) *Aquila chrysaetos*	FP, CDF-S	C3	BCC, LS, MBTA, BGEPA	Y	Y	Y	Y	Not known to nest in the Plan Area. Twelve wintering observations during Lincoln CBCs 2002–2012. Twenty-six observations in the plan area (eBird Data 2013).
Rough-legged hawk (wintering) *Buteo lagopus*	-	C3	MBTA	Y	N	Y	Y	Known to winter and regularly occurs in small numbers on the valley floor in Western Placer County (Webb 2003; eBird Data 2013).
White-tailed kite (nesting) *Elanus leucurus*	FP	C3	LS, MBTA	Y	Y	Y	Y	Frequently observed in the Plan area; known to nest in the Plan area (Lincoln CBC, eBird 2013).
Bald eagle (nesting & wintering) *Haliaeetus leucocephalus*	SE, FP, CDF-S	-	FD, BCC, LS, FS, MBTA, BGEPA	Y	Y	N	Y	Not known to nest in the Plan Area. Individuals regularly overwinter in the Plan Area. Not likely to be listed under federal ESA as it has been recently delisted. Effects to potential nesting habitat expected
Osprey (nesting) *Pandion haliaetus*	CDF-S	C3	MBTA	Y	N	Y	Y	Frequently observed, but few nesting records in Plan area; one recorded in CNDDB (2015).
Merlin (wintering) *Falco columbarius*	-	C3	MBTA	Y	N	Y	Y	Known to winter in the Plan area: 57 observations during Lincoln CBCs 2002–2012; 53 observations in the plan area (eBird Data 2013).

Species	Status[a]			Criteria[b]				Notes
	State	Placer Legacy	Federal	Range	Status	Impact	Data	
Prairie falcon (nesting) *Falco mexicanus*	-	C3	BCC, MBTA	Y	N	Y	Y	Unlikely to nest in the Plan area, but present in winter and migration. 94 wintering observations during Lincoln CBCs 2002–2012. Forty-one observations in the plan area (eBird Data 2013).
American peregrine falcon (nesting) *Falco peregrinus anatum*	SD, FP, CDF-S	-	FD, BCC, MBTA	Y	Y	N	Y	Overwinters in Plan Area. Not likely to be listed under federal ESA or CESA as it has been recently delisted. Effects on potential nesting habitat expected.
Greater sandhill crane (nesting & wintering) *Grus canadensis tabida*	ST, FP	C1	FS, LS, MBTA	Y	Y	N	Y	Does not nest in the Plan area. Rarely observed during winter and migration: 13 observations during Lincoln CBCs 2002–2012.
Short-eared owl (nesting) *Asio flammeus*	SSC	C3	MBTA	Y	Y	Y	Y	May nest in the Plan area. Fifteen wintering observations during Lincoln CBCs 2002–2012. Fifteen observations in the Plan Area (eBird Data 2013).
Long-eared owl (nesting) *Asio otus*	SSC	C3	MBTA	N	Y	N	Y	No observations in the plan area (eBird Data 2015).
Western yellow-billed cuckoo(nesting) *Coccyzus americanus occidentalis*	SE	C2	FT, BCC, FS, LS, MBTA	N	Y	Y	Y	There are no recent records of western yellow-billed cuckoo in Placer County, however the yellow-billed cuckoo occurred historically in the plan area as a breeding species in Auburn Ravine in the early 1900s. No individuals have been observed in the plan area (eBird Data 2013).
Black swift (nesting) *Cypseloides niger*	SSC	C3	BCC, MBTA	N	Y	N	Y	Does not nest in the plan area.
Purple martin (nesting) *Progne subis*	SSC	C4	MBTA	Y	Y	Y	Y	Nesting recorded in the Plan area near Rocklin on bridge in the Taylor Rd/Highway 65 area (eBird Data 2015).
Chipping sparrow (nesting) *Spizella passerina*	-	CC	MBTA	Y	N	Y	Y	Fifteen observations in the plan area (eBird Data 2013).
Plants								
Dwarf downingia *Downingia pusilla*	2B.2	-	-	Y	N	Y	Y	18 occurrences in study area (CNDDB 2015).

Species	Status[a]			Criteria[b]				Notes
	State	Placer Legacy	Federal	Range	Status	Impact	Data	
Boggs Lake hedge-hyssop *Gratiola heterosepala*	SE, 1B.2	-	FS	Y	Y	Y	N	Three occurrences: two between Rocklin and Roseville; the third just north of Lincoln (CNDDB 2015).
Ahart's dwarf rush *Juncus leiospermus* var. *ahartii*	1B.2	-	-	Y	N	Y	N	One occurrence in study area near Highway 65 between Lincoln and Rocklin (CNDBB 2015).
Legenere *Legenere limosa*	1B.1	-	FS	Y	N	Y	N	Two occurrences observed near Highway 65 and between Lincoln and Rocklin (CNDDB 2015).

[a] Status Definitions

Federal

- = No listing.
BCC = U.S. Fish and Wildlife Service Bird of Conservation Concern.
BGEPA = Bald and Golden Eagle Protection Act.
FD = Delisted from the federal Endangered Species Act.
FS = Considered a sensitive species by the U.S. Forest Service.
FT = Listed as threatened under the federal Endangered Species Act.
LS = Considered a sensitive species by the U.S. Bureau of Land Management.
MBTA = Migratory Bird Treaty Act—fully protected from take by the U.S. Fish and Wildlife Service.

State

- = No listing or special status.
1B.1 = California Rare Plant Rank (CRPR) 1B.1: Rare or endangered in California and elsewhere; seriously endangered in California.
1B.2 = CRPR 1B.2: Rare or endangered in California and elsewhere; fairly endangered in California.
2B.2 = CRPR 2B.2: Plants rare, threatened, or endangered in California, but more common elsewhere; fairly endangered in California.
CDF-S = California Department of Forestry and Fire Protection—Sensitive
FP = Fully protected under the California Fish and Game Code.
SD = Delisted from the California Endangered Species Act
SE = Listed as endangered under the California Endangered Species Act.

State, continued

ST = Listed as threatened under the California Endangered Species Act.

SSC = Considered a Species of Special Concern by the California Department of Fish and Wildlife

Placer Legacy

CC = Species of conservation concern to the scientific community; no state or federal protection status

C1 = State/Federal Listed Species known to occur in Placer County

C2 = State/Federal Listed Species that could potentially occur in Placer County

C3 = Other Special Status Species known to occur in Placer County.

C4 = Other Special Status Species that could potentially occur in Placer County.

[b] Criteria

Range: The species is known to occur or is likely to occur within the HCP/PCCP study area, based on credible evidence, or the species is not currently known in the study area but is expected in the study area during the permit term(e.g., through range expansion or reintroduction to historic range.

Status: The species is either:

Listed under the federal ESA as threatened or endangered, or proposed for listing;

Listed under CESA as threatened or endangered or a candidate for such a listing, or listed under the Native Plant Protection Act as rare; or

Expected to be listed under ESA or CESA within the permit term. Potential for listing during the permit term is based on current listing status, consultation with experts and Wildlife Agency staff, evaluation of species population trends and threats, and best professional judgment.

Impact: The species or its habitat would be adversely affected by covered activities or projects that may result in take of the species.

Data: Sufficient data exist on the species' life history, habitat requirements, and occurrence in the study area to adequately evaluate these impacts on the species and to develop conservation measures to mitigate these impacts to levels specified by regulatory standards.

Species proposed for coverage in the Plan were limited to those species for which impacts from covered activities were likely, in order to provide take authorization for the highest priority species. However, many other special-status species are expected to benefit from the Plan.

Y = Sufficient data available.

N = Information on the species is limited.

Museums and Databases:

CBC = Lincoln Christmas Bird Count data from 2002

ICF file data = Unpublished reports and field notes in the files of ICF International, Sacramento, CA

MVZ = Records search (2003) of the Museum of Vertebrate Zoology, University of California, Berkeley, CA

SFAS = Unpublished Placer County field notes and data bases compiled by members of the Sierra Foothills Audubon Society, Grass Valley, CA

UCD = Records search of the Wildlife and Entomology Museums, University of California, Davis (2001)

Other Acronyms

CESA = California Endangered Species Act

ESA = Federal Endangered Species Act

Table C-2. Species Recommended for Coverage Under the HCP/NCCP

Species	Status [a]		Criteria [b]				Notes
	State	Federal	Range	Status	Impact	Data	
Invertebrates							
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	-	FT	Y	Y	Y	Y	Known to occur in study area (CNDDB 2015).
Conservancy fairy shrimp *Branchinecta conservatio*	-	FE	Y	Y	Y	Y	One record in study area (CNDDB 2015).
Vernal pool fairy shrimp *Branchinecta lynchi*	-	FT	Y	Y	Y	Y	Known to occur in study area. (CNDDB 2015).
Vernal pool tadpole shrimp *Lepidurus packardi*	-	FE	Y	Y	Y	Y	Known to occur in study area (CNDDB 2015).
Fish							
Steelhead - Central Valley Distinct Population Segment *Oncorhynchus mykiss irideus*	-	FT	Y	Y	Y	Y	Known to occur in multiple locations in study area (ICF file data).
Chinook salmon - Central Valley fall/late fall-run Evolutionarily Significant Unit *Oncorhynchus tshawytscha*	SSC	NSC, FS	Y	Y	Y	Y	Known to occur in multiple locations in study area.
Reptiles							
Giant gartersnake *Thamnophis gigas*	ST	FT	(Y)	Y	Y	Y	An individual was collected in 1923 near Loomis (MVZ 2003); not currently known to occur in Placer County but occurs nearby (CNDDB 2015).
Western pond turtle *Emys marmorata*	SSC	FS, LS	Y	Y	Y	Y	Known to occur in numerous locations in the study Phase I Planning Area.
Amphibians							
Foothill yellow-legged frog *Rana boylii*	CT, SSC	FS, LS	Y	Y	Y	Y	Historic range includes the plan area, particularly the American River watershed, however no known occurrences of the species have been observed in the plan area. Most recent records from Tahoe National Forest, Bear River, Middle Fork American River, and North

Species	Status [a]		Criteria [b]				Notes
	State	Federal	Range	Status	Impact	Data	
							Fork American River. There are no records from the Phase I Planning Area (CNDDB 2015).
California red-legged frog *Rana draytonii*	SSC	FT	Y	Y	Y	L	Three occurrences in study area. The Auburn area population is considered extirpated. The 3 occurrences are in one population in Michigan Bluff, near Foresthill. (Jennings and Hayes 1994; CNDDB 2015).
Birds							
Swainson's hawk (nesting) *Buteo swainsoni*	ST	LS, MBTA, BCC	Y	Y	Y	Y	Numerous recent nesting records in the Phase I Planning Area, from the vicinity of Roseville, Elverta, and Wheatland (CNDDB 2015). Numerous occurrences have been observed in the plan area by eBird participants (eBird Data 2013).
California black rail *Laterallus jamaicensis coturniculus*	ST, FP	LS, MBTA, BCC	Y	Y	Y	Y	Known to occur occasionally in study area. Three occurrences observed during the Lincoln CBC in 2011, and several occurrences have been documented by eBird participants (eBird data 2013). In addition, University of California research teams discovered individuals in Lincoln and northwest Placer County.
Burrowing owl (burrow sites and some wintering sites) *Athene cunicularia*	SSC	LS, MBTA, BCC	Y	Y	Y	Y	Four occurrences in western Placer County. (CNDDB 2015). A breeding pair was at Doty Ravine Preserve Species. Ten occurrences observed during Lincoln CBC 2002–2012. Three occurrences observed in Roseville by eBird participants (eBird Data 2013).
Tricolored blackbird *Agelaius tricolor*	CE, SSC	LS, MBTA, BCC	Y	Y	Y	Y	Known to breed in area. Numerous occurrences documented during the Lincoln CBC 2002–2012. Numerous occurrences have been observed in the plan area by eBird participants (eBird Data 2013).The local population has experienced a decline.

[a] Status definition:

Federal

- = No listing
BCC = U.S. Fish and Wildlife Service Bird of Conservation Concern.
FE = Listed as Endangered under the federal Endangered Species Act.
FS = Considered a sensitive species by the U.S. Forest Service.
FT = Listed as Threatened under the federal Endangered Species Act.
LS = Considered a sensitive species by the U.S. Bureau of Land Management.
MBTA = Migratory Bird Treaty Act. Fully protected from take by the U.S. Fish and Wildlife Service
NSC = Considered a Species of Concern by the National Marine Fisheries Service

State

- = No listing or special status.
CE = Candidate for listing as Endangered under the California Endangered Species Act.
CT = Candidate for listing as Threatened under the California Endangered Species Act.
FP = Fully protected under the California Fish and Game Code.
SSC = Considered a Species of Special Concern by the California Department of Fish and Wildlife.
ST = Listed as threatened under the California Endangered Species Act.

[b] Criteria

Range: The species is known to occur or is likely to occur within the HCP/PCCP study area, based on credible evidence, or the species is not currently known in the study area but is expected in the study area during the permit term (e.g., through range expansion or reintroduction to historic range.

Status: The species is either:

Listed under the federal ESA as threatened or endangered, or proposed for listing;

Listed under CESA as threatened or endangered or a candidate for such a listing, or listed under the Native Plant Protection Act as rare; or

Expected to be listed under ESA or CESA within the permit term. Potential for listing during the permit term is based on current listing status, consultation with experts and Wildlife Agency staff, evaluation of species population trends and threats, and best professional judgment.

Impact: The species or its habitat would be adversely affected by covered activities or projects that may result in take of the species.

Data: Sufficient data exist on the species' life history, habitat requirements, and occurrence in the study area to adequately evaluate these impacts on the species and to develop conservation measures to mitigate these impacts to levels specified by regulatory standards.

Species proposed for coverage in the Plan were limited to those species for which impacts from covered activities were likely, in order to provide take authorization for the highest priority species. However, many other special-status species are expected to benefit from the Plan.

Y = Sufficient data available.

L = Information on the species is limited.

Museums and Data Bases:

CBC = Lincoln Christmas Bird Count data, 2002–2012

ICF file data = Unpublished reports and field notes in the files of ICF International, Sacramento, CA

MVZ = Records search (2003) of the Museum of Vertebrate Zoology, University of California, Berkeley, CA

References

Written References

California Department of Fish and Game. 2010. A Status Review of the California Tiger Salamander (Ambystoma californiense). Wildlife Branch, Nongame Wildlife Program Report. January 11. Report to the Fish and Game Commission. Sacramento, CA. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=21754&inline

CNDDB: California Department of Fish and Wildlife. 2015. California Natural Diversity Database, RareFind 5, Bios Viewer 5.35.16. (December 4, 2015). Sacramento CA.

eBird. 2013. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available http://www.ebird.org. Accessed: 2013.

Erman, N. A. 1994. Factors affecting the distribution of a new species of Allomyia (Trichoptera: Apataniidae) in cold springs of the Sierra Nevada, California, USA in The Proceedings of the 8th International Symposium on

Erman, N. A., and D. C. Erman. 1995. Spring Permanence, Trichoptera Species Richness, and the Role of Drought. J. Kansas Entomological Soc., 68(2) suppl.. pp. 50-64.

Jennings, M.R., and M.P. Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. California Department of Fish and Game. Available: http://www.elkhornsloughctp.org/uploads/files/1401225720%2382%20%3D%20Jennings%20and%20Hayes.pdf. Accessed: 2013.

Opler, P. A., H. Pavulaan, and R. E. Stanford (coordinators). 1995. Butterflies of North America. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bflyusa.htm (Version 30DEC2002).

Trichoptera, pp. 89–93 (Ohio Biological Survey).

Verner, J. and A. S. Boss. 1980. California wildlife and their habitats: western Sierra Nevada. Gen. Tech Report. PSW-37. Pacific Southwest Range Exp. Station., U.S. Forest Service, Department of Agriculture, Berkeley, CA

Webb, B. 2003. Seasonal checklist of the Birds of Placer County. Unpublished document.

Zeiner, D. C., W. F. Laudenslayer, Jr., K. E. Mayer, and M. White. 1990. California's Wildlife. Volume I: Reptiles and amphibians; Volume II: Birds; Volume III: Mammals. California Department of Fish and Game, Sacramento, CA.

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Appendix D

Species Accounts/Envirograms

Appendix D. Species Accounts

February 2020

The species accounts provide a summary of the biology of the Covered Species addressed in the Placer County Conservation Program, Western Placer County HCP/NCCP:

Birds
1. Swainson's hawk
2. California black rail
3. Western burrowing owl
4. Tricolored blackbird

Reptiles
5. Giant garter snake
6. Western pond turtle

Amphibians
7. Foothill yellow-legged frog
8. California red-legged frog

Fish
9. Steelhead
10. Chinook salmon

Invertebrates
11. Valley elderberry longhorn beetle
12. Vernal pool fairy shrimp
13. Vernal pool tadpole shrimp
14. Conservancy fairy shrimp

Each species account contains a description, an envirogram, and a map of the species occurrence and modeled habitat in Western Placer County.

The description typically presents information on:

Regulatory Status
Distribution
Population status and trends Natural
history
Threats
Context for a regional conservation strategy Modeled
species distribution in the Plan Area References

The envirograms use a flowchart to show the most important ecological factors that affect a population or group of populations of a particular species. See description below.

The maps show known occurrence records and modeled potential habitat. The occurrence data and the methodology for habitat modeling is described in Chapter 3, Section 3.3.2 *Covered Species*. Most Covered Species are associated with one or more land cover types. Land cover associations and spatial habitat features (e.g., elevation, proximity to other land cover types) were used to develop habitat distribution models. The models are an approximation: not all of a land cover type will include the specific habitat requirements for a species, and conversely, habitat may be present in small-scale landscape features that were not mapped.

Envirograms

Envirograms were created for each species from the information contained in the species accounts. The envirograms are included as a component of the Covered Species accounts at the recommendation of the Report of the Science Advisors for the Placer County Natural Communities Conservation Plan and Habitat Conservation Plan, *Planning Principles, Uncertainties, and Management Recommendations*, January 8, 2004. The envirograms were prepared under the direction of Peter Brussard, PhD, University of Nevada, Reno, chairman of the science advisors. The following description is adapted from that report:

An envirogram is a tool that sharpens our understanding of the most important ecological factors that affect a population or group of populations of a particular species. The concept was developed originally by Andrewartha and Birch (1984), and envirograms were first applied to conservation planning by James et al. (1997) who used them to identify factors limiting the abundance of endangered Red-cockaded Woodpeckers in the southeastern United States. The version described below is modified somewhat from these previous applications.

An envirogram consists of a "centrum," components of the environment that directly affect a species' chances to survive and reproduce, and several "webs," distal factors that act in sequence to affect the proximate components of the centrum. The centrum consists of four major categories, resources, reproduction, hazards, and dispersal. Each of these can be subdivided as necessary. For example, resources could be subdivided into foraging habitats, breeding habitats, and food; reproduction could be divided into finding mates, nesting, and fledging. Hazards can be divided into predators (an animal that consumes the subject species in whole or part) and "malentities" (organisms or events that can adversely influence the subject species in other ways such as a cow stepping on a dispersing western spadefoot or the premature drying of a vernal pool). Dispersal also can be subdivided since it can occur at different times in a species' life cycle and it can be either local (such as moving from one habitat type another) or long-distance.

The web identifies the underlying ecological processes or human actions that influence each centrum component. The idea is that distal factors in the web flow in to activate proximate components of the centrum. Each of these flows is called a pathway. Pathways in the web are constructed from right to left, with Web-1 factors directly affecting centrum components, Web-2 factors affecting Web-1 factors, and so on. It is usually unnecessary to have more than three webs to track a centrum component along a pathway to its ultimate underlying influence.

A web factor can have both positive and negative aspects. For example, precipitation is critical to vernal pools. Too little rain results in pools that dry up before their dependent species can complete their life cycles, but greater than average rainfall can result in flooding and dispersal of individuals among pools—an event necessary for gene flow and to replenish dwindling populations.

The centrum components of the envirograms should be accurate reflections of the information in the species profiles, and the web pathways should be logical linkages of indirect environmental components to the proximate drivers of population processes in the centrum. Envirograms are not intended to be stand-alone documents but should be used in conjunction with species profiles and maps showing the distribution of populations and suitable habitat. They are considered to be "works in progress" and always can be modified by new and better information.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Swainson's Hawk

(*Buteo swainsoni*)

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http://sierrabirdbum.com

Status

Federal: Bird Species of Conservation Concern; Federal Migratory Bird Treaty Act

State: Threatened

Critical Habitat: Not Applicable (N/A)

Recovery Plan: N/A

Distribution

North America

Swainson's hawk inhabits grasslands, sage-steppe plains, and agricultural regions of western North America during the breeding season and winters in grassland and agricultural regions from Central Mexico to southern South America (Woodbridge et al. 1995a; Bechard et al. 2010). The North American breeding range extends north from California to British Columbia east of the Sierra Nevada and Cascade Ranges, east to Saskatchewan, and south to northern Mexico (Bechard et al. 2010). Small numbers also breed in interior valleys of British Columbia (Campbell et al. 1990 as cited in Bechard et al. 2010). Several disjunct populations occur throughout the breeding range; these include populations in Alaska, western Missouri, and the Sacramento and San Joaquin Valleys, as well as the valleys of the Sierra Nevada, in California (Bechard et al. 2010).

Swainson's hawk is a long distance migrant. The majority of the population winters in South America, primarily on the Argentine pampas. It appears, however, that the California population is distinctive in that it winters in Mexico, Central America, and Columbia, although a few have been discovered spending a portion of the winter in the Sacramento–San Joaquin Delta in the last decade (Bechard et al. 2010). They are also regular, but uncommon, in Florida in the winter (Bechard et al. 2010).

California

In California, the nesting distribution includes Great Basin sage-steppe communities and associated agricultural valleys in extreme northeastern California, isolated valleys in the Sierra Nevada in Mono and Inyo Counties, the Sacramento and San Joaquin valleys, and at least one known isolated breeding site in the Mojave Desert. The majority of Swainson's hawks in California nest in Sacramento, San Joaquin, and Yolo counties with Solano, Merced, Stanislaus, Sutter, Glenn, and Colusa counties all important to the central range of the bird (Bradbury 2009). Also important are the Swainson's hawks found in Owens Velley and Klamath Basin, though these are considered part of the Great Basin population since they nest east of the Sierra crest (Bradbury 2009). The historic breeding distribution also included much of southern California, particularly the inland valleys, where the species was once considered common (Sharp 1902; Bent 1937; Bloom 1980). Breeding populations in California have been extirpated or are

nearly extirpated from coastal southern California, the Mojave Desert, and the central Coast Ranges (Bloom 1980).

Placer County Plan Area

Historical

Suitable habitat for Swainson's hawk is limited to extreme western Placer County, where breeding habitat was probably limited to very large openings in oak woodland/savanna and riparian corridors along Auburn Ravine and Coon Creek.

Current

Swainson's hawk nests and forages primarily in the valley portion of the Plan Area, below 400 feet elevation. Swainson's hawk has a very patchy distribution in western Placer County. There are seventeen relatively recent records (one in 1996, the rest between 2001 and 2014) of nesting in the Plan Area (CNDDB 2015; Moeszinger 2014).

Population Status & Trends

North America

Partners in Flight estimated 460,000 Swainson's hawks in North American (Rich et al. 2004). As many as 845,000 migrants have been counted over Panama City, Panama, during migration. Population declines have been noted in several portions of the species' range, and the current range-wide population is likely reduced from historic times (Bechard et al. 2010).

California

Early accounts described Swainson's hawk as one of the most common nesting raptors in California, occurring throughout much of lowland California (Sharp 1902). Bloom (1980) estimated as many as 17,136 pairs of Swainson's hawks historically nested in California. Knowledge that an estimated 91% decline in the breeding population had occurred (Bloom 1980) led the California Fish and Wildlife[1] to designate the Swainson's hawk as threatened in 1983 (Estep 1989). Since the mid-1800s, native habitats have undergone a gradual conversion to agricultural use. Today, few native grasslands remain in the state, and only remnants of the formerly extensive riparian forests and oak woodlands still exist (Katibah 1983). This habitat loss has caused a substantial reduction in the breeding range and the size of the breeding population in California (Bloom 1980; Bechard et al. 2010). Swainson's hawk is also sensitive to habitat fragmentation (Estep and Teresa 1992).

The state supported 1,770 – 2,393 breeding pairs in 2005 and 2006, with about 95% of the state's population breeding in the Central Valley (Anderson et al. 2007). Breeding populations in California have

[1] As of January 1, 2013, the California Department of Fish and Game (CDFG) was renamed the California Department of Fish and Wildlife. When this document cites reports prepared by the Department prior to 2013, the reference includes the prior department name of CDFG. Both CDFW and CDFG refer to the same agency.

been extirpated or are nearly extirpated from coastal southern California, the Mojave Desert, and the central Coast Ranges (Bloom 1980).

Populations in California appear relatively stable since 1980, based on nesting records alone. However, continued agricultural conversion and practices, urban development, and water development have reduced available habitat for Swainson's hawk throughout the range in California, thereby potentially contributing to a long-term declining trend. The status of populations, particularly with respect to juvenile survivorship, remains unclear.

Placer County Plan Area

Information on Swainson's hawk in western Placer County is limited. There are seventeen relatively recent records of Swainson's hawk nesting in western Placer County based on California Department of Fish and Game surveys. There is no information on trends in Swainson's hawk populations in western Placer County.

Natural History

The habitat requirements, ecological relationships, life history, and threats to Swainson's hawk described below are summarized in diagram form in Envirogram 1 Swainson's Hawk.

Habitat Requirements

Swainson's hawk is typically present in California from early March, when individuals arrive on breeding grounds, through mid-October, when birds have departed for wintering grounds in Central and South America. In California, Swainson's hawk habitat generally consists of large, flat, open, undeveloped landscapes that include suitable grassland or agricultural foraging habitat and sparsely distributed trees for nesting (Bechard et al. 2010).

Swainson's hawk usually nests in large, native trees such as valley oaks (*Quercus lobata*), cottonwoods (*Populus fremontia*), and willows (*Salix* spp.), although nonnative trees such as eucalyptus (*Eucalyptus* spp.) are also used (Bechard et al. 2010). Nests occur in riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, trees in windbreaks, and on the edges of remnant oak woodlands (Bechard et al. 2010). Nesting areas are within easy flying distance to alfalfa or hay fields. In some Central Valley locales, urban nest sites have also been recorded (England et al. 1995) and a small number of nests have been reported on human-built structures, such as power poles or transmission towers (James 1992). Stringers of remnant riparian forest along drainages contain the majority (87%) of known nests in the Central Valley (England et al. 1995; Schlorff and Bloom 1984). In the Sacramento Valley and Sacramento River Delta in California, most nests were recorded on the flat valley floor (e.g., Yolo, Sacramento, San Joaquin, and Solano counties), with fewer nests located along the margins of the valley (Gifford et al. 2012). Searches for nests above 500 feet in elevation located only a single Swainson's hawk nest (Gifford et al. 2012). Nests are constructed using materials from the nest tree or nearby trees, are up to 24 inches in diameter, and are usually constructed as high as possible in the tree, providing optimal protection and visibility from the nest (Bechard et al. 2010). Nests appear more flimsy or ragged than that of other buteos (Bechard et al. 2010). Some nests are used for more than one year by the same pair or refurbished nests of other Swainson's hawks or avian species (e.g., American crow [*Corvus brachyrhynchos*], common raven [*Corvus corax*], black-billed magpie [*Pica pica*]); however, the majority of nests are likely freshly built (Fitzner 1978; Bechard et al. 2010).

Populations in the Great Basin often use juniper trees (*Juniperus* sp.) for nesting (Bechard et al. 2010), and at least three known nest sites in the Mojave Desert are in Joshua trees (*Yucca brevifolia*) (CNDDB 2015).

Nesting pairs in California have high fidelity to nesting territories and nesting trees (Fitzner 1980; Bechard et al. 2010). Many nest sites in the Sacramento Valley have been occupied annually since 1979 (Estep in prep.), and banding studies conducted since 1986 confirm a high degree of nest and mate fidelity (Estep in prep.).

Swainson's hawk requires wide-open landscapes for foraging. Historically, the species used grass-dominated and desert habitats throughout most of lowland California. Over the past century, conversion of much of the historic range to agricultural use has shifted the nesting distribution into open agricultural areas that mimic grassland habitats or otherwise provide suitable foraging habitat. Agricultural uses that provide suitable foraging habitat include a mixture of alfalfa and other hay crops, grain, row crops, and lightly grazed pasture with low-lying vegetation that support adequate rodent prey populations (Estep 1989; Bechard et al. 2010).

Telemetry studies have demonstrated that individual Swainson's hawks may require in excess of 15,000 acres of foraging habitat or range up to 18 miles from their nest in search of prey (Estep 1989). Other estimates indicate that under optimal conditions, individual nesting pairs require a minimum of approximately 741 acres of suitable foraging habitat; however, foraging ranges are geographically and temporally variable and are dependent largely on cover type and phenology and their relationship to prey availability (Fitzner 1978; Bechard 1982; Estep 1989; Babcock 1995). Agricultural landscapes that consist of a variety of seasonal crops with different planting, growth and harvest regimes, along with a patchwork of perennial cover types (e.g., alfalfa, irrigated pasture, annual grasslands) provide a relatively constant source of suitable foraging habitat for Swainson's hawks throughout the season (Estep 2009). Research in the Central Valley funded by the California Department of Fish and Wildlife identified the following preferred foraging habitats (Estep 1989).

1. Alfalfa: provides a relatively low abundance of prey at a steady rate of accessibility throughout the breeding season (March to September).
2. Fallow fields: provide a high abundance of accessible prey if such fields are not dominated by dense stands of thistle and other weedy vegetation.
3. Beet and tomato fields: provide the largest prey populations, but dense cover reduces accessibility of prey to foraging Swainson's hawk, except during harvesting operations when Swainson's hawk has been observed foraging almost exclusively in these fields (late-July to early-September).
4. Dry-land pasture: may provide primary foraging habitat for some individuals.
5. Irrigated pasture: provides suitable foraging habitat, especially during flooding.

Habitats unsuitable for foraging include any crop where prey are not available due to the high density of vegetation, or have low abundance of prey (i.e., flooded rice fields, mature corn, orchards, and cotton fields).

Reproduction

Most birds apparently do not breed until they are at least 3 years of age (J.K. Schmutz pers. comm. as cited in Bechard et al. 2010). In the Central Valley, Swainson's hawk arrives on the breeding grounds from early March to early April, significantly earlier than most other populations (Bechard et al. 2010). Pair bonding begins immediately and involves courtship displays, reestablishment of territorial boundaries, and nest construction or repair (Bechard et al. 2010). One to four eggs are usually laid in early to mid-April, and incubation continues for 34–35 days until mid-May when young begin to hatch. The brooding period typically continues through early to mid-July when young begin to fledge (Bechard et al. 2010). Nestlings fledge on average at 43 days (range 38–46 days) (Olendorff 1973; Fitzner 1978; Bechard et al. 2010). Studies conducted in the Sacramento Valley indicate that one or two (occasionally three) young typically fledge from successful nests, with an average of 1.6 young per successful nest (England et al. 1995; Estep in prep.). Reproductive success in California was found to be inversely correlated with distance to suitable foraging habitat (Woodbridge 1991; England et al. 1995). After fledging, young remain near the nest and are dependent on the adults for approximately 4 weeks, after which they permanently leave the breeding territory (Anderson et al. in prep.). By mid-August, breeding territories are no longer defended, and Swainson's hawks begin to form premigratory communal groups.

Dispersal Patterns

Woodbridge et al. (1995b) noted an average dispersal distance of 5.5 miles between natal sites and subsequent breeding sites in northeastern California. However, during the study period, one bird bred approximately 23 miles from its' natal site. In the Sacramento Valley, two birds banded as nestlings and subsequently resighted as breeding adults nested within 2.2 miles of their natal site (Estep 1989). Much greater dispersal distances from natal sites have been observed in other parts of the range, most notably distances up to 193 miles in Saskatchewan (Houston and Schmutz 1995). Briggs et al. (2012) found that natal dispersal in their study ranged from 0.6 to 17 miles for males and 0.1 to 28 miles for females. Therefore, female Swainson's hawks were found to disperse significantly farther than males (Briggs et al. 2012). Natal dispersal was negatively correlated with primary productivity and positively correlated with population density around the nest site (Briggs et al. 2012).

A high degree of nest site fidelity has been noted in Swainson's hawk in California. Individuals often use the same nest, the same tree, or a nearby tree in subsequent years (Fitzner 1980; Bechard et al. 1980). In the Sacramento Valley, mean inter-territory adult movement was approximately 328 feet (Estep in prep.). Less nest site fidelity was noted in northeastern California, where mean inter-territory movements between 1984 and 1994 were 1.4 miles (Woodbridge et al. 1995b).

Home range size of breeding adults varies greatly (Bechard et al. 2010). Larger home ranges are found in areas with crop types unsuitable for foraging, such as mature grains and row crops, orchards, and vineyards (Bechard 1982; Estep 1989). The smallest home ranges were reported at nest sites near alfalfa, fallow fields, and dry pastures (Bechard 1982; Estep 1989; Woodbridge 1991). A telemetry study to determine foraging requirements has shown that Swainson's hawks may forage up to 19 miles from the nest site and may use in excess of 15,000 acres habitat for foraging (Estep 1989). Home range size fluctuates throughout the breeding season as the foraging landscape changes (Estep 1989; Estep 2009).

Longevity

Very limited data are available on Swainson's hawk survivorship. In northeastern California, the mean age for hawks banded as nestlings in 1980–1992 and observed in 1993–1994 was 8.2 years (n = 36)

(Woodbridge et al. 1995b). In the Sacramento Valley, the mean age for hawks banded as nestlings in 1980 and observed in 1988–1995 was 8.8 years (n = 5); the oldest was 13 years (Estep in prep.). The oldest male in the banding records to date was a male banded by Peter Bloom in California and retrapped by Brian Woodbridge 24 years later; the longest-lived female was at least 21 years old, having been banded at the age of 2 (Bechard et al. 2010). Distance to agriculture and amount on agriculture in a territory are good predictors of apparent survival for Swainson's hawks (Briggs et al. 2011). Individuals that nested farther from agriculture had decreased nest success, suggesting that the further individuals had to travel for prey the greater the energetic costs incurred. Amount of agriculture in a territory was positively correlated with annual apparent survival (Briggs et al. 2011). Increased agriculture (particularly alfalfa) likely provides increased foraging opportunity and capture success, allowing individuals to spend less time foraging and more time engaged in activities that enhance survival (e.g., caloric intake, resting, ectoparsite removal) (Briggs et al. 2011).

Sources of Mortality

There is no information on predation of adult Swainson's hawks; however, adults have been reported to be killed on highways, shot, or killed in collisions with vehicles (Bechard et al. 2010). Nestlings are susceptible to predation by great horned owl (*Bubo virginianus*), American crow, and various mammalian predators (Dunkle 1977; Woodbridge 1991; Estep in prep.). Large die-offs of adult birds have been documented in Argentina on the wintering grounds following large-scale applications of insecticides (Woodbridge et al. 1995a).

Behavior

There are no data available on the size or characteristics of breeding territories; however, it has been noted that Swainson's hawk aggressively defends the area immediately surrounding nest sites (Rothfels and Lein 1983; Janes 1984; Fitzner 1978). Outside this relatively small area they appear more tolerant, and often forage communally with conspecifics and other buteos (Bechard et al. 2010; Estep 1989). Once young have fledged, adults begin to form communal foraging and premigratory groups and exhibit little territorial behavior.

In California, home ranges are dependent largely on crop patterns and phenology, and they exhibit substantial annual and seasonal variations. Reported mean home ranges in the Central Valley range from 6,820 acres (Estep 1989) to 9,978 acres (Babcock 1995). In portions of the species' range where there is less dependence on agricultural habitats reported home ranges are smaller (Fitzner 1978; Anderson 1995).

During the breeding season, Swainson's hawk feeds primarily on small rodents, including voles (*Microtus* sp.), deer mice (*Peromyscus* sp.), house mice (*Mus musculus*), and pocket gophers (*Thomomys* sp.). Other, less frequent food items include reptiles, birds, and insects. Swainson's hawk typically forages in large fields that support low vegetative cover (to provide access to the ground) and provide the highest densities of prey (Bechard 1982; Estep 1989). In agricultural regions, these habitats include fields of hay and grain crops; certain row crops, such as tomatoes and sugar beets; and lightly grazed pasturelands. Fields lacking adequate prey populations (e.g., flooded rice fields) or those that are inaccessible to foraging birds (e.g., vineyards and orchards) are rarely used (Estep 1989; Babcock 1995).

During the breeding season, Swainson's hawk is an open-country hunter. The usual foraging technique involves searching for prey in a low-altitude soaring flight approximately 100–300 feet above the ground and attacking prey by stooping toward the ground (Estep 1989). Occasionally, Swainson's hawk hunts

from a perch (e.g., fencepost or utility pole). In agricultural habitats, foraging ranges are highly variable depending on crop patterns and crop phenology (Bechard 1982; Estep 1989). Seasonal and annual foraging ranges are dependent on changes in vegetative height and density that fluctuate with the pattern of crop maturity and harvest.

During migration, Swainson's hawks may congregate in large groups (up to 100 or more birds) (Bechard et al. 2010). During this time, Swainson's hawks feed in grasslands and harvested fields, especially where grasshoppers (*Dichroplus* spp.) are numerous. They often perch on fence posts, telephone poles, and power poles (Bechard et al. 2010). Swainson's hawks exclusively eat insects, such as grasshoppers, dragonflies (*Aeshna bonariensi*), and moths (*Lepidoptera* sp.) in winter (Woodbridge et al. 1995b). Non-breeding Swainson's hawks typically hunt communally and will run or walk to catch prey (Bechard et al. 2010).

Throughout its range, Swainson's hawk is known to exploit prey made available through ground-disturbing activities, particularly in agricultural areas. Swainson's hawk is regularly observed on the breeding and wintering grounds hunting behind farm machinery (Estep 1989). Bent (1937) first reported this phenomenon in southern California, and Caldwell (1986) later measured prey capture success.

Movement and Migratory Patterns

In California, Swainson's hawk begins fall migration from late August to late-September (Bloom 1980; Estep 1989; Bechard et al. 2010; Kochert et al. 2011). Satellite radiotelemetry studies from 1995 to 2001 have identified migratory routes, timing, and wintering grounds (Woodbridge et al. 1995a). According to these and other telemetry studies, all but the Central Valley population migrates along the eastern edge of Mexico through Central and South America and winters in the pampas region of Argentina. Unlike other populations of Swainson's hawk, the Central Valley population winters primarily in Central Mexico and, to a lesser extent, throughout portions of Central and South America (Bradbury2009). Swainson's hawks' northward migration largely follows the southward route (Bechard et al. 2010). Swainson's hawks begin migrating north from mid-February through March (Kochert et al. 2011). Southbound migrations last 42 to 98 days and northbound migrations last 51 to 82 days (Kochert et al. 2011). In California, breeding adults arrive at the nesting territory from approximately early March to early April. Courtship and nest construction begin immediately upon arrival.

Ecological Relationships

Swainson's hawk is territorial during the breeding season; however, away from the nest sites adults are more tolerant of conspecifics and other raptors. During the prenesting period, adults are highly aggressive around the nest as they reestablish their territorial boundaries. During communal foraging events and from postfledging through migration and wintering periods, adults are gregarious and tolerate conspecifics as well as other raptor species (Fitzner 1978; Estep 1989; Bechard et al. 2010). Because Swainson's hawk generally arrives at the breeding grounds later than other sympatric buteos, individuals are often engaged in congeneric battles over control of nest sites.

Threats

The loss of agricultural lands and native grasslands to various residential and commercial developments is a serious threat to Swainson's hawks throughout California (Estep 2008; Bradbury 2009). Additional threats are habitat loss caused by riverbank protection projects; conversion from agricultural crops that

provide abundant foraging opportunities to crops such as vineyards and orchards, which provide fewer foraging opportunities; shooting; pesticide poisoning of prey animals and hawks on wintering grounds; collision with stationary objects; competition from other raptors; and human disturbance at nest sites (California Department of Fish and Game 2000; Bechard et al. 2010).

Even though Swainson's hawks prey on agricultural pests, they were historically considered a varmint by many ranchers and farmers, until at least the late 1930s (Bechard et al. 2010). As a result, Swainson's hawks were often shot. Banding recoveries suggest that mortality resulting from shooting on breeding grounds has declined and may not be significant (Houston and Schmutz 1995).

Acute toxicity from poisoning by organophosphate insecticides (e.g., monocrotophos and dimethoate), used to control grasshopper outbreaks in alfalfa and sunflower fields, caused the death of nearly 6,000 Swainson's Hawks in Argentina in 1995 and 1996. Overall, an estimated 20,000 Swainson's hawks were killed in Argentina by pesticide applications. Deaths resulted immediately after hawks were sprayed directly by pesticide applicators while they foraged in fields or within several days after they ate poisoned grasshoppers (Woodbridge et al. 1995a). Since Central Valley Swainson's hawks are not known to migrate to the affected areas in Argentina, it is thought that the poisoning events did not affect this population (Bradbury 2009).

Houston and Schmutz (1995) discovered Swainson's hawks throughout the breeding, wintering, and migratory range died from collisions with stationary/moving objects or structures, such as cars, trains, powerlines, and fences.

Context for a Regional Conservation Strategy

There is little information on the distribution and density of Swainson's hawks in western Placer County. The species does nest in limited numbers in the Plan Area; since 1996, there have been seventeen active nests recorded. The species requires large, open landscapes that include suitable grassland or agricultural foraging habitat and sparsely distributed trees for nesting. In the region, Swainson's hawk is found primarily to the west of Placer County in the Sacramento and Central Valleys, which represents the greatest distribution of the species in California. Records of the bird are absent from counties directly north and south of Placer County, such as Nevada and El Dorado counties. The species has also been recorded to a lesser extent in the north in Siskiyou, Modoc and Lassen counties, and to the south in Mono and Inyo counties. As records of Swainson's hawk are abundant in counties west of Placer County, the population within the Plan Area is not of particular significance statewide. However, as the species is limited in its nesting distribution in western Placer County, and as nest fidelity is common, protection of individual nesting sites is of high priority in the conservation of Swainson's hawk. Also of conservation priority within the Plan Area is acquiring suitable foraging habitat.

Modeled Species Distribution in the Plan Area

Model Assumptions

Nesting Habitat

Swainson's hawk nesting habitat includes riverine/riparian, valley oak woodland, and eucalyptus land-cover types in the Valley floor below 200 feet elevation. The nesting habitat model does not capture

single or small patches of trees, which is potentially suitable nesting habitat when it occurs amongst suitable foraging habitat.

Foraging Habitat

Swainson's hawk foraging habitat is defined by vernal pool complex, annual grassland, pasture, alfalfa, irrigated pasture and row crop land-cover types. Foraging habitat is also restricted to the Valley floor (< 200 feet elevation).

Rationale

In the Central Valley, Swainson's hawks generally nest in open terrain in large, native trees such as valley oaks, cottonwoods, and willows, although nonnative trees such as eucalyptus are also used. Nests occur in riparian woodlands and the edges of remnant oak woodlands. Swainson's hawks also nest in isolated, large, sparsely distributed trees along field borders in other open land-cover types such as annual grassland, along roadsides and agricultural fields. Potential nest sites that occur in isolated stands or individual trees in open terrain (e.g., grasslands, agricultural lands) are not captured in the habitat model as their spatial extent is considerably smaller than the corresponding land-cover mapping unit. Consequently, this model may not encompass every nesting site; however, the extent of nesting habitat not captured by the model is relatively small compared to the extent of nesting habitat that is captured by the model.

Foraging generally occurs within 10 miles of active nest sites; however, as nest site locations will vary throughout the 50 year term of the permit, foraging habitat was modeled to include suitable land-cover types throughout the entire area in the Valley floor (< 200 feet elevation) encompassed by these land-cover types.

Model Results

Species Map 1. *Swainson's Hawk Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for Swainson's hawk within the Plan area. Modeled nesting habitat is primarily restricted to valley foothill riparian along the Bear River, Coon Creek, Markham Ravine, Auburn Ravine, Pleasant Grove Creek, and Dry Creek. Scattered, open-canopy woodlands (i.e., valley oak woodland, oak woodland savanna, rural residential, and eucalyptus groves) comprise the remaining modeled nesting habitat. Many other sites throughout the Valley landscape may also provide suitable nesting habitat in the form of small woodlands and isolated trees. These areas, however, could not be identified in this model because these small-scale features were not mapped. In some cases, precise locations of nests did not occur on modeled primary habitat because the nest trees were likely isolated and not mapped as part of a primary habitat land-cover type.

References

Anderson, D. A., J. Dinsdale, and J. A. Estep. In preparation. Movements, behavior, and post-fledging dependency of juvenile Swainson's hawks in the Central Valley of California.

Anderson, D. E. 1995. Productivity, food habits, and behavior of Swainson's hawks breeding in southeast Colorado. *Journal of raptor research* 29:158–165.

Anderson, R. L., J. L. Dinsdale, and R. Schlorff. 2007. California Swainson's Hawk Inventory: 2005–2007. Final Report. Department of Fish and Game Resource Assessment Program, California Department of Fish and Game. Sacramento, CA, U.S.A.

Babcock, K. W. 1995. Home range and habitat use of breeding Swainson's hawks in the Sacramento Valley of California. *Journal of raptor research* 29:193–197.

Bechard, M. J. 1982. Effect of vegetative cover on foraging site selection by Swainson's hawk. *Condor* 84:153–159.

Bechard, M.J., C. Stuart Houston, Jose H. Sarasola, and A. S. England. 2010. Swainson's hawk (*Buteo swainsoni*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab Ornithology; Retrieved from Birds of North America Online: http://bna.birds.cornell.edu.oca.ucsc.edu/bna/species/265. Accessed September 2015.

Bent, A. C. 1937. L*ife histories of North American birds of prey* (part 1). Bulletin of the U.S. National Museum 167.

Bloom, P. H. 1980. The status of the Swainson's hawk in California. Project Report W-54-R-12. Sacramento, CA: California Department of Fish and Game, Nongame Wildlife Investigations.

Bradbury, M.D. 2009. Friends of the Swainson's hawk conservation strategy for Swainson's hawks in California. Sacramento, California.

Briggs, C.W., B. Woodridge, M.W. Collopy. 2011. Correlates of survival in Swainson's hawks breeding in northern California. The Journal of Wildlife Management 75(6): 1307-1314.

Briggs, C.W., M.W. Collopy, and B. Woodridge. 2012. Correlates and fitness consequences of natal dispersal in Swainson's hawks. The Condor 114(4): 764-770.

Caldwell, L. K. 1986. Predatory bird behavior and tillage operations. *Condor* 88:93–94.

California Department of Fish and Game. 2000. The Status of rare, threatened, and endangered animals and plants in California. Swainson's Hawk. Available at: http://www.dfg.ca.gov/hcpb/species/jsp/ssc_result.jsp?specy=birds&query=Buteo%20swainsoni.

California Natural Diversity Database. 2015. RareFind , Version 3.1.0. (October, 2015). Sacramento, CA: California Department of Fish and Wildlife.

Dunkle, S. W. 1977. Swainson's hawks on the Laramie Plains, Wyoming. *Auk* 94:65–71.

England, A. S., J. A. Estep, and W. R. Holt. 1995. Nest-site selection and reproductive performance of urban-nesting Swainson's hawks in the Central Valley of California. *Journal of Raptor Research* 19:179–186.

Estep, J. A. 1989. Biology, movements, and habitat relationships of the Swainson's hawk in the Central Valley of California, 1986–1987. Sacramento, CA: California Department of Fish and Game, Nongame Bird and Mammal Section.

_____. In preparation. Ecology of the Swainson's hawk in the Central Valley of California.

Estep, J.A. 2009. The influence of vegetation structure on Swainson's hawk (*Buteo swainsoni*) foraging habitat suitability in Yolo County, California. Sacramento, California.

Estep, J. A., and S. Teresa. 1992. Regional conservation planning for the Swainson's hawk (*Buteo swainsoni*) in the Central Valley of California. Pages 775–789 in D. R. McCullough and R.H. Barrett (eds.), *Wildlife 2001: populations*. New York: Elsevier Applied Science.

Fitzner, R. E. 1978. Behavioral ecology of the Swainson's hawk (*Buteo swainsoni*) in southeastern Washington. Ph.D. dissertation, Washington State University, Pullman.

Gifford, D.L., P.S. Hofmann, A.A. Truex, and D.H. Wright. 2012. Monitoring distribution and abundance of nesting Swainson's hawks in the Sacramento Valley and Sacramento River Delta, California. California Fish and Game 98(1): 7-18.

Houston, C. S., and J. K. Schmutz. 1995. Declining reproduction among Swainson's hawks in prairie Canada. *Journal of Raptor Research* 29:198–201.

James, P.C. 1992. Urban-nesting of Swainson's hawks in Saskatchewan. The Condor 94 : 773-774.

Janes, S. W. 1984. Influences of territory composition and interspecific competition on red-tailed hawk reproductive success. *Ecology* 65:862–870.

Katibah, E. F. 1983. A brief history of riparian forests in the Central Valley of California. Pages 23–29 in R. E. Warner, and K.M. Hendrix (eds), *California riparian systems: ecology, conservation, and productive management*. Berkeley, CA: University of California Press.

Kochert, M.N., M.R. Fuller, L.S. Schueck, L. Bond, M.J. Bechard, B. Woodbridge, G.L. Holroyd, M.S. Martell, and U. Banasch. 2011. Migration patterns, use of stopover areas, and austral summer movements of Swainson's hawks. The Condor 113(1): 89-106.

Olendorff, R. R. 1973. The ecology of the nesting birds of prey of northeastern Colorado. USIBP Grassland Biome Technical Report No 211.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, Panjabi, A.O., D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website. http://www.partnersinflight.org/cont_plan/ (VERSION: March 2005).

Rothfels, M., and M. R. Lein. 1983. Territoriality in sympatric populations of red-tailed and Swainson's hawks. *Canadian Journal of Zoology* 61:60–64.

Schlorff, R., and P. H. Bloom. 1984. Importance of riparian systems to nesting Swainson's hawks in the Central Valley of California. Pages 612–618 in R. E. Warner and K.M. Hendrix (eds.), *California riparian systems: ecology, conservation, and productive management*. Berkeley, CA: University of California Press.

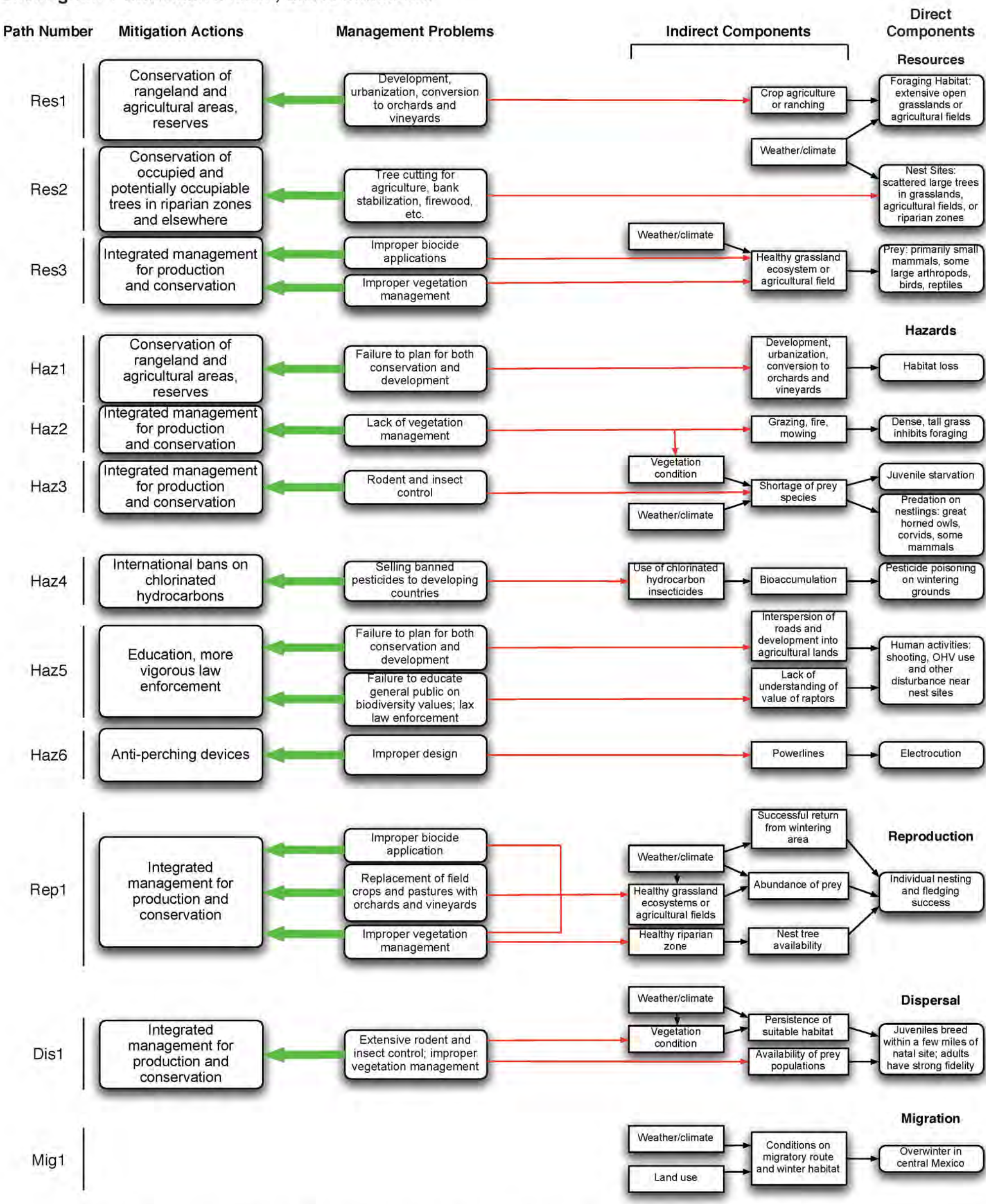
Sharp, C. S. 1902. Nesting of Swainson's hawk. *Condor* 4:116–118.

Woodbridge, B. 1991. Habitat selection by nesting Swainson's hawk: a hierarchical approach. M.S. thesis, Oregon State University, Corvallis.

Woodbridge, B., K. K. Finley, and S. T. Seager. 1995a. An investigation of the Swainson's hawk in Argentina. *Journal of Raptor Research* 29(3):202–204.

Woodbridge, B., K. K. Finley, and P. H. Bloom. 1995b. Reproductive performance, age structure, and natal dispersal of Swainson's hawks in the Butte Valley, California. *Journal of Raptor Research* 29:187–192.

Envirogram 1 Swainson's hawk, *Buteo swainsoni*



Envirogram 1 Swainson's Hawk. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal; Mig = Migration.

Envirogram Narrative

Swainson's Hawk (*Buteo swainsoni*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary. For example, resources are subdivided into foraging habitat, nest sites, and prey.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Swainson's hawks rely upon extensive grasslands or agricultural fields for foraging habitat. In Placer County, this habitat is provided largely by cropland, annual grassland, and pasture. Various types of development and the conversion of fields and pastures to orchards and vineyards has diminished habitat for the hawk. Policies favorable to agricultural conservation help mitigate this loss.

Res2: Swainson's hawks nest in scattered large trees, mostly on the edges of riparian zones in Placer County. Cutting of trees for firewood, lumber, or other purposes diminishes the number of nest sites available; occupied and potential nest trees must be protected. Weather conditions and climate trends link both to foraging habitat and nest sites.

Res3: Swainson's hawks prey primarily on small mammals, although other small vertebrates and large insects are also taken. Favorable weather and healthy grasslands or agricultural fields are necessary for sufficient prey items to be available and improper vegetation management or excessive biocide application diminishes prey items. Management plans that integrate both agriculture and conservation must be developed.

Hazards

Haz1: Loss of rangeland and agricultural areas to residential and commercial development is probably the major reason that Swainson's hawks are in decline on the breeding grounds. Poor planning in the past can be mitigated to some extent by reserves and conservation of agricultural lands.

Haz2: In the absence of burning or grazing, grass growth makes fields unsuitable for foraging by Swainson's hawk, so vegetation management, such as livestock grazing at the proper time and intensity, is necessary.

Haz3: Adult Swainson's hawks are preyed upon rarely, but starvation and predators may kill nestlings and juveniles. Nest predators include great horned owls, crows and other corvids, and some mammals.

Healthy rodent populations provide alternate prey for these species and thereby lessen predation pressure on Swainson's hawk nestlings as well as help prevent starvation in young hawks. Good vegetation condition and favorable weather, along with management designed for both agricultural production and conservation, can maintain a healthy prey base.

Haz4: Swainson's hawks may be poisoned by or accumulate pesticides on their wintering ground (see dispersal and migration section), although this has not been definitively shown for the California population that winters in central Mexico. While this hazard cannot be controlled by the Placer County Conservation Plan, citizens should be encouraged to educate their legislators about the continuing perils of chlorinated hydrocarbon pesticides to the county's wildlife.

Haz5: Protecting Swainson's hawks from casual shooting and disturbance (e.g., OHV use, hiking) at their nest sites is also important. These situations generally result from people being unaware of the value of raptors and a failure to enforce laws that protect raptors and usually occur when residential areas are in close proximity to nest sites. Better education and more vigorous law enforcement can help alleviate this hazard.

Haz6: Swainson's hawks are subject to electrocution on power lines, which can be alleviated by raptor anti-perching devices. There also are devices that shield the dangerous locations on lines (transformers, etc.).

Reproduction

Rep1: The nesting success of individual pairs depends upon successful return from the wintering area, prey availability, and the availability of nest trees. Weather conditions affect successful migration, the state of the ecosystem on which the prey base depends, and the prey base directly. A sufficient prey base requires large expanses of foraging habitat, depending upon the type of vegetation and prey abundance. The replacement of forage and row crops by orchards and vineyards is very detrimental to Swainson's hawk foraging. Prey availability also is influenced by rodent and insect control activities and by the destruction of habitats that support prey species. Nest tree availability depends on conditions in and adjacent to riparian zones. All these problems can be addressed through management plans that integrate agricultural production and biodiversity conservation at a landscape scale.

Dispersal

Dis1: Adult Swainson's hawks are highly philopatric, returning to their old nest sites every year, and young Swainson's hawks usually next in close proximity to their natal sites provided that suitable habitat and a prey base are still present. While this depends to some extent on weather conditions, it is also influenced by improper pesticide and vegetation management practices. Integrating management for both agriculture and conservation can help mitigate these problems.

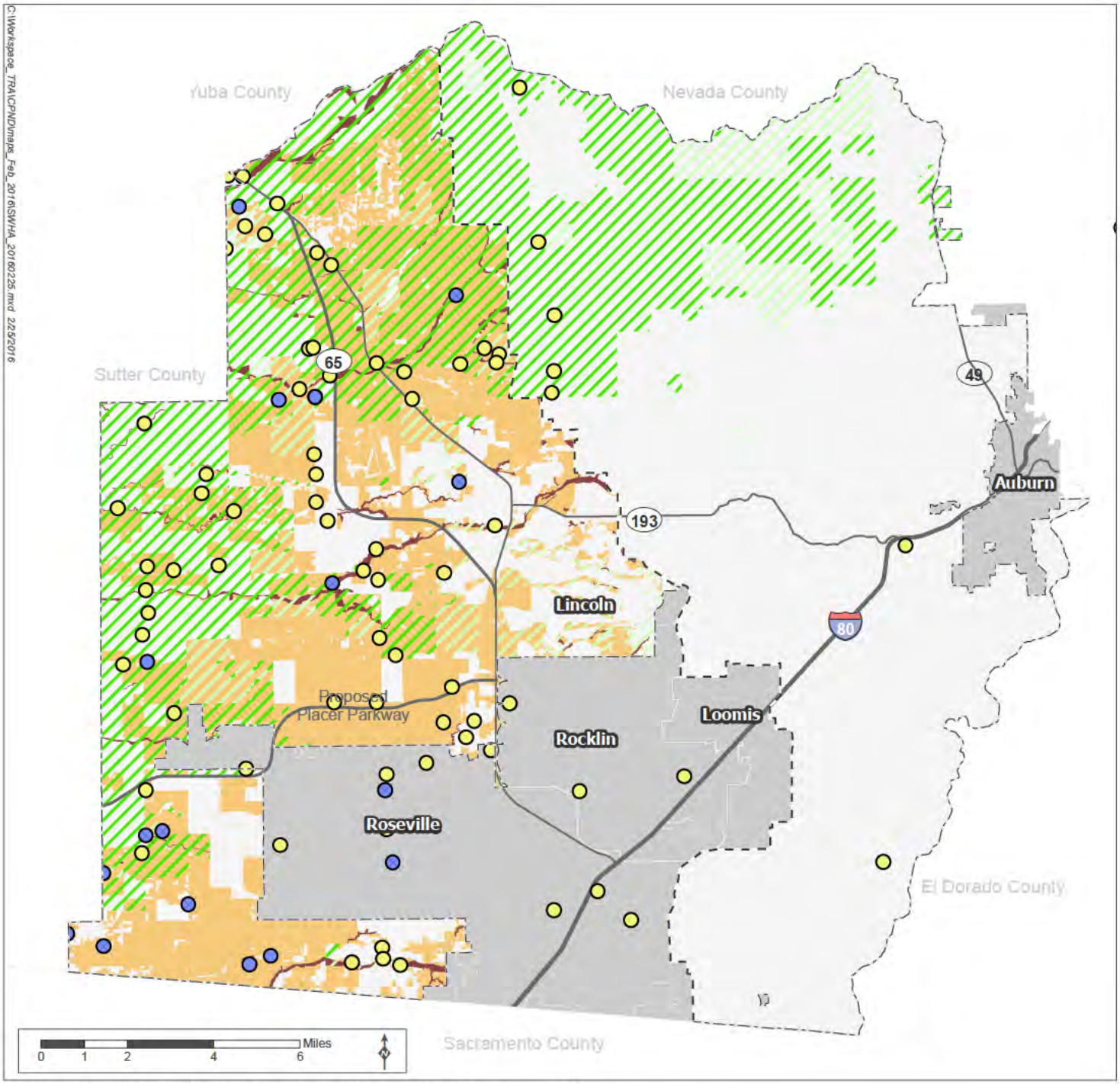
Migration

Mig1: The California population of Swainson's hawk overwinters in central Mexico (although a few individuals may remain in California). The weather and habitat conditions along their migratory route and in their wintering habitats are critical to their survival. Chlorinated hydrocarbon pesticides applied to crops in the wintering areas may be a problem (see Haz5).

Summary

As predators at the top of the grassland food web, Swainson's hawks are highly sensitive to ecosystem conditions and require large expanses of foraging habitat. These factors suggest that the best strategy

for Swainson's hawk conservation is to manage riparian zones to provide adequate nesting trees and secure easements on large acreages of agricultural lands so they will be managed for both biodiversity conservation and sustainable agriculture. The Swainson's hawks' requirements also are such that they are very compatible with large vernal pool-grassland ecosystem reserves provided that nest trees are available and disturbance is minimized especially during breeding.



Source: Placer County, 2014; MIG | TRA, 2015; CNDDB, 2015; Placer Land Trust, 2010; eBird, 2015; Patrick Moeszinger, 2014

Occurrences
- Nest Site - Precise
- Nest Site - General
- eBird and Other Sources

Modeled Habitat
- Nes ing Habitat
- Foraging Habitat
- Non-habitat

- Existing Protected Area
- Reserve Aquisition Area
- Non-participating City
- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 1.
Swainson's Hawk Modeled Habitat Distribution and Occurrence
Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

California Black Rail
(*Laterallus jamaicensis coturniculus*)

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Status

Federal: Bird Species of Conservation Concern; Migratory Bird Treaty Act

State: Threatened; Fully Protected

Critical Habitat: Not Applicable (N/A)

Recovery Plan: **N/A**

Distribution

North America

The California black rail is one of two subspecies of black rail that inhabit North America including the Eastern black rail (*Laterallus jamaicensis jamaicensis*) and the California black rail. The Eastern black rail breeds primarily along the eastern seaboard from Connecticut south to southern Florida and along parts of the Gulf Coast. There are scattered small populations in the Midwest to the southern Great Plains, and interior North Carolina to northern Georgia (Eddleman et al. 1994). The California black rail breeds in the foothills of the Sierra Nevada, coastal California, northwestern Baja California, the lower Imperial Valley, and the lower Colorado River in Arizona and California (Aigner et al. 1995 ; Eddleman et al. 1994; Richmond et al. 2008).

California

California black rail populations were previously thought to be restricted to the San Francisco Bay Area, Bolinas Lagoon, Tomales Bay, Morro Bay, Suisun Bay, the Delta region to White Slough in San Joaquin County, the Salton Sea area, and the Lower Colorado River Valley (Grinnell and Miller 1944; Manolis 1978; Garrett and Dunn 1981; Evens et al. 1991; Eddleman et al. 1994). In 1994, however, populations were discovered in the western Sierra Nevada foothills of Yuba County (Aigner et al. 1995), and subsequent surveys revealed previously unknown populations in the foothills of Butte, Nevada, Placer, and San Joaquin Counties (Richmond et al. 2008). Genetic analysis suggests that California black rail was historically present in the foothills, and that the foothills population had gone undiscovered until recently, rather than this recent discovery reflecting a recent colonization of the foothills (Girard et al. 2010). As of 2014, California black rail has been found in over 200 wetlands in the foothills of Butte, Nevada, Yuba, Placer, and San Joaquin counties, almost all below 1,155 feet (Tecklin 1999; Richmond et al. 2008; Dudek 2014).

Placer County Plan Area

Historical

Detailed information concerning California black rails in the Sierra foothills is limited. How long they have occupied the area and the extent of their distribution is unknown (Tecklin 2006). There are no historical records of California black rail in the Plan Area.

Current

California black rails have been found in various locations in Nevada County, just north of the Placer County border (Tecklin 1999; Richmond et al. 2008; Dudek 2014). There are apparently earlier Christmas Bird Count records of California black rail presence in Placer County (Tecklin 2006; Dudek 2014), as well as recent verified records of occurrence in Clover Valley near Rocklin, California (Tecklin 2006). California black rail have been detected at numerous locations in Placer County since 2002. Formal and informal exploration and field activities of the Black Rail Project of the University of California, Berkeley (https://nature.berkeley.edu/beislab/rail/html/index.html) since its inception in 2002 has discovered black rail occurrences at several sites on private, developed properties and on lands administered by the Placer Land Trust. These more recent findings have not been published or widely reported. Based on these documented and probable records, it is highly likely that other parts of Placer County could represent an extension of the now well established populations in Butte, Nevada, and Yuba Counties. Confirmed California black rail detections in Placer County are shown in Species Map 2. *California Black Rail Modeled Habitat Distribution and Occurrence* and detailed in Table 1.

T**able 1. Confirmed California Black Rail Detections in Placer County**

Location	Date	Observer
Doty Ravine Preserve	10/2012	Tecklin and Hall
Swainson's Grassland Preserve	12/2011	Tecklin and Hall
Redwing on Yankee Slough	08/2011	Tecklin and Hall
Sun City Lincoln Hills Preserve (Ingram Slough)	08/2011	Tecklin and Hall
Sun City Lincoln Hills Preserve (12 Bridges Road, Hillside Springs)	08/2011	Tecklin and Hall
Little Ben and Big Ben Intersection	06/2009	Placer County Big Year Detection
Clover Valley	09/2006	Tecklin
Bickford Parking Area	06/2006	Widdowson
Spears Ranch (now Hidden Falls)	05/2005	Garrison
Near Camp Far West Reservoir	04/2003	Sterling

Dudek 2014; CNDDB 2015

Population Status & Trends

North America

Black rail populations have declined throughout the species' range primarily due to habitat destruction (Eddleman et al. 1994).

California

The current distribution of California black rail breeding range has contracted with the loss of wetland habitat (CDFG 1987[1]). California black rail populations have been extirpated from Ventura to San Diego counties (Garrett and Dunn 1981). The bulk of the population (>80%) of California black rail is confined to the northern reaches of the San Francisco Bay estuary, especially the tidal marshland of the San Pablo Bay and associated rivers (Evens et al. 1991). The loss of 95% of marsh habitat in the San Francisco Bay area likely had a substantial effect on California black rail populations. The remaining California black rail populations are small and isolated (Evens et al. 1991). Populations along the Lower Colorado River declined about 30% from 1973 to 1989 (Evens et al. 1991). The Sierra Nevada foothill population was estimated at 125-184 during 1997 and 1998 (Tecklin 1999). Richmond et al. (2008) estimated 734-1,466 individuals in over 200 marshes/freshwater wetlands based on intensive surveys in 1994-2006 of sites in the Sierra Nevada foothills. Occupied wetlands were found in five (Yuba, Nevada, Butte, Placer, and San Joaquin) of the 14 counties surveyed (Butte, Colusa, El Dorado, Glenn, Lake, Nevada, Placer, Sacramento, San Joaquin, Solano, Sutter, Tehama, Yolo, and Yuba).

California black rail in the Sierra Nevada foothills likely exists as a metapopulation (Richmond et al. 2008); a population of populations connected by dispersal across areas that do not provide habitat. Within a metapopulation, local populations at individual marshes can go extinct, whereas unoccupied marsh sites are colonized. This pattern of extinction and colonization was commonly observed in the Sierra Nevada foothills by Richmond et al. (2008) throughout their study.

Placer County Plan Area

Although California black rail populations were discovered in Yuba and Nevada counties in 1994, populations were only recently discovered in Placer County. Therefore there is no information on population trends in the Plan Area (J. Sterling, pers. comm.).

Natural History

The habitat requirements, ecological relationships, life history, and threats to California black rail described below are summarized in diagram form in Envirogram 2 Black Rail.

Habitat Requirements

California black rails inhabit saltwater, brackish water, and freshwater marshes (Grinnell and Miller 1944, Manolis 1978). California black rails found away from coastal estuaries and salt marshes, such as in the Sierra Nevada foothills, are found in perennial wetlands with standing or flowing water dominated by dense vegetation, including rush (*Juncus effusus and J. balticus*) and cattail (*Typha latifolia and T. domingensis*) and often with other associated plants such as bulrush (*Scirpus acutus),* spikerush (*Eleocharis macrostachya*) and dallis grass (*Paspalum dilatatum*)*,* fireweed (*Epilobium ciliatum*)*, and* cutgrass (*Leersia oryzoides*) (Aigner et al. 1995; Tecklin 1999; Richmond et al. 2008; Richmond et al. 2010). California black rails are most often found in wetlands with perennial standing water or flowing water (permanently or semipermanently flooded), although they are occasionally found in drier

[1] As of January 1, 2013, the California Department of Fish and Game (CDFG) was renamed the California Department of Fish and Wildlife. When this document cites reports prepared by the Department prior to 2013, the reference includes the prior department name of CDFG. Both CDFW and CDFG refer to the same agency

wetlands with seasonally flooded, intermittently exposed or saturated water regimes (Richmond et al. 2010). The source of water for the majority of the wetlands inhabited by California black rail in the Sierra Nevada foothills is from intentional and unintentional inputs of irrigation water, with 68% of wetlands primarily fed by irrigation, 22% by springs, 6% by streams, and 4% by rainfall (Richmond et al. 2010). These wetlands are in open grasslands, grazed pastures or oak savannas (Tecklin 1999). California black rails rarely use livestock water ponds (i.e., stock ponds) with narrow fringes of emergent vegetation and mostly deep water (Richmond et al. 2010). California black rails typically occur in the shallowest zones of wetland edges where water depths are less than 1.2 inches. They construct well concealed nests in dense vegetation over moist soil or very shallow water (Eddleman et al. 1994). Plant composition is not as important for California black rail habitat as the appropriate vegetation cover (i.e., high stem density and canopy coverage) (Richmond et al. 2010). California black rail occupancy declines when overgrazing substantially reduces wetland vegetation cover (Richmond et al. 2010). Wetlands in the Sierra Nevada foothills greater than 1 acre are more likely to support populations that persist over time, though California black rail was found in wetlands as small as 0.2 acres (Tecklin 1999; Richmond et al. 2010). Also, California black rail was not found during surveys of roadside ditches that had dense patches of cattails and bulrush (Tecklin 1999).

Reproduction

California black rail lays 3-8 eggs, incubates them for 17–20 days, and probably broods the semi-precocial chicks for several days after hatching (Eddleman et al. 1994). There is little information on parental care after hatching and no information is available on reproductive success and survivorship.

Dispersal Patterns

Relatively little is known about the dispersal patterns of black rail. A radiotelemetry study in Arizona tracked three black rails that were found to move an average of 0.89 miles between breeding seasons (Flores and Eddleman 1991). An analysis of occupancy patterns and metapopulation dynamics using incidence function methods estimated median dispersal ability of approximately 5 miles in the foothills (Risk et al. 2011). Recent genetic research suggests two-way movement of individuals between San Francisco Bay and Sierra Nevada foothill populations, and that more individuals tend to move from the foothills to the San Francisco Bay area than vice versa. This result is surprising considering that black rails are generally thought to be poor fliers (Girard et al. 2010).

Given the metapopulation structure of California black rail in the foothills, young birds likely disperse to seek new sites for colonization if densities in an occupied marsh exceed the habitat's carrying capacity or if an occupied marsh is degraded. Richmond et al. (2008) observed several cases of rapid colonization within one year of marsh creation. This hypothesis is further supported by records of juveniles from other populations appearing in atypical habitats, records of black rails striking TV towers and buildings, and low recapture rates of banded juveniles compared to those of adults (Eddleman et al. 1994). The likelihood of occupancy of a wetland; however, decreases with distance from an occupied wetland (Richmond et al. 2012).

Longevity

There are no published estimates of black rail longevity; however, one male along the Lower Colorado River in Arizona lived for at least 2.5 years (Eddleman et al. 1994).

Sources of Mortality

Documented predators of California black rail includes great blue heron (*Ardea herodias*), great egret (*Ardea alba*), northern harrier (*Circus cyaneus*), ring-billed gull (*Larus delawarensis*), great horned owl (*Bubo virginianus*), short-eared owl (*Asio flammeus*), and loggerhead shrike (*Lanius ludovicianus*) (Eddleman et al. 1994; Evens and Page 1986). In marshes around San Francisco Bay, rats (*Rattus* spp.), and red fox (*Vulpes vulpes*) are thought to prey on nests (Evens pers. comm. cited in Eddleman et al. 1994).

Behavior

Black rail forages on invertebrates, including snails, beetles, earwigs, grasshoppers, ants; and on seeds from bulrushes (*Scirpus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994). There is no specific information on the diet of the Sierra Nevada foothill population.

Movement and Migratory Patterns

California black rail is mostly resident, although there is some local movement from San Pablo Bay south to the southern San Francisco Bay (Evens et al. 1991). Based on continual presence throughout the year, the Sierra Nevada foothill population is thought to be non-migratory (Richmond et al. 2008).

Ecological Relationships

Black rail occupies marshes with Virginia rail and sora rail (Tecklin 1999) but there is no information on interspecific interactions (Eddleman et al. 1994).

Threats

The primary population threats are destruction, desiccation, flooding, grazing and other forms of degradation of marsh/wetland habitats; development-related increases in predation pressures from domestic cats, herons, egrets, and other predators; and pollution carried by runoff into occupied marshes (Eddleman et al. 1994). At inland sites, agricultural practices, livestock grazing, and urbanization may threaten California black rail. Grazing occurs at 60% of the known wetlands occupied by California black rail in the Sierra Nevada foothills and is the most common threat to those wetlands (Tecklin 1999). California black rail occupancy declines when overgrazing substantially reduces wetland vegetation cover (Richmond et al. 2010; Richmond et al. 2012). Future irrigation practices will play an important role in the quantity and quality of wetland habitat in the Sierra Nevada foothills, as irrigation water is the primary source of water for the Sierra Nevada foothill wetlands inhabited by California black rail (Richmond et al. 2008).

Context for a Regional Conservation Strategy

In California, records of the California black rail are concentrated around the San Francisco Bay area, with a few scattered occurrences in southern California as well. The discovery in 1994 of populations of California black rail in Butte, Yuba and Nevada counties extended the known distribution of this species into the western Sierra Nevada foothills. Although not published or widely reported, formal and informal surveys of Placer County since 2002 through the California Black Rail Study Project associated with the University of California, Berkeley has led to the discovery of California black rail occurrences on

several private, developed properties within the Plan Area. Because of the elusive nature of this bird, other yet undetected populations may also be present. The Placer County population is the most southern of the known foothill populations. Indeed, in his report to the California Natural Diversity Database (reported July 18, 2006), Tecklin speculates that "recent verified [California] black rails at northern Placer County sites and unverified detections at nearby locations indicate this is an important southern extension of the patchy inland distribution of the subspecies."

Due to the species' rarity within the region and state, protection of existing populations or potential habitat is emphasized. Perennial wetland systems, particularly those dominated by bulrushes and cattails, are of highest conservation or acquisition priority for the maintenance or potential increase of California black rail in the Plan Area. As juveniles may disperse from the wetland/marsh in which they were hatched, the maintenance of large, perennial wetland systems could contribute to population success. A series of wetland systems should be preserved, including sites unoccupied by California black rail, to allow for potential colonization from populations in neighboring counties that host California black rail populations. Metapopulations remain stable when the rate of extinction of populations is balanced by colonization of unoccupied sites. Therefore, it is necessary to protect suitable, but unoccupied, habitat to help maintain population stability and allow for the growth of the metapopulation.

Modeled Species Distribution in the Plan Area

Model Assumptions

Year-round Habitat

California black rail modeled habitat is defined as fresh emergent wetlands greater than 0.2 acres in the Plan Area. The scale of the land-cover data and mapping may be too coarse to specifically identify suitable year-round black rail habitat, but the estimated fresh emergent marsh component of mapped marsh complex land cover type is a reasonable measure of modeled habitat.

Rationale

California black rails are year-round residents in the Sierra Nevada foothills and Central Valley. They remain in fresh emergent wetlands year round, except to disperse to other fresh emergent wetlands. Little is known about dispersal habitat, as black rails are rarely found outside wetland habitat. They occupy perennial wetlands dominated by *Juncus effusus* and *J. balticus* and cattails (*Typha latifolia* and *T. domingensis*). These wetlands are in open grasslands, grazed pastures or oak savannas (Tecklin 1999). Wetlands greater than 0.4 hectares are more likely to support populations that persist over time, though California black rails have been found in wetlands as small as 0.2 acres (Tecklin 1999).

Model Results

Species Map 2. *California Black Rail Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for California black rail in the Plan Area. The majority of modeled potential habitat is where large blocks of fresh emergent marsh wetlands are mapped in the northeastern portion of the Plan Area. Because of the mapping methodology, this does not include all areas of actual fresh emergent marsh that may serve as habitat.

References

Printed References

Aigner, P., J. Tecklin, and C. Koehler. 1995. Probable breeding population of the black rail in Yuba County, California. *Western Birds* 26:157–160.

California Natural Diversity Database. 2015. RareFind 3, Version 3.1.0 (September 2015). Sacramento, CA: California Department of Fish and Wildlife.

California Department of Fish and Game. 1987. Five-Year Status Report: California Black Rail. Nongame Bird and Mammal Section, Wildlife Management Division.

Dudek Consulting. 2014. Evaluation of Potentially Suitable Habitat and Recommended Future Survey Locations for Selected Rare Species within the Placer County Conservation Plan/Natural Community Conservation Plan Area.

Eddleman, W., R. Flores, and M. Legare. 1994. Black rail (*Dendroica petechia*). In A. Poole and F. Gill (eds.), *The birds of North America*, No. 123. Philadelphia, PA: The Academy of Natural Sciences and Washington, DC: The American Ornithologists' Union.

Evens, J. G., G. W. Page, S. A. Laymon, and R. W. Stallcup. 1991. Distribution, relative abundance and status of the California black rail in western North America. *Condor* 93:952–966.

Evens, J., and G. W. Page. 1986. Predation on black rails during high tides in salt marshes. *Condor* 88:107–109.

Flores, R. E. and W. R. Eddleman. 1991. Ecology of the California black rail in southwestern Arizona. Final Report. U. S. Bureau of Reclamation, Yuma Project Office and Arizona Dept. of Game and Fish, Yuma, AZ.

Garrett, K. and J. Dunn. 1981. *Birds of southern California*. Los Angeles, CA: Los Angeles Audubon Society.

Girard, P., J. Y. Takekawa, and S. R. Beissinger. 2010. Uncloaking a cryptic, threatened rail with molecular markers: origins, connectivity and demography of a recently-discovered population. Conservation Genetics 11:2409-2418.

Grinnell, J., and A. H. Miller. 1944. *The distribution of the birds of California*. Berkeley, CA: Cooper Ornithological Club, Pacific Coast Avifauna. Number 27. Reprinted 1986. Lee Vining, CA: Artemisia Press.

Manolis, T. 1978. Status of the black rail in central California. *Western Birds* 9:151–158.

Richmond, O. M., S. K. Chen, B. B. Risk, J. Tecklin, and S. R. Beissinger. 2010. California black rails depend on irrigation-fed wetlands in the Sierra Nevada foothills. California Agriculture 64:85–93.

Richmond, O. M., J. Tecklin, and S. R. Beissinger. 2008. Distribution of California black rails in the Sierra Nevada foothills. J. of Field Ornithol. 79:381–390.

Richmond, O. M., J. Tecklin, and S. R. Beissinger. 2012. Impact of cattle grazing on the occupancy of a cryptic, threatened rail. Ecological Applications 22:1655-1664.

Risk, B. B., P. de Valpine, and S. R. Beissinger. 2011. A robust-design formulation of the incidence function model of metapopulation dynamics applied to two species of rails. Ecology 92:462-474.

Tecklin, J. 2006. Exploration for California Black Rails at Clover Valley, Rocklin, California. Unpublished Report. Prepared for David Garst.

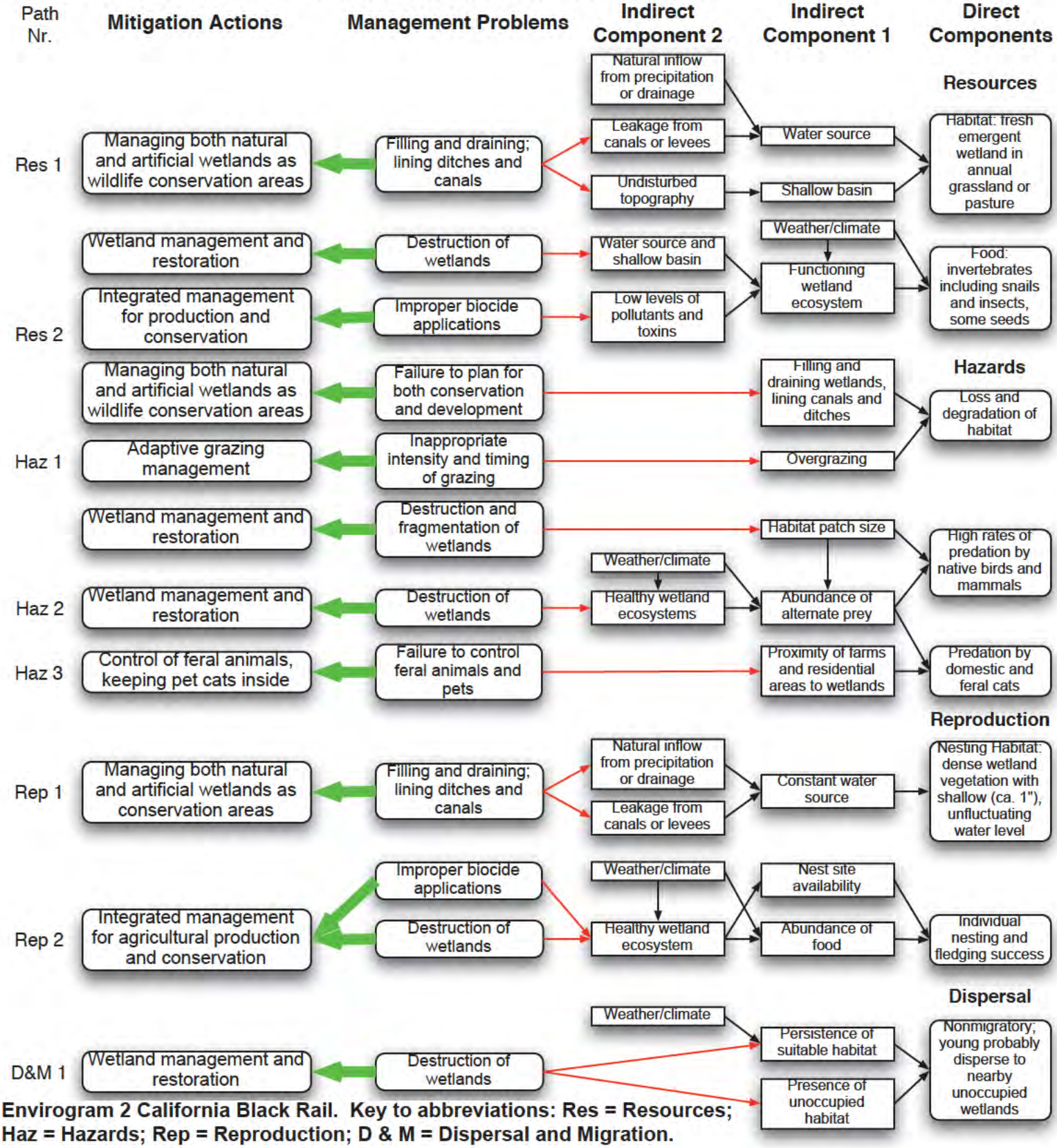
Tecklin, J. 1999. Distribution and abundance of the California black rail (*Laterallus jamaicensis coturniculus*) in the Sacramento Valley region with accounts of ecology and call behavior of the subspecies. Draft report for the California Department of Fish and Game, Contract Nos. FG6154WM and FG6154-1WM.

Personal Communications

Tecklin, Jerry. Black Rail researcher in the Sierra Nevada foothills. 1998– 2011– Field visits and conversations.

Sterling, John. Ornithologist. Jones & Stokes. Field observations 1972 – 2003.

California Black Rail, *Laterallus jamaicensis coturniculus*



Envirogram 2 California Black Rail. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; D & M = Dispersal and Migration.

Envirogram Narrative

California Black Rail (*Laterallus jamaicensis coturniculus*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary. For example, resources are subdivided into food and habitat.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: California black rail requires fresh emergent wetlands in annual grassland or pasture with connectivity among wetlands. These wetlands depend on topography characterized by shallow basins and a water source from either natural inflow from precipitation or drainage or leakage from canals or levees. Filling and draining natural wetlands and lining ditches and canals results in the loss of this habitat, so all natural and many artificial wetlands should be managed as conservation areas.

Res2: California black rail feeds on invertebrates, including snails and a variety of insects. Some seeds are also eaten. The abundance of these prey items depend on a healthy wetland ecosystem, which in turn depends on a dependable water supply and low levels of toxins and other pollutants. Proper management or restoration of wetlands and ensuring that biocides and other agricultural chemicals do not end up in them are the keys to ecosystem health.

Hazards

Haz1: As with most species, the biggest threat to California black rail in Placer County is habitat loss—in this case the loss and degradation of wetlands from draining and filling, lining canals and ditches, and overgrazing. Natural and artificial wetlands should be managed as conservation areas, and grazing within these wetlands should be carefully monitored with regard to timing and intensity to ensure that livestock are not a source of degradation.

Haz2: California black rail is hunted by a variety of other birds such as egrets, northern harriers, gulls, and owls. Various mammals also prey on eggs and nestlings. Predation is related to patch size (small patches maximize edges and predator access) and a shortage of alternate prey. These are inter-related and affected by weather as well. Wetland restoration and management are the keys to reducing predation pressure.

Haz3: Predation by feral and domestic cats may also be a problem for California black rail, although less so in large wetlands. These predators are generally most abundant near homes and farms, particularly

when alternate prey is not available. Controlling feral cats and keeping pet cats inside reduces this hazard.

Reproduction

Rep1: The California black rail nests in dense wetland vegetation where the water is consistently about one inch deep. These conditions require a reliable water source such as inflow from natural drainage or leakage from canals or levees. Filling and draining natural wetlands and lining ditches and canals results in the loss of nesting sites, further emphasizing that all natural and many artificial wetlands should be managed as conservation areas.

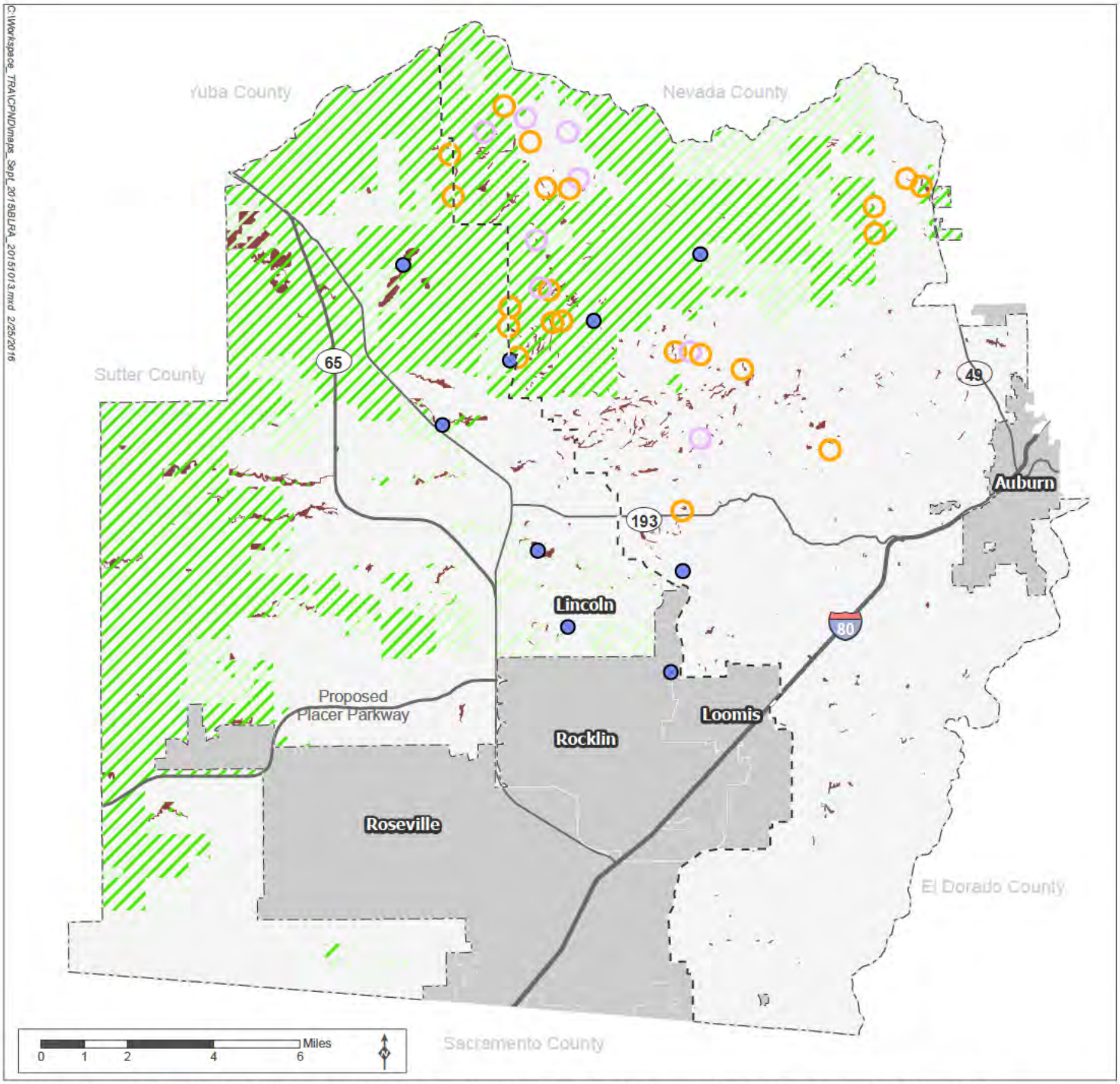
Rep2: Individual nesting and fledging success in California black rail depends on nest site availability and abundance of food. The former is related to the presence of wetlands, and the latter depends on productive foraging habitats associated with healthy wetland ecosystems, favorable weather, and proper application of biocides and other agricultural chemicals in nearby farms and ranches. These factors in turn are related to integrating wildlife needs and agricultural production.

Dispersal and Migration

D&M1: California black rail tends to be non-migratory and remain in Placer County throughout the year, provided that suitable habitat persists. Young birds may disperse and colonize new sites if densities in occupied wetlands become too high; this requires other suitable, unoccupied habitat to be available. This further emphasizes that all natural and many artificial wetlands should be managed as conservation areas and that connectivity among these patches should be maintained.

Summary

California black rail is rare in Placer County and depends on large patches of fresh emergent wetlands for foraging and breeding. This vegetation type has been destroyed or degraded in much of the western part of the County. Restoration and proper management of natural wetlands and wetlands resulting from leaky irrigation structures can have a positive effect on this species, provided that the wetlands are large enough and that connectivity among them is maintained. Large wetlands reduce the impacts of human disturbance and feral and native predators.



Source: Placer County, 2014; MIG | TRA, 2015; CNDDB, 2015; Dudek, 2014; Tecklin and Hall, 2011; Widdowson, 2006; Sterling, 2003; Restoration Resources, 2011; eBird, 2015; Placer County Big Year Detection, 2009;

Occurrences
- Precise Location
- General Location
- Highly Suitable Habitat
- Moderately Suitable Habitat

Modeled Habitat
- Year-round Habitat
- Non-habitat

- Existing Protected Area
- Reserve Aquisition Area
- Non-participating City
- Major Road
- Valley/Foothill Divide
- Area A Boundary

Suitability of potential black rail habitat from Dudek (2014), based on reconnaissance roadside surveys of potentially suitable wetlands. This was not intended to be an exhaustive survey of potentially suitable wetlands in the Plan Area.
Reconnaissance surveys were focused in an area in the central and north central region of the Plan Area where California black rail have been previously detected. Further surveys are needed to assess occupancy.

Species Map 2.
California Black Rail Modeled Habitat Distribution and Occurrence
Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Western Burrowing Owl

(*Athene cunicularia*)

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Status

Federal: Bird of Conservation of Concern; Federal Migratory Bird Treaty Act

State: Petitioned for listing under the California Endangered Species Act, but it was determined listing was not warranted (California Department of Fish and Wildlife [CDFW] 2003); Species of Special Concern

Critical Habitat: Not Applicable (N/A)

Recovery Plan: N/A

Distribution

North America

Burrowing owl lives and breeds in the desert and grassland habitats from south central Canada through most of the western and central United States and Central America to the southern end of South America (Rosenberg et al. 1998). It also occurs in Florida and the Caribbean (Poulin et al. 2011).

California

In California, the range of western burrowing owl extends through the lowlands south and west from north central California to Mexico, with small, scattered populations occurring in the Great Basin and the desert regions of the southwestern part of the state (DeSante et al. 1996). Western burrowing owl is absent from the coast north of Sonoma County and from high mountain areas such as the Sierra Nevada and the ranges extending east from Santa Barbara to San Bernardino. Western burrowing owl populations have been greatly reduced or extirpated from the San Francisco Bay area (Trulio 1997; Wilkerson and Siegel 2010) along the coast to Los Angeles. They have also apparently disappeared from the Coachella Valley. The remaining major population densities of western burrowing owl in California are in the Central and Imperial valleys (DeSante et al. 1996; Wilkerson and Siegel 2010).

Placer County Plan Area

Historical

Data for burrowing owls in the Sierra foothill and valley portions of Placer County is sparse, despite the presence of large areas of annual grasslands in this location (CDFG 2003[1]). There is no information on historic population size and distribution of western burrowing owl that is specific to the Plan Area. Grinnell and Miller (1944) indicated that the species was "originally common" and even "abundant" in suitable habitat that includes the Plan Area.

Current

Western burrowing owl is considered rare in Placer County (Webb 2009). Breeding western burrowing owls have been documented at Swainson's Preserve in 2012, 2013, and 2015 (Wages pers. comm.). A pair with at least two nestlings was observed in 2012, a pair with at least four nestlings was observed in 2013, and two pairs with three nestlings each in 2015 (Wages pers. comm.).

Records of western burrowing owl in Placer County in the California Natural Diversity Database (September 2015) are likely of over-wintering birds. These records include: 1) one burrowing owl observed along Highway 65 south of Sheridan in 2011; 2) two burrowing owls observed along Nader Road off Highway 65 in 2011; 3) one burrowing owl observed in Redwing Preserve in 2005; 4) one adult observed at a burrow site on January 30, February 1, and February 18, 2008 on the Moore Ranch Wetland Restoration Project property 250 feet north of east Catlett Road and 0.4 mile west of Fiddyment Road southwest of Lincoln; 5) two individuals in moderately grazed, rolling grassland on the north side of Philip Road, approximately 0.75 mile west of Fiddyment Road, northwest of Roseville. These individuals were observed year-round in 1998, but none were observed on May 5, 2003; 6) two adults were observed April 29, 2008 at a burrow site in open grassland on the Swainson's Preserve, 0.43 mile south, southeast of the intersection of West Wise Road and Highway 65; and 7) at least one individual was observed at the Sterling Silver Stables in the southwest corner of the Plan Area in 2007. In addition to the California Natural Diversity Database records, a single western burrowing owl has been observed during the annual Lincoln Christmas Bird Count every year since the 2002 count, except in 2006 and 2008 when none were observed. Western burrowing owl was also observed at three locations in the Plan Area during the 2003 watershed surveys for the Placer Legacy program (Pandolfino pers. comm., Easterla pers. comm.).

Population Status & Trends

North America

Burrowing owl was once widespread and generally common over western North America. In recent decades a number of populations have declined or, in some cases, disappeared altogether (Poulin et al. 2011). The burrowing owl range has generally contracted southward and westward in North America (Wellicome and Holroyd 2001 as cited in Poulin et al. 2011). Burrowing owl breeding range has retreated from 1967 to 2008 in southern and northern California, Washington, southern Canada,

[1] As of January 1, 2013, the California Department of Fish and Game (CDFG) was renamed the California Department of Fish and Wildlife. When this document cites reports prepared by the Department prior to 2013, the reference includes the prior department name of CDFG. Both CDFW and CDFG refer to the same agency.

eastern North and South Dakota, eastern Nebraska, eastern Kansas, and southern Texas (Macías-Duarte and Conway 2015). Burrowing owl breeding range is thought to have expanded toward unoccupied areas in southern Montana, eastern Oregon, central Nevada, and the four corners region of the United States (Macías-Duarte and Conway 2015). Burrowing owl is now endangered in Canada, a species with special protection in Mexico, and has declined in many parts of the United States (DeSante et al 1996, 1997; James and Espie 1997; Sauer et al. 2005; Poulin et al. 2011). In California, the species is a species of special concern; it is listed as endangered or threatened in a number of other states.

California

The California Department of Fish and Wildlife indicates that the California population of western burrowing owl is between 1,000 and 10,000 pairs (James and Espie 1997; Rosenberg et al. 1998) with a declining trend (Gervais et al. 2008; Wilkerson and Siegel 2010). Wilkerson and Siegel (2010) estimated the number of burrowing owl pairs statewide from 2006-2007 at 9,298 pairs. The population of burrowing owls was found to be highly concentrated in the Imperial Valley (68.9% of the statewide population) and to a lesser extent, the Southern Central Valley (12% of the statewide population) (Wilkerson and Siegel 2010). Christmas Bird Count data from 1959 – 1988 show declines in midwinter numbers of western burrowing owl in California (Sauer et al. 1996). In contrast, the numbers of western burrowing owl on Breeding Bird Survey Routes in California increased significantly from 1968 to 2004 (Sauer et al. 2005). Wilkerson and Siegel (2010) observed that the major patterns of burrowing owl occurrence across California appeared to be relatively unchanged since 1993, although non-significant declines were observed in numerous regions. The two urban areas in California with the sharpest declines were the San Francisco Bay Area and Bakersfield (Wilkerson and Siegel 2010). The primary factors cited in the decline are habitat loss, pesticides, predators, harassment, reduced burrow availability, and vehicle collisions.

Placer County Plan Area

There is no detailed information on population trends of western burrowing owl in Placer County because of the lack of baseline data; however, Webb (2009) describes the population as declining.

Natural History

The habitat requirements, ecological relationships, life history, and threats to western burrowing owl described below are summarized in diagram form in the Envirogram 1 Western Burrowing Owl.

Habitat Requirements

Western burrowing owl is found in open, dry grasslands, agricultural and range lands, and desert habitats often associated with burrowing animals and short vegetation (Poulin et al. 2011). It can also inhabit grass, forb, and shrub stages of piñon and ponderosa pine habitats. In addition to “natural” breeding habitats, areas such as agricultural fields, golf courses, cemeteries, road allowances, airports, vacant urban lots, and fairgrounds are regularly used (Poulin et al. 2011). Western burrowing owl requires burrows for roosting and nesting (CDFW 2012). In California, nest and roost burrows are most commonly dug by ground squirrels (e.g., *Otospermophilus beecheyi*), but the owl may also use the dens or holes of other species such as badger (*Taxidea taxus*) and coyote (*Canus latrans*) (Ronan 2002). In

some instances, burrowing owls have been known to excavate their own burrows (Barclay 2007 as cited in CDFW 2012) or use natural rock cavities, debris piles, culverts, and pipes (Rosenberg et al. 1998).

Western burrowing owls can be found at elevations ranging from 200 feet below sea level to 9,000 feet above sea level. Foraging habitat is essential to burrowing owls (CDFW 2012). Foraging occurs primarily within 600 meters of their nests during the breeding season (CDFW 2012). Western burrowing owl commonly perches on fence posts or on mounds outside the burrow. It is active day and night, but is usually less active in the peak of the day (Rosenberg et al. 1998).

Reproduction

Western burrowing owls can begin breeding at 10 months of age (Poulin et al. 2011). Although typically monogamous, polygyny has been observed in western burrowing owl populations (Barclay and Menzel 2011). The breeding season for western burrowing owl in California is February to late August (Haug et al. 1993; Thompsen 1971; CDFW 2012), with some variances by geographic location and climatic conditions (CDFW 2012). The season tends to last later in the northern part of the range. Clutch size ranges from 1-12 eggs and averages about 7 eggs (Poulin et al. 2011). The incubation period is 28–30 days (Poulin et al. 2011). The female performs all of the incubation and brooding and is believed to remain continually in the burrow while the male does all the hunting (Poulin et al. 2011). Burrowing owls may use satellite or non-nesting burrows during the breeding season, moving young at 10-14 days, presumably to reduce the risk of predation (Desmond and Savidge 1998 as cited in CDFW 2012). Several studies have documented the number of satellite burrows used by young and adult burrowing owls during the breeding season as between one and 11 burrows with an average use of approximately five burrows (Haug 1985). The young fledge from 44 to 53 days but remain near the burrow and join the adults in foraging flights at dusk (Rosenberg et al. 1998).

Dispersal Patterns

Western burrowing owl tends to be resident where food sources are stable and available year-round. It disperses or migrates south in areas where food becomes seasonally scarce. In resident populations, nest-site fidelity is common, with many adults renesting each year in their previous year's burrow; young from the previous year often establish nest sites near (<1000 feet) their natal sites (Rosenberg et al. 1998). Western burrowing owls in migratory populations also often renest in the same burrow, particularly if the previous year's breeding was successful (Belthoff and King 1997). Other birds in the same population may move to burrows near their previous year's burrow. Differences in site fidelity rates may reflect differences in nest predation rates (Catlin et al. 2005). Despite the high nest fidelity rates, dispersal distances may be considerable for both juveniles (i.e., natal dispersal) and adults (i.e., postbreeding dispersal), but this also varies by location (Catlin 2004; Rosier et al. 2006). Distances of 32 miles to 93 miles have been observed in California for adult and natal dispersal, respectively (CDFW 2012). Holroyd et al. (2011) observed a burrowing owl disperse approximately 1,156 miles between two nesting attempts within the same breeding season. This is the longest distance ever recorded for breeding dispersal for any raptor within the same breeding season (Holroyd et al. 2011).

Longevity

The maximum life span recorded for a banded bird in the wild is about 8.5 years (Rosenberg et al. 1998).

Sources of Mortality

Predators of western burrowing owl includes prairie falcon (*Falco mexicanus*), barn owl (*Tyto alba*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), golden eagle (*Aquila chrysaetos*) (Poulin et al. 2011). In addition, mammals such as badgers, foxes (*Vulpes vulpes*), skunks (*Mephitis* spp.), weasels (*Mustela* spp.), opossums (*Didelphis virginiana*), coyote, and domestic dogs (*Canis lupus familiaris*) and cats (*Felis catus*) are major predators of burrowing owls (Poulin et al. 2011). Many owls are killed at night by traffic when flying low over roads (CDFW 2003; Klute et al. 2003), as well as by wind turbines (Smallwood et al. 2007) and barbed wire fences (Todd et al. 2003). Attempts to exterminate rodents by the use of poisons may also kill western burrowing owls (Rosenberg et al. 1998).

Behavior

Western burrowing owl tends to be an opportunistic feeder (Poulin et al. 2011). Large arthropods, mainly beetles and grasshoppers, comprise a substantial portion of its diet. Small mammals, especially mice, rats, gophers, and ground squirrels, are also important food items. Other prey animals include reptiles and amphibians, scorpions, young cottontail rabbits, bats, and birds such as sparrows and horned larks (*Eremophila alpestris*) (Poulin et al. 2011). Consumption of insects increases during the breeding season. Western burrowing owl hovers while hunting; after catching the prey it returns to perches on fence posts or the ground. Western burrowing owl is primarily active at dusk and dawn, but if necessary will hunt at any time of day (Rosenberg et al. 1998).

Movement and Migratory Patterns

Migration routes of burrowing owls have been poorly documented (Haug et al. 1993). Northern populations of western burrowing owl are usually migratory, while more southern populations (e.g., Florida and southern California) may move short distances (Coulombe 1971; Martin 1973; Botelho 1996; Poulin et al. 2011) or not at all (Brenckle 1936; Ligon 1961; Thomsen 1971; Haug et al. 1993). Burrowing owl primarily winters in California, Arizona, New Mexico, Texas, Louisiana, Florida, and Mexico (Sheffield 1997). Those western burrowing owls breeding farthest north appear to migrate the farthest south (James and Ethier 1989).

Ecological Relationships

Western burrowing owl in California is commensal with California ground squirrel in rangeland and agricultural areas. It may compete incidentally with other predators such as coyote, other owls and hawks, skunks, weasels, and badgers for rodents and a variety of insects (Rosenberg et al. 1998).

Threats

Conversion of grasslands to agriculture, other habitat destruction, and poisoning of ground squirrels have contributed to population reductions first noted in the 1940s. Habitat loss and degradation from rapid urbanization of farmland in the core areas of the Central and Imperial Valleys of California is the greatest threat to burrowing owls in California (Garvais et al. 2008).

The burrowing owl depends on colonies of burrowing mammals for nest sites. The reduction of such colonies by agriculture and control programs has limited access to nest burrows and contributed to the

loss of burrowing owls (Klute et al. 2003; Poulin et al. 2011). In California, ground squirrel burrows are most often used by burrowing owls for nesting and cover; thus, ground squirrel control programs may affect owl numbers in local areas by eliminating a necessary resource (CDFW 2012).

Burrowing owls suffer direct losses from a number of sources (CDFW 2012). Vehicle collisions are a significant source of mortality especially in the urban interface and where owls nest alongside roads (Haug et al. 1993; CDFW 2003; Gervais et al. 2008). Road and ditch maintenance and disking to control weeds in fallow fields, among other activities, may destroy burrows (Catlin and Rosenberg 2006) which may trap or crush owls. Wind turbines at Altamont Pass Wind Resource Area are known to cause direct burrowing owl mortality (Thelander et al. 2003).

Context for a Regional Conservation Strategy

Western burrowing owl is present, but rare, in western Placer County. Populations in the Plan Area are on the eastern edge of the species' central range in California. Breeding western burrowing owls have been documented at Swainson's Preserve in 2012, 2013, and 2015 (Wages pers. comm.). A pair with at least two nestlings were observed in 2012 and a pair with at least four nestlings were observed in 2013 and two pairs with three nestlings each in 2015 (Wages pers. comm.). Records of western burrowing owl in Placer County in the California Natural Diversity Database (September 2015 are likely of over-wintering birds. These records are scattered throughout western Placer County.

In the region, western burrowing owl is known primarily from the south and southeast of western Placer County, although there are scattered records of occurrence in Yuba, Butte and Colusa counties. Although limited in occurrence in the Plan Area, protection of individual occurrences is not critical. Western burrowing owl has been successfully relocated ("passive relocation") and has also been found to utilize man-made burrows (Trulio 1995). The preservation of habitat in general however, is stressed. Loss of habitat and poisoning of ground squirrels are the top causes of decline of the species statewide. Lands prioritized for preservation/acquisition include annual grasslands and rangelands. In addition, agricultural lands often provide suitable habitat and their protection may benefit the species. The presence of ground squirrel burrows on these lands is critical in providing breeding habitat, although the species may forage in grasslands, rangelands, and agricultural lands devoid of burrows.

Modeled Species Distribution in the Plan Area

Model Assumptions

Year-round habitat (Nesting and Overwintering)

Modeled overwintering and nesting habitat for western burrowing owl includes these habitats within the western portion of the Plan Area below 200 feet in elevation: valley oak woodland, oak woodland savanna, vernal pool complex, annual grassland, alfalfa, pasture, and cropland.

Rationale

Western burrowing owls use open, dry grasslands and agricultural and range lands that have burrowing animals and short vegetation. Western burrowing owls forage in open grasslands, pasturelands, agricultural fields and field edges, and along the edges of roads and levees where vegetation is low. They require burrows for roosting and nesting and nest in open habitats with sparse vegetative cover and a

high density of burrows. The land-cover types that characterize nesting and foraging habitat for western burrowing owl capture the general habitat requirements of western burrowing owl. This model, however, overestimates the extent of western burrowing owl habitat because the specific characteristics of western burrowing owl habitat are likely patchily distributed within the Plan Area.

Model Results

Species Map 3. *Western Burrowing Owl Modeled Habitat Distribution and Occurrence* shows the modeled potential year-round habitat for western burrowing owl overwintering and potential nesting within the Plan Area. Potential overwintering and nesting habitat occurs throughout the Plan Area, though it is primarily concentrated in the western Valley portion of the Plan Area below 200 feet in elevation. The known occurrences of this species fall within the modeled habitat.

References

Printed References

Barclay, J.H. and S. Menzel. Apparent polygynous nesting by burrowing owls. Journal of Raptor Research 45(1): 98-100.

Belthoff, J. R., and R. A. King. 1997. Between-year movements and nest burrow use by burrowing owls in southwestern Idaho. Technical Report No. 97-3. Idaho Bureau of Land Management.

Botelho, E. S. 1996. Behavioral ecology and parental care of breeding western burrowing owls (*Speotyto cunicularia hupugaea*) in southern New Mexico, USA. Dissertation, New Mexico State University, Las Cruces.

Brenckle, J. F. 1936. The migration of the western burrowing owl. *Bird Banding* 7:66–68.

California Natural Diversity Database. 2015. RareFind, Version 3.1.0. (September 2015). Sacramento, CA: California Department of Fish and Wildlife.

California Department of Fish and Wildlife (CDFW). 2003. Evaluation of petition: request of the Center for Biological Diversity et al. to list the western burrowing owl (*Athene cunicularia hypugaea*) as a threatened or endangered species.

_____. 2012. Staff Report on Burrowing Owl Mitigation.

Catlin, D.H. 2004. Factors affecting within-season and between-season breeding dispersal of burrowing owls in California. Thesis, Oregon State University, Corvallis, Oregon, USA.

Catlin, D.H., D.K. Rosenberg, and K.L. Haley. 2005. The effects of nesting success and mate fidelity on breeding dispersal in burrowing owls. Canadian Journal of Zoology 83: 1574-1580.

Catlin, D.H. and D.K. Rosenberg. 2006. Nest destruction associated with mortality and dispersal of burrowing owls in the Imperial Valley, California. The Southwestern Naturalist 51(3): 406-409.

Coulombe, H. N. 1971. Behavior and population ecology of the burrowing owl, *Speotyto cunicularia*, in the Imperial Valley of California. *Condor* 73:162–176.

DeSante, D. R., E. D. Ruhlen, S. L. Adamany, K. M. Burton, and S. Amin. 1997. A census of burrowing owls in central California 1991. *Journal of Raptor Research* 9:38–48.

DeSante, D. R., E. D. Ruhlen, and D. K Rosenberg. 1996. The distribution and relative abundance of burrowing owls in California: evidence for a declining population. Unpublished manuscript. Point Reyes Station, CA: Institute for Bird Populations.

Grinnell, J., and A. H. Miller. 1944. *The distribution of the birds of California*. Berkeley, CA: Cooper Ornithological Club, Pacific Coast Avifauna. Number 27. Reprinted 1986. Lee Vining, CA: Artemisia Press.

Gervais, J.A., D.K. Rosenberg, and L.A. Comrack. Burrowing owl (Athene cunicularia) in Shuford, W.D. and T. Gardali, editors. 2008. California bird species of special concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Wildlife, Sacramento, California, USA.

Haug, E. A., B. A. Millsap, and M. S. Martell. 1993. The burrowing owl (*Speotyto cunicularia*). In A. Poole and F. Gill (eds.), *The Birds of North America*, No. 61. Philadelphia, PA: The Academy of Natural Sciences and Washington, DC: The American Ornithologists' Union.

Holroyd, G.L., Conway, C.J., and Trefry, H.E. 2011. Breeding dispersal of a burrowing owl from Arizona to Saskatchewan. The Wilson Journal of Ornithology 123(2): 378-381.

James, P. C., and R. Espie. 1997. Current status of the burrowing owl in North America: an agency survey. *Journal of Raptor Research* 9:3–5.

James, P. C., and T. J. Ethier. 1989. Trends in the winter distribution and abundance of burrowing owls in North America. *American Birds* 43:1224–1225.

Klute, D.S., W.H. Howe, S.R. Sheffield, L.W. Ayers, S.L. Jones, T.S. Zimmerman, M.T. Green, and J.A. Shaffer. Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. Biological Technical Publication BTP-R6001-2003. U.S. Fish and Wildlife Service.

Ligon, J. S. 1961. *New Mexico birds*. Albuquerque, NM: University of New Mexico Press.

Martin, D. J. 1973. Selected aspects of burrowing owl ecology and behavior. *Condor* 75:446–456.

Macías-Duarte, A. and C.J. Conway. 2015. Distributional changes in the western burrowing owl (Athene cunicularia hypugaea) in North America from 1967 to 2008). Journal of Raptor Research 49(1):75-83.

Poulin, R., L. D. Todd, E.A. Haug, B.A. Millsap, and M.S. Martell. 2011. Burrowing owl (Athene cunicularia). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Retrieved from the Birds of North American Online: http://bna.birds.cornell.edu.oca.ucsc.edu/bna/species/061. Site accessed September 2015.

Ronan, N.A. 2002. Habitat selection, reproductive success, and site fidelity of burrowing owls in a grassland ecosystem. Thesis, Oregon State University, Corvallis, Oregon, USA.

Rosenberg, D. K., J. Gervaia, H. Ober, and D. DeSante. 1998. An adaptive management plan for the burrowing owl population at Naval Air Station Lemoore, Lemoore, California.

Rosier, J.R., N.A. Ronan, and D.K. Rosenberg. 2006. Post-breeding dispersal of burrowing owls in an extensive California grassland. American Midland Naturalist 155: 162-167.

Sauer, J. R., J. E. Hines, and J. Fallon. 2005. The North American Breeding Bird Survey, Results and Analysis 1966 - 2004. Version 2005.2. USGS Patuxent Wildlife Research Center, Laurel, MD. Available at http://www.mbr-pwrc.usgs.gov/bbs/bbs.html.

Sauer, J. R., Schwartz, S., and Hoover, B. 1996. The Christmas Bird Count Home Page, version 95.1. Patuxent Wildl. Res. Ctr., Laurel, MD. Available at www.mbr-pwrc.usgs.gov/bbs/cbc.html.

Sheffield, S.R. 1997. Current Status, Distribution, and Conservation of the Burrowing Owl (*Speotyto cunicularia*) in Midwestern and Western North America. Pages 399-407 in J.R. Duncan, D.H. Johnson, and T.H. Nicholls [Eds.], Biology and Conservation of Owls of the Northern Hemisphere: Second International Symposium, February 5-9, 1997, Winnipeg, Manitoba, Canada. USDA For. Serv. Gen. Tech. Rep. NC-190.

Smallwood, S.K., C.G. Thelander, M.L. Morrison, and L.M. Rugge. 2007. Burrowing owl mortality in the Altamont Pass Wind Resource Area. Journal of Wildlife Management 71(5): 1513-1524.

Thelander, C.G., K.S. Smallwood, and L.Rugge. 2003. Bird risk behaviors and fatalities at the Altamont Pass Wind Resource Areas, period of performance: March 1998-December 2000. U.S. Department of Energy, National Renewable Energy Laboratory, Golden, Colorado, USA.

Thomsen, L. 1971. Behavior and ecology of burrowing owls on the Oakland Municipal Airport. *Condor* 73:177–192.

Todd, D., R.G. Poulin, T.I. Willicome, and R.M. Brigham. 2003. Post-fledging survival of burrowing owls in Saskatchewan. The Journal of Wildlife Management 67(3): 512-519.

Trulio, L. 1997. Burrowing owl demography and habitat use at two urban sites in Santa Clara County, California. *Journal of Raptor Research* 9:84–89.

_____.1995. Passive relocation: a method to preserve burrowing owls on disturbed sites. *Journal of Field Ornithology* 66(1): 99-106.

Webb, B. Seasonal Checklist of the Birds of Placer County, California. Retrieved November 15, 2009, from http://placerbirding.com/PlacerCountyBirds.htm

Wilkerson, R.L. and R.B. Siegel. 2010. Assessing changes in the distribution and abundance of burrowing owls in California, 1993-2007. Bird Populations 10:1-36.

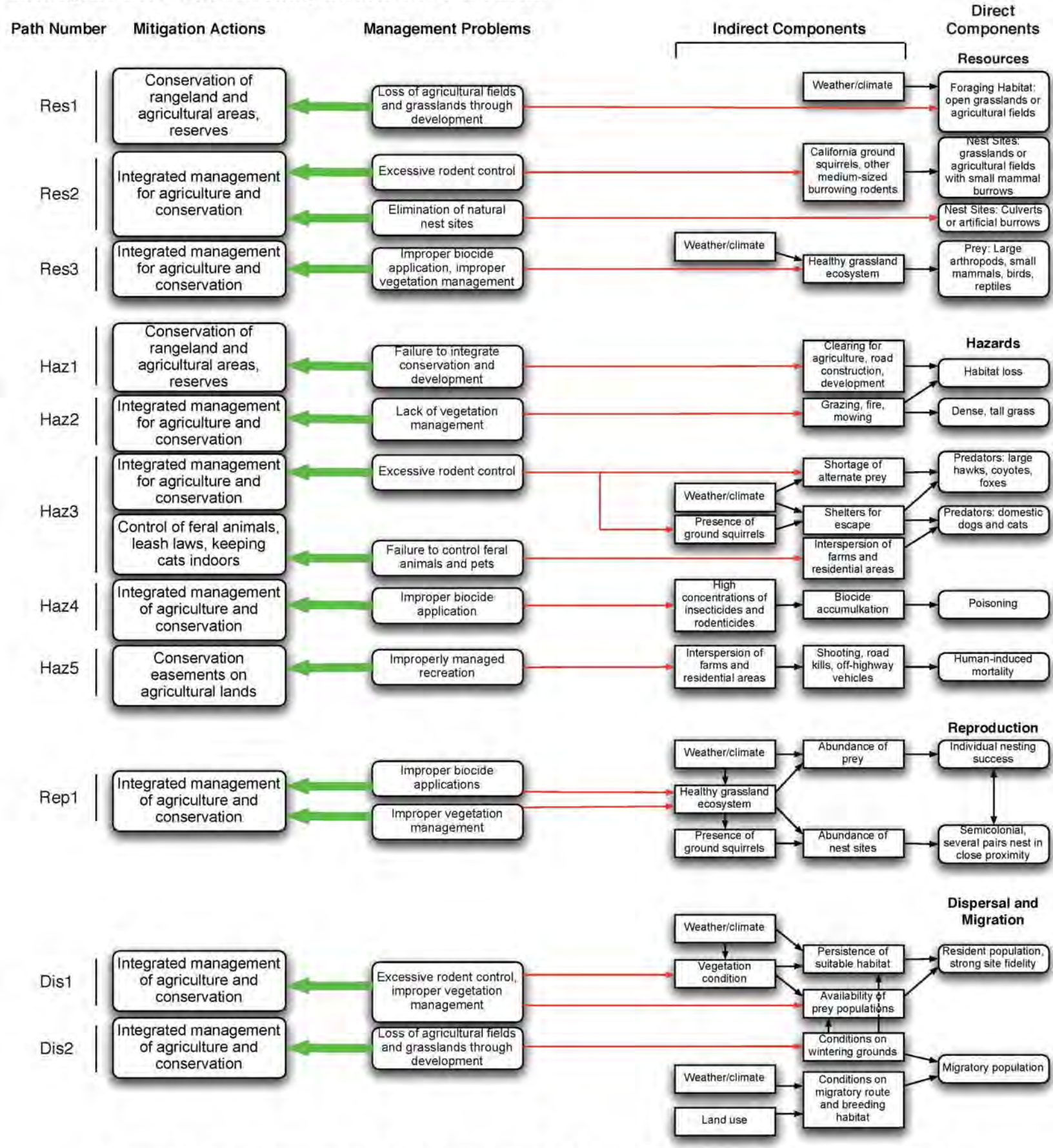
Personal Communications

Easterla, Todd. Ornithologist. December 28, 2002 – Interview during field investigations.

Pandolfino, Ed. Compiler of Lincoln Christmas Bird Count. Sierra Foothill Audubon Society. January 23, 2003 – E-mail correspondence.

Wages, Justin. Land Manager. Placer Land Trust. July 09, 2012 and September 11, 2013 – E-mail correspondence.

Envirogram 3 Western Burrowing Owl, *Athene cunicularia*



Envirogram 3 Western Burrowing Owl. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram Narrative

Western Burrowing Owl (*Athene cunicularia*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary. For example, resources are subdivided into foraging habitat, nest sites, and prey.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Western burrowing owls rely upon grasslands or agricultural fields for foraging habitat, and much of this has been lost to various kinds of development. Conservation of agricultural land and the creation of reserves can mitigate this loss to some degree.

Res2: The owls use burrows created by rodents, especially California ground squirrels (*Spermophilus beecheyi*), for nesting and roosting. Thus, the presence of medium-sized rodents is necessary for western burrowing owls. Excessive rodent control can eliminate these species, so land management that integrates agricultural production and conservation is necessary. Artificial nest sites also are used by the owls and can be used as a management technique to increase population sizes.

Res3: Prey of western burrowing owls includes large arthropods, small mammals, reptiles, amphibians, and small birds. During years with favorable weather, prey species are abundant in healthy grassland ecosystems and agricultural fields that do not have heavy biocide applications. Land management that integrates agricultural production and conservation helps provide these conditions.

Hazards

Haz1: Loss of natural grasslands to agriculture and other types of development has resulted in substantial loss of habitat for western burrowing owls. Conservation easements on agricultural land can mitigate these losses to some extent.

Haz2: In the absence of burning, mowing, or grazing, grass growth makes habitat unsuitable for the western burrowing owls, so vegetation management, such as properly managed livestock grazing, is necessary.

Haz3: Natural predators of western burrowing owls include larger raptors, foxes, and coyotes; additional predation pressure comes from feral and domestic dogs and cats. A healthy ground squirrel population provides refuges and lessens predation pressure on the owls. Predation pressure also is reduced by an

abundance of alternative prey items, largely determined by weather patterns and the extent of rodent control. Land management that integrates agricultural production and conservation helps provide these conditions as does controlling feral cats and dogs and confining pets to yards or houses.

Haz4: Western burrowing owls can accumulate and be poisoned by various biocides. This usually occurs when these toxins are applied in excess. Integrated management for conservation and agricultural production should minimize these circumstances.

Haz5: Protecting western burrowing owls and their habitat from human disturbance such as OHV use and lessening direct mortality from casual shooting and road kills is important. The breeding period is an especially sensitive time because human disturbance can increase nest predation and nest abandonment and result in prolonged exposure of eggs to the elements, nestling starvation, early fledging, and predation upon fledglings.

These problems occur most frequently in the proximity of residential areas and in the absence of properly controlled recreational use of land. Conservation easements on agricultural land may be effective in minimizing these kinds of disturbances to the owls.

Reproduction

Rep1: Western burrowing owls are semi-colonial, and several pairs nest in close proximity. The nesting success of individual pairs depends upon prey abundance, which in turn depends on weather patterns and habitat condition. Excessive biocide application limits prey availability, and tall, rank vegetation inhibits the ability of the owls to hunt successfully. The presence of California ground squirrels or other medium-sized rodents determines the number of nest sites available to a colony. Again, appropriate conditions for the owls depend on the integration of production agriculture and conservation.

Dispersal and Migration

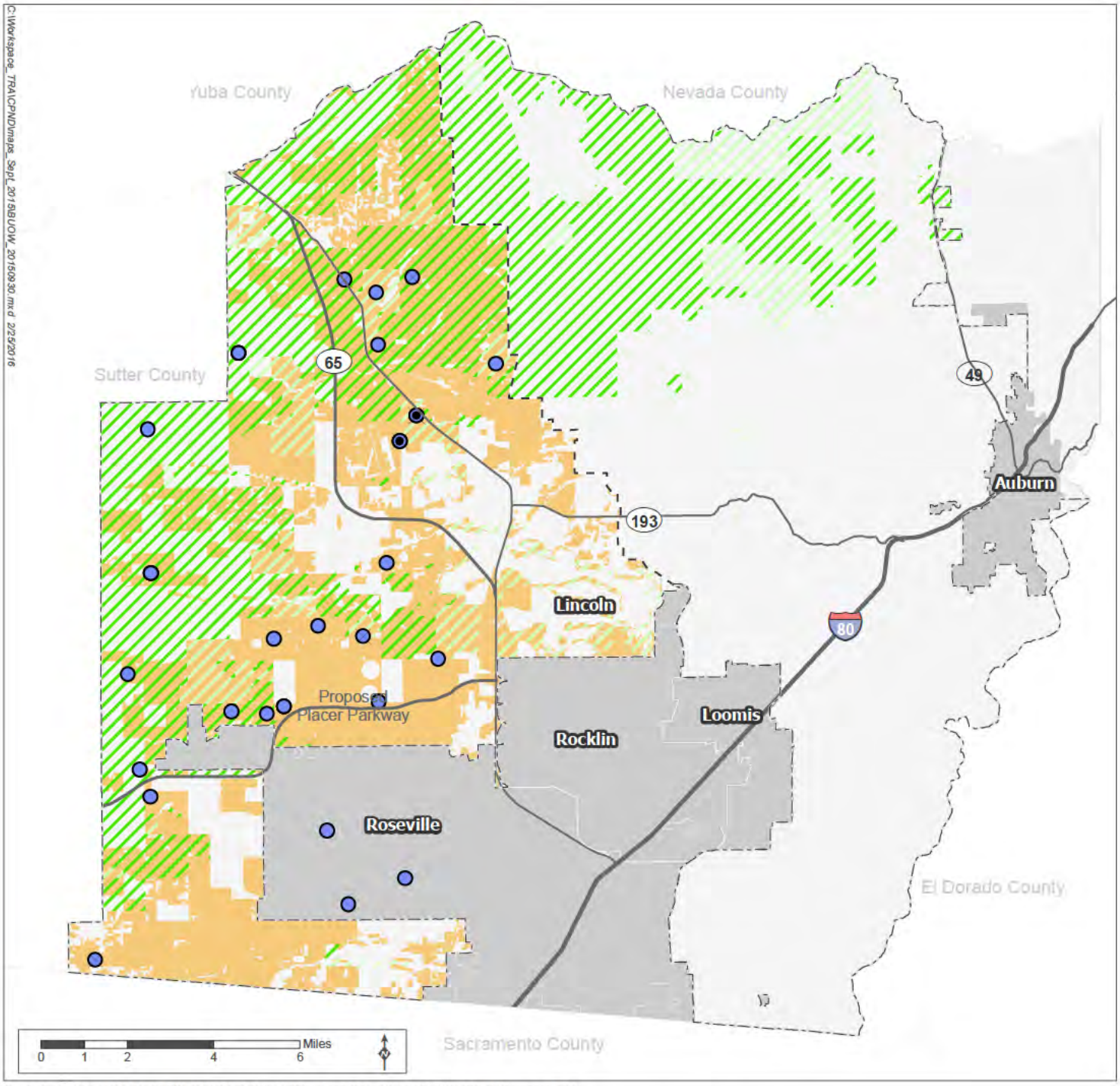
Dis1: A potential resident western burrowing owl population in Placer County is supplemented by additional individuals during winter. Resident populations remain in their breeding localities year around: the adults are highly philopatric, and young owls usually remain to breed close to their natal sites as long as adequate prey resources are available and habitat remains suitable. Weather conditions and integrated management both play major roles in maintaining resident owl populations. Management techniques that encourage stable prey availability may encourage the establishment of resident populations, and increased adult survival during winter will increase recruitment and population sizes.

Dis2: Migrant populations are those that have bred elsewhere but moved to areas of stable food supply in winter. Migration is a hazardous time, and the birds' physical state and energy reserves and the conditions along their migratory routes and in their breeding habitats are beyond the control of Placer County. However, maintaining the conditions that encourage resident populations also will be beneficial for migrant populations.

Summary

As predators near the top of their food web, western burrowing owls are highly sensitive to ecosystem conditions. They are also quite sensitive to various kinds of disturbance caused by human activities and feral and domestic animals, particularly during the breeding season. These factors suggest that the best strategy for western burrowing owl conservation in Placer County is to conserve range and crop land and manage it in an integrated fashion for both production and biodiversity conservation. The owls'

requirements are such that they are very compatible with vernal pool-grassland ecosystem conservation as well.



Source: Placer County, 2014; MIG | TRA, 2015; CNDDB, 2014; Placer Land Trust, 2010; eBird, 2012; Patrick Moeszinger, 2014

Occurrences
- Precise
- General
- Nest Location

Modeled Habitat
- Potential Nesting and Overwintering Habitat
- Non-habitat

- Existing Protected Area
- Reserve Aquisition Area
- Non-participating City
- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 3.

Western Burrowing Owl Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG | TRA

Tricolored Blackbird
(*Agelaius tricolor*)

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Status

Federal: Bird Species of Conservation Concern; Under Review for Federal Endangered Species Act Listing; Migratory Bird Treaty Act

State: Species of Special Concern; Threatened, California Endangered Species Act Listing (2017)

Critical Habitat: Not Applicable (N/A)

Recovery Plan: Conservation Plan for the Tricolored Blackbird (*Agelaius tricolor*) by The Tricolored Blackbird Working Group, dated January 2009

Distribution

North America

Tricolored blackbird is largely endemic to California, and more than 99% of the global population occurs in the state. In any given year, more than 75% of the breeding population can be found in the Central Valley (Hamilton 2000). Small breeding populations also exist at scattered sites in Oregon, Washington, Nevada, and western coastal Baja California (Beedy and Hamilton 1999).

California

The historic breeding range for tricolored blackbirds included the Sacramento and San Joaquin Valleys, the foothills of the Sierra Nevada south to Kern County, the coastal slope from Sonoma County south to the Mexican border, and, sporadically the Modoc Plateau (Neff 1937). Historical surveys; however, did not include large areas of the species' currently known breeding range. Therefore, no the full extent of the tricolored blackbirds historical breeding range is not known.

The overall range of the tricolored blackbird has changed little since the mid-1930's (Beedy and Hamilton 1999), although more recent surveys have documented occurrences of tricolored blackbirds in areas that previously lacked surveys. Tricolored blackbirds are found at low elevation sites the entire length of the state (Dudek 2014). The largest number of birds has for decades been in the Central Valley (Neff 1937, Beedy and Hamilton 1999, Kyle and Kelsey 2011), but the Central Valley has recently seen a dramatic drop in abundance, down about 78% from 2011 to 2014 (Meese 2014). Small numbers of tricolored blackbirds are also found in coastal locations from Santa Barbara County north to Mendocino County, isolated sites in the western interior of southern California, and on the Modoc Plateau in northeastern California (Beedy 2008). Tricolored blackbirds are fairly common but localized breeders in the western Sierra Nevada foothills up to about 1,000 feet (Beedy and Pandolfino 2013), and uncommon breeders up to about 1,500 feet in Calaveras and Stanislaus Counties (Airola pers. comm. 2014).

The species breeds in large colonies, with breeding sites concentrated in the San Joaquin Valley, Sacramento–San Joaquin Delta, and the southern Sacramento Valley. The species also breeds along the California coast from Humboldt to San Diego counties; on the Modoc Plateau and western edge of the Great Basin (mostly Klamath Basin); in lowlands surrounding the Central Valley; and in western portions of San Bernardino, Riverside, and San Diego counties.

Following the breeding season tricolored blackbirds flock with other blackbird species and are concentrated in the Sacramento Valley. During winter, virtually the entire population of the species withdraws from Washington, Oregon (although a few remain), Nevada, and Baja California and wintering populations shift extensively within their breeding range in California (Beedy and Hamilton 1999). Major wintering concentrations occur in and around the Sacramento-San Joaquin River Delta and coastal areas, including Monterey and Marin counties, where they are often associated with dairies (Beedy 2008). Small flocks may also appear at scattered locations from Sonoma County south to San Diego County, and sporadically north to Del Norte County (Beedy and Hamilton 1999, Unitt 2004). Tricolored blackbirds are rare in the winter in the southern San Joaquin Valley and in the Sacramento Valley north of Sacramento County (Beedy and Hamilton 1999). The Southern California population segment south of the Tehachapi Mountains appears to be mostly confined to Southern California, although rarely, some birds will move out of the Central Valley into Southern California (Meese unpubl. data).

Placer County Plan Area

Historical

Neff (1937) found only two tricolored blackbird breeding colonies in Placer County. Both of these were in cattails (*Typha* sp.) along canals near the city of Lincoln in 1933 and 1936 and contained about 1,000 and 1,500 nests, respectively. A colony (unknown number of pairs) was found nesting in cattails in a wet pasture near Lincoln in 1971 (Hosea 1986; California Natural Diversity Database [CNDDB] 2015). Another colony of about 2,000 pairs was found in cattails around a marsh on the Chamberlain Ranch (north-northwest of Lincoln) in 1971 (DeHaven pers. comm.).

Current

Within the Plan Area, tricolored blackbirds occur in the lower elevations from 100 to 300 feet (Jones and Stokes 2004). It is often found in mixed flocks with other species of blackbirds, or may occur as single species flocks in annual grasslands, wetlands, and agricultural areas. Suitable foraging habitat for this species exists in most watersheds in the Plan Area that have not been extensively urbanized.

A statewide survey for tricolored blackbird was conducted in 2008 and again in 2014 (Meese 2014). In addition to the data collected in the statewide survey, data on tricolored blackbird distribution and occupancy is available on the Tricolored Blackbird Portal (http://tricolor.ice.ucdavis.edu/). Data found on the Tricolored Blackbird Portal includes both published and unpublished data from a variety of sources, including data collected by nonprofessional scientists. This account summarizes the published data and numbers from the 2014 statewide survey, as well as distribution and breeding data found on the Tricolored Blackbird Portal that provides valuable information on habitat usage in Placer County.

Meese (2014) groups Placer County into the Sierra Foothills region or the tricolored blackbird range, and data collected in the 2014 statewide survey suggests that this region may continue to support successful breeding by tricolored blackbirds. A total of 25,717 tricolored blackbird individuals were observed in the Sierra Foothills region in 2014 (Meese 2014). The dominant land use in areas occupied by tricolored

blackbirds is ranching. Tricolored blackbirds in Placer County breed primarily in isolated stands of Himalayan blackberry and small cattail and bulrush marshes in stock ponds (Airola et. al. 2015).

A total of 17,600 birds were estimated from four active colonies in Placer County during the April 2014 statewide survey (Meese 2014). Tricolored blackbird colonies were detected at Gleason Ranch on Sunset Boulevard West (6,500 individuals), West Ferrari Ranch Road (1,800 individuals), Little Ben (7,500 individuals) and Orchard Creek (1,800 individuals, also known as Industrial Avenue #2). In 2014, Placer County supported a considerable portion of the tricolored blackbird population within the Sacramento Valley (Meese 2014). Specifically, 33% of the tricolored blackbird individuals counted in nine Sacramento Valley counties (Amador, Butte, Colusa, El Dorado, Placer, Sacramento, Sutter, Yolo, Yuba) occurred in Placer County. Although data from the 2014 statewide survey provides a good one-time snapshot of tricolored blackbird distribution and numbers in Placer County and statewide, additional surveys conducted in Placer County in 2014 are reported in the Tricolored Blackbird Portal.

The Tricolored Blackbird Portal documents 21 colony sites and aggregations in western Placer County, of which 15 are active (i.e., colonies were documented at a set within prior 10 years) and may potentially have breeding colonies, and one is listed as historical (Table 1). The Tricolored Blackbird Portal reports six colonies as being active in 2015, with approximately 12,715 tricolored blackbird individuals detected. These colonies are located at Gleason Ranch on Sunset Boulevard West, Little Ben, Markham Ravine #3, Orchard Creek, West Ferrari Ranch Road, and Dalby East of Highway 65 Lincoln Bypass (Table 1). A total of seven colonies were found to be active in 2014. In addition to the four colonies observed as part of the statewide survey (i.e., Gleason Ranch, West Ferrari Ranch Road, Little Ben, and Orchard Creek), individuals were also observed at Bear Valley Meadow, Yankee Slough, and Dalby East of Highway 65 Lincoln Bypass (Table 1).

A large, and regionally important, winter roost of blackbirds, including tricolored blackbirds, exists at Yankee Slough, northwest of Lincoln in western Placer County. In January 2014, this roost contained approximately 35,000 blackbirds of several species, several thousand of which appeared to be tricolored blackbirds (Dudek 2014). Yankee Slough also supports hundreds of breeding tricolored blackbirds (Meese pers. obs. 2014).

Population Status &Trends

North America/California

Because tricolored blackbird is endemic to California, the California population is also the North American population. The first systematic surveys of tricolored blackbird's population status and distribution were conducted by Neff (1937, 1942). During a 5-year interval, Neff found 252 breeding colonies in 26 California counties; the largest colonies were in rice-growing areas of the Central Valley. As many as 736,500 adults per year were observed in just eight Central Valley counties. The largest colony observed was in Glenn County; it contained more than 200,000 nests (about 300,000 adults) and covered almost 60 acres. Several other colonies in Sacramento and Butte Counties contained more than 100,000 nests (about 150,000 adults).

DeHaven et al. (1975a) estimated that the overall population size in the Sacramento and northern San Joaquin valleys had declined by more than 50% since the mid-1930s. They performed intensive surveys and banding studies in the areas surveyed by Neff (1937) and observed significant declines in tricolored blackbird numbers and the extent of suitable habitat in the period since Neff's surveys. Orians (1961a)

and Payne (1969) observed colonies of up to 100,000 nests in Colusa, Yolo, and Yuba counties, but did not attempt to survey the entire range of the species.

The U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Wildlife, and California Audubon cosponsored intensive, volunteer tricolored blackbird surveys in suitable habitats throughout California in 1994, 1997, 1999, 2000, 2001, 2005, 2008,nd 2014, and 2017 (Hamilton et al. 1995; Beedy and Hamilton 1997; Hamilton 2000; Kelsey 2008; Meese 2014; Meese 2017). Statewide, tricolored blackbird populations have fluctuated since 1994, declining by 62% from 1994 to 2001, increasing from 2001 to 2008, and then decreasing again in 2014 before slightly increasing in 2017 (Table 1). The primary causes of the long-term and more recent declines has been attributed to loss of native breeding habitat and the concentration of large colonies in agriculture fields where large proportions of the colonies are subject to reproductive failure (Hamilton et al. 1999; Hamilton 2000; Meese 2014). The widespread and ongoing conversion of native habitats to dairies, orchards, vineyards, rice, and other forms of agriculture and the use of effective and persistent insecticides may have created unsuitable breeding conditions in much of the core area of the species range (Meese 2015). Graves (2013) describes the range-wide population decline has not occurred uniformly among habitats and regions; a relatively recent agricultural crop (triticale) has supported large breeding populations in the San Joaquin Valley and resulted in an increased proportion of birds being within this region compared to records prior to the 1980s. However, this habitat is ephemeral and carries with it a high risk of failure through harvesting (Graves 2013). In 1994, full season survey results indicated that 70% of all tricolored blackbird nests and 86% of all foraging by nesting birds occurred on private agricultural land (Hamilton et al. 1995). Approximately 54% of all observed tricolored blackbird nesting efforts were associated with agricultural crops, primarily grain crops grown for silage at dairies (Beedy and Hamilton 1997).

Table 1. Total tricolored blackbirds counted in California in statewide surveys from 1994 – 2014.

Year	Number
1994	369,359
1997	237,928
1999	104,786
2000	162,508
2001	146,126
2005	257,802
2008	394,858
2014	145,135
2017	177,656

In 2017, a total of 177,656 birds were counted 37 counties from 44 counties and 884 locations surveyed. Of this total, 172,499 birds were observed at breeding colonies and 5,157 were observed in nonbreeding aggregations or as single birds (Meese 2017). A total of 145,135 birds were counted in 37 counties during the 2014 statewide survey (Meese 2014). Tricolored blackbirds were observed at a total of 143 locations out of 802 locations surveyed. The rate of decline in the number of tricolored blackbirds appears to be increasing. From 2008 to 2011 the number of tricolored blackbirds dropped by 34%, from 394,858 to 259,322 birds (Kyle and Kelsey 2011), and from 2011 to 2014 the number of tricolored blackbirds dropped by 44%, from 259,322 to 145,135 birds. This is despite the fact that in 2014, 75 new location records were added by 27 different Tricolored Blackbird Portal users as result of the statewide

survey. In 2008, 180 sites were visited, in 2011, 608 sites were visited, and in 2014, 802 sites were visited. Despite this substantial increase in sites that were visited, the total number of tricolored blackbirds counted declined dramatically. In addition, the 2014 census reported a substantial downward trend in the sizes of the largest colonies over the past decade (Meese 2014).

In 2014, tricolored blackbird numbers were down markedly from the two previous statewide surveys in the San Joaquin Valley, especially in Kern and Merced counties, where the breeding birds had recently been most concentrated. Overall, the number of breeding birds in the San Joaquin Valley dropped 78% in 6 years, from 2008 to 2014, and the number of birds seen in counties along the Central Coast was less than 10% of that seen in 2008 (Meese 2014). In 2014, the largest nesting colonies occurred in Tulare, Madera, and Merced counties, but these colonies all supported drastically fewer numbers of tricolored blackbirds than in the previous two census surveys (Meese 2014). Meanwhile, Placer and Sacramento counties saw a marked increase in the number of tricolored blackbirds (Meese 2014).

The 2014 statewide survey also identified several important distribution and population trends for tricolored blackbird.

- The rate of decline in the number of tricolored blackbirds appears to be accelerating. The rate of mortality of adults far exceeds that of the recruitment of new breeding birds into the population and chronically low reproductive success since 2007 appears to be a major factor causing the disparity between mortality and recruitment (Meese 2013).
- The number of tricolored blackbirds has decreased steeply statewide, with declines most pronounced in the San Joaquin Valley and along the Central Coast. Meanwhile, the number of tricolored blackbirds in the Sierra Nevada foothills and Sacramento County have increased, suggesting either that tricolored blackbirds are moving into the foothills from other regions or are breeding relatively more successfully in the Sierra Nevada foothills than they are in the San Joaquin Valley or Central Coast (Meese 2014).
- A dramatic decline in the size of the largest colonies is associated with the decline in the number of tricolored blackbirds (Meese 2015)
- A large proportion of birds have become increasingly concentrated into relatively few colonies. Specifically, in 1994, 2000, 2008, and 2014 the top 10 counties accounted for 60%, 59%, 77.5%, and 90% of the total statewide population estimate, respectively.

However, based on the 2017 state-wide surveys, the decline in the number of tricolors observed since the 2008 survey appears to have ceased. From 2008 to 2014 the number of tricolors dropped by 64%, from 395,000 to 145,000 birds (Kelsey 2008, Meese 2014) but the number of birds increased by 22% from 2014 to 2017.

While the results of the 2017 Tricolored Blackbird Statewide Survey suggest that the rapid decline in abundance observed since at least 2008 has been arrested and that there has been an increase in abundance since 2014 of about 32,000 birds. Looking closely at these results shows that the majority of the increase from 2014 to 2017 is due to birds observed in the San Joaquin Valley, where the number of birds estimated increased by more than 44,000 (Meese 2017).

Placer County Plan Area

Tricolored blackbird populations in Placer County estimated from statewide surveys have fluctuated since 1994 (Table 2). Most of its historical nesting and foraging habitats are near the cities of Lincoln and Roseville. Rapid development in these areas may reduce their overall suitability for nesting by conversion of existing freshwater marshes, agricultural lands, and pastures to other land uses.

Table 2. Number of tricolored blackbirds counted in Placer County from 1994 – 2014 (Kelsey 2008, Meese 2014).

Year	Number
1994	1,000
1997	658
1999	4,500
2000	6,200
2001	2,800
2005	1,600
2008	12,050
2014	17,600
2017	960

Natural History

The habitat requirements, ecological relationships, life history, and threats to tricolored blackbird described below are summarized in diagram form in the envirogram (Envirogram 4 *Tricolored Blackbird*).

Habitat Requirements

Tricolored blackbird has three basic requirements for selecting its breeding colony site: open accessible water; a protected nesting substrate, including flooded, thorny, or spiny vegetation; and suitable foraging habitat providing adequate insect prey within a few miles of the nesting colony (Hamilton et al. 1995; Beedy and Hamilton 1997, 1999). Tricolored blackbird requires open water within 1,640 feet for colony settlement (Hamilton 2004). Almost 93% of the 252 breeding colonies reported by Neff (1937) were in freshwater marshes dominated by cattails (*Typha* spp.) and bulrushes (*Scirpus* sp.). The remaining colonies in Neff's study were in willows (*Salix* spp.), blackberries (*Rubus* sp.), thistles (*Cirsium* and *Centaurea* spp.), or nettles (*Urtica* sp.). In contrast, only 53% of the colonies reported during the 1970s were in cattails and bulrushes (DeHaven et al. 1975a).

Proximity to suitable foraging habitat appears to be extremely important for the establishment of colony sites, as tricolored blackbirds usually forage, at least initially, in the field containing the colony site (Cook 1996). However, often only a minor fraction of the area within the commuting range of a colony provides suitable foraging habitat (Beedy and Hamilton 1999). An increasing percentage of tricolored blackbird colonies in the 1980s and 1990s were reported in Himalayan blackberry (*Rubus discolor*) (Cook 1996), and some of the largest recent colonies have been in silage and grain fields (e.g., triticale) (Hamilton et al. 1995; Beedy and Hamilton 1997; Hamilton 2000). In the Sacramento Valley, 67% of the colonies were found on Himalayan blackberry (Kelsey 2008). Other substrates observed to be used by

tricolored blackbird for nesting include giant reed (*Arundo donax*), safflower (*Carthamus tinctorius*) (DeHaven et al. 1975a), tamarisk trees (*Tamarix* spp.), elderberry (*Sambucus* spp.) and poison oak (*Toxicodendron diversilobum*) (Beedy and Hamilton 1999). In addition, triticale, a vigorous wheat and rye hybrid grown to feed the dairy cows, has become an important nesting substrate accounting for nearly half of all early-season nesting and breeding sites and more than half of all known reproduction in 2005 (Hamilton and Meese 2006).

With the loss of a natural flooding cycle and most native wetland and upland habitats in the Central Valley, breeding tricolor blackbird now forages primarily in managed habitats. Ideal foraging conditions for tricolored blackbird is created when shallow flood-irrigation, mowing, or grazing keeps the vegetation at an optimal height (<6 inches) (Tricolored Blackbird Working Group 2009). Foraging habitats in all seasons include annual grasslands; wet and dry vernal pools and other seasonal wetlands; agricultural fields (e.g., rice, alfalfa, irrigated pastures, and ripening or cut grain fields); cattle feedlots; and dairies. Tricolored blackbird also forages occasionally in riparian scrub habitats and along marsh borders. Weed-free row crops and intensively managed vineyards and orchards do not serve as regular foraging sites (Beedy and Hamilton 1997, 1999).

Vernal pool grassland complexes and rice fields characterize the landscape in much of the species' breeding range and preferred foraging habitats in western Placer County. Ungrazed grasslands composed of tall grasses (>6 inches tall) and vernal pools are preferred over dry, grazed grasslands with short grasses. Foraging birds often congregate at the margins of wet vernal pools and within their interiors once they dry (Cook 1996).

Wintering tricolored blackbirds often congregate in huge, mixed-species blackbird flocks that forage in grasslands and agricultural fields with low-growing vegetation and at dairies and feedlots (Beedy 2008).

Foraging

Foods delivered to tricolored blackbird nestlings include beetles and weevils; grasshoppers; caddisfly larvae; moth and butterfly larvae (Orians 1961a; Crase and DeHaven 1977; Skorupa et al. 1980); and, especially in current rice-growing areas, dragonfly larvae (Beedy and Hamilton 1999). Breeding season foraging studies in Merced County showed that animal matter makes up about 91% of the food volume of nestlings and fledglings, 56% of the food volume of adult females, and 28% of the food volume of adult males (Skorupa et al. 1980).

Adults may continue to consume plant foods throughout the nesting cycle but also forage on insects and other animal foods. Immediately before and during nesting, tricolored blackbird is often attracted to the vicinity of dairies, where it eats high-energy livestock feed. Adults with access to livestock feed, such as cracked corn, begin providing it to nestlings when they are about 10 days old (Hamilton et al. 1995). More than 88% of all winter food in the Sacramento Valley is plant material, primarily rice and other grain seed but also weed seeds (Crase and DeHaven 1978). In winter, tricolored blackbirds often associate with other blackbirds, but flocks as large as 15,000 individuals (almost all tricolored blackbirds) may congregate at one location and disperse to foraging sites (Beedy and Hamilton 1999).

Reproduction

Tricolored blackbird breeding extends from mid-March through early August (Beedy and Hamilton 1999). Autumnal breeding (i.e., September through November) has been documented at sites in the Central Valley (Orians 1960, Payne 1969). Tricolored blackbird is closely related to red-winged blackbird

(*Agelaius phoeniceus*), but the two species differ substantially in their breeding ecology. Red-winged blackbird pairs defend individual territories, while tricolored blackbird is among the most colonial of North American passerine birds (Bent 1958; Orians 1961a, 1961b, 1980; Orians and Collier 1963; Payne 1969; Beedy and Hamilton 1999). As many as 20,000 or 30,000 tricolored blackbird nests have been recorded in cattail marshes of 9 acres or less (Neff 1937; DeHaven et al. 1975a), and individual nests may be built less than 1.5 feet apart (Neff 1937). Tricolored blackbird's colonial breeding system may have adapted to exploit a rapidly changing environment where the locations of secure nesting habitat and rich insect food supplies were ephemeral and likely to change each year (Orians 1961a; Orians and Collier 1963; Collier 1968; Payne 1969).

Tricolored blackbird nests are bound to upright plant stems from a few inches to about 6 feet above water or ground (Baicich and Harrison 1997); however, nests in the canopies of willows and ashes may be more than 12 feet high (Hamilton pers. comm.). Their nests are rarely built on the ground (Neff 1937). Deep cup nests are constructed with outer layers of long leaves (e.g., cattail thatch, annual grasses, or forbs) woven tightly around supporting stems. The inner layers are coiled stems of grasses lined with soft plant down, mud, or algal fibers. Nest building takes about 4 days (Payne 1969).

Egg laying can begin as early as the second day after nest initiation but ordinarily starts about 4 days after the local arrival of tricolored blackbirds at breeding sites (Payne 1969). One egg is laid per day, and clutch size is typically 3-4 eggs (Payne 1969; Hamilton et al. 1995). Emlen (1941) and Orians (1961b) estimated the incubation period at 11 or 12 days, while Payne (1969) estimated it to be 11to 14 days. About 9 days generally elapse from hatching until the oldest nestling is willing to jump from the nest when disturbed. Young require about 15 days from this prefledging date until they are independent of their parents. Thus, one successful nesting effort for a reproductive pair takes about 45 days (Hamilton et al. 1995).

Low reproductive success has been recorded for tricolored blackbirds. Higher reproductive success has been found to be associated with greater abundance of favored insect groups in foraging habitats surrounding colonies. Meese (2013) documented widespread reproductive failures of entire colonies from 2006 to 2011 that appeared unrelated to nesting substrate. Instead, Meese (2013) found that insect abundance around these colonies was insufficient to support successful breeding, resulting in nestling starvation and failure of females to lay eggs.

Dispersal Patterns

DeHaven et al. (1975b) found that tricolored blackbird is unlikely to nest at the sites where they hatched or where they had nested the year before (n = 298 recoveries from 45,660 banded birds). However, breeding colonies often exhibit site fidelity and traditionally use many of the same areas year after year if these sites continue to provide essential resources such as secure nesting substrates, water, and suitable foraging habitats (Beedy et al. 1991; Hamilton et al. 1995; Beedy and Hamilton 1997; Hamilton 2000). As discussed in *Movement and Migratory Patterns* below, the distribution of tricolored blackbird in the Central Valley varies according to relatively predictable, seasonal movements. In Placer County, the species may number in the thousands at a colony site in one year and be absent the next year. Over the years of 2008, 2011, 2014 and 2015, 13 total sites were colonized, with an average of 5.75 of the 13 colonies occupied in any given year (Table 1).

Longevity

Banding studies, summarized by Neff (1942) and DeHaven and Neff (1973), indicate that tricolored blackbird can live for at least 13 years, but most live for much shorter periods. There are no annual survivorship studies of tricolored blackbird, and available banding data are inadequate to provide this information (Beedy and Hamilton 1999).

Sources of Mortality

Entire colonies (up to tens of thousands of nests) in cereal crops and silage are often destroyed by harvesting and plowing of agricultural lands in the San Joaquin Valley (Beedy and Hamilton 1999, Graves 2013). The concentration of a high proportion of the known population in a few breeding colonies increases the risk of major reproductive failures, especially in vulnerable habitats such as active agricultural fields. Harvesting of silage grains in locations where colonies have settled causes complete breeding failure of many thousands of birds for at least one breeding attempt (Tricolored Blackbird Working Group 2009).

Historical accounts documented the destruction of nest contents of entire nesting colonies by a diversity of avian, mammalian, and reptilian predators (Beedy and Hamilton 1999). Recently, especially in permanent freshwater marshes of the Central Valley, the contents of nests of entire colonies have been lost to black-crowned night heron (*Nycticorax nycticorax)* and common raven (*Corvus corax*). Some large colonies (up to 100,000 adults) may lose more than 50% of nests to coyotes (*Canis latrans*), especially in silage fields, but also in freshwater marshes when water is withdrawn (Hamilton et al. 1995).

Various poisons and contaminants have caused mass mortality of tricolored blackbird. McCabe (1932) described the strychnine poisoning of 30,000 breeding adults as part of an agricultural experiment. Neff (1942) considered poisoning to regulate numbers of blackbirds preying upon crops (especially rice) to be a major source of mortality. This practice continued until the 1960s, and thousands of tricolored and other blackbirds were exterminated to control damage to rice crops in the Central Valley.

Beedy and Hayworth (1992) observed a complete nesting failure of a large colony (about 47,000 breeding adults) at Kesterson Reservoir in Merced County; selenium toxicosis was diagnosed as the primary cause of death. At a Kern County colony, all eggs sprayed by mosquito abatement oil failed to hatch (Beedy and Hamilton 1999). Hosea (1986) attributed the loss of at least two colonies to aerial herbicide applications.

Behavior

Males defend only the immediate areas around the nests. Male territory size ranges from 19 square feet (Lack and Emlen 1939) to 35 square feet (Orians 1961b). Average size of recently established territories of six banded males at two different colonies was 35 square feet; volumetric territories in willows were calculated to be 300–400 cubic feet (Collier 1968). Some Himalayan blackberry colonies have nesting densities up to six nests/m^2 (0.56 nest/square foot) (Cook, pers. comm.; Hamilton pers. comm.). After one week of nest-building and egg-laying, males may cease territorial defense (Orians 1961b).

Tricolored blackbird generally forages within 3 miles of the colony site (Orians 1961a), but commutes distances of over 9 miles have been reported (Beedy and Hamilton 1999). Short-distance foraging (i.e., within sight of the colony) for nestling provisioning also is common. Both sexes are known to provision the nestlings (Beedy and Hamilton 1999).

Proximity to suitable foraging habitat appears to be extremely important for the establishment of colony sites, as tricolored blackbird always forages, at least initially, in the field containing the colony site (Hamilton and Meese 2006, Cook 1996). However, usually only a minor fraction of the area within the commuting range of a colony provides suitable foraging habitat. For example, within a 3 mile radius there may be low-quality foraging habitats such as cultivated row crops, orchards, vineyards, and heavily grazed rangelands in association with high-quality foraging areas such as irrigated pastures, lightly grazed rangelands, vernal pools, and recently mowed alfalfa fields (Beedy and Hamilton 1999; Cook 1999). Tricolored blackbird has been documented to travel more than 8 kilometers in search of animal prey with which to feed their young (Hamilton and Meese 2006).

Movement and Migratory Patterns

During the breeding season, tricolored blackbird exhibits itinerant breeding whereby individuals often move after their first nesting attempts and breed again at a different geographical location (Hamilton 1998). In the north Central Valley and northeastern California, individuals move after first nesting attempts, both successful and unsuccessful (Beedy and Hamilton 1997). Banding studies indicate that significant movement into the Sacramento Valley occurs during the postbreeding period (DeHaven et al. 1975b).

Wintering Tricolored Blackbird populations move extensively throughout their range during the non-breeding season. In winter, the number of tricolored blackbirds decreases in the Sacramento Valley and increases in the Sacramento–San Joaquin River Delta and north San Joaquin Valley (Neff 1937; Orians 1961a; Payne 1969; DeHaven et al. 1975b). By late October, large flocks also congregate in pasturelands in southern Solano County and coastal areas near dairies in Marin and Monterey Counties (Shuford and Gardali 2008, Beedy and Hamilton 1999). Other birds winter in the central and southern San Joaquin Valley. Concentrations of more than 15,000 wintering Tricolored Blackbirds may gather at one location and disperse up to 20 miles to forage (Neff 1937; Beedy and Hamilton 1999). Individual birds may leave winter roost sites after less than 3 weeks and move to other locations (Collier 1968), suggesting winter turnover and mobility. In early March/April, most birds vacate the wintering areas in the Central Valley and along the coast and move to breeding locations in the Sacramento and San Joaquin Valleys (DeHaven et al. 1975b).

Ecological Relationships

Tricolored blackbird occupies a unique niche in the Central Valley/coastal marshland ecosystems. In areas where numbers are high, this species both aggressively and passively dominates and often displaces sympatric marsh-nesting species, including red-winged and yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), through sheer numbers (Orians and Collier 1963; Payne 1969).

Population Threats

The greatest threats to this species are the direct loss and alteration of habitat, but other human activities and predation also threaten tricolored blackbird populations in the Central Valley (Beedy and Hamilton 1999).

Habitat Loss and Alteration

Most native habitats that once supported nesting and foraging tricolored blackbird in the Central Valley has been lost or degraded. In 1939, only 560,500 of an original 4,000,000 acres (about 4%) of wetlands in the Central Valley were extant. By the mid-1980s, an estimated 480,000 acres of freshwater emergent marshes, or 85% of the total remaining freshwater wetlands in 1939, were reduced by one-half to about 243,000 acres (Beedy and Hamilton 1997). Much of the Central Valley has been altered by urbanization and unsuitable agricultural uses, including vineyards, orchards, and row crops (Frayer et al. 1989; Wilen and Frayer 1990). In Sacramento County, a historic breeding center of the species, the conversion of grassland and pastures to vineyards expanded from 7,536 acres in 1996 to 13,171 acres in 1998 (DeHaven 2000). The total vineyard lands in Sacramento County expanded further from over 16,500 acres in 2005 to over 21,200 in 2013 (Center for Biological Diversity 2015). Many former agricultural areas within the historical range of tricolored blackbird are now being urbanized; in western Placer County, where tricolored blackbird forages in the ungrazed annual grasslands associated with rural subdivisions, suitable habitat will be largely eliminated as current land conversion patterns continue.

In some places, most historical tricolored blackbird breeding and foraging habitats have been eliminated and there is currently little or no breeding effort where there once were large colonies (Orians 1961a; Beedy et al. 1991). Elsewhere, tricolored blackbird has shifted from cattails as a primary nesting substrate (Neff 1937) to Himalayan blackberry (DeHaven et al. 1975a), and more recently to cereal crops and barley silage (Hamilton et al. 1995).

Other Human Activities

Nests and nest contents in cereal crops and silage are often destroyed by agricultural operations (Hamilton et al. 1995; Beedy and Hamilton 1997). Harvest of grain silage is conducted in relation to moisture content of the forage, the timing of which coincides with tricolored blackbirds using the crops for nesting (USFWS 2000). This causes nest destruction and direct mortality, which in turn is threatening much of the remaining breeding population of the species (USFWS 2000). Harvesting of silage and plowing of weedy fields are currently the most common reasons tricolored blackbird nesting colonies are destroyed on agricultural lands. In 2014, it was reported 38% of all nesting substrate consisted of silage (e.g., triticale) (Meese 2014). The concentration of most of the tricolored blackbird reproductive effort into a few large colonies that are selecting grain silage as a nesting substrate has greatly increased the risk of threats to the species should the annual destruction of such a large proportion of nests continue unabated (Cook and Toft 2005).

Other factors that may affect the nesting success of colonies in agricultural areas include herbicide and pesticide applications and spraying for mosquito abatement (Beedy and Hamilton 1999). Beedy and Hamilton (1999) observed a colony sprayed by mosquito abatement operators in Kern County and all sprayed eggs failed to hatch. In addition, the loss of at least two tricolored blackbird colonies was attributed to herbicide applications (Beedy and Hamilton 1999). Beedy and Hayworth (1992) observed a complete nesting failure of a large colony (about 47,000 breeding adults) at Kesterson Reservoir in Merced County, and selenium toxicosis was diagnosed as the primary cause of death.

Predation

Predation is possibly a major cause of complete nesting failure at some tricolored blackbird colonies in the Central Valley. Historical accounts documented the reproductive failure of nesting colonies to predation of nest contents by a diversity of avian, mammalian, and reptilian predators. Heron and

raccoon predation upon colonies nesting in marshes can destroy all or nearly all nests within colonies (Hamilton et al. 1995, Hamilton 2000). Entire colonies (>50,000 nests) have been lost to black-crowned night herons, common ravens, coyotes, and other predators, especially in permanent freshwater marshes of the Central Valley (Beedy and Hamilton 1999). More recent studies have documented wholesale reproductive failure of entire colonies due to predation by cattle egrets (Meese 2013).

Context for a Regional Conservation Strategy

Tricolored blackbird breeding colonies have been reported in western Placer County in recent years and are treated as present; however, because the distribution and abundance of breeding colonies varies annually, the current breeding population at a given colony site may be small or absent. Therefore, currently unoccupied colony sites that provide suitable habitat characteristics retain conservation value as sites that may be used in the future. Table 1 lists 21 tricolored blackbird colony sites and aggregations within Plan Area A, of which 15 are active or recently active (a colony site is assumed active if tricolored blackbirds were documented nesting at a site within the prior 10 years). Within a breeding season, surveys have found tricolored blackbirds at 2-6 colony sites in Plan Area A. Regular monitoring of colony sites has confirmed breeding at four sites in 2014 and five in 2015 (Airola pers. comm.). Of the 15 active or recently active colony sites found in Plan Area A, six are in the RAA, 3-4 are protected in Existing Protected Areas, and five are in the PFG.

In California, species occurrences are scattered throughout much of the state, with densities greatest in the Central Valley and surrounding lowlands. In the Sierra Nevada foothill region, tricolored blackbird has been recorded from all counties surrounding western Placer, including Sacramento, western Yuba, Butte, Sutter, Colusa, Glenn and Yolo counties. Placer County is; therefore, not highly significant in terms of the species' distribution and range. However, Placer County has been found to support a considerable proportion of the regional population (see above: *Distribution, Placer County Plan Area, Current*). The general decline of breeding colonies in the state and the rapid urbanization of previously occupied sites in the Plan Area lend value to remaining populations and suitable habitat.

A study on tricolored blackbirds was conducted in seven counties that contribute in some part to the Sierra Nevada foothills ecoregion, which includes grassland dominated regions of lower elevations in Placer County. The 2014 tricolored blackbird nesting population of foothills in these counties was 43,009 birds, of which 12,473 (29%) occurred in Placer County (Airola et. al. 2015). The relatively large number of birds that bred successfully in the Sierra Nevada foothills grasslands, which includes Placer County, in a year of historic drought when the number of breeding birds in the San Joaquin Valley was 78% lower than in 2008 (Meese 2014) suggests that the Sierra Nevada foothills region may play a significant role in tricolored blackbird species conservation (Airola et. al. 2015).

Tricolored blackbird colonies will breed at freshwater marsh dominated by cattails and bulrushes, or in other flooded or thorny vegetation such as willows, blackberries, thistles, or nettles at open and accessible water. The species will also use agricultural fields for nesting, such as silage and grain fields. Suitable foraging habitat within a few miles of the nesting colony is required. Tricolored blackbird will forage over annual grasslands, wet and dry vernal pools and other seasonal wetlands, agricultural fields, cattle feedlots and dairies. Ungrazed vernal pool grassland complexes and rice fields characterize the landscape in much of the species' breeding range and preferred foraging habitats in western Placer County. For the conservation of tricolored blackbird in the Plan Area, acquisition and protection of the habitats described above, including current and past colony sites, is of highest priority. Meese et. al. (2015) states that locations with relatively higher average reproductive success should be preferred

targets for conservation investments and that land uses within a 5 kilometer radius of the nesting sites should be considered equally as important as nesting vegetation.

Modeled Species Distribution in the Plan Area

Model Assumptions

Nesting Habitat

Tricolored blackbird nesting habitat includes the marsh complex land cover type below 300 feet elevation.

Foraging Habitat

Modeled foraging habitat for tricolored blackbird emphasizes the open cover below 300 foot elevation which is mapped as vernal pool complex, annual grassland, pasture, alfalfa, and cropland. While tricolored blackbird may forage in rural residential, urban golf courses, urban parks, and urban wetland, those rural residential and urban/suburban land-cover types are not included in modeled foraging habitat for tricolored blackbird.

Rationale

Tricolored blackbirds breed and overwinter in the Plan Area; therefore, foraging habitat may be used year-round. Tricolored blackbirds have three basic requirements for selecting their breeding colony sites: open accessible water; a protected nesting substrate, including either flooded, thorny, or spiny vegetation; and suitable foraging habitat providing adequate insect prey within a few miles of the nesting colony. Tricolored blackbirds require open water within 1,500 feet for colony settlement. Historically, most breeding colonies were in freshwater marshes dominated by cattails and bulrushes (*Schoenoplectus* sp.), with a small percentage in willows (*Salix* spp.), blackberries (*Rubus* sp.), thistles (*Cirsium* and *Centaurea* spp.), or nettles (*Urtica* sp.). Documented tricolored blackbird colonies in the Plan Area are mostly located in large stands of Himalayan blackberry. The scale of the land cover model does not delineate stands of Himalayan blackberry, so Himalayan blackberry stands are not included as nesting habitat in this model Such stands are occasionally found within annual grassland and valley foothill riparian land-cover types, so nesting habitat should be suitably captured by including these layers as potential nesting habitat. These stands comprise a small percentage of the total amount of these land-cover types; therefore, the total acreage for nesting habitat is an overestimate.

Model Results

Species Map 4. *Tricolored Blackbird Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for tricolored blackbird in the Plan area. Potential tricolored habitat is distributed throughout much of the Plan Area below 300 foot elevation; there is considerably more secondary habitat than primary habitat. All of the known occurrences of nesting colonies fall within the modeled habitat, the majority of them within primary habitat. Those that do not occur in stands of Himalayan blackberry not distinguished in the GIS land-cover layers.

References

Printed References

Airola, Dan., R. Meese, and D. E. Krolick. 2015. Tricolored Blackbird Conservation Status and Opportunities in the Sierra Nevada Foothills of California. Central Valley Bird Club Bulletin Vol. 17 No. 2-4.

Baicich, P. J., and C. J. O. Harrison. 1997. *A guide to the nests, eggs, and nestlings of North American birds* (second edition). San Diego, CA: Academic Press.

Beedy, E. C., S. D. Sanders, and D. Bloom. 1991. Breeding status, distribution, and habitat associations of the Tricolored Blackbird (*Agelaius tricolor*) 1859–1989. Prepared for U.S. Fish and Wildlife Service, Sacramento, CA.

Beedy, E. C., and A. Hayworth. 1992. Tricolored blackbird nesting failures in the Central Valley of California: general trends or isolated phenomena? Pages 33–46 in D. F. Williams, S. Byrne, and T. A. Rado (eds.), *Endangered and sensitive species of the San Joaquin Valley, California*. Sacramento, CA: California Energy Commission.

Beedy, E. C., and W. J. Hamilton III. 1997. Tricolored blackbird status update and management guidelines. Prepared for U.S. Fish and Wildlife Service Migratory Birds and Habitat Programs and California Department of Fish and Game Bird and Mammal Conservation Program. Sacramento, CA.

_____. 1999. Tricolored blackbird *(Agelaius tricolor).* In A. Poole and F. Gill (eds.), *The birds of North America*, No. 423. Philadelphia, PA: Academy of Natural Sciences and Washington, DC: American Ornithologists' Union.

Bent, A. C. 1958. Life histories of North American blackbirds, orioles, tanagers, and allies. Dover, New York: Publications, Inc.

California Natural Diversity Database. 2015. RareFind 3, Version 3.1.0 (August 2015). Sacramento, CA: California Department of Fish and Wildlife.

Center for Biological Diversity (CBD). 2015. Before the Secretary of Interior: A Petition to List the Tricolored Blackbird as Endangered under the U.S. Endangered Species Act. San Francisco.

Collier, G. 1968. Annual cycle and behavioral relationships in the red-winged and tricolored blackbirds of southern California. Ph.D. dissertation, University of California, Los Angeles.

Cook, L. 1996. Nesting adaptations of tricolored blackbirds (*Agelaius tricolor*). Master's thesis, University of California, Davis.

Cook, L. and C. A. Toft. 2005. Dynamics of extinction: Population decline in the colonial Tricolored Blackbird (Agelaius tricolor). Bird Conservation International 15:73-88.

Crase, F. T., and R. W. DeHaven. 1977. Food of nestling tricolored blackbirds. *Condor* 79:265–269.

_____. 1978. Food selection by five sympatric California blackbird species. *California Fish and Game* 64:255–267.

Dawson, W. L. 1923. *The birds of California: Volume I*. San Francisco: South Moulton Company.

DeHaven, R.W. 2000. Breeding tricolored blackbirds in the Central Valley, California: a quarter-century perspective. Unpublished report. Sacramento, CA: U.S. Fish and Wildlife Service.

DeHaven, R. W., F. T. Crase, and P. D. Woronecki. 1975a. Breeding status of the tricolored blackbird, 1969–1972. *California Fish and Game* 61:166–180.

_____. 1975b. Movements of tricolored blackbirds banded in the Central Valley of California, 1965–1972. *Bird-Banding* 46:220–229.

DeHaven, R. W., and J. A. Neff. 1973. Recoveries and returns of tricolored blackbirds, 1941–1964. *Western Bird Bander* 48:10–11.

Dudek, 2014. Evaluation of Potentially Suitable Habitat and Recommended Future Survey Locations for Selected Rare Species within the Placer County Conservation Plan/Natural Community Conservation Plan Area.

Emlen, J. T. 1941. An experimental analysis of the breeding cycle of the tricolored red-wing. *Condor* 43:209–219.

Frayer, W. E., D. D. Peters, and H. R. Pywell. 1989. Wetlands of the California Central Valley: status and trends – 1939 to mid-1980s. Portland, OR: U.S. Fish and Wildlife Service, Region 1.

Graves, E. E., M. Holyoak, T. R. Kelsey, and R. J. Meese. 2013. Understanding the contribution of habitats and regional variation to long-term population trends in tricolored blackbirds. Ecology and Evolution. doi: 10.1002/ece3.681

Grinnell, J., and A. H. Miller. 1944. *The distribution of the birds of California*. No. 27. Berkeley, CA: Pacific Coast Avifauna.

Hamilton, W. J., III. 1998. Tricolored blackbird itinerant breeding in California. *Condor* 100:218-226.

Hamilton, W. J. III, L. Cook, and R. Grey. 1995. Tricolored blackbird project 1994. Unpublished report prepared for U.S. Fish and Wildlife Service, Portland, OR.

Hamilton, B. [W.J., III], L. Cook, and K. Hunting. 1999. Tricolored blackbirds 1999 status report. Report prepared for Calif. Dep. Of fish and Game, Sacramento CA, and U. S. Fish and Wildlife Service, Portland, Oregon.

Hamilton, W. J., III. 2000. Tricolored blackbird 2000 survey and population analysis. Unpublished report prepared for U.S. Fish and Wildlife Service, Portland, OR.

Hamilton, W. J. 2004. Tricolored Blackbird (*Agelaius tricolor*). *In* The Riparian Bird Conservation Plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html.

Hamilton, W. J. III and R. J. Meese, 2006. Habitat and population characteristics of Tricolored Blackbird colonies in California. Final Report to California Department of Fish and Game.

Hosea, R. C. 1986. A population census of the tricolored blackbird, *Agelaius tricolor* (Audubon), in four counties in northern Central Valley of California. M.S. thesis, California State University, Sacramento.

Jones & Stokes. 2004. Placer County natural resources report. Edward C. Beedy, Principal-in-charge. Prepared for Placer County Planning Department, Auburn, California. Jones & Stokes, Sacramento, California.

Kelsey, R. 2008. Results of the Tricolored Blackbird 2008 Census. Audubon California. http://tricolor.ice.ucdavis.edu/files/trbl/Tricolored%20Blackbird%202008%20Status%20Report%20Final.pdf

Kyle, K, and R. Kelsey. 2011. Results of the 2011 Tricolored Blackbird Statewide Survey. Audubon California.

Lack, D., and J. T. Emlen. 1939. Observations on breeding behavior in tricolored red-wings. *Condor* 41:225–230.

McCabe, T. T. 1932. Wholesale poison for the red-wings. Condor 34:49–50.

Meese, R.J. 2013. Chronic low reproductive success of the colonial Tricolored Blackbird from 2006 to 2011. Western Birds 44: 98-113.

Meese, R. J. 2014. Results of the 2014 Tricolored Blackbird Statewide Survey. U.C. Davis.

Meese, R. J. 2015. Efforts to Assess the Status of the Tricolored Blackbird from 1931 to 2014. Central Valley Bird Club Bulletin Vol. 17 No. 2-4.

Meese, R. J., D. A. Airola, E. C. Beedy, and R. Cook. 2015. Recovering the Tricolored Blackbird in California. Central Valley Bird Club Bulletin Vol. 17 No. 2-4.

Neff, J. A. 1937. Nesting distribution of the tricolored red-wing. Condor 39:61–81.

_____. 1942. Migration of the tricolored red-wing in central California. *Condor* 44:45-53.

Orians, G. H. 1961a. The ecology of blackbird (*Agelaius*) social systems. *Ecology Monographs* 31:285–312.

_____. 1961b. Social stimulation within blackbird colonies. *Condor* 63: 330–337.

_____. 1980. Some adaptations of marsh-nesting blackbirds. *Monographs in Population Biology*. Princeton, NJ: Princeton University Press.

Orians, G. H., and G. Collier. 1963. Competition and blackbird social systems. *Evolution* 17:449–459.

Payne, R. 1969. Breeding seasons and reproductive physiology of tricolored blackbirds and red-winged blackbirds. *University of California Publications in Zoology*, Volume 90. Berkeley, CA: University of California Press.

Shuford, W. D., and Gardali, T., eds. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. W. Field Ornithol., Camarillo, CA, and Calif. Dept. Fish and Game, Sacramento.

Skorupa, J. P., R. L. Hothem, and R. W. DeHaven. 1980. Foods of breeding tricolored blackbirds in agricultural areas of Merced County, California. *Condor* 82:465–467.

Tricolored Blackbird Working Group. 2009. Conservation Plan for the Tricolored Blackbird (*Agelaius tricolor*). Susan Kester (ed.). Sustainable Conservation. San Francisco, CA.

U.S. Fish and Wildlife Service. 1999. Draft Recovery Plan for the Giant Garter Snake (*Thamnopsis gigas*). U.S. Fish and Wildlife Service, Portland, Oregon. ix+ 192 pp.

U. S. Fish and Wildlife Service (USFWS). 2000. Strategy for Exit from the Dilemma of Tricolored Blackbirds Nesting in Dairy Silage Fields in the San Joaquin Valley, California.

Wilen, B. O., and W. E. Frayer. 1990. Status and trends of United States wetlands and deepwater habitats. *Forest Ecology Management* 33:181–192.

Williams, B. 1996. Seasonal checklist of the birds of Placer County. Grass Valley, CA: Sierra Foothills Audubon Society.

Personal Communications

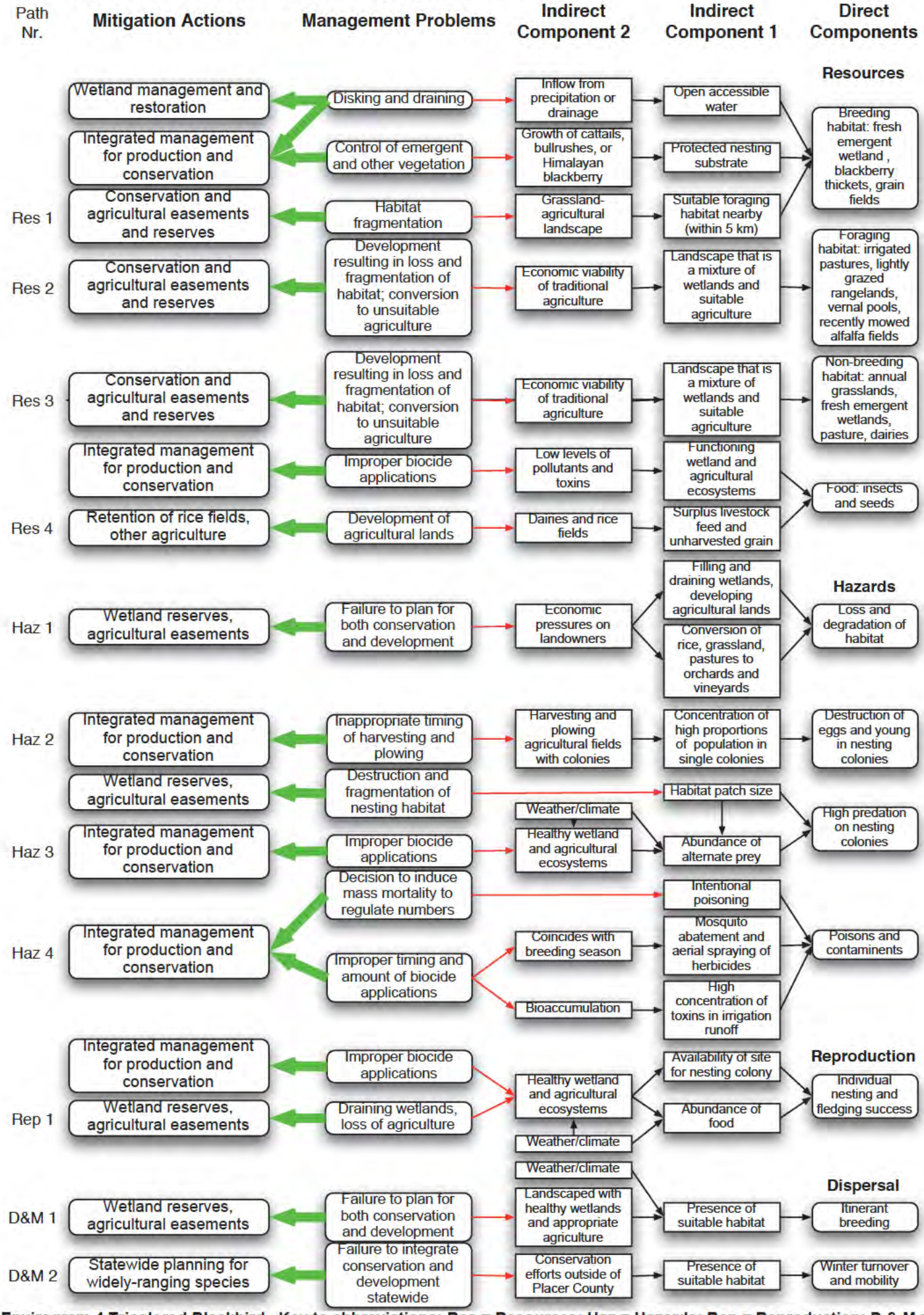
Airola, Dan. Local bird expert and member of Central Valley Bird Club: Editor and Chair of Club Bulletin. September 2015 – emails.

Cook, L. Wildlife Biologist. California Department of Water Resources. May 1999 – telephone conversation.

DeHaven, R. Wildlife biologist, U.S. Fish and Wildlife Service, Sacramento, CA. May 1999 – telephone conversation.

Hamilton, W. J. III. Emeritus professor, Division of Environmental Studies, University of California, Davis. 1996–2000 – telephone conversations.

Envirogram 4 Tricolored Blackbird, *Agelaius tricolor*



Envirogram 4 Tricolored Blackbird. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; D & M = Dispersal and Migration.

Envirogram Narrative

Tricolored Blackbird (*Agelaius tricolor*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary. For example, resources are subdivided into breeding habitat, foraging habitat, non-breeding habitat, and food.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1**:** Breeding habitat for tricolored blackbird requires open accessible water, protected nesting substrate, and suitable foraging habitat within three miles. Disking and draining of wetlands has reduced the first requisite, which could be mitigated by better wetland management or restoration. Cattails and bulrush originally were the preferred nesting substrate, but upland shrubs and vines (including the introduced Himalayan blackberry) can substitute provided that they are not eliminated by vegetation management. Suitable foraging habitat can be found in large, contiguous grassland-agricultural landscapes that have not been converted to orchards, vineyards, or row crops. Conservation and agricultural easements can ensure that these large habitat patches will still be present in Placer County.

Res2**:** Foraging habitat includes fresh emergent wetlands, irrigated pastures, lightly grazed rangelands, vernal pools, and recently mowed alfalfa fields. Such habitat can be found in large, contiguous grassland- agricultural landscapes that have not been developed or converted to orchards, vineyards, or row crops. The persistence of such landscapes in Placer County depends on the continued viability of traditional agriculture. Conservation and agricultural easements may ensure that suitable landscapes will still be present in Placer County.

Res3**:** Non-breeding habitat is similar to foraging habitat, but requires the presence of more grain and seeds because insects are less available (see path Res4). The presence of suitable non-breeding habitat has the same requirements as foraging habitat (path Res2).

Res4**:** Tricolored blackbird eats primarily insects during the breeding season and mostly seeds and grain at other times of the year. The presence of adequate insect prey depends on wetland and agricultural ecosystems that have low levels of pollutants and toxins—a result of proper management. An integrated approach to agricultural production and conservation can help insure adequate insect abundance. Much of the grain consumed by the tricolored blackbird during the non-breeding season comes from surplus livestock feed or unharvested rice. Thus, dairies and rice fields are important to this species, and these enterprises must be conserved through conservation and agricultural easements.

Hazards

Haz1**:** Continued loss of habitat is a hazard faced by the tricolored blackbird. Filling and draining wetlands and developing agricultural lands are one source of loss; conversion of rice fields, grasslands, and pastures to row crops, orchards, and vineyards are another. Both of these problems result from economic pressures on landowners that are the legacy of a failure to plan for both conservation and development. Wetland reserves and agricultural easements can help alleviate these pressures.

Haz2**:** Destruction of eggs and young in entire nesting colonies can be catastrophic for the species' annual reproductive success because such a large proportion of its total population can be found in a single colony. Harvesting and plowing during the nesting season is a cause of the destruction; it can be mitigated by integrating production agriculture with conservation. Easements or other kinds of economic incentives may be necessary.

Haz3**:** Entire nesting colonies have been decimated by predators, including herons, ravens, and coyotes. Lack of alternate prey and easy access to breeding colonies because of habitat fragmentation facilitate such mass predation events. Maintaining large, unfragmented wetland and agricultural ecosystems through reserves, easements, and proper management practices can minimize this hazard.

Haz4**:** Various poisons and contaminants are another hazard for the tricolored blackbird. Entire colonies have been eliminated by intentional poisoning with strychnine in the past. Aerial spraying for mosquito abatement or weed and pest control still can have severe consequences for breeding colonies either directly or indirectly through its effects on insect prey. Various toxins such as selenium that are found in irrigation tailwater can bioaccumulate and cause mortality and reproductive failure as well. Integrated management for agricultural production and conservation, especially on the timing and management of pesticides, can help minimize this hazard.

Reproduction

Rep1**:** Individual nesting and fledging success depends on the presence of an appropriate habitat for colonial nesting and sufficient food to sustain the colony. While food abundance depends to some extent on weather conditions, the presence of healthy wetland and agricultural ecosystems is critical. Wetland reserves, agricultural easements, and proper management of pesticides and land use help ensure that reproduction will succeed.

Dispersal and Migration

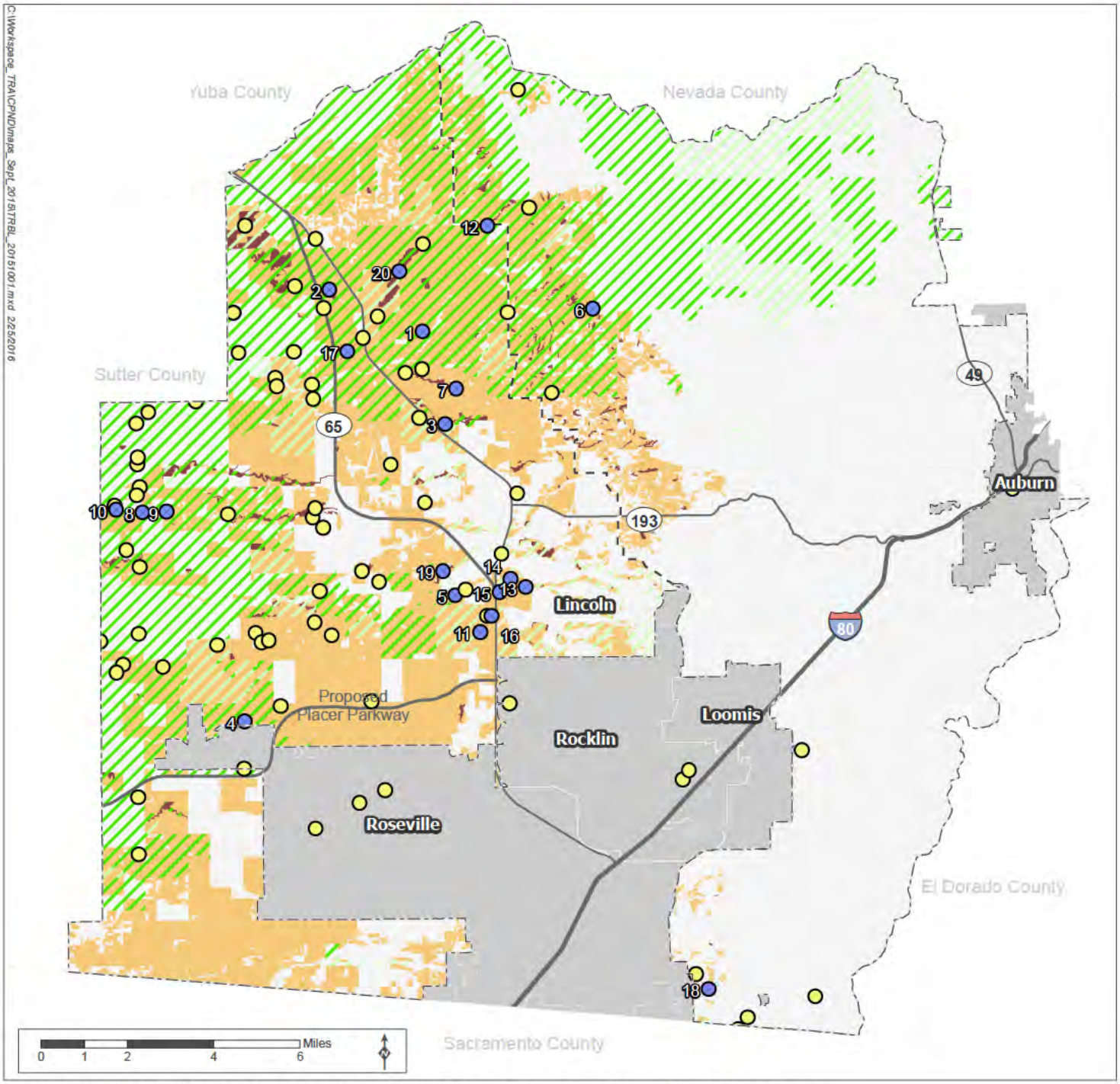
D&M1: Tricolored blackbird is an itinerant breeder; areas that supported breeding colonies one year may be empty in others. Habitat suitability depends to some extent on weather conditions, but primarily on landscapes that are mixtures of healthy wetlands and appropriate agriculture. Past planning failures that are responsible for the disappearance of such landscapes can be mitigated partially by creating wetland and agricultural reserves now.

D&M2: Tricolored blackbird colonies wander throughout the greater Central Valley-Delta region during the non-breeding season as well as remain near breeding areas. Clearly, the survival of this species requires habitat throughout the entire region, and that will depend upon conservation activities outside of Placer County. Statewide planning efforts are necessary for the continued existence of this species.

Summary

Tricolored blackbird, originally a wetland species, adapted to agricultural areas after most of the Central Valley's wetlands were lost. The continued existence of this species will not only depend on wetland

conservation and restoration but also on conserving rice farms, dairies, and ranches and managing these operations in ways that are compatible to the species' needs. Agricultural/conservation easements in Placer County should be very specific about these management goals.



Source: Placer County, 2014; MIG | TRA, 2015; CNDDB, 2015; eBird, 2012; Tricolored Blackbird Portal, 2015; eBird, 2015; Placer Land Trust, 2010; Restoration Resources, 2005

Occurrences
- Nest Colony Sites - Tricolored Blackbird Portal
- Other Sightings - eBird and Other Sources

Modeled Habitat
- Nesting Habitat
- Foraging Habitat
- Non-habitat

- Existing Protected Area
- Reserve Aquisition Area
- Non-participating City

- Major Road
- Valley/Foothill Divide
- Area A Boundary

Colony #	Colony Name	Colony #	Colony Name
1	Chamberlain Ranch	11	Orchard Creek
2	Dalby East of Hwy 65 Lincoln Bypass	12	Riosa Road
3	Gladding Highway 65	13	Rodeo Ground Open Space 1
4	Gleason Ranch on Sunset Blvd West	14	Rodeo Ground Open Space 2
5	Industrial Avenue	15	Rodeo Ground Open Space 3
6	Little Ben	16	Twelve Bridges and Hwy 65 West
7	Manzanita Road	17	Waltz East Hwy. 65 Bypass
8	Markham Ravine #1	18	Wellington Way
9	Markham Ravine #2	19	West Ferrari Ranch Road
10	Markham Ravine #3	20	Yankee Slough

Species Map 4.

Tricolored Blackbird Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Giant Garter Snake
(*Thamnophis gigas*)

© Gary Nafis

Status

Federal: Threatened (USFWS 1993)

State: Threatened

Recovery Plan: Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*) (USFWS 1999); Recovery Plan for the Giant Garter Snake (USFWS 2017).

Critical Habitat: No critical habitat rules have been published for the giant garter snake.

Distribution

California

Giant garter snake is endemic to California, found only in the Sacramento and San Joaquin Valleys (Fitch 1941; Hansen and Brode 1980; Rossman and Stewart 1987; USFWS 1999). Records of giant garter snakes coincide roughly with the historical distribution of the large flood basins, freshwater marshes, and tributary streams of the Central Valley of California (Hansen and Brode 1980). The distributional range of this species probably extended from Butte County in the north to Buena Vista Lake in Kern County in the south. The eastern and western boundaries of the range are believed to be the foothills of the Coast Ranges and the Sierra Nevada (USFWS 1999). Rossmann et al. (1996) described an elevation range for giant garter snake of 0–400 feet. Occurrence records in the southern Sacramento Valley occurred between 10–40 feet elevation (Hansen 1986). Agricultural and flood control activities have extirpated the species from the southern one-third of its range in the former wetlands associated with the historic Buena Vista, Tulare, and Kern lakebeds (Hansen and Brode 1980; Hansen 1986, 1988; CDFG 1992[1]; USFWS 1999). Today, populations of giant garter snake are found in the Sacramento Valley and isolated portions of the San Joaquin Valley (USFWS 1999; USFWS 2006; CNDDB 2015). Recent records indicate 13 recognized populations distributed from the vicinity of Chico in Butte County to near Burrel in Fresno County (Hansen and Brode 1980; Rossman and Stewart 1987; USFWS 1999; USFWS 2006; Wood et al. 2015; CNDDB 2015). This range is currently divided into three recovery units including the Northern Sacramento Valley Recovery Unit (Butte, Colusa, and Sutter Basins), Southern Sacramento Valley Recovery Unit (American, Yolo, and Delta Basins), and San Joaquin Valley Recovery Unit (San Joaquin and Tulare Basins) (Wood et al. 2015). The recovery units are presumed to be distinct from one another based on ecological and geographical characteristics and unique recovery actions needed within them (USFWS 1993; 2006).

[1] As of January 1, 2013, the California Department of Fish and Game (CDFG) was renamed the California Department of Fish and Wildlife. When this document cites reports prepared by the Department prior to 2013, the reference includes the prior department name of CDFG. Both CDFW and CDFG refer to the same agency.

Placer County Plan Area

Historical

The western third of the Plan Area occurs within the Central Valley proper and supports numerous low-elevation tributaries and wetlands that could have provided suitable habitat for this species. However, there are no historical records of this species in the Plan Area.

Current

There are no current records of giant garter snake within the Placer County Plan Area. However, suitable habitat occurs in the drainage network associated with agricultural fields in the western section of the County, from approximately Sheridan south to the area of Baseline Road and South Brewer Road (USFWS 1999; USFWS 2006; Dudek 2014). Several locations within this area are used for growing rice, and the associated agricultural ditches and wetlands/sloughs containing emergent vegetation in conjunction with suitable adjacent upland habitat could be used by giant garter snake during both the active and inactive seasons (Dudek 2014).

A total of 19 occurrences of giant garter snake have been reported within five miles to the west and south of the Placer County line in the Sutter and Natomas Basins of Sutter and Sacramento Counties (CNDDB 2015). The closest occurrence was recorded in the Natomas Basin of Sacramento County approximately 1.5 miles to the southwest of the Placer County line. Another population occurs in Auburn Ravine, west of the Plan Area in Sutter County (Paquin et al. 2006).

Population Status & Trends

California

The current distribution and abundance of giant garter snake is reduced and declining due to loss, degradation, and fragmentation of habitat (USFWS 1999). Despite the loss of 93% of historic wetlands throughout the Central Valley, giant garter snakes continue to persist in relatively small, isolated patches of highly modified agricultural wetlands (Wood et al. 2015). Giant garter snake have become increasingly fragmented in recent decades and persist in small clusters of populations primarily in agricultural canals and drains associated with rice agriculture and remnant managed wetlands (Halstead et al. 2010). Prior to 1970, the species was known from 17 populations (Hansen and Brode 1980). At the time of listing in 1993, 13 of these populations were extant; only three of these populations are currently considered stable and safe from threats. Populations of giant garter snake have been nearly extirpated from the San Joaquin Valley Recovery Unit where only a few isolated populations remain within the San Joaquin Basin. They are presumed extirpated further south of the San Joaquin Basin in the Tulare Basin: Buena Vista Lake, Kern Lake, and Tulare Lake (Dickert 2005 as cited in Wood et al. 2015).

Giant garter snake populations north of the Sacramento-San Joaquin Delta are believed to be relatively stable compared to the San Joaquin Valley where populations appear to be in notable decline (USFWS 2012). The previous USFWS status review for giant garter snake found that, of the 13 populations in the listing, the population at Burrell/Lanare in the San Joaquin Valley is likely extirpated and that several locality records in the San Joaquin Valley and within the Sacramento-San Joaquin Delta are threatened with extirpation (USFWS 2006). Surveys conducted since 2006 strongly indicate that populations at Burrell/Lanare and at Liberty Farms in Yolo County are extirpated (Hansen 2008 as cited in USFWS 2012). The other populations listed in the previous status review all appear to be extant. Giant garter

snakes are known to be extant in Butte County, Glenn County, Colusa County, Sutter County, Sacramento County, Yolo County, Solano County, San Joaquin County, Contra Costa County, Merced County, and Fresno County (USFWS 2012).

Placer County Plan Area

There are no known records of giant garter snakes in the Plan Area. Consequently, the status of any population that may occur there is unknown.

Natural History

The habitat requirements, ecological relationships, life history, and threats to giant garter snake described below are summarized in diagram form in the Envirogram 5 Giant Garter Snake.

Habitat Requirements

Giant garter snake inhabits agricultural wetlands and associated waterways. These include irrigation and drainage canals, rice fields, marshes, sloughs, ponds, small lakes, low-gradient streams, and adjacent uplands (USFWS 1999; USFWS 2012). Features of these habitats important to giant garter snakes include: sufficient water during the snake's active season (early spring through mid-fall) to maintain an adequate prey base; emergent vegetation such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) for escape cover and foraging habitat; upland habitat with grassy banks and openings to waterside vegetation for basking; and adjacent upland areas for cover and refuge from floodwaters during the species' inactive season (Hansen 1980; Hansen 1988; Brode and Hansen 1992; Hansen and Brode 1993; USFWS 2012). Studies suggest that permanent wetlands with emergent vegetation harbor the greatest densities of giant garter snakes, and that wetlands that do not provide water during giant garter snakes inactive season (April to October) cannot support large populations of the giant garter snake (Wylie et al. 1997). In addition, irrigated pastures provide indirect habitat for giant garter snake because the pastures require early summer flooding of pastures and frequent irrigation—often from a maze of irrigation canals (Paquin et al. 2006; Paquin, pers. comm.). Giant garter snake primarily occurs where a dense network of canals exists among rice agriculture and wetlands (Halstead et al. 2010).

Giant garter snake is absent from larger rivers; wetlands with sand, gravel, or rock substrates; and from riparian woodland areas lacking suitable basking sites or suitable prey populations (Hansen 1980; Rossman and Stewart 1987; Brode 1988; Hansen 1988; USFWS 1999). Instead, Giant garter snake typically inhabits stagnant or slow-moving waterbodies with abundant emergent vegetation (Halstead et al. 2010).

Although many wildlife refuges within the range of giant garter snake contain wetlands, those that use "wet-soil management" do not provide suitable habitat for giant garter snakes (Paquin et al 2006). In wet-soil management, the wetlands are left to dry in the summer months in order to promote the growth of wetland plant species that provide food for overwintering waterfowl (Paquin et al 2006). Therefore, this type of management does not provide enough aquatic habitat during the snake's active season.

According to the Draft Recovery Plan for the Giant Garter Snake (USFWS 1999), the ideal concept of a marsh managed as giant garter snake habitat should have shallow and deep water and variations in topography, including some higher ground resembling the ditch banks, or "islands", similar to a rice check. Rice fields contain warm shallow water with sheltering emergent vegetation (i.e. rice plants),

which is present within the fields during the giant garter snake active season in the spring, summer, and early fall. During the late summer when rice fields contain large numbers of mosquito fish and Pacific chorus frogs (*Pseudacris regilla*), rice fields may provide important nursery areas for newborn giant garter snakes (Brode and Hansen 1992, Hansen and Brode 1993). The habitat and its associated water conveyance system, if managed properly, provides the giant garter snake ease of movement; protection from predators; warmth to aid metabolism, gestation, and digestion; and a source of food.

The diverse habitat elements of ricelands; the rice fields, tail water marshes, the ditch and drain components of the water conveyance system, delivery canals, and associated levees, all contribute structure and complexity to this man-made ecosystem. Giant garter snakes can survive in this artificial ecosystem because the spring and summer flooding and fall dry-down of rice culture coincides fairly closely with the biological needs of the species (USFWS 1999). Giant garter snake utilizes ricelands extensively and depends on them for habitat. In the spring, when the rice is planted and the fields are flooded with several inches of water, they contain prey species such as small fish or frogs attract giant garter snakes. In the summer, while the flooded rice continues to grow, giant garter snake continues to use rice fields as long as their prey are present in sufficient densities. In the late summer and fall, when the water is drained from the rice fields, giant garter snake moves off the fields to other adjacent habitats. Rice is harvested at this time and female garter snakes have just borne young and need food to regain their body weight; in the fall, the snake can get a good supply of food from the rice lands because prey are concentrated in the rice drains. In the winter, while the rice fields are fallow, giant garter snakes are dormant.

Within rice fields and the irrigation canals, giant garter snake also basks in openings in vegetation, created by riprap placed around water control structures. Giant garter snake uses small mammal burrows and other soil crevices above prevailing flood elevations during the winter (i.e., November to mid-March). Giant garter snake typically selects burrows with sunny exposures along south and west facing slopes (USFWS 1999). Small mammal burrows, crayfish burrows, and soil crevices provide retreats from extreme heat for giant garter snake during the active season (Hansen and Brode 1993). Wintering sites varied from canal banks and marsh locations, to riprap along a railroad grade near the marsh (Wylie et al. 1997). Wintering locations of radio-telemetered snakes tended to be in the vicinity of spring capture sites.

Individuals have been found using burrows as far as 164 ft from marsh edges during the active season, and as far as 820 ft from the edge of wetland habitats while overwintering, presumably to reach hibernacula above the annual high water mark (Hansen 1986, Wylie et al. 1997, USFWS 1999).

Reproduction

Giant garter snake is live bearing. The breeding season lasts from March into May and resumes briefly during September (Hansen and Hansen 1990; USFWS 1999). Males begin searching for females immediately after emergence from overwintering sites. Females brood young internally and typically give birth to 10–46 young (mean = 23) from late July through early September (Hansen and Hansen 1990).

Foraging Behavior

Giant garter snake feeds primarily on fish and amphibians, taking advantage of pools that trap and concentrate prey (Brode 1988; Hansen 1980; Hansen 1988; Hansen and Brode 1993). Prey species include bullfrog (*Lithobates catesbeianus*), Pacific chorus frog, carp (*Cyprinus carpio*), mosquitofish

(*Gambusia affinis*), and blackfish (*Othodox microlepidotus*) (Fitch 1941; Fox 1952; Cunningham 1959; Hansen 1980; Brode 1988; Hansen and Brode 1993; Rossman et al. 1996).

Dispersal Patterns

No estimates of dispersal distances have been reported for giant garter snake. Newborn giant garter snakes disperse into dense cover immediately after birth and absorb their yolk sacs, after which they begin fending for themselves (USFWS 1999). Adults may disperse away from seasonal wetlands or rice fields when they dry up.

Demography

Giant garter snake is about 8 inches long at birth. It typically doubles in size by one year of age (USFWS 1999); males usually reach sexual maturity in three years and females in five years. Sex ratios of adult females to males vary from 1:1 to 2:1, but this variance may be a function of capture methods employed in different studies (Hansen and Brode 1993; Wylie et al. 1997; USFWS 1999). Adult females are on average longer and heavier than males; males can reach 32.3 inches in snout-vent length (mean = 26.2 inches) and females can reach 42.5 inches snout-vent length (mean = 34.9 inches). Males weigh up to 10.2 ounces (mean = 4.9 ounces) and females weigh up to 27.7 ounces (mean = 15.3 ounces) (USFWS 1999).

There are few population estimates for giant garter snake. Mark and release studies have produced varied results. Some of these estimates are: 84 snakes in a 1 square-mile area of rice land in the Natomas Basin (Hansen and Brode 1993); 1,000 snakes within one square mile (USFWS 1999); 206 individuals in Gilsizer Slough (3,500 acres) (USFWS 1999); 132 individuals in the Colusa National Wildlife Refuge (11,120 acres); and 191 giant garter snakes in Badger Creek Marsh (580 acres).

Longevity

No information is available on the longevity or survival rates of giant garter snake; such estimates are very limited for the genus as a whole. The best survivorship data available for garter snake is from a study of *T. sirtalis* in northern California. The results of this study show one- and two-year survivorship of neonates to be 28.7% and 16.4%, respectively; yearly survivorship was 50.8%, and annual survivorship of individuals more than two years old was only 32.7 % (Rossman et al. 1996).

Sources of Mortality

Giant garter snakes are subject to widespread mortality from habitat loss, increased predation in degraded habitats, vehicular traffic, contamination from pesticides and other toxins, agricultural practices, water maintenance activities, and flooding (USFWS 1993, 1999).

Behavior

Home range estimates for giant garter snake based on radio telemetry data vary with location; estimates averaged 47 acres in Gilsizer Slough (n = 27; range: 2.0–640 acres);131 acres in Colusa National Wildlife Refuge (n = 29; range: 3.2–2,792 acres); and 23 acres at Badger Creek (n = 8; range: 10.4–202.6 acres) (USFWS 1999).

Movement, Migratory, and Activity Patterns

Giant garter snake is most active from early spring through mid-fall; activity is dependent on local weather conditions (Brode 1990; Hansen and Brode 1993). Giant garter snake begins to emerge from winter retreats around April 1. By the beginning of May, all giant garter snakes have usually emerged and are actively foraging. By about October 1, giant garter snakes begin seeking winter retreats. Foraging and other activities are sporadic at this time and dependent on weather conditions. By November 1, most snakes are in winter retreats and will remain there until spring. During winter, giant garter snake is generally inactive, although some individuals may bask or move short distances on warmer days (USFWS 1999). During the active season, giant garter snake generally remains near wetland habitats but can move more than 800 feet from the water (Hansen 1988; Wylie et al. 1997) during the day. Some individuals may move up to five miles over a period of several days if the conditions of their habitat become unsuitable (e.g., as a result of flooding) (Wylie et al. 1997).

As discussed above, giant garter snake uses burrows in the summer as much as 164 feet away from the marsh edge, whereas, overwintering snakes use burrows as far as 820 feet from the edge of marsh habitat (Wylie et al. 1997).

Genetic studies from six watersheds in the Sacramento Valley found significant genetic variation between watersheds with low interpopulation and interregion gene flow (Paquin et al. 2006). Studies also reveal that gene flow appears to be restricted across the major watershed basins, which lends support for naming the basins separate populations (USFWS 2012).

Ecological Relationships

Giant garter snake preys on a variety of fish and amphibians available within its habitat; it is in turn prey for raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), opossums (*Didelphis virginiana*), red foxes (*Vulpes vulpes*), gray foxes (*Urocyon cinereoargenteus*), hawks (*Buteo* spp.), northern harriers (*Circus cyaneus*), great egrets (*Ardea alba*), snowy egrets (*Egretta thula*), American bitterns (*Botaurus lentiginosus*), and great blue herons (*Ardea herodias*). Giant garter snakes may coexist with two other species of garter snake: valley garter snake (*T. sirtalis fitichi*) and western terrestrial garter snake (*T. elegans*) (Hansen 1980; Hansen 1986). This coexistence may be possible because of differences in foraging behavior (USFWS 1999).

Threats

Loss, degradation, and fragmentation of habitat are the primary threats to the viability of giant garter snake populations (USFWS 1999). Conversion of wetlands for agricultural, urban, and industrial development has resulted in the loss of more than 90% of suitable habitat for this species in the Central Valley. Degradation of habitat, including maintenance of flood control and agricultural waterways, weed abatement, rodent control, discharge of contaminants into wetlands and waterways, and overgrazing in wetland or streamside habitats, may also cumulatively threaten the survival of some giant garter snake populations (Hansen 1988; Brode and Hansen 1992; CDFG 1992; Hansen and Brode 1993).

The introduction of nonnative predators, including bullfrog, largemouth bass (*Micropterus salmoides*), and catfish (*Ictalurus* spp.), has been responsible for eliminating many species of native fishes and aquatic vertebrates in the western United States (Minkley 1973; Moyle 1976; Holland 1992). Exotic species have probably had detrimental effects on the giant garter snake through direct predation (sensu

Bury and Whelan 1984; Treanor 1993) and competition for smaller forage fish (CDFG 1992; Hansen 1986; Schwalbe and Rosen 1989).

Toxic contamination, particularly from selenium, and impaired water quality have also been identified as threats to some populations of the giant garter snake (Ohlendorf et al. 1986; Saiki and Lowe 1987; USFWS 1993). Preliminary studies have documented potential bioaccumulative effects on giant garter snake or its prey species caused by agriculturally derived contaminants (Saiki et al. 1992, 1993). Disease and parasitism, potentially exacerbated by compromised immune response ability as a result of contaminant exposure, may also pose a threat to this species (USFWS 1999).

Populations across the Central Valley have been affected by diversion of water (i.e., dams, levees, and irrigation systems) and the expansion of agriculture for over a century. This has resulted in the loss of over 93% of historic wetlands in the Central Valley (USFWS 2006). Microsatellite analyses conducted by Wood et al. (2015) indicate that reductions in population size (i.e., genetic bottlenecks) have occurred in about half of the populations sampled in the Central Valley. Genetic evidence of bottlenecks was also observed in several northern populations, indicating that giant garter snake declines are not limited to the San Joaquin Valley (Wood et al. 2015). Small effective population sizes and geographic isolation leave these populations susceptible to stochastic events (i.e., disease and prolonged drought) and the deleterious consequences of genetic drift, both of which can lead to extinction of this species (Wood et al. 2015).

Climate change will likely adversely affect the giant garter snake (Halstead et al. 2010). Climate change models predict that the climate in the Sierra Nevada mountains will become drier (Hayhoe et al. 2004; Barnett et al. 2008), potentially shrining the area of habitats suitable for giant garter snake through drying of wetlands and cessation of rice agriculture as the cost of water increases (Halstead et al. 2010).

Conservation Considerations

Status of Recovery Planning

Giant garter snake was listed as threatened in California in 1971; it was federally listed in 1993. Subsequent conservation actions have included establishment of guidelines and mechanisms to minimize and mitigate take (USFWS 1999); habitat and population surveys (Hansen 1982, 1986, 1996; Hansen and Brode 1980); and development of management plans for public lands and land acquisitions (USFWS 1999). A draft recovery plan for giant garter snake was completed in 1999.

Compatible Land Uses

Rice fields currently provide a significant amount of giant garter snake habitat; however, flooding makes thousands of acres uninhabitable, and burning the fields in winter leaves snakes exposed to increased predation and thermal stress upon spring emergence. Establishing management practices that are compatible with giant garter snake ecology should enhance the perpetuation of the species. By changing the timing of water management and the method and timing of ditch and field maintenance, rice farmers can minimize impacts on this species (Engles 1994).

Context for a Regional Conservation Strategy

There are no records of giant garter snake in western Placer County; however, the species has been recorded in the region and specifically in neighboring Sutter and Sacramento counties and suitable habitat is present within the Plan Area. Specifically, Dudek (2014) identified suitable habitat for giant garter snake within the Plan Area from approximately Sheridan south to the area of Baseline Road and South Brewer Road (USFWS 1999; USFWS 2006; Dudek 2014). Several locations within this area are used for growing rice, and the associated agricultural ditches and wetlands/sloughs containing emergent vegetation in conjunction with suitable adjacent upland habitat could be used by giant garter snake during both the active and inactive seasons (Dudek 2014).

Records of giant garter snake are restricted to the Sacramento and San Joaquin Valleys. The widest range is within the Sacramento Valley, where there are historical or current records of giant garter snake from nine counties. As the western boundary of the Plan Area touches into the region of highest giant garter snake density based off of California Natural Diversity Database records, conservation of potential habitat within western Placer County is stressed. For the conservation of giant garter snake within the Plan Area, agricultural wetlands and associated waterways are of highest conservation and/or acquisition priority.

Modeled Species Distribution in the Plan Area

Model Assumptions

Aquatic Habitat

Modeled habitat includes the following land-cover types below 100 feet in elevation: ponds, fresh emergent marsh, flooded rice, and riverine (only smaller, low-gradient streams, tributaries, and canals).

Upland Habitat

Modeled habitat includes the following land-cover types below 100 foot elevation and within 200 feet of the edge of wetland habitats: annual grassland, pasture, alfalfa, irrigated pasture, unidentified croplands, vernal pool complex, and row crop.

Rationale

Giant garter snakes require sufficient water during the snake's active season (early spring through mid-fall) to maintain an adequate prey base; emergent vegetation for escape cover and foraging habitat; adjacent upland habitat with grassy banks and openings to waterside vegetation for basking; and adjacent upland areas for cover and refuge from floodwaters during the species' inactive season. They are known to inhabit agricultural wetlands and associated waterways including irrigation and drainage canals, rice fields, marshes, sloughs, ponds, small lakes, low-gradient streams, and adjacent uplands. Giant garter snakes inhabit small mammal burrows and other soil crevices above prevailing flood elevations throughout the winter dormancy period (November to mid-March). Individuals have been found using burrows as far as 165 ft from marsh edges during the active season, and as far as 820 ft from the edge of wetland habitats while overwintering, presumably to reach hibernacula above the annual high water mark (Hansen 1986, Wylie et al. 1997, USFWS 1999). Changing agricultural regimes, development, and other shifts in land use create an ever-changing mosaic of available habitat. Giant garter snakes move around in response to these changes in order to find suitable sources of food, cover, and prey. Connectivity between regions is therefore extremely important for providing access to

available habitat and for genetic interchange. In an agricultural setting, giant garter snakes rely largely upon the interconnected network of canals and ditches that provide irrigation and drainage to provide this connectivity. Primary habitat includes breeding, foraging, and movement habitat because breeding habitat could not be differentiated from foraging and movement habitat at the resolution of the GIS land-cover data. Also, giant garter snake may use breeding habitat for foraging and movement. Upland habitats were modeled to include suitable land-cover types within 200 feet of the edge of wetland habitats as described in the 1997 Biological Opinion for USACE projects with relatively small effects on the giant garter snake in within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo Counties, California (USFWS 1997).

Model Results

Species Map 5. *Giant Garter Snake Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for giant garter snake within the Plan Area. The majority of the modeled habitat occurs in the far western portion of the Plan Area that supports flooded rice and other suitable agricultural lands.

References

Printed References

Barnett, T.P., D.W. Pierce, H.G. Hidalgo, C. Bonfils, B.D. Santer, T. Das, G. Bala, A.W. Wood, T. Nozawa, A.A. Mirin, D.R. Cayan, and M.D. Dettinger. 2008. Human induced changes in the hydrology of the western United States. Science 319: 1080-1083.

Brode, J. 1988. Natural history of the giant garter snake (*Thamnophis couchii gigas*). Pages 25–28 in H. F. DeListe, P. R. Brown, B. Kaufman, and B. M. McGurty (eds.), *Proceedings of the conference on California herpetology*. Special Publication No. 4, Southwestern Herpetologists Society.

_____. 1990. Guidelines for procedures and timing of activities related to modification or relocation of giant garter snake habitat. California Department of Fish and Game Inland Fisheries Division.

Brode, J., and G. Hansen. 1992. Status and future management of the giant garter snake (*Thamnophis gigas*) within the southern American Basin, Sacramento and Sutter Counties, California. California Department of Fish and Game Inland Fisheries Division.

Bury, R. B., and J. A. Whelan. 1984. *Ecology and management of the bullfrog*. Resource Publication 155:1–23. U.S. Fish and Wildlife Service.

California Department of Fish and Game. 1992. Draft five year status report. Californian Department of Fish and Game Inland Fisheries Division.

California Natural Diversity Database. 2015. RareFind 3, Version 3.1.0 (September 2015). Sacramento, CA: California Department of Fish and Wildlife.

Cunningham, J. D. 1959. Reproduction and food of some California snakes. *Herptetologica* 15(1):17–20.

Dudek Consulting. 2014. Evaluation of Potentially Suitable Habitat and Recommended Future Survey Locations for Selected Rare Species within the Placer County Conservation Plan/Natural Community Conservation Plan Area.

Engles, E. 1994. Rice farming: best hope for the giant garter snake: Page 283 in C. G. Thelander and M. Crabtree (eds.), *Life on the edge: a guide to California's endangered natural resources: wildlife*. Santa Cruz, CA: Biosystems Books.

Fitch, H. S. 1941. *The feeding habits of California garter snakes*. California Department of Fish and Game 27:2–32.

Fox, W. 1952. Notes on the feeding habits of Pacific coast garter snakes. *Herpetologica* 8:4–8.

Halstead, B.J., G.D. Wylie, and M.L. Casazza. 2010. Habitat suitability and conservation of the giant gartersnake (*Thamnophis gigas*) in the Sacramento Valley of California. Copeia 4: 591-599.

Hansen, G. E. 1982. Status of the giant garter snake (*Thamnophis couchii gigas*) along portions of Laguna and Elk Grove Creeks, Sacramento County, California. Report to Sacramento County Planning Department.

_____. 1986. Status of the giant garter snake *Thamnophis couchi gigas* (Fitch) in the southern San Joaquin Valley during 1986. Final report for California Department of Fish and Game, Standard Agreement no. C-1433. Unpublished.

_____. 1988. Review of the status of the giant garter snake (*Thamnophis couchi gigas*) and its supporting habitat during 1986–1987. Final report for California Department of Fish and Game, Contract C-2060. Unpublished.

_____. 1996. Status of the giant garter snake (*Thamnophis gigas*) in the San Joaquin Valley in 1995. Final report for California Department of Fish and Game, Standard Agreement no. FG4052IF. Unpublished.

Hansen, G. E., and J. M. Brode. 1980. Status of the giant garter snake, *Thamnophis couchi gigas* (Fitch). Inland Fisheries Endangered Species Program Special Publication Report No. 80-5. California Department of Fish and Game.

_____. 1993. Results of relocating canal habitat of the giant garter snake (*Thamnophis gigas*) during widening of State Route 99/70 in Sacramento and Sutter Counties, California. Final report for Caltrans Interagency Agreement 03E325 (FG7550)(FY87/88-91-92). Unpublished.

Hansen, R. W. 1980. Western aquatic garter snakes in central California: an ecological and evolutionary perspective. M.S. thesis, Department of Biology, California State University, Fresno.

Hansen, R. W., and G. E. Hansen. 1990. *Thamnophis gigas*. Reproduction. *Herpetological Review* 21(4):93–94.

Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences of the United States of America 101: 124222-12427.

Holland, D. 1992. A synopsis of the ecology and status of the western pond turtle (*Clemmys marmorata*) in 1991. Unpublished report for the U.S. Fish and Wildlife Service, San Simeon, CA.

Minkley, W. L. 1973. *Fishes of Arizona*. Phoenix, AZ: Arizona Game and Fish Department.

Moyle, P. B. 1976. *Inland fishes of California*. Berkeley, Los Angeles, and London: University of California Press.

Ohlendorf, H. M., D. J. Hoffman, M. K. Saiki, and T. W. Aldrich. 1986. Embryonic mortality and abnormalities of aquatic birds: apparent impacts of selenium from irrigation drainwater. *Science of the Total Environment* 52:49–63.

Paquin, M, Wylie, G. and E. Routman, 2006. Population structure of the giant garter snake, Thamnophis gigas, Conservation genetics 7(1): 25-36.

Rossman, D., and G. Stewart. 1987. Taxonomic reevaluation of *Thamnophis couchii* (Serpentes: Colubridae). *Occasional Papers of the Museum of Zoology, Louisiana State University*, No. 63Baton Rouge, LA.

Rossman, D. A., N. B. Ford, and R. A. Seigel. 1996. *The garter snakes: evolution and ecology*. Norman, OK: University of Oklahoma Press.

Saiki, M. K., and T. P. Lowe. 1987. Selenium in aquatic organisms from subsurface agricultural drainage water, San Joaquin Valley, California. *Archives of Environmental Contaminants and Toxicology*. 16:657–670.

Saiki, M. K., M. R. Jennings, and T. W. May. 1992. Selenium and other elements in freshwater fishes from the irrigated San Joaquin Valley, California. *Science of the Total Environment* 126:109–137.

Saiki, M. K., M. R. Jennings, and W. G. Brumbaugh. 1993. Boron, molybdenum, and selenium in aquatic food chains from the lower San Joaquin River and its tributaries, California. *Archives of Environmental Contaminants and Toxicology* 24:307–319.

Schwalbe, C. R., and P. C. Rosen. 1989. Preliminary report on effect of bullfrogs on wetland herpetofaunas in southeastern Arizona. Pages 166–173 in R. C. Szaro, K. E. Severson and D. R. Patton (technical coordinators), *Management and amphibians, reptiles, and small mammals in North America*. General Technical Report RM-166. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Treanor, R. R. 1993. Contributions to the biology of the bullfrog, (*Rana catesbeiana* Shaw), in California. Inland Fisheries Administrative Report No. 83-1. California Department of Fish and Game.

U. S. Fish and Wildlife Service. 1997. Programmatic formal consultation for U.S. Army Corps of Engineers 404 permitted projects with relatively small effects on the giant garter snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo Counties, California. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office. 1-1-F-97-149.

_____. 1993. Endangered and threatened wildlife and plants; determination of threatened status for the giant garter snake. 58 Federal Register 54053–54066.

_____. 1999. *Draft recovery plan for the giant garter snake* (Thamnophis gigas). Portland, OR.

_____. 2006. Giant Garter Snake (*Thamnophis gigas*) 5 Year Review: Summary and Evaluation. Sacramento, Ca.

_____. 2012. Giant Garter Snake (*Thamnophis gigas*) 5 Year Review: Summary and Evaluation. Sacramento, Ca.

Wood, D.A., B.J. Halstead, M.L. Casazza, E.C. Hansen, G.D. Wylie, and A.G. Vandergast. 2015. Defining population structure and genetic signatures of decline in the giant gartersnake (*Thamnophis gigas*): implications for conserving threatened species within highly altered landscapes. Conservation Genetics. Available online at DOI 10.1007/s10592-015-0720-6. Accessed August 2015.

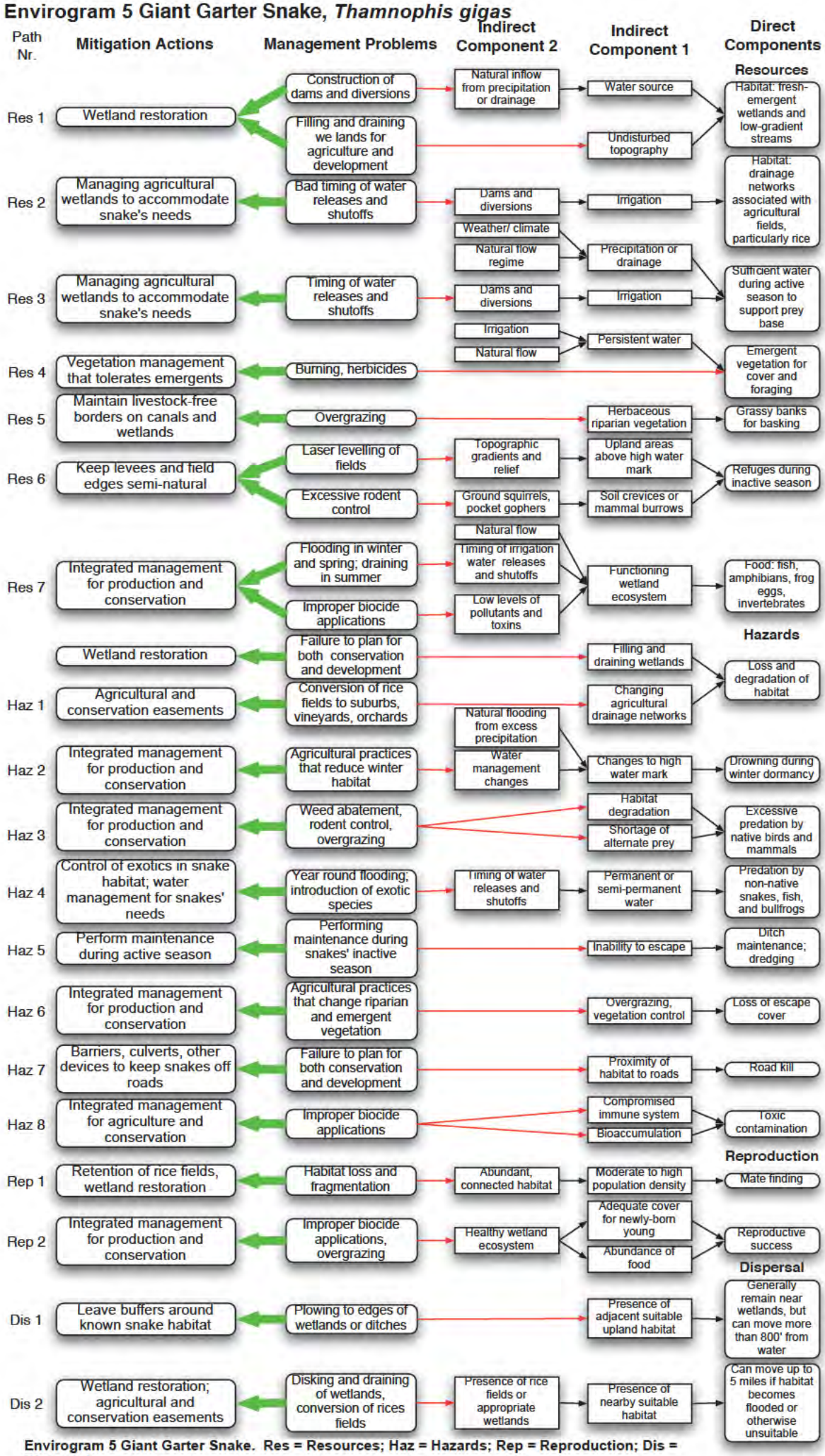
Wylie, G. D., M. Cassaza, and J. K. Daugherty. 1997. 1996 progress report for the giant garter snake study. Preliminary report, U.S. Geological Survey, Biological Resources Division.

Personal Communications

Kelly, David. Biologist. U.S. Fish and Wildlife. E-mail and phone conversation. July 23, 2009.

Paquin, Melanie. Biologist. National Marine Fisheries Service. E-mail. January 28, 2009.

Envirogram 5 Giant Garter Snake, *Thamnophis gigas*



Envirogram 5 Giant Garter Snake. Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram Narrative

Giant Garter Snake (*Thamnophis gigas*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Giant garter snake originally was found in fresh emergent wetlands, ponds, small lakes with appropriate shoreline, and low gradient streams in the Central Valley. These areas required a particular topography and a water source, either precipitation or natural drainage. The construction of dams and diversions and the filling and draining of wetlands for agriculture and development has eliminated most of this habitat type. Substantial wetland restoration will be required to mitigate the loss.

Res2: Giant garter snake now mostly inhabits drainage networks associated with agriculture, particularly rice fields. The dams and diversions that helped destroy its original habitat have made possible the irrigation that maintains this new one. Bad timing of water releases and shutoffs can make these fields unsuitable for giant garter snake, however, so water management must take the giant garter snakes' needs into account.

Res3: During its active season the giant garter snake needs enough water in its habitat to support a prey base. The water can come either from precipitation and drainage and a natural flow regime or from irrigation. The suitability of irrigation water depends on the timing of water releases and shutoffs as in path Res2.

Res4: Giant garter snake needs emergent vegetation for cover and foraging habitat. This requires persistent water during the giant garter snake's active season, either from natural flow or irrigation. Burning or treating emergent vegetation with herbicide results in unsuitable habitat for the giant garter snake; emergent vegetation must be allowed to grow during the giant garter snake's active season.

Res5: Giant garter snake also requires grassy banks for basking. Thus, herbaceous riparian vegetation should not be overgrazed, and livestock should be excluded from the edges of fields and ditches.

Res6: During the inactive season, giant garter snake hibernates in mammal burrows or crevices above the high water line. This means that levees or natural topographic features must be present in otherwise

level—or leveled—areas and that some rodent burrowing must be tolerated in giant garter snake habitat.

Res7: Giant garter snake feeds on fish, amphibians and their eggs, and invertebrates. The presence of these organisms requires a functioning wetland ecosystem with unpolluted water persisting during the giant garter snakes' active season. Proper pesticide application and timing of irrigation releases are critical.

Hazards

Haz1: Loss and degradation of habitat, either by filling and draining natural wetlands or by converting rice fields and other suitable agricultural areas to suburbs, vineyards, and orchards, is the major hazard to giant garter snake. Active wetland restoration and agricultural and conservation easements can help mitigate this loss.

Haz2: Drowning during winter dormancy is another hazard faced by the giant garter snake. Drowning occurs when normal high water marks are exceeded either by natural floods or by modifying water management practices. Agricultural practices that accommodate the giant garter snake's needs should be encouraged and made part of conservation easements.

Haz3: Excessive predation levels by native species can occur when alternate prey items are not available or the giant garter snake habitat has been degraded (usually by loss of cover). These problems can occur as a result of a variety of management actions including weed abatement, rodent control, and overgrazing. Integrated management for production and conservation could minimize these hazards.

Haz4: Predation by non-native snakes, fish (mostly cetrarchids), and bullfrogs is another hazard for giant garter snake. These introduced species live in permanent or semi-permanent waters, so shutting off irrigation water during the giant garter snake's inactive season, along with control efforts on the exotics, can help eliminate this problem.

Haz5: Giant garter snake can be killed during ditch maintenance or dredging if these activities occur during their inactive season. However, if these activities are conducted during the giant garter snake's active season they usually can escape.

Haz6: Loss of escape cover, through vegetation management or overgrazing, is another hazard for the giant garter snake. Integrated management for production and conservation needs to include protection of riparian and emergent vegetation during the giant garter snakes' active season.

Haz7: Snakes are killed by vehicles when roads are close to their habitat. Conservation areas should be well isolated from development; if this is not feasible, culverts and barriers should be installed to separate snakes from automobiles.

Haz8: Toxic contamination has been shown to be another hazard to the giant garter snake. Contaminants bioaccumulate and can result in weakened immune systems. Over-application of pesticides and the concentration of toxin-bearing runoff must be addressed in areas inhabited by this species.

Reproduction

Rep1: Population density should be adequate for mate finding in abundant, well connected habitat, but habitat loss and fragmentation have been severe in Placer County. Retention of rice fields and wetland restoration can help mitigate this problem.

Rep2: Giant garter snake bears live young (ovoviviparity). Reproductive success depends upon adequate food and escape cover for young giant garter snakes, both of which require healthy wetland ecosystems. Improper pesticide applications, overgrazing, and other activities that degrade these ecosystems must be addressed in management plans associated with conservation easements on farmland.

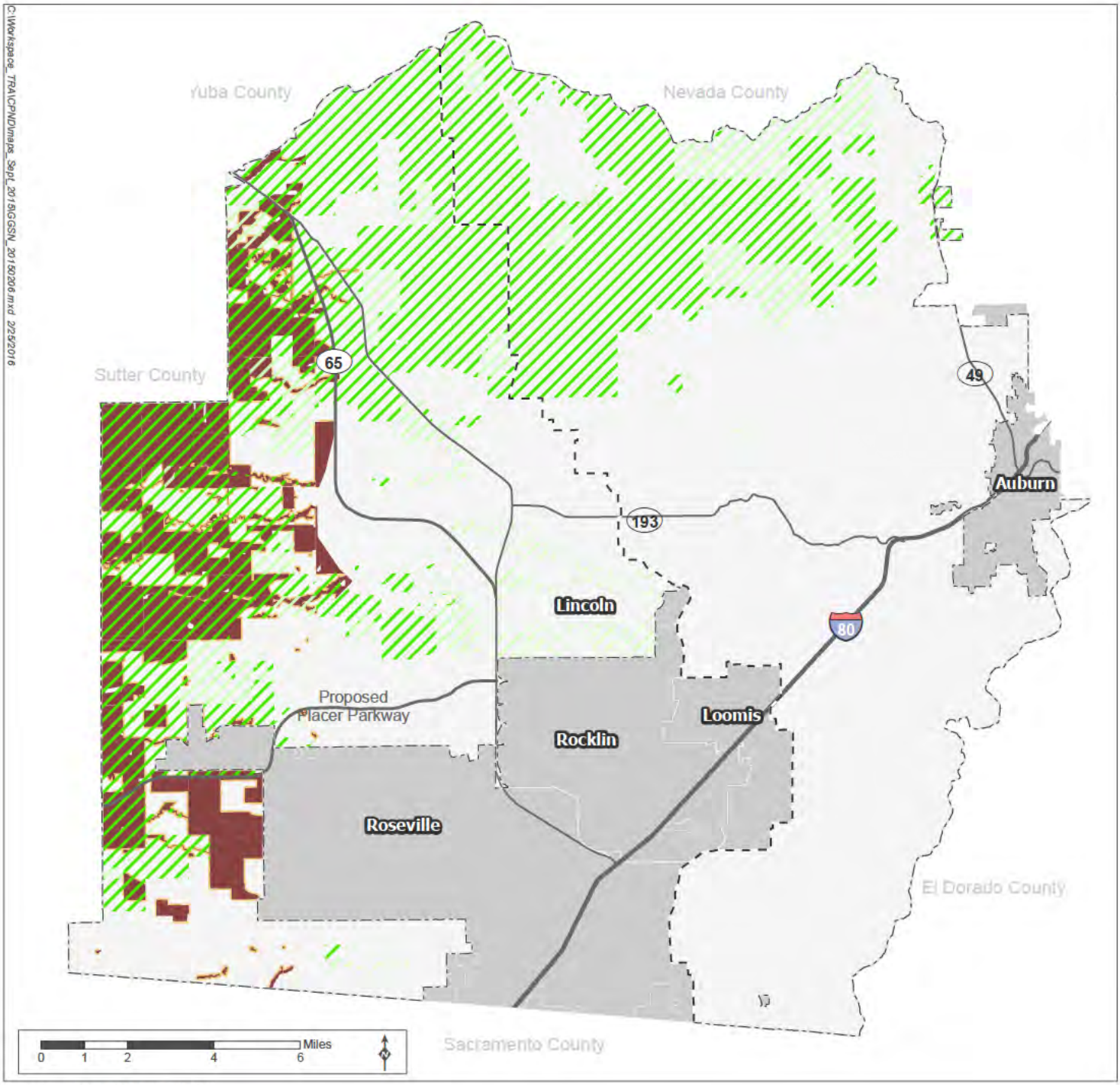
Dispersal

Dis1: Giant garter snake usually remains close to water, but has been known to venture 800 feet into adjacent upland areas. Thus, substantial buffers should be maintained around wetlands or rice fields known to support the snakes.

Dis2: If a habitat patch becomes unsuitable, giant garter snakes can move up to five miles to find a suitable one. Thus, the proximity of other wetlands or rice fields, managed to be compatible with the giant garter snake's needs and connected by suitable dispersal habitat, are critical to giant garter snake conservation.

Summary

The giant garter snake now depends almost entirely on agriculture, particularly rice growing, for its continued existence. Managing rice fields in ways compatible with the needs of giant garter snakes is quite possible, and these management prescriptions should be spelled out in agricultural/conservation easements. Restoring large fresh emergent wetlands would lessen the giant garter snake's dependence on agriculture.



Species Map 5.

Giant Garter Snake Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Western Pond Turtle
(*Emys marmorata*)

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Status

Federal: Under Review by the U.S. Fish and Wildlife Service. In 2015, USFWS issued a 90-day finding based on their review of the petition and sources cited in the petition. USFWS found that the petition presented substantial scientific or commercial information indicating that the petitioned action for listing the species may be warranted.

State: Species of Special Concern

Critical Habitat: Not Applicable (N/A)

Recovery Plan: N/A; though considered in the Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*) (USFWS 1999). A recovery plan has been developed by the State of Washington (Hayes et al. 1999).

Taxonomy

The western pond turtle was originally named and described *Emys marmorata* by Baird and Girard (1852) from a specimen found in the Puget Sound area. In 1945, Seeliger named and described two separate subspecies based on differing morphological characteristics: northwestern pond turtle (*Clemmys marmorata marmorata*) and southwestern pond turtle (*Clemmys marmorata pallida*). The northwestern subspecies was described by Seeliger (1945) as ranging from Puget Sound south to the Sacramento Valley in California. The southwestern subspecies was found to be from Monterey County south to Baja California Norte with intergradation occurring between the American River drainage and the Transverse Ranges in the San Joaquin Valley of California (Seeliger 1945).

A genetic study by Spinks and Shaffer (2005) suggested the existence of four unnamed clades within *Emys marmorata*, with the following geographical distribution: 1) from the Transverse Mountains (Los Angeles Mountains or range) south to Baja California Norte; 2) the San Joaquin Valley and associated foothills; 3) Ventura and Santa Barbara Counties in Central Coastal California; and 4) all remaining populations to the north. However, a more recent genetic study conducted by Spinks and Shaffer (2014) clarified that two primary clades exist and that subpopulations within each clade have been incorrectly interpreted as intergrades. As a result, Spinks and Shaffer (2014) proposed using the name *Emys marmorata* for all populations north of the San Francisco Bay area plus populations from the Great Central Valley north including an apparently introduced population in Nevada. Thus, *Emys pallida* is used for those populations inhabiting the central coast range south of the San Francisco Bay area to the species' southern range boundary, including the Mojave River. *Emys marmorata* and *Emys pallida* show very limited intergradation in a few populations in the northern central coast range and adjacent Sierra Nevada foothills, although at all intergrade sites pure individuals of the locally prevalent species were also found (Spinks and Shaffer 2014). In addition, although populations from Baja California are included in *Emys pallida*, these animals may also represent a distinct species pending results from additional analyses (Spinks and Shaffer 2014).

Distribution

North America

Western pond turtle is distributed along the North American Pacific Coast from Washington State to Baja California in Mexico. The species inhabits a variety of aquatic systems, mainly west of the Cascade-Sierra Nevada-Peninsula Mountains. Western pond turtle occurs from Puget Sound in Washington south through Oregon to the American River drainage in central California, and generally west of the Cascade-Sierra crest to the American River drainage. In the Central Valley, western pond turtle historically inhabited the vast permanent and seasonal wetlands of the area, with the Tulare Lake basin as a major population center (Hayes et al. 1999).

California

Historically, this species occurred in most Pacific slope drainages between the Oregon and Mexican borders and in only two drainages on the desert slope (i.e., the Mojave River in San Bernardino County and Andreas Canyon in Riverside County) (Jennings and Hayes 1994). Today, western pond turtle occurs in 90% of its historic range in the Central Valley and west of the Sierra Nevada mountains, but in greatly reduced numbers (Jennings and Hayes 1994; Germano and Bury 2001). It currently occurs from the Oregon border south to the San Francisco Bay Area and east through San Joaquin and Tuolumne County. The southwestern pond turtle is known from Santa Clara County south to the Mexican border.

Placer County Plan Area

Historical

Western pond turtle occurred in suitable habitat throughout the American River drainage, including the Placer County Plan Area (USFWS 1999).

Current

Four occurrences of western pond turtles have been documented within the Plan Area and vicinity (CNDDB 2015). This includes an occurrence at three locations on Coon Creek in Hidden Falls Park, within a reservoir north-northwest of Newcastle, on the western edge of Folsom Lake, and on the southern border of Placer County in the Baldwin Reservoir (CNDDB 2010).

Population Status & Trends

North America

Western pond turtle was once abundant in California, Oregon, and locally in Washington, but is declining in numbers throughout its range, particularly in Washington, northern Oregon, southern California and Baja California (Holland and Bury 1998; Hayes et al. 1999). Loss, degradation, and fragmentation of habitat are the primary factors contributing to the decline of the species (Hayes et al. 1999).

California

Western pond turtle is declining in California primarily as a result of habitat loss and alteration; more than 90% of California's historic wetlands have been diked, drained, and filled—primarily for agricultural development and secondarily for urban development (Frayer et al. 1989). Commercial harvesting of

western pond turtle for food during the 1890s to 1920s is also believed to have contributed significantly to the decline of this subspecies in the San Francisco area and Central Valley (Storer 1930; Hayes et al. 1999). More than 18,000 pond turtles were offered for sale in San Francisco markets, presumably in one year, in the 1890s (Smith 1895).

Placer County Plan Area

The population status and trends of western pond turtle in the Plan Area are unknown. The taxon is believed to have been abundant in the area when it supported extensive wetlands (Hayes et al. 1999), but some conversion of former wetlands to agricultural lands has likely resulted in local declines of these populations (Jennings and Hayes 1994).

Natural History

The habitat requirements, ecological relationships, life history, and threats to western pond turtle described below are summarized in diagram form in the Envirogram 6 Western Pond Turtle.

Habitat Requirements

Western pond turtle inhabits a variety of aquatic habitats from sea level to elevations of 6,500 feet. It is found in rivers, streams, lakes, ponds, wetlands, reservoirs, brackish estuarine waters, canals and even sewage ponds (Holland 1994; Jennings and Hayes 1994; Germano and Bury 2001). Hatchling and young turtles (i.e., 1 year) require shallow water areas (i.e., less than 11.8 inches deep) dominated by emergent aquatic reeds, such as Juncus (*Juncus* sp.) and sedge (*Carex* sp.) (Holland 1991). Western pond turtle uses aquatic habitats primarily for foraging, thermoregulation, and avoidance of predators; it requires emergent basking sites, and has been observed to avoid areas of open water lacking them (Holland 1994). Basking sites can include rocks, logs, or emergent vegetation, and are used by the turtle for thermoregulation. Western pond turtle can be found in waters with temperatures as low as 34ºF, and rarely in water with temperatures exceeding 102–104ºF (Jennings and Hayes 1994).

Western pond turtle overwinters in both aquatic and terrestrial habitats. Aquatic refugia consist of rocks, logs, mud, submerged vegetation, and undercut areas along banks. Terrestrial overwintering habitat consists of burrows in leaf litter or soil. The presence of a duff layer seems to be a general characteristic of overwintering habitat. In woodland and sage scrub habitats along coastal streams in central California, most pond turtles leave the drying creeks in late summer and return after winter floods. These turtles spend an average of 111 days at upland refuges that are an average of 164 feet from the creeks (Rathbun et al. 2002).

Upland nesting sites must be dry and often have a high clay or silt fraction. Nests are typically located in open areas dominated by grasses and forbs. Typically, western pond turtle digs nests on unshaded slopes no steeper than 25°. Gravid females leave drying creeks in June to oviposit in sunny upland habitats, including grazed pastures. Nesting has been reported to occur up to 1,391 feet from water (Jennings and Hayes 1994), but is usually closer, averaging 92 feet from aquatic habitat (Rathbun et al. 2002).

Reproduction

Western pond turtles first breed at 10 to14 years of age (UFWS 1999). Mating generally occurs in late April or early May (Jennings and Hayes 1994). Most females lay eggs in alternate years. Clutch size ranges from 1 to 13 eggs, with larger females generally laying larger clutches (Holland 1985a, 1991a).

Females move inland 39–1,319 feet to upland habitat to nest from May through July, although this can occur as late as early August (Jennings and Hayes 1994). The eggs are best suited for development in dry, warm places because of their thin shells. Females typically dig the nest in soil with high clay or silt content on an unshaded slope (Jennings and Hayes 1994). Proximity of the nesting site to aquatic habitat is reliant on availability, but is generally within 650 feet of aquatic habitat, although it can be up to 1,320 feet away (Storer 1930; Jennings and Hayes 1994). Incubation lasts 80–100 days, and the normal hatch success is approximately 70%. Nest predation rates are high and complete failure of nests is common. In southern California, juveniles emerge from the nest in early fall (Holland 1994). Most hatchlings overwinter in the nest and move to water in March–April, although some leave the nest in September (Holland 1985a, 1991a, 1991b).

Demography

Survivorship of western pond turtle is apparently dependent on age and sex. Hatchlings and first-year juveniles average only 8–12% survivorship; this rate may not increase significantly until turtles are 4-5 years old (USFWS 1999). Once the turtles reach adult size survivorship increases dramatically, with an average adult turnover rate of only 3–5%. Adult males generally have a higher probability of survivorship than adult females, with skewed sex ratios reaching 4:1 (males to females). The apparent cause for this difference is a higher mortality experienced by females from predation during overland nesting attempts (Holland 1991a).

Dispersal Patterns

Males generally move greater distances than females or juveniles (Bury 1972a), but there is little movement between drainages (Holland 1991b). Measured home ranges of western pond turtle average 2.5 acres for males, 0.7 acre for females, and 1 acre for juveniles (Bury 1972a). Western pond turtles rarely move between drainages (Holland 1991a). Turtles may move up to 820 feet from aquatic habitat to overwinter under dense vegetation, logs, or leaf litter (Holland 1991a).

Foraging Behavior

Western pond turtle is an omnivorous feeder, opportunistic predator, and occasional scavenger (Holland 1985a, 1985b, Bury 1986). The majority of the diet consists of crustaceans, midges, dragonflies, beetles, stoneflies, and caddisflies, but pond turtle also feeds on mammal, bird, reptile, amphibian, and fish carrion. Western pond turtle will eat plant matter and has been observed foraging on willow and alder catkins and on ditch grass inflorescences (Holland 1991b). Partial herbivory in adults may provide an important source of readily available nutrients and some proteins when animal food is unavailable. Adults, especially females, consume a greater percentage of plant material than do juveniles (Bury 1986).

Longevity

The maximum recorded age for western pond turtle is 39–40 years, but the expected longevity for this species probably reaches 50–70 years (Holland 1991a). On average, adult males have a higher probability of survivorship than adult females (Holland 1991a).

Sources of Mortality

Western pond turtle is preyed upon by a wide variety of native and introduced predators, including raccoon (*Procyon lotor*), spotted skunk (*Spilogale putorius*), river otter (*Lontra canadensis*), black bear (*Ursus americanus*), coyote (*Canis latrans*), bullfrog (*Rana catesbeiana*) and largemouth bass (*Micropterus salmoides*) (Moyle 1973; Holland 1991a; Hayes et al. 1999). Bobcat (*Lynx rufus*), great blue heron (A*rdea herodias*), black-crowned night-heron (*Nycticorax nycticorax*), golden eagle (*Aquila chrysaetos*), red-shouldered hawk (*Buteo lineatus*), and giant garter snake (*Thamnophis gigas*) are also believed to be predators of western pond turtle (Holland 1994). Prolonged drought, contaminants, disease, and parasites also contribute to mortality in western pond turtle populations (Frye et al. 1977; Hayes et al. 1999).

Behavior

Western pond turtle is not known to be territorial, but aggressive encounters, including gesturing and physical combat (Bury and Wolfheim 1973), are common, and may function to maintain spacing on basking sites and to settle disputes over preferred spots. Competing individuals may push and ram each other, threaten one another with open-mouthed gestures, and occasionally bite one another.

Western pond turtle commonly forages during late afternoon or early evening. It also basks intermittently throughout the day in order to maintain a body temperature of 75–90ºF. In general, this species typically becomes more active in water that consistently reaches 60ºF (Jennings and Hayes 1994). Extreme heat is avoided by moving to cooler areas on the bottom of pools. Western pond turtles tend to avoid water temperatures greater than 104ºF (Jennings and Hayes 1994).

In some parts of the range, western pond turtle is seasonally active, overwintering from October/November through March/April. However, in the Central Valley and along the California coast it may be active throughout the year (Holland 1991a).

Movement and Migratory Patterns

During spring or early summer, females move overland up to1,319 feet to find suitable sites for egg laying (Hays et al. 1999). Other long-distance movements may occur in response to drying of local water bodies or other factors. The species is capable of moving long distances (at least one mile overland) to find water; however, no mass migrations have been observed (Pilliod et al. 2013). In addition, movement patterns appeared to be independent of each other (Pilliod et al. 2013). Pilliod et al. (2-13) also found that western pond turtles make two types of movements during the winter, including short movements (less than 33 feet) within a vegetation patch and longer movements (approximately 330 feet) to new habitat patches. Genetic analysis suggests that movement of this species occurs within drainages (Spinks and Shaffer 2005).

Studies have been conducted on western pond turtles at intermittent sites and perennial sites (Bondi and Marks 2013). These studies found that turtles from intermittent sites migrated from the river substantially earlier than those from the perennial site and initiated terrestrial estivation in mid-summer, apparently in response to the declining water levels. In contrast, those turtles in the perennial sites did not migrate from the river until early fall, with the onset of declining air and water temperatures. Overall, turtles from the intermittent site spent significantly less time in the water compared to those in the perennial site. As a result, these turtles had lower body condition and were smaller, most likely due to less time available each year for aquatic foraging (Bondi and Marks 2013).

Ecological Relationships

Introduced species have altered the ecological conditions of many areas inhabited by western pond turtle. Bullfrogs and warm water fish are significant predators on hatchlings and small juvenile western pond turtle. Sunfish compete for invertebrate prey. Carp can cause turbidity (Lampman 1946), which can influence the densities of zooplankton important in the diet of hatchlings and young turtles (Holland 1985b). Introduced turtles, such as sliders (*Trachemys scripta*), snapping turtles (*Chelydra serpentina*), and painted turtles (*Chrysemys picta*), may compete with pond turtles and expose them to diseases for which pond turtles have no resistance (Hayes et al. 1999). In California, Oregon, and Nevada, 17 species of exotic aquatic or semi-aquatic turtles have been found in pond turtle habitats (Holland and Bury 1998). Additionally, in ranching areas cattle trample and eat aquatic vegetation that serves as habitat for hatchlings, and they may crush pond turtle nests. Domestic dogs may also occasionally mutilate turtles (Hayes et al. 1999).

Threats

Numerous factors, including loss, degradation, and fragmentation of habitat; disease; introduced predators and competitors; and other natural and anthropogenic conditions present ongoing threats to western pond turtle throughout 75–80% of its range (USFWS 1999; Holland 1991a). Extant wetlands are often indirectly affected by adjacent agricultural practices. Many aquatic habitats (e.g., rice lands) are used to convey and store agricultural water and are consequently subject to changes in the timing and amount of water flow. Many wetlands are channelized and periodically cleaned of aquatic vegetation, rendering them unsuitable for pond turtle. Farming activities conducted to the edge of occupied aquatic habitat may limit or eliminate upland nesting opportunities for pond turtle. Because pond turtle is long-lived, populations may persist in these isolated wetlands long after recruitment of young has ceased (Holland 1991a; USFWS 1999).

Flow regime has a profound influence on western pond turtle movement ecology and morphology (Bondi and Marks 2013). Changes in the nature and timing of water releases from reservoirs may adversely affect downstream habitat by eliminating or altering basking sites, refugia, foraging areas, and hatchling microhabitat (Holland 1991a; USFWS 1999). The reservoirs themselves generally provide poor habitat for turtle because of the lack of emergent aquatic vegetation and basking sites, high recreational disturbance (Nyhof and Trulio 2015), and the presence of exotic predatory fish species. Water diversions for agriculture can also have negative impacts on turtle populations by resulting in very low or no flows for miles of stream habitat during summer months. Agricultural diversions have resulted in the elimination of pond turtle from such streams and isolation of turtle populations located in other portions of affected drainages (Holland 1991a).

Roads can create barriers to dispersal movements of western pond turtle and contribute to the isolation of populations. Contaminants from road materials, leaks, and spills could further degrade aquatic habitats used by this species. Corridors from aquatic habitat to historical and long-term nesting sites can be blocked by roads and development (Holland 1991a).

Additional threats include habitat degradation from cattle grazing; instream and streamside sand and gravel mining operations; removal of basking sites (e.g., logs, snags, and rocks) for aesthetic purposes or to facilitate recreational use; and collection of turtles for food or for the pet trade. Incidental collection of turtles, exposure to diseases from introduced exotic species, introduced predators, such as the bullfrog (*Rana catesbeiana*), will eat hatchling and young western pond turtles (Holland 1994), indiscriminate shooting, construction of highway barriers in upland nesting/migration corridors, off-road vehicle activity, boat activity, and increased exposure to contaminants are also likely to contribute to

population declines in western pond turtle (Bury 1972b; Holland 1991a). Finally, extended drought and associated fire can also result in significant mortality of western pond turtle (Holland 1991a).

Context for a Regional Conservation Strategy

There are four known occurrences of western pond turtle in the Plan Area and the subspecies may be present in other locations not yet surveyed. In the state, the subspecies is primarily scattered throughout areas east and west of the Central Valley, with greatest concentrations in the San Francisco Bay area. In the Placer County region, western pond turtle has been recorded from all surrounding counties with the exception of those east of the Sierra Nevada, with concentrations greatest in Sacramento County. Given the species' broad distribution in northern California, Placer County is not of particular significance in the western pond turtle's range and distribution. However, the species' overall decline throughout the state dictates that protection of all remaining, intact habitat is important for the species' persistence. Within the Plan Area, protection or acquisition of aquatic habitats including rivers, streams, lakes, ponds, wetlands and reservoirs with emergent basking sites and upland refugia and nesting sites is of highest priority.

Modeled Species Distribution in the Plan Area

Model Assumptions

Aquatic Habitat

Western pond turtle aquatic habitat is defined by fresh emergent wetlands, seasonal wetland, riverine/riparian, and ponds.

Upland Nesting Habitat

Nesting habitat (nesting, burrowing habitat) is defined as any land cover type within 150 feet of aquatic habitat, except for urban/suburban, rural residential, agricultural types, barren, and disturbed land cover types.

Rationale

Western pond turtles are found in rivers, streams, lakes, ponds, wetlands, reservoirs, and brackish estuarine waters up to 6,500 feet above sea level (Holland 1994; Jennings and Hayes 1994). Western pond turtles use aquatic habitats primarily for foraging, thermoregulation, and avoidance of predators; they require emergent basking sites, and have been observed to avoid areas of open water lacking them (Holland 1994). Basking sites can include rocks, logs, or emergent vegetation, and are used by the turtles for thermoregulation.

Western pond turtles overwinter in both aquatic and terrestrial habitats. Terrestrial overwintering habitat consists of burrows in leaf litter or soil. Typically, western pond turtles dig nests on unshaded slopes. Nesting has been reported to occur up to 1,391 feet from water (Jennings and Hayes 1994), but is usually closer, averaging 92 feet from aquatic habitat (Rathbun et al. 2002). To remain conservative, modeled nesting habitat included a buffer of 150 feet, which should account for most possible nesting sites in the Plan Area. To account for long-distance dispersal to nest sites or movement between water bodies, the distance of 1,200 feet from all aquatic habitats was used to model movement and secondary habitat. Though this is not all inclusive of the documented 1,391 foot dispersal by Jennings and Hayes (1994), it likely still overestimate the actual upland habitat use by this species.

Model Results

Species Map 6. *Western Pond Turtle Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for western pond turtle within the Plan Area. Primary habitat is distributed throughout the Plan Area along streams. Movement habitat is found throughout the Plan Area adjacent to streams and other primary aquatic habitats. The documented occurrences of western pond turtle in the Plan Area generally correspond to modeled habitat.

References

Printed References

Baird, S. F., and C. Girard. 1852. Descriptions of new species of reptiles collected by the U.S. Exploring Expedition under the command of Capt. Charles Wilkes, USN. Proc. Acad. Nat. Sci. Phila. 6:174-177.

Bondi, C.A. and S.B. Marks. 2013. Differences in flow regime influence the seasonal migrations, body size, and body condition of western pond turtles (Actinemys marmorata) that inhabit perennial and intermittent riverine sites in Northern California. Copeia 1: 142-153.

Bury, R. B. 1970. Clemmys marmorata. Catalogue of American Amphibians and Reptiles 100:1–3.

_____. 1986. Feeding ecology of the turtle Clemmys marmorata. Journal of Herpetology 20:515–521.

_____. 1972a. Habits and home range of the Pacific pond turtle, Clemmys marmorata, in a stream community. Ph.D. dissertation, University of California, Berkeley.

_____. 1972b. The effects of diesel fuel on a stream fauna. California Fish and Game 58:291–295.

Barkhurst, C. B. Bury, S. Kohlmann, L. Todd, S. Wray, G. Sieglitz, and N. Sisk. 1997. Western Pond Turtle Survey and Monitoring Plan (DRAFT). Western Pond Turtle Working Group. 41 pp.

Bury, R. B., and J. H. Wolfheim. 1973. Aggression in free-living pond turtles (Clemmys marmorata). Bio-Science 23:659–662.

California Natural Diversity Database. 2010. RareFind, Version 3.1.0. (May 30, 2010). Sacramento, CA: California Department of Fish and Game.

Collins & Taggart. 2002. Standard Common and Current Scientific Names for North American Amphibians, Turtles, Reptiles, and Crocodilians. The Center for North American Herpetology, Lawrence, Kansas. 44 pp.

Frayer, W.E., D.E. Peters, and H.R. Pywell. 1989. Wetlands of the California Central Valley: status and trends, 1939 to mid- 1980's. U.S. Fish and Wildlife Service, Portland, OR. 29 pp.

Frye, F. L., L. S. Oshiro, F. R. Dutra, and J. D. Carney. 1977. Herpes virus–like infection in two Pacific pond turtles. Journal of the American Veterinary Medical Association 171(9):882–884.

Germano, D. J., and R. B. Bury. 2001. Western pond turtles (*Clemmys marmorata*) in the Central Valley of California: status and population structure. Transactions of the Western Section of the Wildlife Society 37:22-36.

Gray, E. M. 1995. DNA fingerprinting reveals a lack of genetic variation in northern populations of the western pond turtle (*Clemmys marmorata*). Conservation Biology 9(5):1244–1254.

Hayes, D. W., K. R. McAllister, S. A. Richardson, and D. W. Stinson. 1999. Washington state recovery plan for the western pond turtle. Olympia, WA: Washington Department of Fish and Wildlife.

Holland, D. C. 1985a. An ecological and quantitative study of the western pond turtle (*Clemmys marmorata*) in San Luis Obispo County, California. M.S. thesis, California State University, Fresno.

_____. 1985b. Western pond turtle (*Clemmys marmorata*): feeding. Herpetological Review 16(4): 112–113.

_____. 1988. Western pond turtle (*Clemmys marmorata*): Behavior. Herpetological Review 19:87.

_____. 1991a. Status and reproductive dynamics of a population of western pond turtles (*Clemmys marmorata*) in Klickitat County, Washington in 1990. Unpublished report. Olympia, WA: Washington Department of Wildlife.

_____. 1991b. A synopsis of the ecology and status of the western pond turtle (*Clemmys marmorata*) in 1991. Unpublished report prepared for the USDI Fish and Wildlife Service.

_____. 1994. The western pond turtle: habitat and history. Portland, OR: U.S. Department of Energy, Bonneville Power Administration.

Holland, D. C. and R. B. Bury. 1998. *Clemmys marmorata* (Baird and Girard 1852) western pond turtle. In P.C. H. Pritchard and A. G. J Rhodin (eds.), The conservation biology of freshwater turtles. Chelonian Research Monographs 2(2).

Holman, J.A. and U. Fritz. 2001 A new emydine species from the middle Miocene (Barstovian) of Nebraska, USA with a generic arrangement of the species *Clemmys sensu* McDowell (1964) (Reptilia: Testudines: Emydidae). Zoologische Abhandlungen Staatliches Museum für Tierkunde Dresden (51(20): 331-353).

Iverson, J.B., P.A. Meylan and Seidel. 2008. Testudines-Turtles. In: Crother, B.I. (Ed.). Scientific and standard English names of amphibians and reptiles of North America and Mexico. SSAR Herpetological Circular 37: 67-64.

Jennings, M. R., and M. P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA, under contract 8023.

Lampman, B. H. 1946. The coming of the pond fishes. Portland, OR: Binfords and Mort.

Moyle, P. B. 1973. Effect of introduced bullfrogs (*Rana catesbeiana*) on the native frogs of the San Joaquin Valley, California. Copeia 1973:18–22.

Nyhof, P.E. and L. Trulio. 2015. Basking Western Pond Turtle Disturbance to Recreational Trail Use in Urban California. Chelonian Conservation and Biology, 14(2) : 182-184.

Parham, J.F. and A.G.J. Rhodin (corresponding authors). Turtle Taxonomy Working Group. 2007. An annotated list of modern turtle terminal taxa (with comments on areas of instability and recent change). Chelonian Conservation and Biology Research Monographs 4:173-199.

Pilliod, D.S., J.L. Welty, R. Stafford. 2013. Terrestrial movement patterns of western pond turtles (*Actinemys marmorata*) in Central California. Herpetological Conservation and Biology 8(1): 207-221.

Rathbun, G. B., N. J. Scott, T. G. Murphey. 2002. Terrestrial habitat use by Pacific pond turtles in a Mediterranean climate. Southwestern Naturalist 47(2):225–235.

Seeliger, M. L. 1945. Variation in the Pacific mud turtle. Copeia 1945(3):150–159.

Smith, H. M. 1895. Notes on a reconnaissance of the fisheries of the Pacific coast of the United States in 1894. Bulletin United States Fish Commission 14:223–288.

Spinks, P. Q., and H. B. Shaffer. 2005. Range-wide molecular analysis of the western pond turtle (*Emys marmorata*): cryptic variation, isolation by distance, and their conservation implications. Molecular Ecology14:2047–2064.

Spinks, P.Q., R.C. Thomson, H.B. Shaffer. 2014. The advantages of going large: genome-wide SNPs clarify the complex population history and systematics of the threatened western pond turtle. Molecular Ecology 23: 2228-2241.

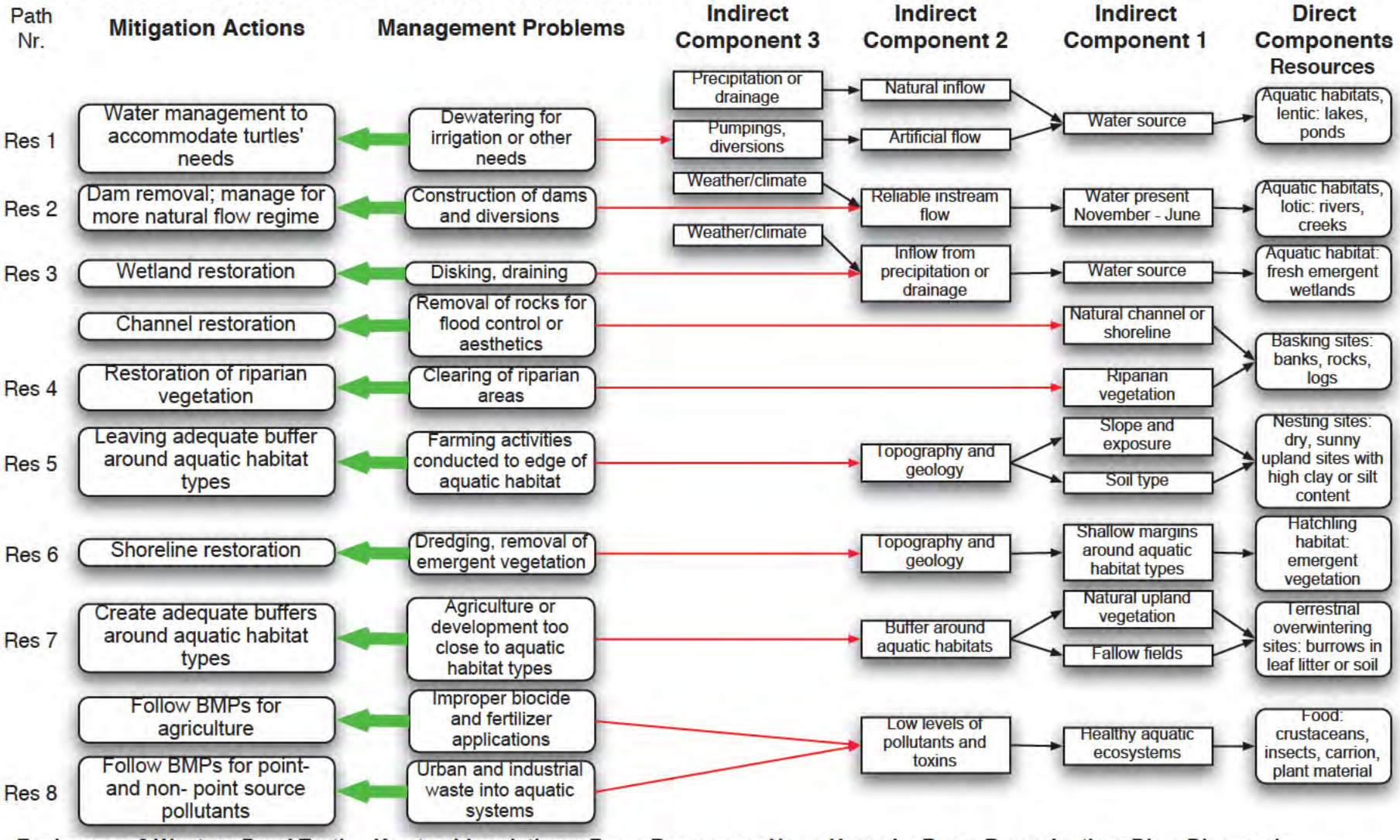
Stephens, P. R. and J. J. Wiens. 2003. Ecological diversification and phylogeny of emydid turtles. Biological Journal of the Linnean Society 79:577–610.

Storer, T. I. 1930. Notes on the range and life-history of the Pacific fresh-water turtle, Cle*mmys marmorata*. University of California Publications in Zoology 32:429–441.

U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; notice of a 1-year petition finding on the western pond turtle. 58 FR 42717–42718.

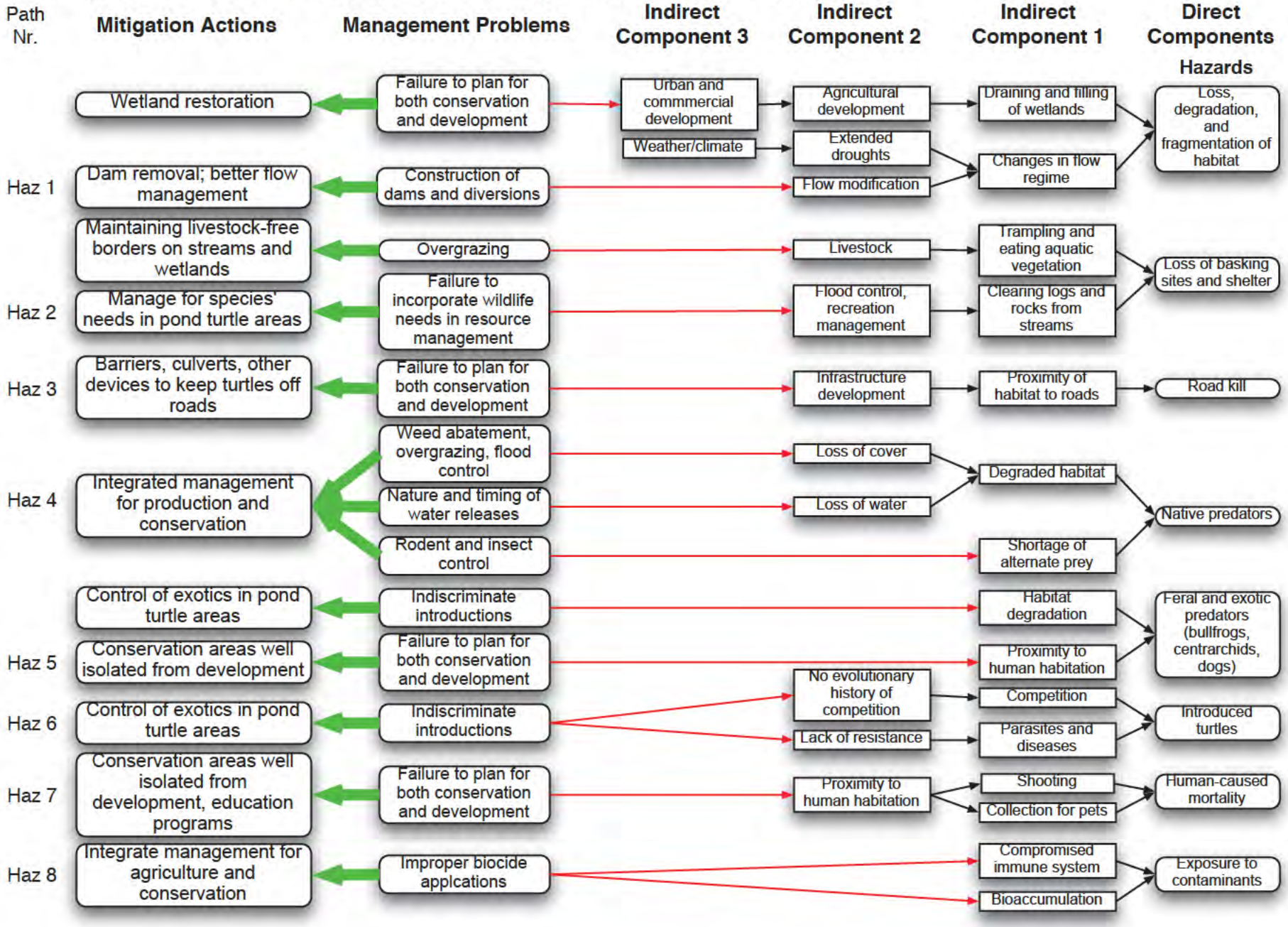
_____. 1999. Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). Portland, Oregon. ix+ 192 pp.

Envirogram 6 Western Pond Turtle, *Emys marmorata*

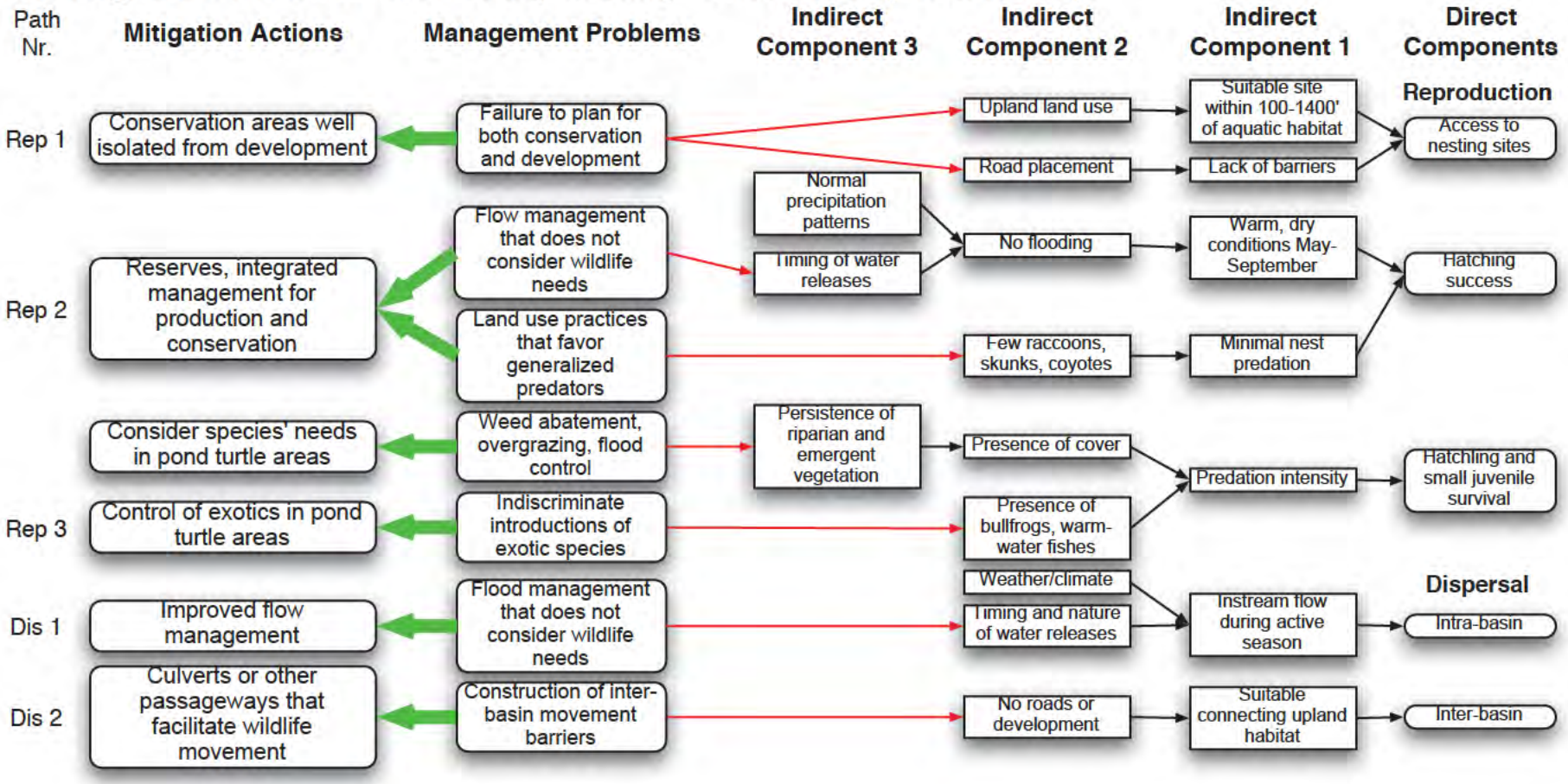


Envirogram 6 Western Pond Turtle. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram 6 Western Pond Turtle, *Clemmys marmorata* (continued 2)



Envirogram 6 Western Pond Turtle, *Clemmys marmorata* (continued 3)



Envirogram Narrative

Western Pond Turtle (*Emys marmorata*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1**:** Lentic (i.e., still water) habitats for the western pond turtle include lakes and ponds, both of which require a water source, either from natural inflow resulting from precipitation or drainage, or artificial inflow from pumping or diversions. If the artificial inflow stops because of dewatering for irrigation or other needs, the habitat may no longer exist. Managing water resources with the needs of the turtle in mind may help mitigate this problem.

Res2**:** Lotic (i.e., moving water) habitats for the western pond turtle include rivers and creeks that have water present in them between November and June. Normal precipitation patterns result in reliable instream flow during these months if the stream is not dammed or diverted. Removing these structures or managing streams for a more normal flow regime potentially can restore lost habitat for the turtle.

Res3**:** Western pond turtle also occurs in fresh emergent wetlands that result from natural precipitation or drainage. Disking and draining has destroyed most of these wetlands, but many can be restored.

Res4**:** Western pond turtle needs basking sites such as gently sloping banks, rocks, or logs. These features are found along lentic or lotic habitat types with natural channels and shorelines and riparian vegetation. The removal of rocks and logs for flood control and the clearing of riparian areas have resulted in the loss of basking sites; the restoration of natural banks and channels and restoration vegetation can restore them.

Res5**:** Western pond turtle lays its eggs in dry, sunny, upland sites with high clay or silt content. The presence of appropriate nesting sites depends on both slope and exposure and soil type, which in turn are related to local topography and geology. Farming activities that are conducted close to the edges of aquatic habitat types can result in the loss of nesting habitat. Leaving adequate buffers around aquatic habitat types can help ensure that good nesting sites are available.

Res6: Hatchling western pond turtles require emergent vegetation for cover. The presence of emergent vegetation depends upon the presence of shallow margins around northwestern pond turtle aquatic

habitats, which partly depends on the microtopography of the site and partly on past management activities. Shoreline restoration can re-create appropriate bank morphology and vegetation.

Res7**:** Western pond turtle overwinters in burrows in leaf litter or soil. Appropriate sites are found in both natural upland vegetation and some fallow agricultural fields. Buffers around aquatic habitat types also help ensure the presence of good overwintering sites.

Res8**:** Western pond turtle feeds on a variety of aquatic invertebrates including crustaceans and insects, carrion, and some plant material. These items are abundant in healthy aquatic ecosystems with low levels of pollutants and toxins. Keeping agricultural, industrial, and urban pollutants out of aquatic systems by following Best Management Practices can help maintain ecosystem health.

Hazards

Haz1**:** The major hazard faced by western pond turtle is the loss, degradation, and fragmentation of its habitat. Draining and filling wetlands for agricultural development followed by poorly planned urban and commercial development is a major cause for the decline or loss of populations. Some of these wetlands may be restorable, however. Another source of habitat loss and degradation has been changes to natural flow regimes through both natural (extended droughts) and human (various types of flow modifications) causes. Removal of dams and diversions and better flow management can help ameliorate the latter.

Haz2**:** Loss of basking sites and shelter is another hazard for the western pond turtle. Trampling and eating aquatic vegetation by livestock and clearing logs and rocks from streams for flood control or recreation enhancement are largely responsible. Elimination of overgrazing by keeping livestock out of streams and wetlands and managing aquatic habitat types for wildlife as well as other uses can improve the availability of basking sites.

Haz3**:** Western pond turtle can be killed on roads when moving from aquatic to nesting or overwintering habitat. New roads built in proximity to western pond turtle habitat should be made “turtle-friendly” with barriers to discourage crossing and culverts to facilitate dispersal.

Haz4**:** Various native species prey on western pond turtle (e.g., raccoon, skunk, otter, and coyote on adults and herons and giant garter snake on young). Excessive predation usually results from degraded habitat, particularly loss of cover from weed abatement, overgrazing, or flood control, and lack of water from bad timing of water releases. Heavy predation pressure on the western pond turtle also can occur during periods when alternate prey are scarce because of rodent or insect control. These problems can be ameliorated to some extent by integrated management for production and conservation.

Haz5**:** Feral and exotic predators such as bullfrog and centrarchid fishes prey on adults and young western pond turtle. Habitat degradation and proximity to human habitation increase predation pressure from these species. Isolating turtle conservation areas from development and control of exotics can ameliorate this pressure to some extent.

Haz6**:** Introduced turtles (e.g., painted turtle, *Chrysemys picta*) compete with western pond turtles for food and other resources. Western pond turtles are especially vulnerable to such competition because it evolved in the absence of other turtles. Exotic species also are sources of parasites and diseases to which the western pond turtle apparently has little resistance. Control of exotic species in western pond turtle habitat is a necessary conservation tactic.

Haz7**:** Direct human-caused mortality such as shooting or collection for pets is another hazard for the western pond turtle. These problems are exacerbated near human habitation, suggesting that conservation areas for the western pond turtle should be well isolated from development and that education on the conservation of native species should be expanded.

Haz8**:** Exposure to contaminants, resulting in either bioaccumulation or a compromised immune system, is another hazard for the western pond turtle. Many contaminants enter aquatic ecosystems because of improper pesticide applications; these can be ameliorated by integrated management for both agriculture and conservation.

Reproduction

Rep1**:** Western pond turtle needs access to nesting sites. Suitable sites must be present with no barriers within 1,200 feet of aquatic habitats. These factors largely depend on upland land use and road placement. Conservation areas well away from development seem to be the best way to insure access to nest sites.

Rep2**:** Hatching success depends on warm, dry conditions from May to December. Such conditions require that the nest not be flooded either from irrigation or abnormal precipitation. Flow management that considers the needs of the western pond turtle is critical. Hatching success also depends on minimal nest predation; the major predators seem to be raccoon, skunk, and coyote. Integrated management for both agriculture and conservation can help ensure that favorable conditions are maintained.

Rep3**:** Reproductive success also depends on the survival of hatchlings and juveniles. Heavy predation by bullfrog and warm-water fish, exacerbated by the absence of cover provided by riparian and emergent vegetation, results in poor survival. These problems result from indiscriminate introductions of exotic species and vegetation management that does not consider wildlife needs. Control of exotics and management for factors that favor the western pond turtle can help ameliorate these problems.

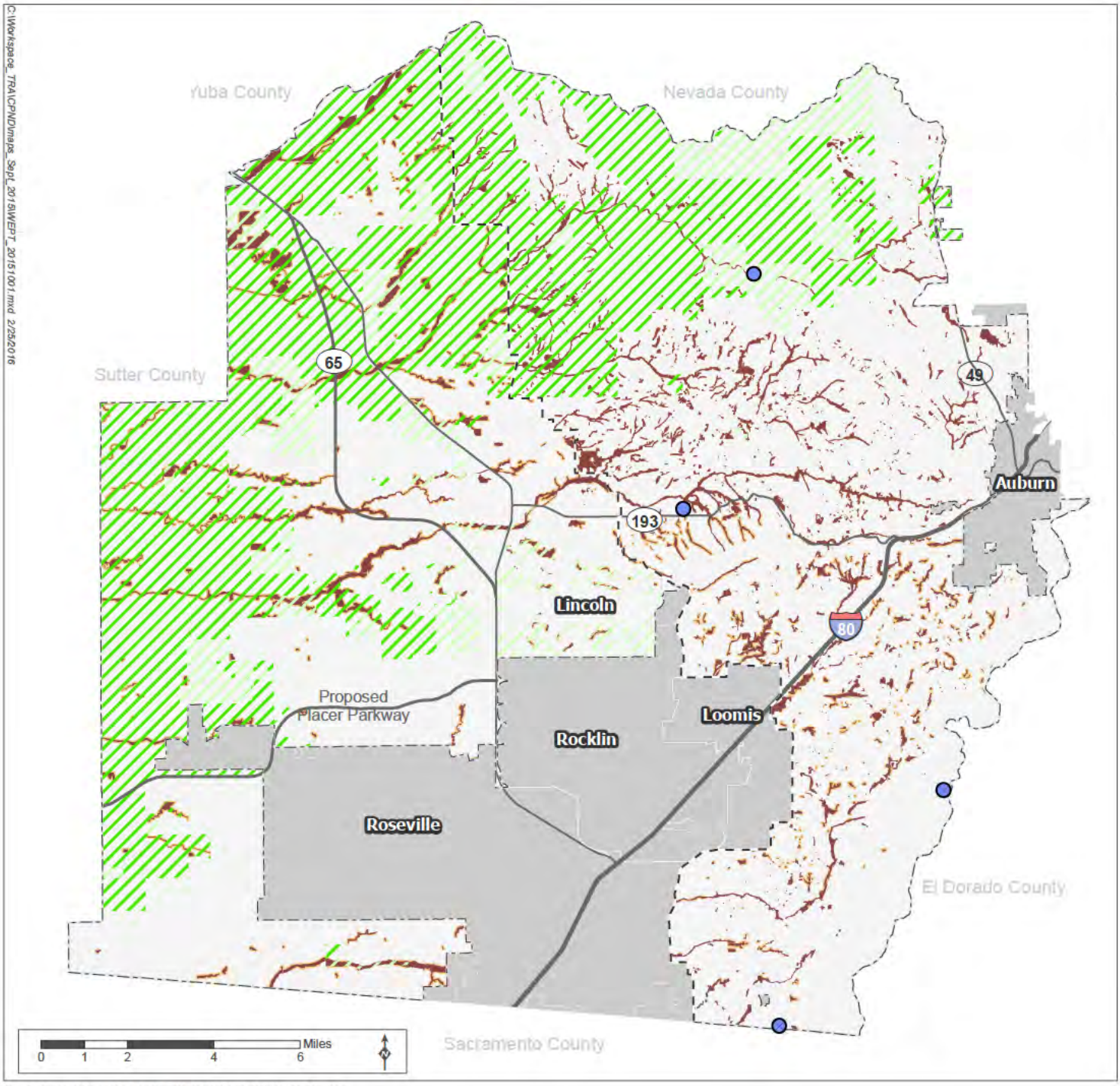
Dispersal

Dis1**:** Long-range dispersal within a watershed depends on adequate instream flow during the active season. Suitable precipitation and appropriate timing of water releases facilitates these movements.

Dis2**:** Dispersal among watersheds is rare and depends on suitable upland habitat with few roads and development. Making landscapes more permeable by removing barriers and installing devices that facilitate dispersal may allow some intra-basin movement.

Summary

Western pond turtle is a conservation challenge not only because it relies on both aquatic and terrestrial habitats but also because so much of its habitat has been lost in Placer County. Its life history strategy—many breeding attempts over a long life—is very vulnerable to increases in adult mortality rates. Because it evolved in the absence of other turtles, it also lacks evolutionary experience with introduced turtle species and their parasites and diseases. Reserve areas well isolated from intense human activity and managed primarily for the western pond turtle and compatible species seem to be the best conservation strategy.



Source: Placer County, 2014; MIG | TRA, 2015; CNDDB, 2015; CDFG, 2005

Occurrences
- Precise Location
- General Location

Modeled Habitat
- Aquatic Habitat
- Upland Habitat
- Non-habitat

- Existing Protected Area
- Reserve Aquisition Area
- Non-participating City

- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 6.

Western Pond Turtle Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Foothill Yellow-legged Frog (*Rana boylii*)

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www.Californiaherps.com

Status

Federal: Under review for listing under the Endangered Species Act (USFWS 2015)

State: Species of Special Concern

Critical Habitat: Not Applicable (N/A)

Recovery Plan: N/A

Distribution

North America

Historically, foothill yellow-legged frog occurred in most Pacific coast drainages west of the Sierra/Cascade crest from the Santiam River in Marion County, Oregon to the San Gabriel drainage in Los Angeles County, California (Jennings and Hayes 1988). Records also exist for an isolated population in the Sierra San Pedro Martir in Baja California, Mexico (Loomis 1965).

California

Historically, foothill yellow-legged frog occurred from west of the crest of the Cascade Mountains in Oregon south to the Transverse Ranges in Los Angeles County, and in the Sierra Nevada foothills south to Kern County (Zweifel 1955; Stebbins 1985). An isolated population was reported in Sierra San Pedro Martir, Baja Mexico (Loomis 1965). The current range excludes coastal areas south of northern San Luis Obispo County and foothill areas south of Fresno County where the species is apparently extirpated (Jennings and Hayes 1994). Fellars (2009) found uneven distribution of foothill yellow-legged frog in California, with 30% of streams in the south coast range (south of San Francisco) and 12% of the Sierra Nevada foothills streams inhabited.

Placer County Plan Area

Historical

There is very little information on the historical occurrence of foothill yellow-legged frog in Placer County. Jennings and Hayes (1994) showed several records for foothill yellow-legged frogs in the foothill areas of Placer County.

Current

Jennings and Hayes (1994) reported that foothill yellow-legged frog is widely scattered on the western slope of the northern Sierra Nevada and considered it threatened in this area. Brian Williams (pers. comm.) conducted surveys for foothill yellow-legged frogs in 2002 along tributaries of the American River and believes that foothill yellow-legged frog is likely to be widespread throughout the foothill portions of Placer County. There are twenty recent records (1998–2008) for this species in the central

portion of Placer County outside of the Plan Area (California Natural Diversity Database 2009). However, there are no documented occurrences of foothill yellow-legged frog within the Plan Area or in close proximity to Auburn, Lincoln, Loomis, Newcastle, or Rocklin (Dudek 2014).

The bulk of the CNDDB records are 5 or more miles from the eastern boundary of the Plan Area. The closest recorded occurrences to the Plan Area are either on the North Fork American River or on a tributary to the river upstream of the confluence with the Middle Fork American River (Dudek 2014). The closest documented occurrence of foothill yellow-legged frog to the Plan Area is a specimen from 1952 collected at the North Fork American River confluence with the Middle Fork American River, approximately 1 mile east-northeast of the eastern boundary of the Plan Area (Dudek 2014). The closest extant occurrence of foothill yellow-legged frog to the Plan Area is located just downstream of the Clementine Reservoir, approximately 2.5 miles east of the northeastern boundary of the Plan Area. Additional occurrences are located at Dog Bar Bridge along the Bear River (just over the border in Nevada County), the Bear River upstream of Rollins Reservoir and upstream of Lake Combie, further upstream on the North Fork American River, and along the Middle Fork American River (just south of the border in El Dorado County) (California Natural Diversity Database 2015; Dudek 2014).

Dudek (2014) conducted an assessment of potentially suitable habitat for foothill yellow-legged frog in the Plan Area in August 2014. Based on this assessment, moderate to moderately high-quality breeding, larval development, and juvenile/adult habitat for foothill yellow-legged frog in the Plan Area is limited and high-quality habitat does not appear to be present. They found that, in general, vegetation encroachment and lack of suitable substrates within many stream reaches are likely the primary reason for the limited habitat within the Plan Area. Overall, the upper reaches of Coon Creek were found to provide the most suitable habitat for foothill yellow-legged frog in the Plan Area, although the portion of the Bear River within the Plan Area may also provide some potentially suitable habitat for this species. In addition, a few streams within other watersheds in the Plan Area have potentially suitable habitat for foothill yellow-legged frog, although it is generally limited in extent and isolated from other potential stream areas. Streams with isolated, short reaches of potentially suitable habitat within the Plan Area include Mormon Ravine and the upper reaches of South Fork Dry Creek.

Population Status & Trends

California

Foothill yellow-legged frog has disappeared from 54 percent of its range (Kupferberg et al. 2012). Foothill yellow-legged frog has become rare in the west slope drainages of the Sierra Nevada and southern Cascade Mountains east of the Sacramento–San Joaquin Valleys. It has not been observed since the mid-1970s at 19 historical localities on the western slope of the southern Sierra Nevada (Jennings and Hayes 1994).

The species is extremely rare in central and southern California south of the Salinas River. The last reliable observation of a foothill yellow-legged frog in this region was in 1970 (Jennings and Hayes 1994). In the Coast Ranges north of the Salinas River the species still occurs at many locations but is subject to several risk factors (Jennings and Hayes 1994) that could threaten these populations (see *Population Threats* below).

Populations of foothill yellow-legged frog in Oregon also appear to be declining (Borisenko and Hayes 1999). Foothill yellow-legged frogs were absent from at least 55% of 90 historical locations in Oregon

that were surveyed by Borisenko and Hayes (1999). Recent information on the status of populations in Baja Mexico is not available.

Placer County Plan Area

Foothill yellow-legged frog may have occurred historically in the eastern portion of Placer County near Auburn; however, these populations were determined to be extirpated (Jennings and Hayes 1994). There are no recent records for foothill yellow-legged frogs in the western portion of the County within the Plan Area (Jennings and Hayes 1994; California Natural Diversity Database 2009; Dudek 2014).

Natural History

The habitat requirements, ecological relationships, life history, and threats to foothill yellow-legged frog described below are summarized in diagram form in the Envirogram 7 Foothill Yellow-legged Frog.

Habitat Requirements

Foothill yellow-legged frog occupies rocky streams in valley-foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow habitat types (Zeiner et al. 1988) from sea level to 6,370 feet (Jennings and Hayes 1994). It is nearly always found within a few feet of water. Foothill yellow-legged frog is frequently found in moving but not swiftly flowing water (Stebbins 1954). The species is most common along streams with rocky bottoms but has also been found along streams with mud bottoms (Stebbins 1951). Foothill yellow-legged frog requires permanent streams or, at a minimum, streams where pools persist through the dry season (Stebbins 1951). Foothill yellow-legged frog exhibits fidelity to breeding sites, using the same areas for reproductive activity annually for many years (Kupferberg 1996; Wheeler 2006). Foothill yellow-legged frogs are usually absent from habitats where introduced aquatic predators, such as sunfish (*Lepomis* spp.) and bullfrogs (*Lithobates catesbeianus*), are present (Jennings and Hayes 1994). While foothill yellow-legged frogs are rarely found away from water during the breeding season, during the winter, the species has been observed up to 100 meters from streams (Zeiner 1988). Nonetheless the species is considered to be highly aquatic.

Reproduction

Foothill yellow-legged frog breeds from mid-March to May after the high-water stage in streams has passed and less sediment is being conveyed (Stebbins 1954). Breeding sites are typically shallow, low velocity areas close to shore (Lind et al. 1996). Foothill yellow-legged frog will use the same areas for reproduction from one year to the next (Kupferberg 1996). Eggs have been observed in early and mid-May in streams in southern California, indicating that oviposition occurs later in the south than in the north (Stebbins 1951). Eggs are deposited in clusters near margins of steams in shallow water. The egg clusters are attached to stones, vegetation, or the bank itself (Stebbins 1954.) Warm edge-water habitat is especially important for developing tadpoles. The embryos have a critical thermal maximum temperature of 26º Celsius. Tadpoles metamorphose in approximately three to four months (Storer 1925; Stebbins 1951).

Dispersal Patterns

Females tend to move greater distances than males during and following the breeding season (Wheeler et al. 2006). Little information is available regarding the distances foothill yellow-legged frog will travel. Twitty et al. (1967) observed that newly metamorphosed foothill yellow-legged frogs consistently moved upstream during fall and winter over a three-year period.

Longevity

Adult size is attained in two years (Storer 1925), but no longevity data are available for this species (Jennings and Hayes 1994). Other anurans have been reported to live 6–36 years in captivity (Duellman and Trueb 1986).

Sources of Mortality

Foothill yellow-legged frog is preyed upon by garter snakes (*Thamnophis* spp.), fish, birds, and mammals (see *Ecological Relationships* below). In addition, bullfrogs are known to feed on native ranid larvae (Jennings 1996) and are likely to feed on foothill yellow-legged frog larvae where they co-occur (Moyle 1973). Other sources of mortality include desiccation from drought or unnatural fluctuations in flow releases (Moyle 1973; Kupferberg 1996); scouring of egg masses from floods or dam releases (Lind et al. 1996; Kupferberg 1996); urbanization; habitat alteration (Jennings 1996); and pesticides (Davidson et al. 2002).

Behavior

Foothill yellow-legged frog is active from late February or early March through summer and into fall. The beginning of seasonal activity appears to correspond with the warming of streams to suitable temperatures. It is not known where these frogs spend the winter but it is thought that they remain close to streams. Few foothill yellow-legged frogs have been observed in hibernation areas away from streams (Zweifel 1955).

Normal home range of foothill yellow-legged frogs is probably not more than 33 feet in the longest dimension (Zeiner et al. 1988). If it follows the pattern of other ranid frogs, males probably defend territories during the breeding season (Martof 1953; Emlen 1968).

Foothill yellow-legged frogs eat aquatic and terrestrial arthropods, particularly insects. Insects found in the stomachs of this frog include grasshoppers, hornets, carpenter ants, water striders, small beetles, and dipterans (mosquitoes and others) (Storer 1925; Stebbins 1951).

Movement and Migratory Patterns

Adult foothill yellow-legged frogs are primarily diurnal and occupy small home ranges. Foothill yellow-legged frogs are highly aquatic and spend most of their life in or near streams. During periods of high water conditions, foothill yellow-legged frog may make occasional long-distance movements (up to 165 feet) (Zeiner et al. 1988). At a study site in Del Norte County, in northwestern California, females tended to move greater distances (from breeding to non-breeding sites) than males, and that males tended to remain at their breeding sites following reproductive activity (Wheeler et al. 2006). In contrast, Van Wagner (1996, as cited in Wheeler 2006) found that males and females moved similar distances.

Ecological Relationships

Bullfrog is known to prey upon foothill yellow-legged frog (see *Population Threats* below). Several species of garter snakes, including red-sided garter snake (*Thamnophis sirtalis parietalis*), western terrestrial garter snake (*T. elegans*), and Oregon garter snake (*T. couchii hydrophilus*), are predators of post-hatching stages of foothill yellow-legged frogs (Zweifel 1955; Jennings and Hayes 1994). Oregon garter snakes have been observed to feed more frequently on tadpoles, whereas the other two species of garter snakes have been observed to feed more frequently on post-metamorphic individuals (Jennings and Hayes 1994). Rough-skinned newt (*Taricha granulosa*) has been recorded preying on foothill yellow-legged frog eggs (Evenden 1948). In addition, when Centrarchid fishes were offered *Rana* tadpoles and eggs, they ate them readily (Werschkul and Christensen 1977). Fish, mammals (e.g., raccoons), and birds are likely to prey on one or more stages of foothill yellow-legged frog (Zweifel 1955). Foothill yellow-legged frog coexists with Cascades frog (*Rana cascadae*) and red-legged frog (*Rana aurora*) at some localities; however, different microhabitat preferences may limit competition (Zeiner et al. 1988).

Threats

Habitat Alteration and Degradation

Tremendous population growth and the resulting urbanization of California since World War II have had devastating effects on native ranids in California. Controlling water flow, building roads into natural areas, and polluting waterways are examples of human activities that have modified and degraded amphibian habitat (Jennings 1988). In areas where human activities have greatly altered habitats, amphibian populations have declined or been eliminated (Davidson et al. 2002).

Drought, Flooding, and Water Management

Scouring floods that occur approximately every 500 years have been implicated in declines of foothill yellow-legged frog in southern California (Hayes and Jennings 1986). Poor timing and high-flow releases of water from upstream reservoirs can have the same effect by scouring eggs from their oviposition substrates (Kupferberg 1996; Lind et al. 1996). Eggs are washed away when streams experience high-flow velocities for several days in a row (Kupferberg 1996; Bondi et al. 2013). The magnitude and timing of spring pulse flows can affect survival of foothill yellow-legged frog embryos. Large magnitude pulses decrease egg survival and smaller magnitude pulses late in the breeding season can cause higher mortality because egg jelly adhesion and cohesion may be diminished (Kupferberg 2008). Decreased water flows can also have a negative result by stranding eggs or forcing foothill yellow-legged frog into permanent pools where it may be more susceptible to predation (Moyle 1973; Kupferberg 1996). Results of surveys in Oregon by Borisenko and Hayes (1999) suggest a direct correlation between the absence of frogs and the presence of dams and grazing activities. Large dams substantially alter habitat by changing the hydrology and geomorphology of the water system, resulting in degraded habitat for foothill yellow-legged frog (Borisenko and Hayes 1999). Presence of dams in the upstream watershed is associated with an absence of foothill yellow-legged frogs, suggesting that flow alteration is associated with lower abundance of this species (Kupferberg et al. 2012).

Introduction of Nonnative Predators

One of the primary factors in decline of the foothill yellow-legged frog in the Sierra Nevada is the introduction of nonnative predators (Jennings 1996). At least 60 species of fish, many of them predatory, have been introduced in western North America over the past 120 years (Jennings 1988). Fish are known to prey upon various life stages of anurans (Hayes and Jennings 1986) and have been implicated in the decline of populations of frogs in some areas (Cory 1963; Knapp and Mathews 2000). Locations where introduced fishes were abundant contained few foothill yellow-legged frogs, indicating that the presence of these fish had a negative influence on the abundance of the frog (Moyle 1973; Hayes and Jennings 1986; Jennings and Hayes 1994).

Bullfrogs were introduced to California in the late 1800s (Hayes and Jennings 1986) and have spread throughout the state (Bury and Luckenbach 1976). Several observations provide evidence that bullfrog preys upon foothill yellow-legged frog: yellow-legged frog abundance was inversely correlated with bullfrog abundance, bullfrogs occupied areas that once had yellow-legged frog, and captive bullfrogs ate yellow-legged frogs soon after the two species were placed together (Moyle 1973; Hayes and Jennings 1986). In Oregon, foothill yellow-legged frogs were rarely found co-occurring with bullfrog (Borisenko and Hayes 1999). The alteration of foothill streams by human activities has increased the amount of suitable habitat for bullfrog, which competes with and preys on foothill yellow-legged frog (Moyle 1973; Borisenko and Hayes 1999).

Pesticides and Herbicides

Pesticides, herbicides, and other toxins are known to be harmful to various life stages of ranid frogs (Hayes and Jennings 1986). Research has demonstrated that amphibians absorb pesticides in aquatic and terrestrial systems; the toxins disrupt their nervous systems and cause death by respiratory failure (Yosemite Association 2001). Pesticide drift has recently been implicated as a potential cause of declining populations of four ranid species in California, including foothill yellow-legged frog. Davidson et al. (2002) compared the spatial pattern of declines for eight species of California amphibians with the amount of upwind agricultural land use. Predominant winds flow from the coast through the Central Valley and into the foothills and mountains of the Sierra Nevada. Declines of four ranid species were strongly associated with upwind agricultural use, suggesting that this group of amphibians may have a particular sensitivity to agrochemicals.

Pathogens

Recent attention has been given to the role pathogens may play on localized population fluctuations of amphibians. The chytrid fungus has been found in several species of amphibians in California (U. S. Fish and Wildlife Service 2000; Vredenburg 2001). Chytrid fungus causes deterioration of the mouthparts of tadpoles and has been implicated in amphibian declines in North America (Oulett et al. 2005), Australia, Central and South America, and Europe (Vredenburg 2001). The fungus has been found in a number of amphibians whose populations are declining, and current studies indicate that the chytrid fungus may be playing a role in that decline (Adams et al 2017).

Context for a Regional Conservation Strategy

There are no current records of foothill yellow-legged frog in western Placer County, although the species has been recently recorded in Placer County and is assumed to be present or potentially present

within the foothill region of the Plan Area. Moderate to moderately high-quality breeding, larval development, and juvenile/adult habitat for foothill yellow-legged frog is present (although limited) in the Plan Area and high-quality habitat does not appear to be present, including in the upper reaches of Coon Creek, portions of the Bear River, Mormon Ravine, and the upper reaches of South Fork Dry Creek (Dudek 2014).

In California, the range of recorded yellow-legged frog extends along western California from Del Norte County south to San Luis Obispo County, and east of the Central Valley from Siskiyou County to Tulare County. The species has become rare on the western slopes of the Sierra Nevada, and although there are records from counties north and south of Placer (including Nevada, Sierra and Plumas counties to the north and El Dorado and Amador counties to the south) the significant reduction of yellow-legged frog in the region heightens the value of existing populations and suitable habitat. Human-induced changes such as introduced non-native predators, pesticide run-off, hydrologic changes resulting from dams, and urbanization are the leading causes of population declines. Within the Plan Area, suitable habitat where these threats are minimized is of greatest conservation or acquisition priority.

Modeled Species Distribution in the Plan Area

Model Assumptions

Year-round Habitat

Modeled year-round habitat for foothill yellow-legged frog is defined by riverine land-cover above 500 feet in elevation.

Rationale

Foothill yellow-legged frog occurs from sea level to 6,370 feet (Jennings and hayes 1994); however, the CDFW has modeled the foothill yellow-legged frog habitat in California and restricts it to above 500 feet in elevation in the Plan Area (Hooper pers. comm.). Foothill yellow-legged frogs occupy, and are nearly always found within a few feet of, rocky streams that run through oak woodlands. Foothill yellow-legged frogs are frequently found in moving but not swiftly flowing water (Stebbins 1954). Foothill yellow-legged frogs require permanent streams or, at a minimum, streams where pools persist through the dry season (Stebbins 1951).

Model Results

Species Map 7. *Foothill Yellow-legged Frog Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for foothill-yellow legged frog within the Plan Area. Modeled potential habitat is limited primarily to the western portion of the Bear River, Coon Creek and upper tributaries, Auburn Ravine, Pleasant Grove Creek, and Dry Creek and its upper tributaries.

References

Printed References

Adams AJ, Pessier AP, Briggs CJ Rapid extirpation of a North American frog coincides with an increase in fungal pathogen prevalence: Historical analysis and implications for reintroduction. *Ecol Evol*. 2017;7:10216–10232. https://doi.org/10.1002/ece3.3468

Bondi, C.A., Yarnell, S.M., and Lind, A.J. 2013. Transferability of Habitat Suitability Criteria for a Stream Breeding Frog (*Rana boylii*) in the Sierra Nevada, California. Herpetological Conservation and Biology 8(1): 88-103.

Borisenko, A. and M. P. Hayes. 1999. Status of the foothill yellow-legged frog (*Rana boylii*) in Oregon. Final report prepared for The Nature Conservancy under contract to the U. S. Fish and Wildlife Service.

Bury, R. B. and R. A. Luckenbach. 1976. Introduced amphibians and reptiles in California. *Biological Conservation* 10 (1976):1–14.

California Natural Diversity Database. 2009. RareFind, Version 3.1.0 (May 30, 2009 update). Sacramento, CA: California Department of Fish and Game.

Cory, B. L. 1963. Effects of introduced trout on the evolution of native frogs in the high Sierra Nevada Mountains. *Proceedings XVI International Congress of Zoology* 2:172

Davidson, C., H. B. Shaffer, and M. R. Jennings. 2002. Spatial tests of the pesticide drift, habitat destruction, UV-B, and climate-change hypotheses for California amphibian declines. *Conservation Biology* 16(6):1588–1601.

Dudek Consulting. 2014. Evaluation of Potentially Suitable Habitat and Recommended Future Survey Locations for Selected Rare Species within the Placer County Conservation Plan/Natural Community Conservation Plan Area.

Duellman, W. E. and L. Trueb. 1986. *Biology of amphibians*. New York: McGraw-Hill.

Emlen, S. T. 1968. Territoriality in the bullfrog, *Rana catesbeiana*. *Copeia* 1968:240–243.

Evenden, F. G., Jr. 1948. Food habits of *Triturus granulosus* in western Oregon. *Copeia* 1948 (3):219–220.

Fellers, G. M. 2000. E-mail dated June 19, 2000. Posted to U.C. Davis Listproc Web Site June 24, 2000. Available at: http://listproc.ucdavis.edu/archives/herp-l/log0006/0015.html.

Fellers, Gary M. AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2009. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/. (Accessed: Sep 28, 2009).

Hayes, M. P., and M. R. Jennings. 1986. Decline of ranid frog species in Western North America: are bullfrogs (*Rana catesbeiana*) responsible? *Journal of Herpetology* 20(4):490–509.

Jennings, M. R. 1988. Natural history and decline of native ranids in California. Pages 61–72 in H. F. DeLisle, P. R. Brown, B. Kaufman, and B. M. McCurthy (eds.), *Proceedings of the Conference on California Herpetology*. Special Publication No. 4. Based on regional conference held at the Los Angeles County Museum of Natural History, Los Angeles, CA, October 10 and 11, 1987. Van Nuys, CA: Southwestern Herpetologists Society.

Jennings, M. R. 1996. Status of amphibians. *Sierra Nevada Ecosystems Project: final report to Congress*. Volume II: *Assessments and scientific basis for management options*. Davis, CA: University of California, Centers for Water and Wildland Resources.

Jennings, M. R., and M. P. Hayes. 1994. *Amphibian and reptile species of special concern in California*. Rancho Cordova, CA: California Department of Fish and Game, Inland Fisheries Division.

Knapp, R. A., and K. R. Matthews. 2000. Non-native fish introductions and the decline of the mountain yellow-legged frog from within protected areas. *Conservation Biology* 14(2): 428–438.

Kupferberg, S. J. 1996. Hydrologic and geomorphic factors affecting conservation of a river-breeding frog (*Rana boylii*). *Ecological Applications* 64(4):1332–1344.

Kupferberg, S., Lind, A., Mount, J., and Yarnell, S. 2008. Pulsed flow effects on the Foothill Yellow-Legged Frog (*Rana boylii*): Integration of empirical, experimental and hydrodynamic modeling approaches. Final Report. California Energy Commission, PIER. Publication number TBD.

Kupferberg, S., Palen, W., Lind, A., Bobzien, S., Catenazzi, A., Drennan, J., and Power, M. 2012. Effects of Flow Regimes Altered by Dams on Survival, Population Declines, and Range-Wide Losses of California River-Breeding Frogs. Conservation Biology 26 (3): 513-524.

Lind, A. J., H. H. Welsh Jr., and R. A. Wilson. 1996. The effects of a dam on breeding habitat and egg survival of the foothill yellow-legged frog (*Rana boylii*) in Northwestern California. *Herpetological Review* 27(2):62–67

Loomis, R. B. 1965. The yellow-legged frog, *Rana boylii*, from the Sierra San Redro Martir, Baja California Norte, Mexico. *Herpetologica* 2(1):78–80.

Martof, B. S. 1953. Territoriality in the green frog, *Rana clamitans*. *Ecology* 34:165–174.

Moyle, P. B. 1973. Effects of introduced bullfrogs, *Rana catesbeiana*, on the native frogs of the San Joaquin Valley, California. *Copeia* 1973 (1):18–22.

Ouellet, M., Mikaelian, I., Paulie, B. D., Rodrigue, J., and Green, D. M. 2005. Historical evidence of widespread Chytrid infection in North American amphibian populations.Conservation Biology 19: 1431- 1440.

Stebbins, R. C. 1951. *Amphibians of western North America*. University of California Press, Berkeley, California.

_____. 1954. Amphibians and reptiles of western North America. New York: McGraw-Hill.

_____. 1985. *A field guide to western amphibians and reptiles* (second edition). New York: Houghton Mifflin Company.

Storer, T. I. 1925. *A synopsis of the Amphibia of California*. University of California Publications in Zoology 27:1–342.

Twitty, V., D. Grant, and O. Anderson. 1967. Amphibian orientation: an unexpected observation. *Science* 155(3760):352–353.

U.S. Fish and Wildlife Service (USFWS). 2000. Draft recovery plan for the California red-legged frog (*Rana aurora draytonii*). Portland, OR.

_____. 2015. 90-Day Finding on a Petition to List the Foothill Yellow-Legged Frog under the Endangered Species Act. Federal Docket No. FWS-R8-ES-2015-0050.

Vredenburg, V. 2001. Chytrid fungus in the Sierra Nevada mountains of California, USA. Amphibia Web http://elib.cs.berkeley.edu/aw/chytrid. June 28, 2001.

Wheeler, C. A., H. H. Welsh, and T. Roelofs. 2006. Oviposition site selection, movement, and spatial ecology of the foothill yellow-legged frog (Rana boylii). Final report to the California Department of Fish and Game.

Werschkul, D. F., and M. T. Christensen. 1977. Differential predation by *Lepomis macrochirus* on the eggs and tadpoles of *Rana*. *Herpetologica* 33:237–241.

Yosemite Association. 2001. USGS research shows wind may blow agricultural contaminants to Sierra. *Yosemite* 63(1):2–3.

Zeiner, D. C., W. F. Laudenslayer, and K. E. Mayer (eds.). 1988. *California's wildlife*. Volume I: *Amphibians and reptiles*. California Statewide Wildlife Habitat Relationships System. Sacramento, CA: California Department of Fish and Game.

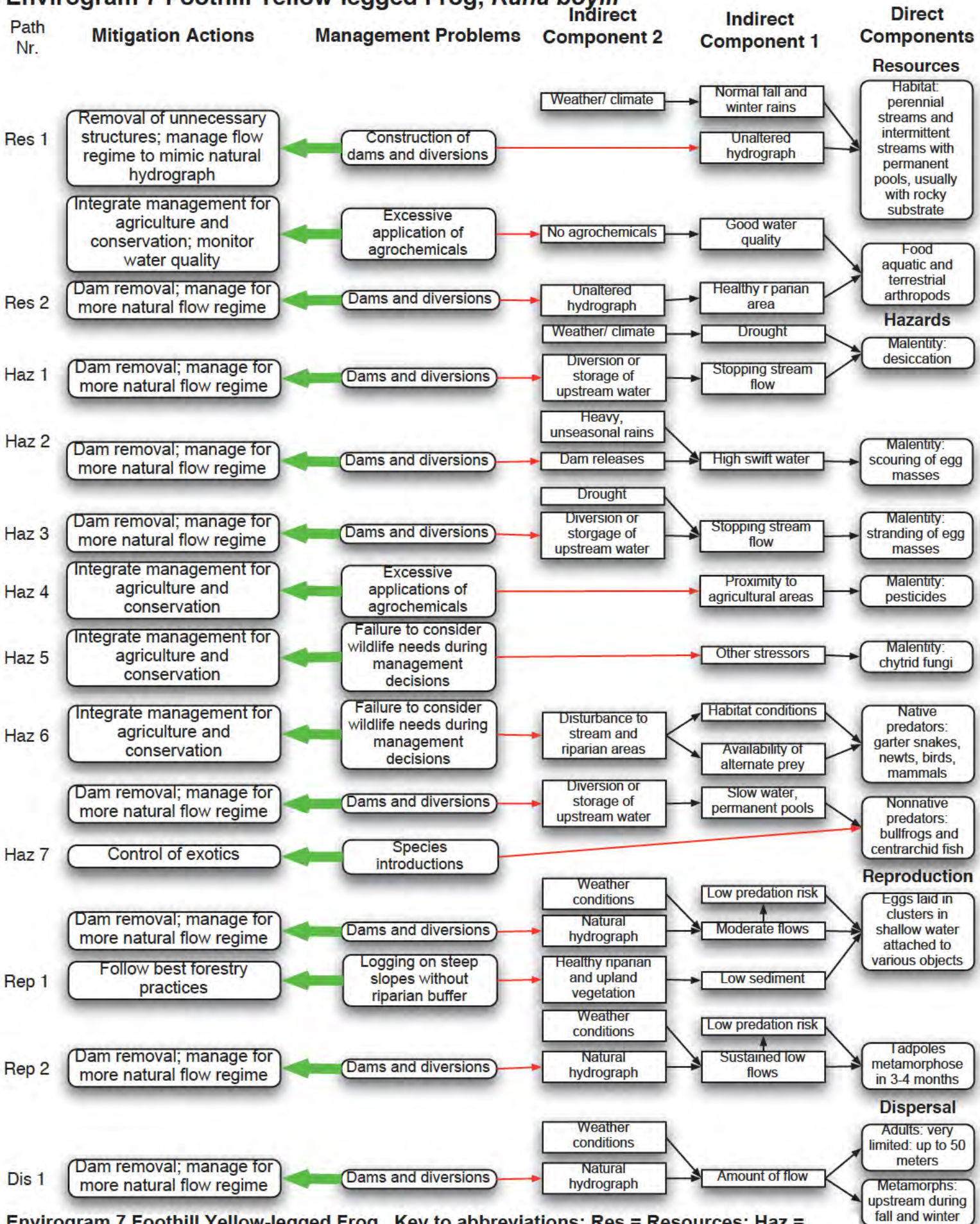
Zweifel, R. G. 1955. Ecology, distribution, and systematics of frogs of the *Rana boylei* group. University of California Publications in Zoology 54 (4):207–292.

Personal Communications

Hooper, Stacy. CWHR Program Lead. Biogeographic Data Branch. California Department of Fish and Wildlife. Sacramento, CA. August 20, 2013 – e-mail correspondence.

Williams, Brian. Wildlife and Conservation Ecologist. Williams Wildland Consulting, Inc., Granite Bay, CA. January 3, 2003 – e-mail correspondence.

Envirogram 7 Foothill Yellow-legged Frog, *Rana boylii*



Envirogram 7 Foothill Yellow-legged Frog. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram Narrative

Foothill Yellow-legged Frog (*Rana boylii*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Foothill yellow-legged frog inhabits both perennial streams and intermittent streams with permanent pools; preferred streams usually have rocky substrates. Suitable conditions for the species depend on adequate rainfall and a natural hydrograph. The construction of dams and diversions has made many streams unsuitable, but the removal of unnecessary structures and managing the flow regime to mimic historic conditions can mitigate this problem to some extent.

Res2: Foothill yellow-legged frog preys on both aquatic and terrestrial arthropods. Aquatic arthropods require good water quality, and agrochemicals entering streams because of excessive application are a major threat to water quality. Best management practices that integrate agriculture and conservation can protect water quality; water quality monitoring is necessary to ensure that these practices are being followed. A healthy riparian zone resulting from an unaltered hydrograph is favorable for terrestrial arthropods; the removal of unnecessary structures and managing the flow regime to mimic historic conditions encourages good riparian conditions.

Hazards

Haz1: Larval and adult foothill yellow-legged frogs can desiccate when their streams dry up from drought or blocked stream flow. The removal of unnecessary structures and managing the flow regime to mimic historic conditions can help mitigate this problem.

Haz2: High, swift water resulting from unseasonal heavy rains or dam releases can scour egg masses from their attachments. Mitigation is the same as for Haz1.

Haz3: Egg masses can be stranded in pools that make them susceptible to predation and high temperatures. Stranding results from drought or blocked stream flow. Mitigation is the same as for Haz1.

Haz4: Pesticide poisoning has been implicated in amphibian mortality; this is most likely to happen in streams that flow through agricultural areas where agrochemicals are applied to excess. Best management practices that integrate agriculture and conservation can help mitigate this problem.

Haz5: Chytrid fungi also have been implicated in amphibian mortality. Infections usually result when the amphibians are stressed from other factors; multiple stressors can be alleviated by management practices that integrate agriculture and conservation.

Haz6: A number of native predators eat all life stages of foothill yellow-legged frog. Predation pressure is minimized when habitat conditions are favorable to foothill yellow-legged frog (see Res1) and alternate prey items are available (see Res2). These conditions require management practices that integrate agriculture and conservation.

Haz7: Non-native predators, particularly bullfrogs and centrarchid fishes (e.g. bass, sunfish), are very effective predators on foothill yellow-legged frog, particularly larvae. These species thrive in altered flow regimes and are often introduced into farm ponds or dammed streams for food or sport fishing. Removal of unnecessary structures and managing the flow regime to mimic historic conditions provides conditions that are less favorable to exotic species, and introductions of these species should not occur within or near conservation areas. Control of bullfrogs and other non-native predators also may be necessary.

Reproduction

Rep1: Eggs are laid in clusters in shallow water and are attached to various objects to keep them from floating away. Anything that increases sedimentation or changes the flow regime such as dams and diversions, drought or deluge, or logging too close to streams can make conditions unsuitable for eggs and may increase predation risk (see Haz6 and Haz7). Removal of unnecessary structures, managing the flow regime to mimic historic conditions, and following best forestry practices mitigate such conditions.

Rep2: Tadpoles require three to four months of low flow to develop. Anything that changes the flow regime such as dams and diversions or drought or deluge can make conditions unsuitable for tadpoles and may increase predation risk (see Haz6 and Haz7). Removal of unnecessary structures and managing the flow regime to mimic historic conditions can help mitigate these problems.

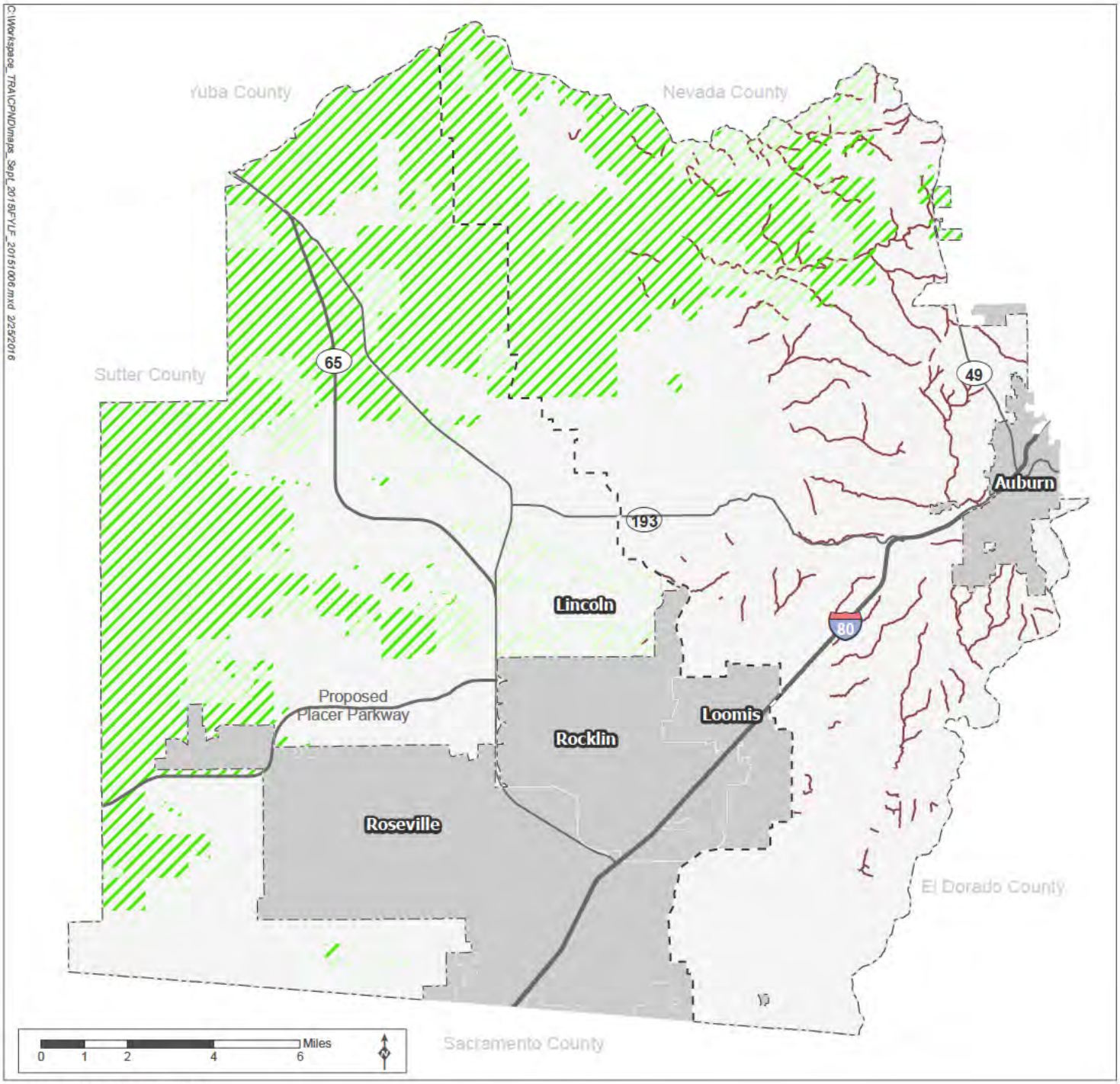
Dispersal

Dis1: Foothill yellow-legged frog is apparently very sedentary, with adults and metamorphs moving only very short distances (150 feet). Dispersal is facilitated by natural flow conditions, which in turn depends on an unaltered hydrograph. Removal of unnecessary structures and managing the flow regime to mimic historic conditions can help facilitate dispersal.

Summary

Almost all of the foothill yellow-legged frog's life history is tied to pre-settlement conditions—high water in the spring following winter rains, low flows in the summer and fall, and healthy riparian vegetation.

Deviations from these conditions brought about by human activities result in increased rats of predation, reproductive failure, and food shortages. Dams and diversions, destruction of riparian vegetation, and introduced predators all have reduced populations of this species considerably. Reversals of these problems are necessary for this species to recover.



Species Map 7

Foothill Yellow-legged Frog Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

California Red-legged Frog (*Rana draytonii*)

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Status

Federal: Threatened.

Critical Habitat: Critical habitat designated on April 12, 2001 (USFWS 1996); Critical habitat designation revised on March 17, 2010 (USFWS 2010).

State: Species of Special Concern

Other: None

Recovery Plan: Recovery Plan for the California red-legged Frog (USFWS 2002)

Distribution

California

The historical range of the California red-legged frog extended coastally from the vicinity of Point Reyes National Seashore in Marin County, and inland from the vicinity of Redding south to northwestern Baja California (Storer 1925; Jennings and Hayes 1985; Hayes and Krempels 1986).

The species' current coastal distribution extends from Sonoma to Los Angeles counties; it also occurs in isolated locations in the Sierra Nevada/Cascade, the northern Coast, and the northern Transverse Ranges. It is relatively common in the San Francisco Bay area. California red-legged frog is believed to be extirpated from the floor of the Central Valley (USFWS 2002). Two populations were recently discovered in the southern Transverse and Peninsular Ranges, where the species was believed to be extirpated (USFWS 2001).

Placer County Plan Area

Historical

Historically, the California red-legged frog occupied sections of the western slope of the Sierra Nevada from Shasta to Tulare counties. The species occurred in at least 30 foothill drainages bordering the Central Valley; however, no specific location information is available for Placer County (USFWS 2002). Museum specimens and photographs obtained for the Sierra Nevada represented 21 localities where California red-legged frog occurred that extended from French Creek in east central Butte County southeast to O'Neals in Madera County (Barry and Fellers 2013). There are three historical records for California red-legged frog in Placer County (Barry and Fellers 2013; Jennings and Hayes 1994; California Natural Diversity Database 2015; Williams pers. comm.). One of these occurrences from 1946 was reportedly near the Placer County Superior Courthouse in Auburn within the Plan Area (Barry and Fellers 2013). One other occurrence from 1916 was located near Michigan Bluff within the Plan Area (Barry and Fellers 2013; California Natural Diversity Database 2009). The other occurrence was from 1939 and was located near Dutch Flat (Barry and Fellers 2013), 15–20 miles outside of the Plan Area.

Current

Most of the known California red-legged frog populations on the western slope of the Sierra Nevada foothills have been eliminated or fragmented, with only ten occurrences discovered since 1991, including one extant historical population, six new populations, and three new single specimen occurrences (Barry and Fellers 2013). These recent occurrences extend from Jack Creek in east central Butte County southeast to Cuneo Creek in Mariposa County (Barry and Fellers 2013). Of these occurrences, one large population of California red-legged frog is present within the Plan Area near Michigan Bluff at Big Gun Diggings. This population is the only historical population of California red-legged frog in the Sierra Nevada known to be extant (Barry and Fellers 2013). Previously undesignated as critical habitat (USFWS 2001), 1,243 acres of the Michigan Bluff area are currently designated as critical habitat unit PLA-1 (USFWS 2010). Big Gun Diggings, now called the Big Gun Conservation Bank, was acquired by Westervelt Ecological Services in 2007 and is now privately held as a California red-legged frog habitat mitigation bank (Barry and Fellers 2013; Westervelt Ecological Services 2012). The site includes six mine tailing ponds situated on a bluff northeast of the Middle Fork of the American River.

Population Status and Trends

California

California red-legged frog has sustained a 70% reduction in its geographic range as a result of several factors acting singly or in combination (Jennings et al. 1992). Before 1960, California red-legged frog populations were densely distributed throughout the California Coast Range and the species was widespread in the coastal southern California foothills (Jennings and Hayes 1994). By 1970, all but a handful of populations were extirpated from southern California and local declines and extirpations occurred from Monterey to Ventura counties (Jennings and Hayes 1994; USFWS 2002). Habitat loss and alteration, over-exploitation, and the introduction of exotic predators were significant factors in the species' decline in the early- to mid-1900s. Reservoir construction, expansion of introduced predators, grazing, and prolonged drought fragmented and eliminated many of the Sierra Nevada foothill populations (USFWS 1996); however, studies conducted since 1990 in the Sierra Nevada foothills have identified new populations and also documented surviving populations that were previously reported as extirpated (Barry and Fellers 2013; Jennings and Hayes 1994; USFWS 2002). The Sierra Nevada distribution of California red-legged frog seems to have declined very little, if at all, since the 1960's (Barry and Fellers 2013). California red-legged frog still occurs in Baja California (USFWS 2001); however, information on the species' status in that portion of the range could not be located. California red-legged frog remains relatively widespread in the coastal mountains north of Point Conception, but it is only common in the San Francisco Bay area (USFWS 2002).

Placer County Plan Area

Population status and trends in Placer County are difficult to determine because there is little information available on locations of California red-legged frog. There are only three historical records for California red-legged frog in Placer County. Two of these are located within the Plan Area, including one near Placer County Superior Courthouse in Auburn and one near Michigan Bluff (Barry and Fellers 2013). Of these occurrences, only one historical occurrence within the Plan Area is currently extant. This population is a large population of California red-legged frog near Michigan Bluff at the Big Gun Conservation Bank (Barry and Fellers 2013). Only one additional location near Ralston Ridge in Placer

County was found to have California red-legged frog; however, this occurrence was located at least 10 miles from the Plan Area.

Natural History

The habitat requirements, ecological relationships, life history, and threats to California red-legged frog described below are summarized in diagram form in the Envirogram 8 California Red-legged Frog.

Habitat Requirements

California red-legged frog has been found at elevations from sea level to about 5,000 feet. It uses a variety of habitat types including various aquatic, riparian, and upland habitats (USFWS 2002). California red-legged frog can use many aquatic systems, provided a permanent water source, ideally free of nonnative predators, is nearby (USFWS 2001). However, individual frogs may complete their entire life cycle in a pond or other aquatic site that is suitable for all life stages (USFWS 2001). California red-legged frog breeds in aquatic habitats such as marshes, ponds, deep pools and backwaters in streams and creeks, lagoons, and estuaries. Breeding adults are often associated with dense, shrubby riparian or emergent vegetation and areas with deep (>27 inches) still or slow-moving water (USFWS 2001; 2002). However, this subspecies often successfully breeds in artificial ponds with little or no emergent vegetation and has been observed in stream reaches that are not covered in riparian vegetation. An important factor influencing the suitability of aquatic breeding sites is the general lack of introduced aquatic predators (USFWS 2002).

California red-legged frog spends a substantial amount of time resting and feeding in riparian and emergent vegetation. The moisture and camouflage provided by the riparian plant community may provide good foraging habitat and may facilitate dispersal in addition to providing pools and backwater aquatic areas for breeding. Dispersal sites typically provide forage or cover opportunities and include boulders or rocks and organic debris such as downed trees or logs; industrial debris; and agricultural features such as drains, watering troughs, spring boxes, and abandoned sheds (USFWS 2001). California red-legged frog also uses small mammal burrows and moist leaf litter (Jennings and Hayes 1994). Incised stream channels with portions narrower and deeper than 18 inches may also provide habitat (USFWS 1996). Use of this habitat type by California red-legged frog is most likely dependent on year-to-year variations in climate and habitat suitability and varying requisites per life stage (USFWS 2001).

During summer, California red-legged frog generally remains in or near water. If water is not available it often disperses from the breeding habitat to forage and seek summer habitat (USFWS 2002). This habitat may include shelter under boulders, rocks, logs, industrial debris, agricultural drains, watering troughs, abandoned sheds, or hay-ricks. California red-legged frog will also use small mammal burrows and moist leaf litter and incised streamed channels (Jennings and Hayes 1994; USFWS 1996, 2002). This summer movement behavior, however, has not been observed in all California red-legged frog populations studied.

Reproduction

California red-legged frog breeds from November through March, although earlier breeding has been recorded in southern localities (Storer 1925). Males have paired vocal sacs and call in air (Hayes and Krempels 1986). Males appear at breeding sites two to four weeks before females (Storer 1925). Female California red-legged frog deposit egg masses on emergent vegetation so that the masses float on the

surface of the water (Hayes and Miyamoto 1984). Egg masses contain about 2,000–5,000 moderate-sized (0.08–0.11 inches in diameter), dark reddish brown eggs (Storer 1925; Jennings and Hayes 1985). Eggs hatch in 6–14 days (Storer 1925). Larvae generally undergo metamorphosis 3.5–7 months after hatching (Storer 1925; Wright and Wright 1949; Jennings et al. 1992); however, California red-legged frog tadpoles have recently been observed to overwinter in some areas (Fellers et al. 2001). Survival from hatching to metamorphosis has been estimated as ranging from less than 1% (Jennings et al. 1992) to 1.9% (Cook 1997). In one pond study fewer than 5% of California red-legged frog larvae reached metamorphosis when bullfrog (*Lithobates catesbeiana*) tadpoles were placed in the ponds with them, whereas 30–40% reached metamorphosis in ponds that did not have bullfrog tadpoles (Lawler et al. 1999). Males attain sexual maturity by two years and females by three years of age (Jennings and Hayes 1985).

Dispersal Patterns

California red-legged frog often disperses from its breeding habitat to utilize various aquatic, riparian, and upland aestivation habitats in the summer; however it is also common for individuals to remain in the breeding area on a year-round basis (USFWS 2001). Bulger et al. (2003) postulated that the observed under-representation of subadults, or postmetamorphs (males < two years, females < three years), at breeding locations signifies a largely terrestrial existence, and that this age class likely contributes significantly more to regional metapopulation persistence than adults. Other ranid species such as the northern leopard frog (*Rana pipiens*) and the wood frog (*Rana sylvatica*) have been found to disperse radially from their natal site and travel upwards of three miles in the two to three years between metamorphosis and first breeding (Dole 1965; Berven and Grudzien 1990). Bulger et al. (2003) found that 11 – 22% of a Santa Cruz County coastal population of California red-legged frog migrated. Fellers and Kleeman (2007) found 66% of studied females and 25% of studied males migrated. Both studies found migration events to be almost exclusively between a breeding location and the nearest non-breeding habitat, and that frogs mostly traveled between these habitats using straight-line trajectories, regardless of habitat type (Bulger et al. 2003; Fellers and Kleeman 2007). Bulger et al. (2003) documented three frogs traveling over 9,240 feet between the same breeding and non-breeding location when the closest breeding location was only 1,980 feet away.

Longevity

In a long term tagging study conducted at Waddell Creek and Lagoon, the oldest frogs recorded were two males at 11 and 12 years (Smith pers. comm.). Females were captured far less often; the oldest female at the Waddell site was found to be 8 years (Smith pers. comm.)

Sources of Mortality

California red-legged frog is eaten by native predators such as raccoon (*Procyon lotor*), great blue heron (*Ardea herodias*), and garter snake (*Thamnophis* sp.), as well as by nonnative predators such as bullfrog (USFWS 2002). Hayes and Jennings (1986) suggested a variety of fish species may feed on California red-legged frog and foothill yellow-legged frog (*Rana boylii*). Smallmouth bass (*Micropterus dolomieui*) are known to eat larval and postmetamorphic red-legged frog (Kiesecker and Blaustein 1998). Calef (1973) looked extensively into predation on red-legged frog and found that *Odonata* (dragonfly and damselfly) larvae and giant diving beetles (*Lethocerus americanus*) prey on red-legged frog eggs. He also found that larvae were regularly preyed upon by salamanders and newts. Fungal infection or localized desiccation is reported as sources of egg mortality (Calef 1973).

Behavior

Hayes and Tennant (1985) found juvenile frogs to be active diurnally and nocturnally, whereas adult frogs were largely active at night. The season of activity for red-legged frog seems to vary with the local climate (Storer 1925); individuals from coastal populations with more constant temperatures are rarely inactive (Jennings et al. 1992). Individuals from inland sites, where temperatures are lower, may become inactive for long intervals (Jennings et al. 1992).

California red-legged frog has a varied diet that includes both invertebrates and vertebrates (USFWS 2002). The tadpoles are believed to eat algae; however, this has not been studied (Jennings et al. 1992). In general, amphibian larvae feed on bacteria, protozoans, free-floating algae, and other small particles suspended in water (Stebbins and Cohen 1995). Invertebrates were found to be the most common food item consumed by adult frogs. However, larger California red-legged frogs will eat vertebrates, such as Pacific tree frog (*Hyla regilla*) and California mice (*Peromyscus californicus*) (Hayes and Tennant 1985). Vertebrates represented more than half the prey mass eaten by larger frogs examined by Hayes and Tennant (1985). Feeding activity probably occurs along the shoreline and on the surface of the water as evidenced by the types of foods eaten (Hayes and Tennant 1985).

Movement and Migratory Patterns

Although percentages vary by location, if perennial breeding habitat is present, some portion of any given red-legged frog population will likely be migratory (Bulger et al. 2003; Fellars and Kleeman 2007). Although most adult migration occurs during the rainy months (November – April), California red-legged frog is known to move throughout the year, often times despite the persistence of a breeding site (Bulger et al. 2003; Fellars and Kleeman 2007). Adult movement during the dry season (May – October) is generally associated with the drying up of seasonal breeding ponds (Fellars and Kleeman 2007), although adult frogs have been found to persist in the desiccation cracks of dried ponds (Cook 2004).

During the wet season, dispersing California red-legged frog can travel long distances (over 2 miles) over land, mostly in point-to-point, straight-line trajectories, between breeding and non-breeding locations, through a diversity of pristine and modified habitats including pastureland, fallow and planted agricultural land, forestland, fields, and grasslands (Bulger et al. 2003; Fellars and Kleeman 2007). Non-migratory frogs generally stay year-round at a breeding location and rarely travel more than 100 feet from water (Bulger et al. 2003; Fellars and Kleeman 2007). During dry periods, California red-legged frog generally remains in or near water (USFWS 2002).

Ecological Relationships

California red-legged frog is preyed upon during every life stage (Lawler et al. 1999; Calef 1973). However, postmetamorphic California red-legged frog will consume anything it can catch that is not distasteful (Jennings et al. 1992). California red-legged frog larvae appear to reduce their level of activity while in the presence of potential predators. This may affect their ability to forage and can potentially reduce the size of the animal at metamorphosis (Lawler et al. 1999). Intraspecific competition among adult red-legged frogs is rare. Calef (1973) suggested that natural mortality is so high during the premetamorphic stage that competition among postmetamorphic frogs is negligible.

California red-legged frog occasionally co-occurs with foothill yellow-legged frog at some localities; however, different microhabitat preferences may limit competition (Zeiner et al. 1988). The introduction

of nonnative predatory fishes and bullfrog has had a significant effect on this species. These impacts are discussed in more detail in other sections (*Sources of Mortality* above and *Population Threats* below).

Threats

Threats to populations of California red-legged frog have only recently been addressed. Reasons for declines and potential threats to populations of California red-legged frog include habitat loss, degradation, and fragmentation; introduced nonnative predators; water management; pesticides; and natural pathogens. These are discussed below.

Habitat Loss, Degradation, and Fragmentation

The primary factors that have led to declining populations of California red-legged frog are loss, degradation, and fragmentation of habitat. Urbanization, conversion of land to agriculture, overgrazing, and timber harvesting are some of the activities that have resulted in habitat loss, degradation, and fragmentation. The rate of urbanization in California is considered a significant threat to California red-legged frog. Urbanization often isolates or fragments existing habitat. In addition, adjacent habitat may become more susceptible to exotic invasions. Drainages in the area of developments often experience changes in hydroperiod due to water diversions and/or wastewater effluent. Conversion of intermittent drainages to perennial ones may create suitable conditions for nonnative predators (USFWS 2002). Land use changes such as conversion of natural lands to agriculture, livestock grazing in riparian areas, timber harvesting, and historic placer mining not only changed or eliminated existing habitat but contributed significantly to the siltation of aquatic habitats (Jennings et al. 1992; Jennings 1996; Fisher and Shaffer 1996; USFWS 2002).

Introduced Predators

Predatory, nonnative fish and amphibians are particularly significant threats to California red-legged frog. Moyle (1973) suggested that bullfrog were the single most important factor leading to the elimination of California red-legged frog from the San Joaquin Valley floor. Several studies provide evidence that bullfrog may play a role in the decline of California red-legged frog populations (Fisher and Shaffer 1996; Kiesecker and Blaustein 1998; Lawler et al. 1999). Although California red-legged frog can occasionally persist with bullfrog, survivorship of California red-legged frog substantially declines when nonnative fish are also present (Kiesecker and Blaustein 1998). Locations where introduced fishes were abundant contained few California red-legged frogs, indicating that the presence of these fish had a negative influence on the abundance of the frog (Hayes and Jennings 1986).

In addition to predation, bullfrog may also have a competitive advantage over California red-legged frog (Hayes and Jennings 1986). Bullfrog is larger, has more generalized food habits, and has an extended breeding season; moreover, bullfrog eggs and larvae are unpalatable to predatory fish (Walters 1975). Bullfrog also can interfere with red-legged frog reproduction; both California and northern red-legged frog have been observed in amplexus with both male and female bullfrog (USFWS 2002).

Water Management

Hydrologic alteration has been associated with decreases in the distribution and abundance of California red-legged frog (Kupferberg et al. 2012). Rapid changes in flow can dislodge or strand clutches of eggs and are associated with low survival of clutches to hatching (Kupferberg et al. 2012). In contrast, water

diversions and impoundments have altered habitat and made it less suitable for many ranid species (Jennings 1996). Water diversions change the hydrology of drainage systems; these changes can isolate populations and restrict the use of or eliminate dispersal corridors. Water impoundments have a similar effect where they create a barrier to dispersal (Jennings 1996; USFWS 2002). Additionally, reservoirs provide suitable habitat for bullfrog and are typically stocked with nonnative fish. These nonnative species frequently disperse upstream and downstream of reservoirs into California red-legged frog habitat (USFWS 2002).

Pesticides

Pesticides, herbicides, and other toxins are known to be harmful to various life stages of ranid frogs (Hayes and Jennings 1986). Researchers have found that amphibians absorb pesticides in aquatic and terrestrial systems. The pesticides disrupt the amphibian's nervous system and cause death by respiratory failure (Yosemite Association 2001). Pesticide drift has recently been implicated as a potential cause of declining populations of four species of ranids in California, including California red-legged frog. Davidson et al. (2002) compared the spatial pattern of declines for eight species of California amphibians with the amount of upwind agricultural land use. Predominant winds flow from the coast through the Central Valley and into the foothills and mountains of the Sierra Nevada. Declines of four ranid species were strongly associated with locations downwind of agriculture use, suggesting that this group of amphibians may have a high sensitivity to agrochemicals.

Pathogens

Recent attention has been given to the role pathogens may play on localized population fluctuations of amphibians. The chytrid fungus has been found in several species of amphibians in California (USFWS 2002; Vredenburg 2001). Chytrid fungus causes deterioration of the mouthparts of tadpoles and has been implicated in amphibian declines in Australia, Central and South America, and Europe (Vrendenburg 2001). The fungus has been found in a number of amphibians whose populations are declining and current studies indicate that the chytrid fungus may be playing a role in that decline (Adams et al 2017).

Context for a Regional Conservation Strategy

There are only three historical records for California red-legged frog in Placer County. Two of these are located within the Plan Area, including one near Placer County Superior Courthouse in Auburn and one near Michigan Bluff (Barry and Fellers 2013). Of these occurrences, only one historical occurrence within the Plan Area is currently extant. This population is a large population of California red-legged frog near Michigan Bluff at Big Gun Diggings (Barry and Fellers 2013).

Previously undesignated as critical habitat (USFWS 2001), 1,243 acres of the Michigan Bluff area are currently designated as critical habitat unit PLA-1 (USFWS 2010) within the Plan Area. In addition, Big Gun Diggings, which is located within the Plan Area, was acquired by Westervelt Ecological Services in 2007 and is now privately held as California red-legged frog habitat mitigation bank (Barry and Fellers 2013; Westervelt Ecological Services 2012). The site includes six mine tailing ponds situated on a bluff northeast of the Middle Fork of the American River.

Much of Placer County land that is privately owned has not been surveyed and may support unidentified populations of California red-legged frog. Where suitable habitat persists, California red-legged frog has

some potential for occurrence in the Plan Area. If additional extant populations of California red-legged frog were discovered in the Plan Area, protection of associated habitat would be critical due to the species' rarity in the County and in the region. In general, maintenance of suitable aquatic habitats with adjacent upland areas are of highest priority for conservation of California red-legged frog, and ponds that provide potential breeding habitat should be protected when feasible within the Reserve System.

Modeled Species Distribution in the Plan Area

Model Assumptions

Aquatic Habitat (Breeding and Foraging Habitat)

Modeled breeding habitat for California red-legged frog is defined by the following land-cover types: lacustrine (excluding the largest reservoirs such as Camp Far West, Folsom), fresh emergent wetlands, seasonal wetlands, riverine, valley foothill riparian, stock ponds, urban riparian, and urban wetland at elevations above 200 feet.

Upland Habitat (Upland Refugia and Movement Habitat)

Upland refugia habitat is defined as all oak woodland land-cover types, annual grassland, and pasture within 100 feet of modeled breeding habitat. Movement habitat is defined as all oak woodland, annual grassland, pasture, valley foothill riparian, all agricultural land-cover types, urban riparian, urban wetland, and landscape and golf course ponds beyond 100 feet but within one mile of modeled breeding habitat.

Rationale

Modeled habitat was restricted to elevations above 200 feet in the Plan Area because California red-legged frogs are believed to be extirpated from the floor of the Central Valley. Historically, the California red-legged frog occupied sections of the western slope of the Sierra Nevada. California red-legged frogs use a variety of aquatic habitats for breeding, including streams, deep pools, backwaters within streams and creeks, and ponds (USFWS 2002). Breeding adults are often associated with deep (> 2 feet) still or slow moving water and dense, shrubby riparian or emergent vegetation (Hayes and Jennings 1988). California red-legged frogs also breed in stock ponds and other artificial impoundments that are managed to provide suitable habitat.

If aquatic breeding habitats dry up during the summer, California red-legged frog often disperse to other areas with water or to temporary shelter or aestivation sites (U.S. Fish and Wildlife Service 2002). Temporary shelter and aestivation sites include shelter under boulders, rocks, logs, and leaf litter. Dispersal and migration movements can be straight-line movements or along migratory corridors such as riparian habitats (Bulger et al. 2003; Fellers and Kleeman 2007); however, the distance moved, and habitats moved through, is site-dependent (e.g., proximity of breeding and non-breeding habitat), and influenced by local landscape (Bulger et al 2003; Fellers and Kleeman 2007). Because the actual movement patterns of California red-legged frog in western Placer County landscapes is generally not known, movement habitat was conservatively modeled to include suitable land-cover types within a radius of one mile from all potential breeding sites.

Model Results

Species Map 8. *California Red-legged Frog Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for California red-legged frog in the Plan Area. Potential suitable habitat is located in the foothills portion of the Plan Area above 200 feet in elevation. Due to the abundance of aquatic primary habitat in the eastern portion of the Plan Area, the associated upland refugia and movement habitat is extensive.

References

Printed References

Adams AJ, Pessier AP, Briggs CJ Rapid extirpation of a North American frog coincides with an increase in fungal pathogen prevalence: Historical analysis and implications for reintroduction. *Ecol Evol*. 2017;7:10216–10232. https://doi.org/10.1002/ece3.3468

Barry, S.J. and Fellers, G.M. 2013. History and status of the California red-legged frog (*Rana draytonii*) in the Sierra Nevada, California, USA. Herpetological Conservation and Biology 8 (2): 456-502.

Berven, K.A., and T.A. Grudzien. 1990. Dispersal of the wood frog (*Rana sylvatica*): Implications for genetic population structure. Evolution 44: 2047-2056.

Bulger, J. B., N. J. Scott Jr., and R. B. Seymour. 2003. Terrestrial activity and conservation of adult California Red-legged Frogs *Rana aurora draytonii* in coastal forests and grasslands. Biological Conservation 110:85–95.

Calef, G. M. 1973. Natural mortality of tadpoles in a population of *Rana aurora*. *Ecology* 54(4):741–758.

California Natural Diversity Database. 2015. RareFind, Version 3.1.0 (October 2015). Sacramento, CA: California Department of Fish and Wildlife.

Cook, D. 1997. Biology of the California red-legged frog: a synopsis. In M. Morrison (ed.), *1997 Transactions of the Western Section of the Wildlife Society* 33:79–-82. Oakland, CA: Western Section of the Wildlife Society.

Cook, D. 2004. *Rana aurora draytonii*, microhabitat. Herpetological Review 35(2): 162-163.

Davidson, C., H. B. Shaffer, and M. R. Jennings. 2002. Spatial tests of the pesticide drift, habitat destruction, UV-B, and climate-change hypotheses for California amphibian declines. *Conservation Biology* 16(6):1588–1601.

Dole, J.W. 1965. Summer movement of adult leopard frogs, *Rana pipiens*, in Northern Michigan. Ecology 46, 236 –255.

Fellers, G. M. 2000. E-mail dated June 19, 2000. Posted to U.C. Davis Listproc Web Site June 24, 2000. Available at: http://listproc.ucdavis.edu/archives/herp-l/log0006/0015.html.

Fellers, G. M., A. E. Launer, G. Rathbun, S. Bobzien, J. Alvarez, D. Sterner, R. B. Seymour, and M. Westphal. 2001. Overwintering tadpoles in the California red-legged frog (*Rana aurora draytonii*). *Herpetological Review*. 32(3):156–157.

Fellers, Gary M. and Patrick M. Kleeman. 2007. California red-legged frog (*Rana draytonii*) movement and habitat use: Implications for conservation. Journal of Herpetology 41(2): 276-286.

Fisher, R. N., and H. B. Shaffer. 1996. The decline of amphibians in California's Great Central Valley. *Conservation Biology* 10(5):1387–1397.

Hayes, M. P., and M. R. Jennings. 1986. Decline of ranid frog species in western North America: are bullfrogs (*Rana catesbeiana*) responsible? *Journal of Herpetology* 20(4):490–509.

Hayes, M. P., and D. M. Krempels. 1986. Vocal sac variation among frogs of the genus *Rana* from western North America. *Copeia* 1986(4):927–936.

Hayes, M. P., and M. M. Miyamoto. 1984. Biochemical, behavioral and body size differences between *Rana aurora aurora* and *R. a. draytonii*. *Copeia* 1984(4):1018–1022.

Hayes, M. P., and M. R. Tennant. 1985. Diet and feeding behavior of the California red-legged frog, *Rana aurora draytonii* (Ranidae). *The Southwestern Naturalist* 30(4):601–605.

Jennings, M. R. 1996. Status of amphibians. *Sierra Nevada Ecosystems Project: final report to Congress*. Volume II: *Assessments and scientific basis for management options*. Davis, CA: University of California, Centers for Water and Wildland Resources.

Jennings, M. R., and M. P. Hayes. 1985. Pre-1900 overharvest of California red-legged frogs (*Rana aurora draytonii*): the inducement for bullfrog (*Rana catesbeiana*) introduction. *Herpetologica* 41(1):94–103.

Jennings, M. R., and M. P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA, under contract 8023.

Jennings, M. R., M. P. Hayes, and D. C. Holland. 1992. Petition to the U.S. Fish and Wildlife Service to place the California red-legged frog (*Rana aurora draytonii*) and the western pond turtle (*Clemmys marmorata*) on the list of endangered and threatened wildlife and plants.

Kiesecker, J. M., and A. R. Blaustein. 1998. Effects of introduced bullfrogs and smallmouth bass on microhabitat use, growth, and survival of native red-legged frogs (*Rana aurora*). *Conservation Biology* 12(4):776–785.

Kupferberg, S.J., Palen, W.J., Lind, A.J., Bobzien, S., Catenazzi, A., Drennan, J., and Power, M. 2012. Effects of flow regimes altered by dams on survival, population declines, and range-wide losses of California river-breeding frogs. *Conservation Biology* 26 (3): 513-524.

Lawler, S. P., D. Dritz, R. Strange, and M. Holyoak. 1999. Effects of introduced mosquitofish and bullfrogs on the threatened California red-legged frog. *Conservation Biology* 13(3):613–22.

Moyle, P. B. 1973. Effects of introduced bullfrogs, *Rana catesbeiana*, on the native frogs of the San Joaquin Valley, California. *Copeia* 1973 (1):18–22.

Stebbins, R. C., and N. W. Cohen. 1995. *A natural history of amphibians*. Princeton, NJ: Princeton University Press.

Storer, T. I. 1925. *A synopsis of the amphibia of California*. University of California Publications in Zoology 27:1–342.

U.S. Fish and Wildlife Service. 1996. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the California Red-Legged Frog. 61(110) FR 25813–25833 (May 23).

U.S. Fish and Wildlife Service. 2001. Endangered and Threatened Wildlife and Plants; Final Determinations of Critical Habitat for the California Red-legged Frog; Final Rule. 66:14625-14674.

_____. 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, OR.

_____. 2005. Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog. August.

_____. 2008. Revised Critical Habitat for the California Red-Legged Frog (*Rana aurora draytonii*); Proposed Rule. 73: 53491-53680.

_____. 2010. Revised Critical Habitat for the California Red-Legged Frog; Final Rule. Federal Register 75 (51): 12816-12959.

Vredenburg, V. 2001. Chytrid fungus in the Sierra Nevada mountains of California, USA. Amphibia Web http://elib.cs.berkeley.edu/aw/chytrid. June 28, 2001.

Walters, B. 1975. Studies of interspecific predation within an amphibian community. *Journal of Herpetology* 9(3):267–279.

Westervelt Ecological Services. 2012. Big Gun Conservation Bank. Available online at http://www.wesmitigation.com/mitigation-conservation-projects/big-gun-conservation-bank.cfm#page=general. Accessed August 2015.

Wright, A. H. and A. A. Wright. 1949. *Handbook of frogs and toads of the United States and Canada*. Ithaca, NY: Comstock Publishing Company, Inc.

Yosemite Association. 2001. USGS research shows wind may blow agricultural contaminants to Sierra. *Yosemite* 63(1):2–3.

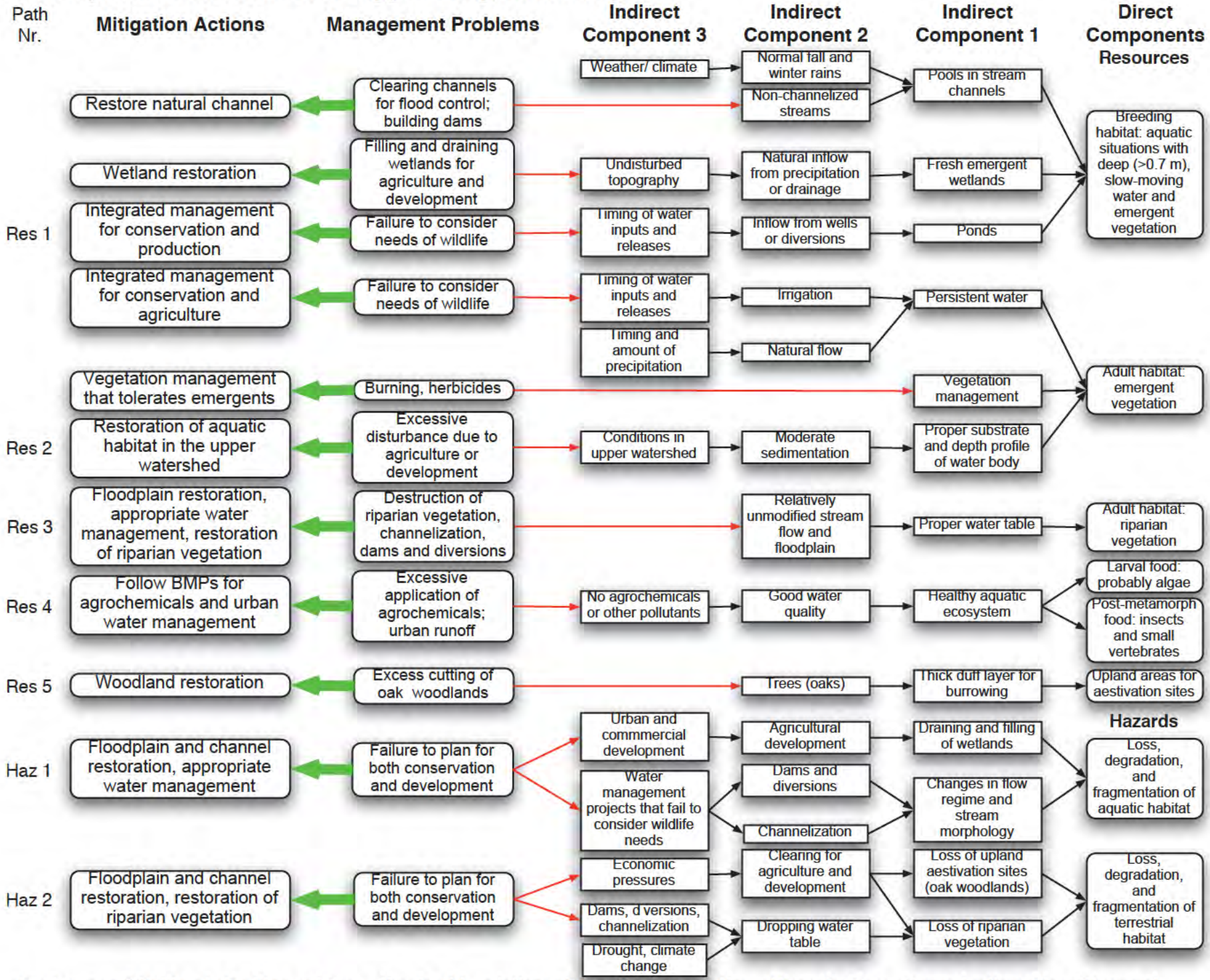
Zeiner, D. C., W. F. Laudenslayer, and K. E. Mayer (eds.). 1988. *California's wildlife*. Volume I: *Amphibians and reptiles*. California Statewide Wildlife Habitat Relationships System. Sacramento, CA: California Department of Fish and Game.

Personal Communications

Smith, Jerry. Associate Professor of Biology. San Jose State University. San Jose, CA. June 25th, 2009 – e-mail correspondence.

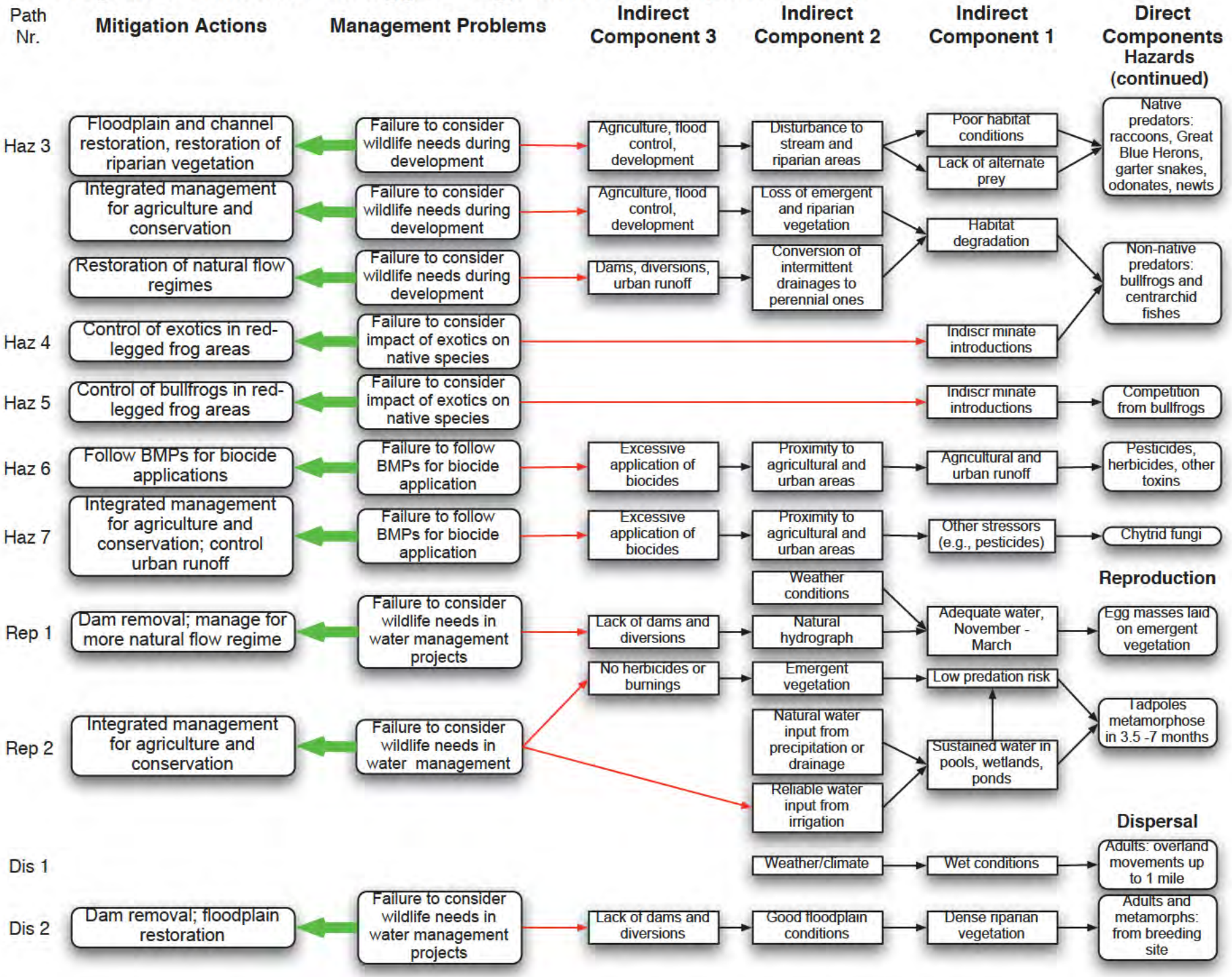
Williams, Brian. Wildlife and Conservation Ecologist. Williams Wildland Consulting, Inc. Granite Bay, CA. January 3, 2003 – e-mail correspondence.

Envirogram 8 California Red-legged Frog, *Rana draytonii*



Envirogram 8 California Red-legged Frog. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram 8 California Red-legged Frog, *Rana draytonii* (continued 2)



Envirogram Narrative

California Red-legged Frog (*Rana draytonii*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to help depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: California red-legged frog requires aquatic habitats with deep (>2.3 feet), slow-moving water and emergent vegetation for breeding. These microhabitats are found in pools in stream channels, fresh emergent wetlands, and artificial ponds. Appropriate stream pools are most likely to be found in non-channelized creeks that flow as a result of normal fall and winter rains. Channelized and impounded streams sometimes can be restored to more natural conditions to improve breeding conditions for the frog. Areas with natural depressions that capture precipitation or runoff often form fresh emergent wetlands with the proper microhabitat for California red-legged frog breeding. Many of these wetlands in Placer County have been filled or drained, but it is possible to restore some of them. Sometimes farm ponds that receive inflow from diversions or wells also provide breeding habitat, provided that the timing of water inputs and releases is compatible with California red-legged frogs' needs. Integrated management for conservation and agricultural production can help insure this.

Res2: Emergent vegetation is important adult habitat for California red-legged frog. Persistent water and a proper substrate and depth profile of the water body are necessary for emergent vegetation. Persistent water can come either from irrigation or natural flow. The timing of water inputs and releases is important to the former, and this depends on how well conservation and agriculture is integrated. Natural flow largely depends on the timing and amount of precipitation. Proper substrate and depth profiles depend on a moderate amount of sedimentation, a function of conditions in the upper watershed. Excessive disturbance may result in too much sediment and loss of aquatic habitat; extensive restoration of both the habitat and upper watershed may be necessary. Finally, the persistence of emergent vegetation also depends on a management strategy that tolerates its presence rather than using burning or herbicides to eliminate it.

Res3: Riparian vegetation regulates water temperature, helps maintain water quality, and provides cover and thus is another important adult habitat component for the California red-legged frog. The development of riparian vegetation depends on a proper water table that in turn depends on unmodified stream flow and a healthy floodplain. The effects of destruction of riparian vegetation,

stream channelization, and dams and diversions need to be reversed in California red-legged frog conservation areas.

Res4: California red-legged frog tadpoles eat algae, and adults eat a variety of insects and small vertebrates. The presence of these items depends on the presence of a healthy aquatic ecosystem and good water quality free of pollutants. Excessive application of agrochemicals and urban runoff result inpollution; following best management practices for chemical use and runoff management can help ensure healthy aquatic ecosystems.

Res5: Adult and metamorph California red-legged frogs use uplands as aestivation sites to survive pond/creek drying. (This is probably one reason why it occasionally can persist in the presence of bullfrogs—bullfrogs will not use uplands.) Appropriate sites need a thick duff layer into which the frogs can burrow; these are usually found in oak woodlands. Persistent oak removal has made these sites scarce in western Placer County. Restoration and enhancement of oak woodland would benefit California red-legged frog.

Hazards

Haz1: As with most species in Placer County, one of the biggest hazards for the California red-legged frog is the loss and degradation of its aquatic habitats resulting from the draining and filling of wetlands for agricultural, urban, and commercial development and from changes to the flow regime and morphology of streams through dams and diversions and channelization. Floodplain and channel restoration and water management that considers wildlife's needs can mitigate this hazard to some extent.

Haz2: A second major hazard is the loss and degradation of the California red-legged frog's terrestrial habitat, riparian vegetation, and upland aestivation sites (usually oak woodlands). Clearing for agriculture and development and dropping water tables resulting from dams, diversions, and stream channelization are largely responsible for the loss of this vegetation. Floodplain and channel restoration and the restoration of riparian vegetation may help mitigate these problems.

Haz3: The California red-legged frog is preyed upon by a wide variety of native predators. Raccoons, great blue herons, and garter snakes take post-metamorphic stages, while odonate larvae and newts prey on tadpoles. Poor habitat conditions and the scarcity of alternate prey resulting from various disturbances to aquatic and terrestrial habitats exacerbate predation pressure. Floodplain and channel restoration and the restoration of riparian vegetation should help reduce native predation pressure to tolerable levels.

Haz4: Non-native predators, particularly bullfrogs and centrarchid fishes, are a much bigger problem for the California red-legged frog than are native predators. Non-native predators result from both thoughtless and indiscriminate introductions and habitat modifications that favor exotic species. Loss of emergent and riparian vegetation from agriculture, flood control, and development and the conversion of intermittent streams into perennial ones because of impoundments and irrigation runoff are habitat modifications that make California red-legged frogs more vulnerable to predation by exotic species. Integrated management for agriculture and conservation, restoration of natural flow regimes, and control of exotics in California red-legged frog conservation areas are necessary to reduce these impacts.

Haz5: Bullfrogs also compete directly with adult California red-legged frogs for food and space. Bullfrogs must be controlled in California red-legged frog conservation areas.

Haz6: Pesticides, herbicides, and other toxins in agricultural and urban runoff, largely resulting from over- application of these chemicals, can poison California red-legged frog directly. Following best management practices for the application of pesticides can help mitigate this problem.

Haz7: Chytrid fungi and perhaps other pathogens attack California red-legged frog that have been already weakened by other stressors such as pesticides, herbicides, and other toxins in agricultural and urban runoff. The presence of these pesticides in aquatic habitats usually result from their over-application, and following best management practices for the application of pesticides can help mitigate this problem.

Reproduction

Rep1: California Red-legged frog egg masses are laid on emergent vegetation so that they float on the surface. The presence of appropriate breeding conditions depends on adequate water from November to March and is related to both weather conditions and a natural flow regime. If the flow regime is altered by dams or diversions, a management regime that considers the California red-legged frog should be instituted.

Rep2: Tadpoles metamorphose in 3.5-7 months provided that there is sustained water and low predation risk. Sustained water can come from either natural sources or from irrigation, and emergent vegetation provides cover that lowers predation risk. Managing water and vegetation in ways that benefit the California red-legged frog are necessary in agricultural areas with conservation easements.

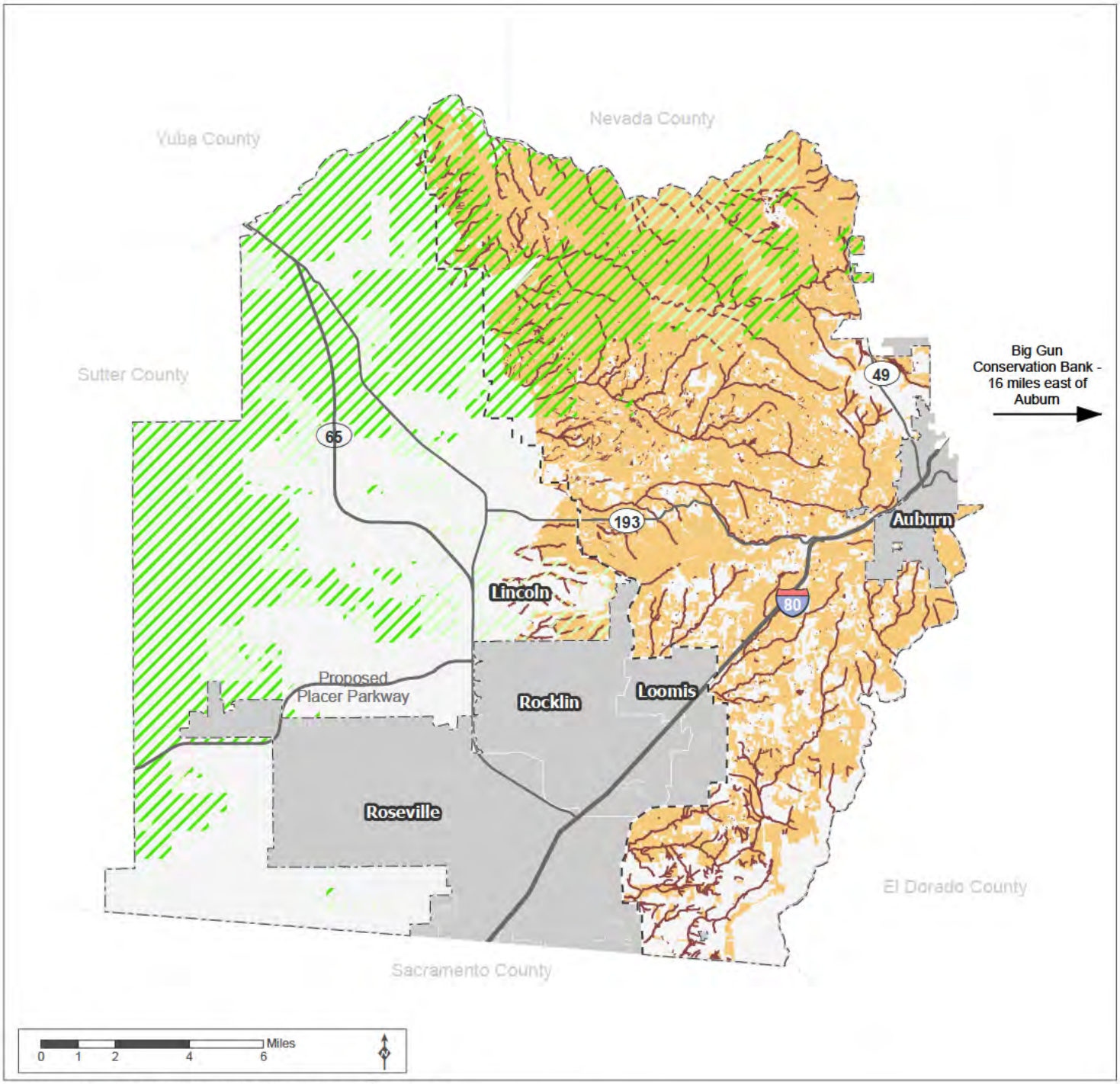
Dispersal

Dis1: In addition to movements to aestivation sites during dry conditions, adult California red-legged frog has been known to disperse overland up to one mile during wet conditions. These movements tend to be in straight lines, point-to-point, rather than along corridors.

Dis2: Adults and metamorphs disperse from breeding sites using dense riparian vegetation for cover. Thus, the presence of dispersal habitat depends on a proper water table that in turn relies on unmodified stream flow and a healthy floodplain. Dam removal and floodplain restoration are necessary in California red-legged frog conservation areas.

Summary

California red-legged frog is a conservation challenge not only because it relies on both aquatic and terrestrial habitats but also because it is so strongly affected by bullfrogs and centrarchid fishes that are now virtually ubiquitous in the western part of Placer County. California red-legged frog is also susceptible to various pesticides and pathogens—also virtually ubiquitous. Restoration and enhancement of habitat (healthy wetlands and creeks with natural flow regimes and channel morphology and functional floodplains), along with diligent control of exotic species, may be an effective conservation strategy for this species.



Source: Placer County, 2014; MIG | TRA, 2015; CNDDB, 2015; Westervelt Ecological Services, 2015

Occurrences
- General Location

Modeled Habitat
- Aquatic Habitat
- Upland Habitat
- Modeled as Non-habitat

- Exis ing Reserve
- Reserve Aquisition Area
- NPC

- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 8.

California Red-legged Frog Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG | TRA

Central Valley Steelhead – Distinct Population Segment (*Oncorhynchus mykiss irideus*)

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Status

Federal: Threatened (NMFS 1998a; 2006); Magnuson-Stevens Act managed species

State: None

Critical Habitat: Critical habitat designated September 2, 2005 (NMFS 2005)

Recovery Plan: Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead (NMFS 2014)

Distribution

North America

Current distribution of steelhead ranges from southern California to the Kuskokwim drainages near the Alaska Range. A number of known distinct populations occur from Canada to southern California.

California

The Central Valley steelhead Distinct Population Segment (DPS) includes the Sacramento and San Joaquin rivers, along with all of their tributaries (NMFS 2009). Existing wild steelhead populations in the Sacramento River basin occur in the upper Sacramento River and its tributaries, including Cottonwood, Antelope, Deer, and Mill creeks and the Yuba River (NMFS 2014). Other Sacramento River basin populations may exist in Big Chico and Butte creeks, and a few wild steelhead are produced in the American and Feather rivers (McEwan 2001). A hatchery supported population of steelhead also occurs in the Mokelumne River, which flows directly into the Delta in between where the Sacramento and San Joaquin rivers enter the Sacramento-San Joaquin Delta (Delta) (NMFS 2014). Central Valley steelhead were thought to be extirpated from the San Joaquin River system, until recent monitoring detected small populations of steelhead in the Stanislaus, Mokelumne, and Calaveras rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001).

Placer County Plan Area

<u>Historical</u>

McEwan (2001) synthesized many historical accounts of steelhead and Chinook distribution throughout the Central Valley and estimated that steelhead were historically well distributed throughout Sacramento and San Joaquin watersheds, including those west-draining tributaries of the Sacramento. One-time sampling events conducted in 1966, 1967, 1972, and 1984 on Secret Ravine indicated the presence of juvenile steelhead (California Department of Fish and Wildlife [CDFW] Region II memos summarized by Bailey 2003). Auburn Ravine sampling events in 1959, 1971, 1979, and 1984,

summarized by Bailey (2003), indicate historic presence of steelhead. Although no sampling data were found, Bailey (2003) reported several anecdotal stories as evidence of historic steelhead presence in the Coon Creek watershed.

Current

Central Valley steelhead is known to be present in the Bear River, Coon Creek (including the Doty Ravine tributary), Auburn Ravine, and Dry Creek (including Secret Ravine and Miner's Ravine tributaries) (Bailey 2003; County of Placer 2009; NMFS 2009). Coon Creek and one of its tributaries, Doty Ravine, as well as Dry Creek and two of its tributaries, Secret Ravine and Miners Ravine, are listed as critical habitat for Central Valley steelhead (NMFS 2005). Secret Ravine supports the highest quality habitat for steelhead in the Dry Creek watershed. Coon Creek appears to contain good migration corridors for adult salmonids, patchy spawning habitat and good juvenile rearing habitat in lower reaches, and good spawning habitat and juvenile rearing habitat in the reach from McCourtney Road to the downstream end of the canyon section below Garden Bar Road. Doty Ravine contains good migration corridors and juvenile rearing habitat. Lower reaches contain primarily small-sized sediments (sand and gravel) with occasional small patches of larger material. Spawning gravel is larger and more abundant in upstream reaches.

Population Status & Trends

California

Overall, population trend data is limited for Central Valley steelhead (Williams et al. 2011). Steelhead apparently were common in the Central Valley tributaries, but records for them are few and fragmented (Yoshiyama et al. 1998). One of the primary problems with determining the population status of steelhead is the difficulty in distinguishing between the truly ocean-run fish and resident rainbow trout (Vogel 2011). What is known is that Central Valley steelhead are now restricted to the Sacramento River downstream of Keswick Dam; the lower reaches of the Feather River, American River, and other large tributaries downstream of impassable dams; small, perennial tributaries of the Sacramento River; and the Sacramento–San Joaquin Delta. Lindley et al. (2006) estimated that historically there were at least 81 independent Central Valley steelhead populations primarily distributed throughout the eastern tributaries of the Sacramento and San Joaquin rivers. Hallock (1987) as cited by Vogel (2011) estimated that upper Sacramento River steelhead populations decreased from more than 20,000 in the 1950s to less than 5,000 in the 1980s. In 1996, NMFS estimated the Central Valley steelhead run size based on dam counts, hatchery returns, and past spawning surveys. They found that probably fewer than 10,000 fish were present. Presently, impassable dams block access to 80 percent of historically available habitat, and block access to all historical spawning habitat for about 38 percent of historical populations (Lindley et al. 2006). Good et al. (2005) estimated that an average of 3,628 naturally-spawning females spawned in the entire Central Valley between 1998 and 2000. This estimate was calculated by applying the following two assumptions to juvenile steelhead abundance data collected downstream of the Sacramento-San Joaquin river confluence between 1998 and 2000: each female lays 5,000 eggs and approximately 1% of all eggs survive (Good et al. 2005). The most recent status review for the Central Valley steelhead DPS was completed in June 2005 (Good et al. 2005). The majority opinion of the Biological Review Team (BRT) (66% of the members) was that the Central Valley steelhead DPS is "in danger of extinction." This is in agreement with three previous status reviews (Busby et al. 1996; National Marine Fisheries Service 1997 and 1998a). Overall, the status of Central Valley steelhead appears to have worsened since the Good et al. (2005) status review when the BRT concluded that the

Central Valley steelhead DPS was in danger of extinction (Williams et al. 2011). An idea of the decline of steelhead can be obtained by looking at returns to the upper Sacramento River, which are based on counts from fish ladders and hatchery returns. These estimates went from an average of 6,574 steelhead in 1967-1991 to an average of 1,282 steelhead from 1992 to 2008 (Moyle et al. 2008).

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Status

The CDFW has, throughout its management history of the Dry Creek drainage, regarded Antelope Creek and its tributary, Clover Valley Creek, as salmonid spawning and rearing habitat. In a memorandum dated October 19, 1964, CDFW staff reported the presence of rainbow trout in upper Clover Valley creek (CDFW 2015). Spawned-out salmon carcasses and live salmon were observed in Clover Valley Creek in December 1963 and salmon fry were observed in the creek in April 1964 (CDFW 2015). Currently, there is no reliable data to determine whether steelhead are present in Antelope Creek or Clover Valley Creek.

A 2004 to 2005 fish community survey was performed by the California Department of Fish and Game (2008) throughout the main stems of Auburn Ravine (seven sampling locations) and Coon Creek (seven sampling locations) in western Placer County. Multiple-pass, depletion electrofishing methods were applied in December of 2004 and again in April and June of 2005 (California Department of Fish and Game 2008). Steelhead were found to be, on average, the most abundant fish species during both the winter 2004 and spring 2005 sampling efforts in Auburn Ravine. Enough steelhead data were collected to estimate an average of 2,163 juvenile steelhead present per river mile between the McBean Park and Wise Road sampling locations. Far fewer steelhead were found on Coon Creek. At the Spears Ranch Lower sampling location in Coon Creek, one juvenile steelhead was found in December of 2004 and 12 juveniles were found in April of 2005 (CDFW 2008).

Various small spring and summer survey efforts conducted between 1992 and 2002 in the main stem of Dry Creek yielded no evidence of juvenile steelhead rearing (Bailey 2003). Electrofish and screw trap sampling conducted between the winter of 1998 and the summer of 2000 in Miners and Secret Ravine documented the presence of steelhead in both Dry Creek tributaries. In Miners Creek, juvenile steelhead were found exclusively at the Dick Cook Road crossing site, while steelhead were somewhat common in the central and upper portions of Secret Ravine (CDFG memo summarized by Bailey 2003). In addition, several steelhead smolts were caught in the spring of 1999 and 2000 just downstream of the confluence of Secret and Miners Ravine, suggesting the presence of a naturally-spawning population.

During the fall/winter of 2004 and the spring of 2005, CDFW conducted two-pass electrofishing surveys on a total of seven reaches in Dry Creek, as well as in several reaches in Miners and Secret ravines. During the 2004 fall/winter survey, 41 steelhead/rainbow trout were captured in Secret Ravine and during the 2005 spring survey, 95 steelhead/rainbow trout were captured here (CDFW 2005, unpublished data). During the 2005 spring survey in Secret Ravine, five pit-tagged steelhead/rainbow trout were re-captured from the 2004 fall/winter survey. No steelhead/rainbow trout were identified in Dry Creek or Miners Ravine.

A 2013 study found different life stages of rainbow trout/steelhead in Auburn Ravine. Life stage developmental stages were classified as parr, silvery parr, and smolt. Auburn Ravine is designated critical habitat for Central Valley steelhead; however, opportunities for anadromy have been compromised for several decades and thus the collection of smolt life stages is an important finding (Healey 2014).

Trends

With little historic or current steelhead population data for western Placer County, assessing current trends is difficult. However, several regional trends suggest population declines throughout the area are likely. As mentioned above in the California Population Status and Trends section, the majority opinion of the NMFS biological review team was that Central Valley steelhead are in danger of extinction (NMFS 2005). In addition, 2008 saw the smallest number of returning adult Sacramento River Chinook salmon since records began in 1970 (Pacific Fishery Management Council Salmon Technical Team 2009). The proximate cause of the decline was found to be poor ocean conditions (National Marine Fisheries Service 2009). These poor ocean conditions likely had a similar impact on Central Valley steelhead populations.

Natural History

The habitat requirements, ecological relationships, life history, and threats to Central Valley steelhead described below are summarized in diagram form in the Envirogram 9 Central Valley Steelhead.

Habitat Requirements

Steelhead depends on suitable water temperature and substrate for successful spawning and incubation. Although the suitability of gravel substrate for spawning depends largely on the fish size, a number of studies have determined substrate ranges that represent the most suitable conditions. Generally, steelhead prefers substrates no larger than 3.9 inches (Bjornn and Reiser 1991).

The quality of spawning habitat is also correlated with intra-gravel flow. Low intra-gravel flow may provide insufficient dissolved oxygen, contribute to growth of fungus and bacteria, and result in high levels of metabolic waste. High percentage of fines in gravel substrates can substantially limit intra-gravel flow, affecting the amount of spawning gravel available in the river (Healey 1991). Raleigh et al. (1986) concluded that optimal gravel conditions would include less than 5–10% fine sediments measuring 0.12 inch or less in diameter. In addition, alevins of Chinook salmon (*Oncorhynchus tshawytscha*), steelhead, and coho salmon (*Oncorhynchus kisutch*) have been observed in laboratory studies to have difficulty emerging when gravels exceeded 30–40% fine sediments (Phillips et al. 1975 as cited in Bjornn and Reiser 1991; Waters 1995).

Water depth criteria vary widely; there is little agreement among studies about the minimum and maximum values for depth (Healey 1991). Salmonids will spawn in water depths that range from a few inches to several feet. A minimum depth of 0.8 foot for steelhead spawning has been widely used in the literature and is within the range observed in some Central Valley rivers (California Department of Fish and Game 1991). Minimum water depth for steelhead spawning has been observed to be at least deep enough to cover the fish (Bjornn and Reiser 1991). Many fish spawn in deeper water.

Preferred water temperature range for steelhead spawning is reported to be approximately 30–52ºFarenheit (ºF) (CDFW 2000 as cited in NMFS 2014). Conditions supporting steelhead spawning and incubation are assumed to deteriorate as temperature warms to 52–59ºF (Myrick and Cech 2001). Steelhead eggs that are subjected to temperatures warmer than 59ºF are prone to increased mortality.

Rearing habitat for salmonids is defined by environmental conditions such as water temperature, dissolved oxygen, turbidity, substrate, area, water velocity, water depth, and cover (Bjornn and Reiser 1991; Healey 1991; Jackson 1992). Environmental conditions and interactions among individuals,

predators, competitors, and food sources determine habitat quantity and quality and the productivity of the stream (Bjornn and Reiser 1991). Regardless of life history strategy, for the first year or two, rainbow trout and steelhead are found in cool, clear, fast-flowing permanent streams and rivers where riffles predominate over pools, there is ample cover from riparian vegetation or undercut banks, and invertebrate life is diverse and abundant (Moyle 2002). Everest and Chapman (1972) found juvenile Chinook salmon and steelhead of the same size utilizing similar in-channel rearing areas. Juvenile steelhead are year-round residents; they generally use riffles and runs in the main and secondary channels along with the head and tail of pools. Shallow riffles are the most important channel type for steelhead during their first year (Barnhart 1986). Steelhead also uses seasonal habitats of intermittent streams for rearing (McEwan 2001). Floodplain habitat does not appear to provide significant rearing habitat for steelhead as it does for Chinook salmon.

Water velocity is of particular importance in determining where juvenile salmonids occur because it determines the energetic requirements for maintaining position and the amount of food delivered to a particular location. Juvenile salmonids tend to select positions that maximize energetic gain, but these positions can be altered by interaction with other fish and the presence of cover (Shirvell 1990). The water velocity preferred by Chinook salmon varies with size of the fish; larger fish occupy higher velocity and deeper areas than smaller fish, potentially gaining access to abundant food and avoiding predatory birds (Bjornn and Reiser 1991; Jackson 1992). Griffith (1972) as cited in Raleigh et al. (1984) found water velocities of 0.32–0.72 foot per second to be associated with occurrence of rainbow trout. Sheppard and Johnson (1985) found similar results for juvenile steelhead; they measured velocities of 0.40 to 0.80 foot per second. Bovee (1978) as cited in California Department of Fish and Game (1991) presented water velocities of 0.6 –1.2 feet per second as having a suitability index of 1 for juvenile rainbow trout and steelhead. Moyle (2002) found that water velocities over redds are typically 20 to 155 centimeters per second.

Stream substrates are important for juvenile salmonids, particularly fry; and for production of aquatic invertebrates that are food for salmonids (Bjornn and Reiser 1991). Waters (1995) and Bjornn and Reiser (1991) indicated the importance of interstitial space in riffles in influencing fry density and stream carrying capacity. The summer or winter carrying capacity of a stream declined when fine sediments filled the interstitial spaces of the substrate.

Juvenile salmonids occur over a wide variety of substrates; substrate does not appear to be a critical criterion determining rearing area selection. Baltz et al. (1987) as cited in Jackson (1992) found that temperature was a better predictor of habitat utilization by rainbow trout and other native fish species than mean water velocity and substrate. Hampton (1988) as cited in Jackson (1992) found that substrate was an important factor for rearing when large cobbles or boulders were used as velocity shelters in riffles and runs. This adaptation increases energetic gain by helping to minimize energy expenditure.

Instream and overhead cover (e.g., undercut banks, downed trees, and overhanging tree branches) are important for juvenile rearing. The addition of cover increases spatial complexity and may increase productivity. The abundance of food and the occurrence of competitors and predators determine cover value. Fine-textured instream woody material provides the hydraulic diversity necessary for selection of suitable velocities, access to drifting food, and escape refugia from predatory fish. An area of cover greater than 15% of the total habitat area may be adequate for juvenile salmonids (Raleigh et al. 1984).

Juvenile steelhead can be found where daytime water temperatures range from 32–81ºF in the summer, although mortality may result at extremely low (<39 ºF) or extremely high (>73 ºF) water temperatures (NMFS 2014). Juvenile rearing success is assumed to deteriorate at water temperatures of

62.6–77ºF (Raleigh et al. 1984; Myrick and Cech 2001). Smolt transformation requires cooler temperatures than rearing; successful transformation occurs at temperatures of 42.8–50ºF. Juvenile steelhead, however, are observed to migrate through the Delta at water temperatures substantially warmer than 55ºF. Juvenile steelhead has been captured at Chipps Island in June and July and at water temperatures exceeding 68ºF (Nobriega and Cadrett 2001). Optimal water temperatures for growth of steelhead have been reported to be 59 ºF to 64.4 ºF (Moyle 2002).

Successful adult migration and holding is assumed to deteriorate as water temperature warms to 14–21ºC (52–69.8ºF). Adult steelhead appear to be much more sensitive to thermal extremes than are juveniles (McCullough 1999).

Reproduction

Spawning in the Sacramento River basin typically occurs from late December through April, with most adults spawning in January through March. The female steelhead selects a site with good intergravel flow, digs a red with her tail (usually in coarse gravel in or near a riffle), and deposits eggs while an attendant male fertilizes them (NMFS 2014). Water velocities over redds are typically 20 to 155 centimeters per second and the depths are 10 to 150 centimeters (Moyle 2002). The preferred water temperature range for steelhead spawning is approximately 30–52ºF (CDFW 2000 as cited in NMFS 2014). The eggs hatch 19 to 80 days after spawning, depending on water temperature (NMFS 2014). Steelhead eggs can survive at water temperatures of 35.6–59ºF; however, the highest survival rates are observed at water temperatures from 44.6–50ºF (Myrick and Cech 2001 as cited in NMFS 2014). Larvae remain in the gravel for four to six weeks before emerging as young juveniles or fry and begin actively feeding (NMFS 1998b; Moyle 2002). Unlike other pacific salmonids, steelhead are capable of spawning more than once before they die. However, it is rare for a steelhead to spawn more than twice before dying (Moyle 2002).

Dispersal Patterns

Adult Central Valley steelhead migrates upstream from the ocean July through May; most migrate after October and before May. Juvenile migration to the ocean generally occurs from November through May. Based on salvage data at the state and federal export facilities in the Delta, the peak months of juvenile migration appear to be March and April. After two to three years of ocean residence, adult steelhead returns to the natal stream to spawn as four or five-year-olds (National Marine Fisheries Service 1998b). Juvenile steelhead rear a minimum of one and typically two or more years in fresh water before migrating to the ocean following smoltification (e.g., the process of physiological change that allows ocean survival).

Longevity

Although such longevity is uncommon, steelhead may reach nine years of age. An individual, following two to three years in freshwater and an additional one to three years in saltwater, may return to spawn several times, often missing alternate years. Many early spawning individuals do not survive beyond their first upstream migration (National Marine Fisheries Service 1999; Moyle 2002).

Sources of Mortality

Impassable dams block access to most of the historical headwater spawning and rearing habitat of Central Valley steelhead. In addition, much of the remaining accessible spawning and rearing habitat is severely degraded by elevated water temperatures, agricultural and municipal water diversions, unscreened and poorly screened water intakes, restricted and regulated streamflows, levee and bank stabilization projects, and poor quality and quantity of riparian and shaded riverine aquatic (SRA) cover (Busby et al. 1996). Low flows, resulting in warmer water temperatures and decreased dissolved oxygen levels, increase mortality of eggs and juvenile steelhead. Egg survival is reduced when elevated water temperatures reduce oxygen availability in the gravel. Another result of increased temperatures is the threat of heightened predation by nonnative fish species; sub-lethal temperatures reduce growth of juvenile steelhead and may increase potential predator's metabolism, thus increasing the risk of predation by centrarchids and other nonnative fish species adapted to higher water temperatures.

Reynolds et al. (1993) reported that 95 percent of salmonid habitat in California's Central Valley has been lost, mainly due to mining and water development activities. They also noted that declines in Central Valley steelhead stocks are due mostly to water development resulting in inadequate flows, flow fluctuations, blockages, and entrainment into diversions. Entrainment at diversions is a source of mortality; low flows can confuse or detain migrating juveniles, resulting in higher entrainment at diversions.

Behavior

Steelhead and rainbow trout are the same species. In general, steelhead refers to the anadromous form of the species. Normally, adult steelhead reach a larger size than resident rainbow trout (NMFS 2014). Currently, Central Valley steelhead are recognized only as winter-run, although prior to the construction of large dams there may have been summer-run steelhead present (Moyle 2002; Sandtrom et al. 2012).

While in streams, steelhead is an opportunistic feeder and varies its diet according to seasonal availability. In the summer months, it feeds primarily on drifting aquatic invertebrates, terrestrial insects, and active bottom invertebrates. Individual fish, however, do not usually feed on the full range of food available. Larger fish tend to eat larger prey. Feeding can occur any time of day, but most activity occurs around dusk (Moyle 2002).

After migrating to the ocean, steelhead feeds on estuarine invertebrates and krill. As the juvenile steelhead grows, other fish constitute an increasing component of its diet. Steelhead's large size and rapid growth in the ocean can be attributed to a diet of fish, squid, and crustaceans. Adult steelhead in streams feed opportunistically, but it is not uncommon for it to stop eating for periods of time (Moyle 2002).

Steelhead occupies the freshwater system from the estuary to stream headwaters, depending on access, water temperature, and perennial flow. The distance that Central Valley steelhead migrate in the ocean is unknown.

Movement and Migratory Patterns

Steelhead typically migrate to marine waters after spending two years in freshwater (NMFS 2014). They typically reside in marine waters for two or three years prior to returning to their natal stream to spawn as four or five year olds (NMFS 2014). Central Valley steelhead enter freshwater from August through April (NMFS 2014). Steelhead adults typically spawn from December through April, with peak spawning

occurring from January through March in small streams and tributaries where cool, well oxygenated water is available year-round (McEwan 2001). Juvenile steelhead generally migrate to the ocean in spring and early summer at one to three years of age, with migration through the Delta occurring in March and April (NMFS 2014). Steelhead may remain in the ocean from one to four years, growing rapidly as they feed on highly productive currents, before they return to freshwater (NMFS 2014).

Ecological Relationships

The predator/prey relationship between juvenile steelhead and nonnative fish species has a significant effect on mortality of young steelhead. Warm water temperatures cause stress and suppress growth; both conditions increase vulnerability to predators. Moreover, because nonnative fish are adapted to warmer water temperatures, their predatory efficiency is increased by the same condition that heightens the vulnerability of juvenile steelhead.

Population Threats

The widespread degradation, destruction, and blockage of freshwater habitats within the Central Valley, and the continuing impacts to habitat resulting from water management were identified as key reasons why Central Valley steelhead were listed under the Endangered Species Act. Good et al. (2005) described the threats to Central Valley salmon and steelhead as falling into three broad categories: loss of historical spawning habitat, degradation of remaining habitat, and genetic threats from the stocking programs. The decline in steelhead populations is attributable to changes in habitat quality and quantity. The availability of steelhead habitat in the Central Valley has been reduced by as much as 95% or more by barriers to movement (i.e., dams). Other factors contributing to the decline of steelhead in the Central Valley include mining; agriculture; urbanization; logging; harvest; hatchery influences; and flow management, including reservoir operations, hydropower generation, and water diversion and extraction (NMFS 1996).

In the Sacramento River and its major tributaries, the operation of the Central Valley Project and State Water Project controls the river flow. Low flows limit habitat area and adversely affect water quality by elevating water temperatures and depressing dissolved oxygen; these conditions stress incubating eggs and rearing juvenile steelhead. Low flows may affect migration of juvenile and adult steelhead; decreased depths can inhibit adult passage, and reduced velocity can impede the downstream movement of juveniles. Low flows in combination with diversions may result in higher entrainment losses (U.S. Army Corps of Engineers 2000).

Along with habitat loss and habitat degradation, hatchery management was identified as a key factor in listing the Central Valley steelhead (NMFS 1998a). Over the past several decades, the genetic integrity of the Central Valley steelhead population has been diminished by increases in the proportion of hatchery fish relative to naturally produced fish, the use of out-of-basin stocks for hatchery production, and straying hatchery produced fish (NMFS 2014). Potential threats to steelhead from hatchery programs includes: mortality of natural steelhead in fisheries targeting hatchery origin fish, disease transmission, and genetic introgression by hatchery origin fish that spawn naturally and interbreed with natural populations (NMFS 2014).

Predation on steelhead parr and smolts by both native and non-native predators is highly likely both in their native rivers and during their migration through the lower rivers in the Delta. In Clifton Court

Forebay, tagged hatchery smolts are known to be heavily preyed on by striped bass (*Morone saxatilis*). However, predation on steelhead is difficult to quantify.

In Placer County aquatic systems, sewage outfalls, lack of riparian cover, thermal pollution, and nonnative predators may all adversely affect the likelihood a healthy fishery. Below Roseville, Dry Creek steelhead must migrate past two sewage outfalls and a 6.2-mile stretch of channelized, nearly stagnant backwater in order to either spawn or outmigrate. The Coon and Auburn Creek systems pose similar difficulties for fisheries, with at least 6.2 miles of slough water to traverse. Other factors that may limit steelhead success in Placer County creeks include low fall/winter flows, excessive sediment, increased stormwater runoff, channel bank erosion, migration barriers, and elevated water temperatures.

Context for a Regional Conservation Strategy

As few sampling efforts have been conducted in Placer County, knowledge of Central Valley steelhead distribution in the Plan Area is incomplete. Central Valley steelhead is known to be present in the Plan Area in Bear River, Coon Creek (including the Doty Ravine tributary), Auburn Ravine, and Dry Creek (including Secret Ravine and Miner's Ravine tributaries) (Bailey 2003; County of Placer 2009; NMFS 2009). Coon Creek and one of its tributaries, Doty Ravine, as well as Dry Creek and two of its tributaries, Secret Ravine and Miners Ravine, are listed as critical habitat for Central Valley steelhead (NMFS 2005, p. 52614). In California, the population is restricted to the Sacramento and San Joaquin rivers and their tributaries. Due to the need for unimpeded access from spawning sites to the ocean, maintenance of migration routes and habitat in the Plan Area has great bearing on the California population throughout the downstream Sacramento riverine system. Degradation of habitat within Placer County and the species range overall has led to declines in steelhead populations. Restoration efforts within the Plan Area are most crucial to maintaining and restoring population levels.

The Recovery Plan (NMFS 2014) states that presently, no viable independent steelhead populations have been identified and all are at high risk of extinction. Therefore, the recovery strategy includes securing extant populations in the near-term, and establishing spawning populations in numerous streams and rivers within individual Diversity Groups throughout the Central Valley. The recovery strategy for the Auburn Ravine/Coon Creek watershed includes the maintenance of steelhead spawning populations in the upper reaches of Auburn Ravine and Coon Creek, and in Doty Ravine. The recovery strategy for the Dry Creek Watershed includes the maintenance of steelhead spawning populations in Miner's Ravine and Secret Ravine.

Modeled Species Distribution in the Plan Area

Model Assumptions

Spawning and Rearing Habitat

Modeled spawning and rearing habitat for Central Valley steelhead includes riverine and valley foothill riparian land-cover types in the following river reaches: Coon Creek upstream of Gladding Road; Doty Creek (a tributary to Coon Creek) upstream of Crosby Herold Road; Auburn Ravine east of the Highway 65 bridge in the City of Lincoln; and the entirety of Secret and Miners Ravine in the Dry Creek watershed, as well as Linda, Cirby, Clover Valley, and Antelope creeks.

Migration and Rearing Habitat

Modeled migration and rearing habitat for Central Valley steelhead includes riverine and valley foothill riparian land-cover types in the following river reaches: Bear River between the western border of the County and Camp Far West Reservoir; the main stem of Coon Creek downstream of the Gladding Road Crossing to the western border of the County; Doty Creek downstream of the Crosby Herold Road crossing; Auburn Ravine downstream of the Highway 65 bridge in the City of Lincoln to the western border of the County, and the main stem of Dry Creek downstream of the confluence with Miners and Secret Ravine to the southern border of the County.

Rationale

Central Valley steelhead spawn in stream reaches with flows generally between 7 to 61 in/s (Moyle 2002), depths between 4 and 59 in (Moyle 2002), and temperatures between 30 °F and 55 °F (California Department of Fish and Game 2000, as cited in NMFS 2009). Central Valley steelhead typically spawn in sediments dominated by gravels at the tail of pools or in riffles. Gravel-sized sediment is small enough to be moved by the digging action of an adult female steelhead but coarse enough to provide adequate intergravel flow, and therefore oxygenated water, to incubating eggs and aelvin. Pool tails and riffles are those habitat types that provide the best conditions for intergravel flow. In western Placer County streams, these characteristics are found primarily in the upper reaches of the watersheds.

Because juvenile steelhead migrate downstream during their first year or two of life, rearing occurs throughout the watershed. Juvenile steelhead are primarily found in stream reaches dominated by runs, riffles, and pools and/or characterized by complex habitat such as undercut banks, large woody debris, and an intact riparian canopy. Juvenile steelhead can tolerate a wide range of temperatures, from 32 °F to 81 °F (Moyle 2002), but physiological stress has been documented to begin at 71.6 °F (Nielsen et al. 1994).

Migration and holding habitat are those corridors through which adult and juvenile Central Valley steelhead must travel to get to spawning and rearing grounds. In western Placer County, migration habitat includes the canals, culverts, diversion dams, and hardened stream reaches characteristic of highly urbanized areas.

Rearing habitat in the lower stream reaches of western Placer County is limited to those areas that were able to maintain those remnant habitat characteristics described above. In addition, Central Valley steelhead are also known to take advantage of urbanized stream features such as pools associated with water diversion and flood control structures.

This habitat model uses the spawning, migration, and rearing habitat identified by the National Marine Fisheries Service (NMFS 2009) in the Draft Recovery Plan for Central Valley steelhead. NMFS used the observations and survey data synthesized in the Auburn Ravine and Coon Creek Ecosystem Restoration Plan (County of Placer 2002) and the Dry Creek Coordinated Resource Management Plan (ECORP Consulting 2003) to identify the location of spawning, migration, and rearing habitat.

Model Results

Species Map 9 Central Valley Steelhead *Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for steelhead in the Plan area.

References

Printed References

Bailey, Randy. 2003. Streams of Western Placer County: Aquatic Habitat and Biological Resources Literature Review. Prepared for Sierra Business Council, December 2003.

Busby, P. J., T. C. Wainwright, G. J. Bryant, L. Lierheimer, R. S. Waples, F. W. Waknitz, and I. V. Lagomarsino. 1996. Status review of West Coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-27.Bailey, Randy 2003. Streams of Western Placer County: Aquatic Habitat and Biological Resources Literature Review. Prepared for Sierra Business Council, December, 2003.

Barnhart, R. A. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest) – steelhead. June. (Biological Report 82 [11.60], TREL-82-4.) Slidell, LA: U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Coastal Ecology Group, Waterways Experiment Station.

Bjornn, T. C., and D. W. Reiser. 1991. Habitat requirements of salmonids in streams. American Fisheries Society Special Publication 19:139–179.

California Department of Fish and Wildlife (CDFW). 1991. Lower Mokelumne River fisheries management plan. November.

_____. 2005. Unpublished data. Auburn Ravine Electrofishing Data. Microsoft Excel Worksheet.

_____. 2008. Summary of 2004 and 2005 fish community surveys in Auburn Ravine and Coon Creek (Placer County). Memorandum to Fisheries Files by James Navicky. Region II Office, North Central Region; Rancho Cordova, CA.

_____. 2015. Use of Antelope Creek (Dry Creek Drainage, Placer County) by Chinook Salmon and Steelhead Trout. Memorandum to Mr. Robert Chase of the U.S. Army Corps of Engineers. Sacramento, CA. September 29, 2015.

County of Placer. 2002. Auburn Ravine/Coon Creek Ecosystem Restoration Plan. Available at http://www.placer.ca.gov. Accessed June 2009.

County of Placer. 2009. Auburn Tunnel Outlet Modification Project. Initial Study/Mitigated Negative Declaration. Prepared by HDR/SWRI.

Everest, F. H., and D. W. Chapman. 1972. Habitat selection and spatial interaction by juvenile chinook salmon and steelhead trout in two Idaho streams. Journal of the Fisheries Research Board of Canada 29(1):91–100.

ECORP Consulting. 2003. Dry Creek Watershed Coordinated Resource Management Plan. Available at: http://www.drycreekconservancy.org/. Accessed June, 2009.

Good, T.P., R.S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-66, 598 p.

Healey, M. C. 1991. Life History of Chinook Salmon (*Oncorhynchus tshawytscha*) in Pacific Salmon Life Histories. Groot, C. and Margolis, L. (ed.), Vancouver B.C.: UBC Press, pp 311-393.

Healey, M. C. 2014. Completion of the 2013 Auburn Ravine Rotary Screw Trap Monitoring Report. Letter to Mr. Colin Purdy, Senior Environmental Scientist (Supervisor) Department of Fish and Wildlife. Rancho Cordovo. July 10.

Jackson, T. A. 1992. Microhabitat utilization by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in relation to stream discharges in the lower American River of California. M.S thesis, Oregon State University.

Lindley, S.T., R.S. Schick, A. Agrawal, M. Goslin, T. Pearson, E. Mora, J.J. Anderson, B. May, S. Greene, C. Hanson, A. Low, D. McEwan, R.B. MacFarlane, C. Swanson, and J.G. Williams. 2006. Historical population structure of Central Valley steelhead and it alteration by dams. San Francisco Bay Estuary and Watershed Science 4(1): 1-19. Available online at http://repositories. cdlib.org/jmie/sfews/vol4/iss1/art3.

McCullough, D. A. 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to chinook salmon. EPA 910-R-99-010, July.

McEwan, D. R. 2001. Central valley steelhead. Pages 1–45 in R. Brown (ed), Contributions to the biology of Central Valley salmonids. Volume 1. Fish Bulletin 179. California Department of Fish and Game.

Moyle, P. B. 2002. Inland fishes of California (second edition). Davis, CA: University of California Press.

Moyle, P.B., Israel, J.A., and Purdy, S.E. 2008. Salmon, Steelhead, and Trout in California: Status of an Emblematic Fauna. University of California, Davis Center for Watershed Sciences. Report commissioned by California Trout.

Myrick, C. A., and J. J. Cech. Jr. 2001. Temperature effects on chinook salmon and steelhead: a review focusing on California's central valley populations. Davis, CA: University of California.

National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS). 1996. Factors for decline: a supplement to the notice of determination for west coast steelhead under the Endangered Species Act. Portland, OR.

_____. 1997. Status review update for West Coast steelhead from Washington, Idaho, Oregon, and California. Memorandum date 7 July 1997 from the Biological Review Team to the National Marine Fisheries Service Northwest Regional Office.

_____. 1998a. Final Rule: Notice of Determination. Endangered and threatened species: Threatened status for two ESUs of steelhead in Washington, Oregon, and California. Federal Register 63(53):13347-13371. March 19, 1998.

_____. 1998b. A primer for federal agencies—essential fish habitat: new marine fish habitat conservation mandate for federal agencies.

_____. 1999. Status review of west coast steelhead from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27.

_____. 2006. Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead, Final Rule. Federal Register Vol. 71: 834-862. January 5, 2006).

_____. 2009. What caused the Sacramento River fall Chinook stock collapse? Work Group Report. Agenda Item H.2.B. Draft copy accessed at http://www.pcouncil.org/bb/2009/0409/H2b_WGR_0409.pdf on September 19th, 2009.

_____. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Sacramento Protected Resources Division. October 2009.

_____. 2014. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead. Sacramento. July 2014.

Nobriega, M., and P. Cadrett. 2001. Differences among hatchery and wild steelhead: evidence from Delta fish monitoring programs. Interagency Ecological Program for the San Francisco Estuary, Sacramento, CA. *IEP Newsletter* 14(3):30–38.

Pacific Fishery Management Council. 2009. Preseason Report I: Stock Abundance Analysis for 2009 Ocean Salmon Fisheries. (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 101, Portland, Oregon 97220-1384.

Raleigh, R. F., T. Hickman, R. C. Soloman, and P. C. Nelson. 1984. Habitat suitability information: rainbow trout. (Biological Report 82 [10.60]) U. S. Fish and Wildlife Service. Washington, DC. (FWS/OBS-82/10.60)

Raleigh, R. F., W. J. Miller, and P. C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: chinook salmon. U.S. Fish and Wildlife Service Biological Report 82(10.122).

Reynolds, F.L., Mills, T.J., Benthin, R., and Low, A. 1993. Restoring Central Valley Streams: A Plan for Action. California Department of Fish and Game, Inland Fisheries Division. Sacramento, California.

Sheppard, D. J., and J. H. Johnson. 1985. Probability of use for depth, velocity and substrate by subyearling Coho salmon and steelhead in Lake Ontario tributary streams. North American Journal of Fisheries Management 5:277–282.

Shirvell, C. S. 1990. Role of instream rootwads as juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*O. mykiss*) cover habitat under varying streamflows. Canadian Journal of Fisheries and Aquatic Sciences 47:852–861.

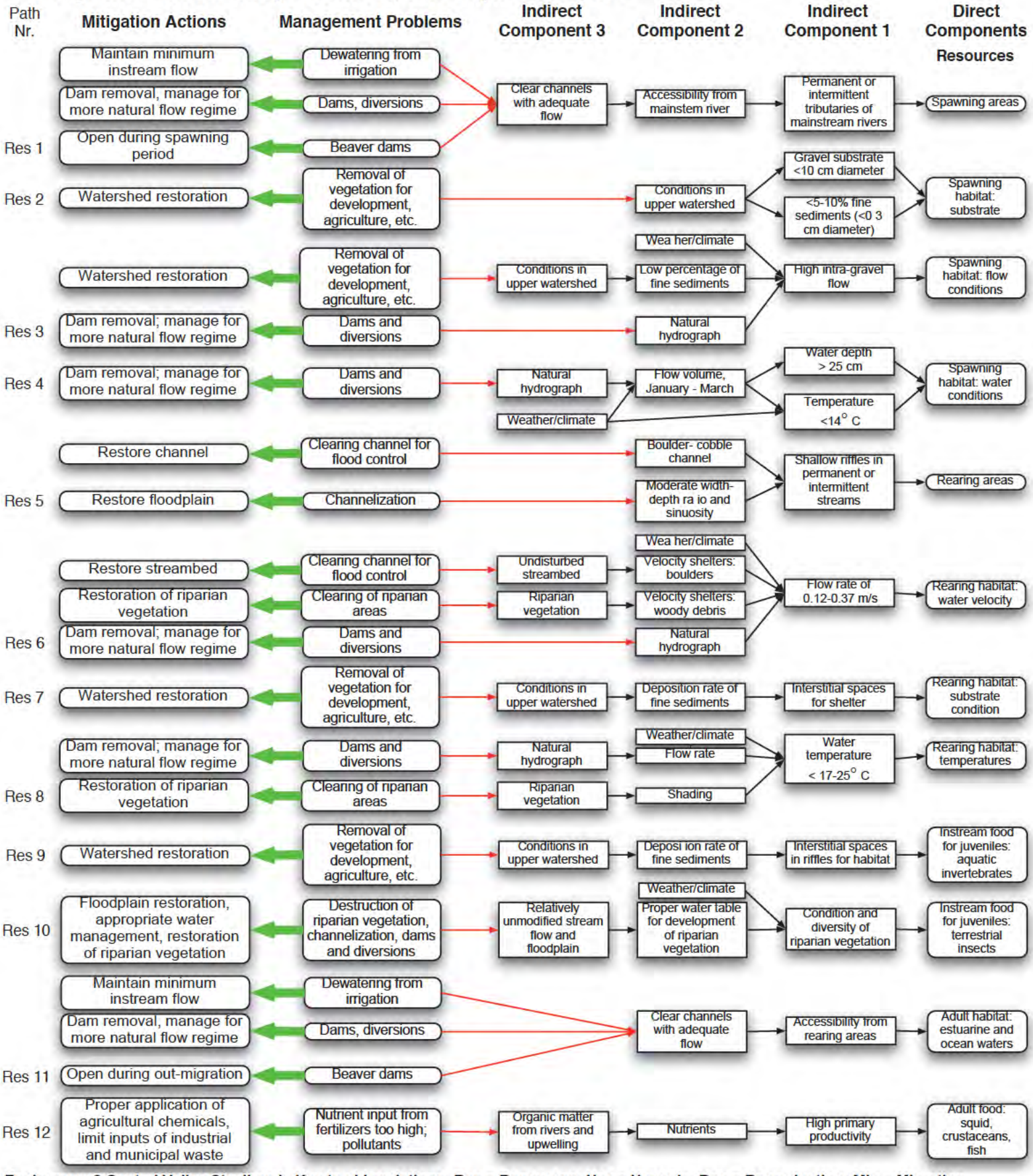
U.S. Army Corps of Engineers. 2000. Biological data report of steelhead and chinook salmon. Guadalupe River flood control project downtown San Jose, CA. Prepared for National Marine Fisheries Service, Santa Rosa, CA. February

Vogel, D. 2011. Insights into the problems, progress, and potential solutions for Sacramento River Basin native anadromous fish restoration. Prepared for Northern California Water Association and Sacramento Valley Water Users. Red Bluff, California.

Waters, T. F. 1995. Sediment in streams – sources, biological effects and control. American Fisheries Society Monograph 7. Bethesda, MD.

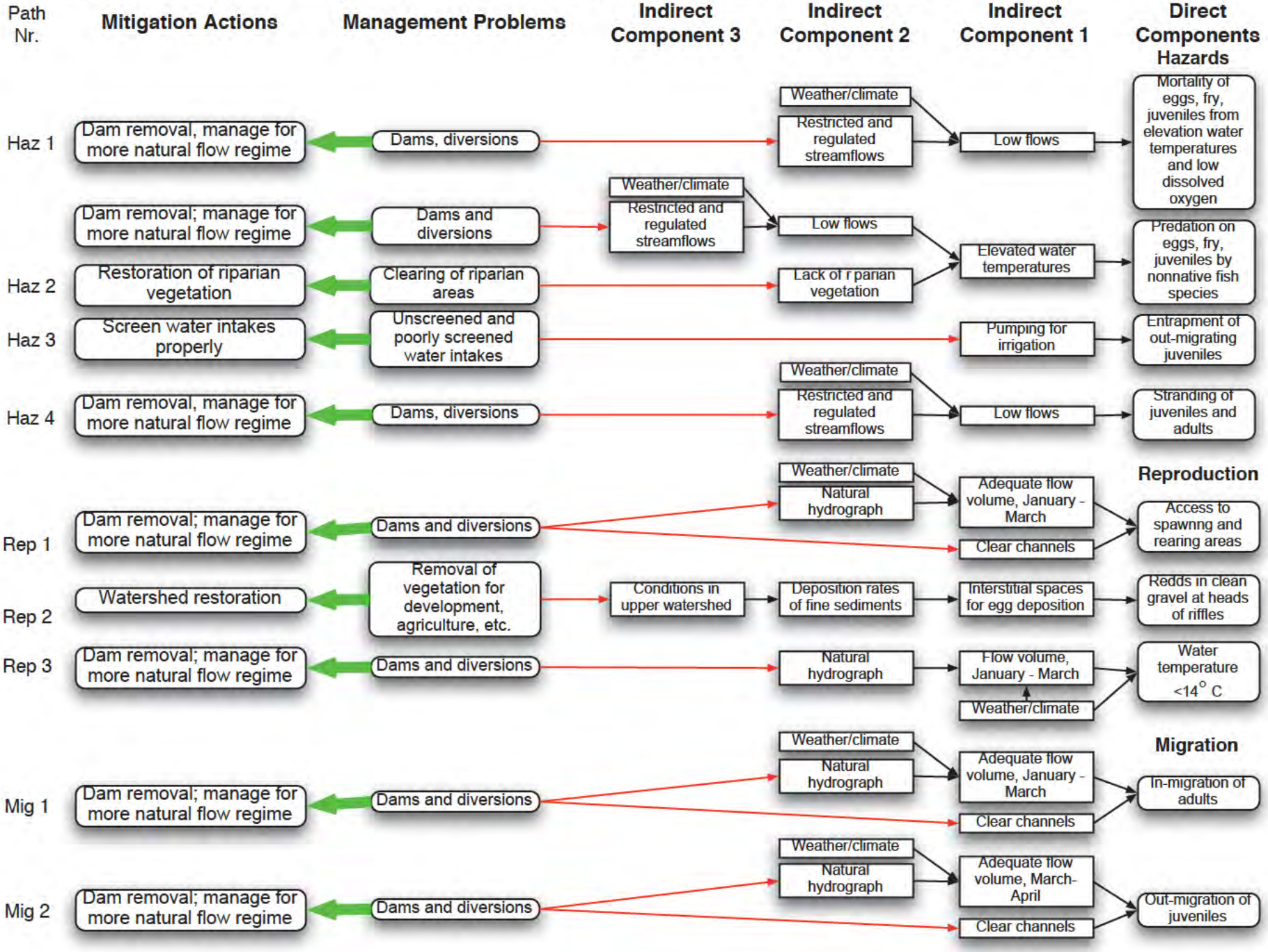
Williams, T. H., S. T. Lindley, B.C. Spence, and D.A. Boughton. 2011. Status Review Update for Pacific Salmon Listed Under the Endangered Species Act: Southwest. 17 May 2001 – Update to 5 January 2001 report. National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, CA.

Envirogram 9 Central Valley Steelhead, *Oncorhynchus mykiss*



Envirogram 9 Central Valley Steelhead. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Mig = Migration.

Envirogram 9 Central Valley Steelhead, *Oncorhynchus mykiss* (continued 2)



Envirogram Narrative

Central Valley Steelhead (*Oncorhynchus mykiss irideus*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Spawning areas for the Central Valley steelhead are in permanent or intermittent tributaries of the Sacramento River. The fish need to access these streams from the mainstem river, and to do this they need clear channels with adequate flow. Dams and diversions, dewatering from irrigation, and beaver dams often make this access problematic. Dam removal, maintaining minimum instream flow, managing for a more natural flow regime, and opening up beaver dams in spawning streams improve access. None of these options is without cost; for example, beaver dams are very useful for restoring floodplains and wetlands.

Res2: Central Valley steelhead have very specific requirements for spawning substrate. The gravel needs to be smaller than 10 cm in diameter, and fine sediments need to be less than 5-10% of the substrate. Proper substrate conditions depend to a large extent on conditions in the upper watershed; sedimentation resulting from logging, development, agriculture, or other activities degrades spawning areas. Watershed restoration can help mitigate this problem.

Res3: High intra-gravel flow is important to egg development, and it depends on weather, the amount of fine sediments in the substrate (<5-10%), and on a natural hydrograph (flow regime). These in turn depend on stream characteristics (see path Res1) and the shape of the upper watershed (path Res2).

Res4: Water depth (>9.75 inches) and temperature (<57 °F) are also important to egg development. These factors are related to flow volume during the spawning season (January through March), which is also dependent on a natural hydrograph. Weather conditions are also a major influence. Dams and diversions that impede normal flow should be removed if possible so that a more normal flow pattern and volume can be re-established.

Res5: Shallow riffles in permanent or intermittent streams provide rearing areas for fry and juveniles. The presence of these areas depends on channel composition and stream morphology, both of which can be altered by channelization and channel clearing. Floodplain and channel restoration may be necessary to re-create proper conditions.

Res6: To be good rearing habitat, riffles also need to have moderate flow rates of 0.12 to 0.37 m/s. Fish can use boulders and woody debris as velocity shelters to protect themselves from high flows resulting from heavy rains if these objects are present. Boulders and logs are often removed from streambeds by channel clearing, and woody debris is not replenished if the riparian vegetation is missing. Streambed and riparian restoration may be necessary to re-create velocity shelters.

Res7: Rearing habitat must have interstitial spaces in the substrate to provide shelter for juveniles. If the deposition rates of fine sediments are too high because of surface disturbances in the upper watershed, these spaces disappear. Restoration of the upper watershed is the appropriate mitigation.

Res8: Rearing habitat requires cool water temperatures (estimates of upper limits range from 17 to 25 °C). Weather conditions, flow rate, and shading all affect water temperature. The re-creation of a more natural hydrograph through dam removal and flow management and the restoration of riparian vegetation can help mitigate past management mistakes.

Res9: Rearing habitat also must have interstitial spaces in the substrate to provide habitat for the aquatic invertebrates that are food for juvenile steelhead. If the deposition rates of fine sediments are too high because of surface disturbances in the upper watershed, these spaces disappear. Restoration of the upper watershed is the appropriate mitigation.

Res10: Juveniles also eat terrestrial insects that fall into the water. The health and diversity of the riparian vegetation determines the number of terrestrial insects available, and riparian quality depends to some extent on weather but largely on the water table, flow regime, and floodplain condition. Destruction of riparian vegetation, the creation of dams and diversions, and channelization have modified these things in most Placer County streams, and appropriate restoration actions will be necessary.

Res11: Estuarine and ocean waters provide habitat for adult Central Valley steelhead. To access these areas from rearing habitat requires open channels and adequate flow; the management problems and mitigation actions for these conditions are the same as for path Res1.

Res12: Adult steelhead feed on crustaceans, squid, and fish. These organisms are plentiful in estuarine and oceanic ecosystems because of the high productivity that results from nutrient inputs coming from upwelling and fresh-water flows. However, excess inputs of nutrients and toxins from agricultural, industrial, and municipal runoff have deleterious effects on these ecosystems, which may affect steelhead populations negatively. Proper application of agricultural chemicals and limiting the inputs of industrial and municipal wastes can help restore appropriate nutrient cycles.

Hazards

Haz1: Elevated water temperatures (see path Res8) and low dissolved oxygen resulting from low flows are a hazard for eggs, fry, and juveniles. Low flows can be caused by drought conditions, but they are more likely to result from restricted and regulated streamflows because of dams and diversions. Dam removal and water management for a more natural flow regime can mitigate these problems to some extent.

Haz2: Predation on all life stages by non-native fishes is another hazard. These species thrive in elevated water temperatures resulting from low flows and lack of riparian vegetation. Low flows can be caused by drought conditions, but they are more likely to result from dams and diversions restricting and regulating streamflow. Loss of riparian vegetation results from clearing riparian areas for agriculture or

flood control. Dam removal and water management for a more natural flow regime and riparian restoration can help mitigate these problems.

Haz3: Entrapment of out-migrating juvenile steelhead is another hazard. Entrapment results from unscreened or poorly screened water intakes on irrigation pumps or hydroelectric generators, and it can be mitigated by proper screening.

Haz4: Juvenile and adult steelhead can be stranded by low flows resulting from drought or dams that restrict and regulate streamflow. Dam removal and water management for a more natural flow regime can mitigate this problem to some extent.

Reproduction

Rep1: To reproduce, adults require access to spawning and rearing areas. Access depends on adequate flows from January to March; this is related to favorable weather, clear channels, and a natural hydrograph. Dams and diversions block the channel and change the hydrograph, and removing these structures or managing for a more normal flow regime is necessary to ensure access.

Rep2: Redds for egg laying are constructed by female steelhead in clean gravel at the heads of riffles. Interstitial spaces in the gravel are necessary to protect the eggs from predators, and the presence of these spaces depends on the deposition rate of fine sediments. If surface disturbances in the upper watershed result in excessive deposition of fine sediments, they must be mitigated by restoration.

Rep3: Successful reproduction also depends on water temperature (<57 °F) during January through March. Temperature is related to weather conditions and flow volume, and a natural hydrograph is important to maintaining adequate flows. Dams and diversions change the hydrograph, so removing these structures or managing for a more normal flow regime may be necessary to maintain suitable temperatures.

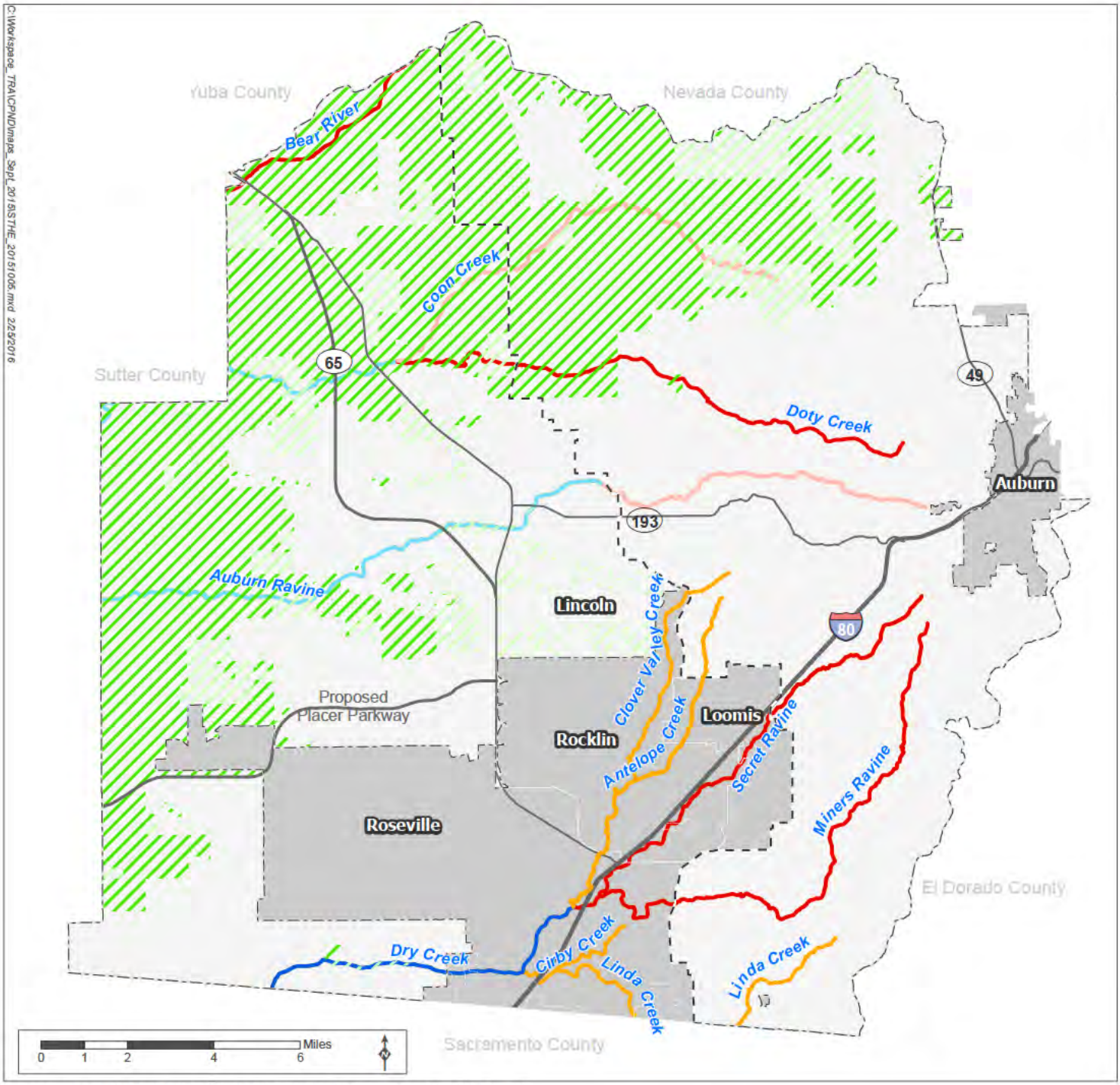
Migration

Mig1: The life history of the Central Valley steelhead depends on two types of migration, the in-migration of adults to the spawning areas and the out-migration of juveniles to estuarine and oceanic waters. The in-migration path is the same as path Res1.

Mig2: The out-migration of juveniles usually occurs during March and April and depends on weather conditions, adequate flow volumes, and clear channels. The latter two can be disrupted by dams and diversions, so removing those structures or managing for a more normal flow regime may be necessary for fish passage.

Summary

The reproductive biology of the Central Valley steelhead depends on a natural flow regime, proper substrate that is not choked with fine sediments, cool temperatures, and clear channels. Thus, for breeding populations of this species to remain in Placer County, a great deal of stream, riparian, and upper watershed restoration will be required. Placer County also may be contributing to the heavy nutrient and pollutant load in the Bay-Delta region, so attention paid to the proper use of agricultural chemicals and eliminating sources of industrial and municipal waste are also important.



Source: Placer County, 2014; MIG | TRA, 2015; NOAA NMFS, 2014; Dry Creek Conservancy 2003-2014; Bates 2015

Habitat Distribution - Steelhead Recovery Plan

- Spawning - Independent Population
- Rearing and/or Migration - Independent Population
- Spawning
- Rearing and/or Migration
- Spawning - Other Sources
- Modeled as Non-habitat
- Exis ing Protected Area
- Reserve Aquisition Area
- Non-participating City
- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 9.

Central Valley Steelhead Habitat Distribution

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Central Valley Fall/Late Fall-Run Chinook Salmon – Evolutionary Significant Unit (*Oncorhynchus tshawytscha*)

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Status

Federal: Species of Concern (NMFS 2004); Magnuson-Stevens Act managed species

State: Species of Special Concern

Critical Habitat: Not Applicable (N/A)

Recovery Plan: N/A; however, recovery actions identified in the Recovery Plan for the Evolutionary Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead (NMFS 2014) would likely also apply to the recovery of Central Valley fall/late fall-run Chinook salmon.

Distribution

North America

There are probably over a thousand spawning populations of Chinook salmon on the North American coast from southeastern Alaska to California (Healey 1991). Chinook salmon is one of the most abundant salmon species in North America.

California

The Central Valley fall/late fall-run evolutionarily significant unit (ESU) includes fall-run and late fall-run Chinook salmon in the Sacramento and San Joaquin rivers and their tributaries east of Carquinez Strait (NMFS 1999). Historically, Chinook salmon were widely distributed throughout all major streams of the Central Valley drainage (Yoshiyama et al. 2001). The runs of Chinook salmon in California are differentiated by the maturity of fish entering fresh water, time of spawning migrations, spawning areas, incubation times, incubation requirements, and migration of juveniles (Moyle et al. 1995). The late fall-run Chinook salmon was identified as separate from the fall-run in the Sacramento River after the Red Bluff Diversion Dam was constructed in 1966 and fish counts could be more accurately made at the fish ladder in this location (Moyle et al. 1995). Central Valley fall-run Chinook salmon currently spawn in suitable habitat downstream of dams on every major tributary in the Sacramento and San Joaquin River system (Moyle et al. 2008). Late fall-run Chinook salmon spawning is limited to the mainstem and tributaries of the Sacramento River, and most spawning occurs in the reach between Red Bluff Diversion Dam and the Keswick Dam in Redding (Moyle et al. 2008).

Placer County Plan Area

Historical

The Bear River watershed comprises a small portion of northeastern Placer County, and is the second largest tributary to the Feather River. The Bear River historically hosted a "substantial" Chinook run (Reynolds et al. 1993 as cited in Yoshiyama et al. 2001). Adult salmon ascended as far as present day Camp Far West Reservoir, where a waterfall in that vicinity probably barred further passage (Yoshiyama et al. 2001). In addition, the American River watershed in Placer County was also known to have historically hosted fall-run Chinook (County of Placer 2013).

In the 1950's, there were up to a thousand Chinook salmon spawning in the Dry Creek system (Miners Ravine, Secret Ravine, Antelope Creek, Clover Valley Creek, Linda/Cirby Creek, and the main stem of Dry Creek), about 10 percent of which used Miners Ravine (Finlayson 1977 as cited in California Department of Water Resources 2002). A 1964 California Department of Fish and Game (CDFG[1]) memo summarized by Bailey (2003) estimated Secret Ravine, a tributary to Dry Creek, to have a run of 600 plus Chinook salmon. The oldest known record from Auburn Ravine was a CDFG report summarized by Bailey (2003), which estimated that the stream had a run of approximately 300 Chinook. Anecdotal observations from local residents, summarized by Bailey (2003), suggest Coon Creek also had a historic Chinook salmon run. Doty Ravine, a major tributary to Coon Creek, was known to have significant runs of Chinook salmon every fall (County of Placer 2013). In 1964, fall-run Chinook salmon were observed spawning and rearing in both Antelope Creek and Clover Valley Creek (CDFW 2015). The estimated run in Antelope Creek was 10 Chinook salmon (CDFW 2015). Pleasant Grove and Curry Creek are not believed to have historically hosted Chinook salmon runs, likely due to their intermittent nature (Bailey 2003).

Current

Central Valley fall/late fall-run Chinook salmon spawn and rear, or have potential to spawn and rear, in western Placer County streams, including Bear River, Coon Creek, Doty Ravine, Auburn Ravine, Dry Creek, Antelope Creek, Clover Valley Creek, Secret Ravine, and Miners Ravine (Jones and Stokes 2005). Bailey (2003), summarizing data from multiple sources including unpublished data held by the Region II Office of the California Department of Fish and Game, found native and hatchery-origin, fall-run Chinook to be present in the Coon Creek, Auburn Ravine, and Dry Creek Watersheds and absent from the Pleasant Grove and Curry Creek watersheds, likely due to their intermittent character. Juvenile, fall-run Chinook originating from the Feather River and Nimbus hatcheries are known to occur in the Coon Creek and Auburn Ravine watersheds (Bailey 2003). Juvenile fall-run Chinook from hatcheries on the Feather River have been stocked in the tributaries of Dry Creek (ECORP 2003). Fall-run Chinook salmon continue to be documented in Antelope Creek during an annual one-day salmon count coordinated by the Dry Creek Conservancy (CDFW 2015). In 2003, 44 live Chinook salmon and 7 carcasses were observed in Antelope Creek (CDFW 2015). The Bear River supports an occasional run of adult fall-run Chinook salmon in years when flows are sufficient to provide passage (Yoshiyama et al. 1996; County of Placer 2013). The American River watershed in Placer County no longer supports salmonids (County of Placer 2013).

[1] As of January 1, 2013, the California Department of Fish and Game (CDFG) was renamed the California Department of Fish and Wildlife. When this document cites reports prepared by the Department prior to 2013, the reference includes the prior department name of CDFG. Both CDFW and CDFG refer to the same agency.

As part of the Placer County Legacy Program, two concrete structures (i.e., Nevada Irrigation District Gaging Station in the City of Lincoln and the Nevada Irrigation District Hemphill Dam in Placer County) impeding salmon movement in the Auburn Ravine watershed have been modified to allow fish passage (County of Placer 2013). With the successful modification of the Nevada Irrigation District Gaging Station, nearly 300 Chinook salmon ascended the structure in November and December 2012 (County of Placer 2013). In response to Chinook salmon observations upstream of the Nevada Irrigation District Gaging Station, a rotary screw trap was deployed in Auburn Ravine at the Aitken Ranch site in January 2013. In April 2013, twenty five juvenile fall-run Chinook salmon were collected in Auburn Ravine at Hemphill Dam approximately 8 miles upstream of the rotary screw trap (CDFW 2014). Additional fall-run size Chinook salmon were also captured at the rotary screw trap location (CDFW 2014).

Chinook salmon were also found at the Hidden Falls Park after new gravel was placed as part of the construction of a new bridge over Coon Creek (County of Placer 2013). Additional fall-run sized Chinook salmon were observed in Coon Creek near McCourtney Road in May 2015 (Haas pers. comm.).

Population Status & Trends

California

The historic abundance of fall-run Chinook is hard to ascertain because they were heavily fished in the 19th century, hydraulic mining debris buried major spawning and rearing areas, and estimates are inaccurate due to poor record keeping (Moyle et al. 2008). The most abundant populations of fall-run Chinook salmon occur in the Sacramento, Feather, Yuba, and American Rivers (Mills and Fisher 1994). The ESU also occurs in smaller tributaries of the Sacramento River and in tributaries of the San Joaquin River. Fall-run Chinook salmon have a relatively large hatchery component, averaging more than 25,000 adults. Natural spawners average about 200,000 adults for the Sacramento and San Joaquin systems (Moyle 2002). In 1992 to 2005, the run averaged about 450,000 fish per year, although it dropped to less than 200,000 fish in 2006 and to about 90,000 spawners in 2007 (Moyle et al. 2008). Yoshiyama et al. (2001) calculated that approximately 72% of the historic spawning and holding habitat in the Central Valley drainage is no longer available.

In 2008, approximately 66,200 Sacramento River fall-run Chinook adults returned to spawn in the Sacramento River Basin. This is the lowest return of Sacramento River fall Chinook on record and is well below the annual conservation objective of 122,000-180,000 adult spawners set by the Pacific Fishery Management Council's Salmon Fishery Management Plan (Pacific Fishery Management Council 2010). A National Marine Fisheries Service (NMFS) working group found poor ocean conditions to be the proximate cause of Chinook population declines (NMFS 2009). This is based on evidence of normal juvenile recruitment rates prior to ocean entry and known poor ocean conditions upon entry such as weak upwelling, warm sea temperatures, and low densities of prey items (NMFS 2009). Although the NMFS group points to ocean conditions as the reason for recent significant declines, it acknowledge that decades of freshwater and estuarine habitat degradation along with hatchery production has created a population that has little fitness or resiliency to withstand natural stochastic events (NMFS 2009).

Historic abundance of late fall-run Chinook salmon is not known because it was recognized as distinct from fall-run Chinook only after Red Bluff Diversion Dam was constructed in 1966 (Moyle et al. 1995). Late fall-run Chinook are one of the least numerous runs in the Sacramento River (Moyle et al. 1995). During 1967 to 1976, the run averaged about 22,009 fish annually. Between 1982 and 1991, the run averaged 9,700 fish annually. During 1992 to 2007 the run averaged 21,000 fish (Moyle et al. 2008). The

population today is likely partly sustained by hatchery production at the Coleman National Fish Hatchery on Battle Creek.

Placer County Plan Area

The most current occurrence data are from the Dry Creek watershed. With six years of winter data (2003 – 2008) from one-day surveys performed generally in mid-November, the Dry Creek Conservancy has counted live and moribund adult Chinook salmon, and the presence of redds, in the main stem of Dry Creek as well as all of its major tributaries: Linda Creek, Cirby Creek, Antelope Creek, Miners Ravine, and Secret Ravine (Dry Creek Conservancy 2009; Gregg Bates pers. comm. 2015).

A 2004 – 2005 fish community survey was performed by the California Department of Fish and Game (2008) throughout the main stems of Auburn Ravine (seven sampling locations) and Coon Creek (seven sampling locations) in western Placer County. Multiple-pass, depletion electrofishing methods were applied in November and December of 2004 and again in April of 2005 (CDFG 2008). Because juvenile Chinook are expected only in the spring, just the April 2005 data are presented here. One juvenile Chinook salmon was found in Auburn Ravine (at the Catlett Road crossing site) with a catch per unit effort of 0.09 fish / hour (total effort was 11.03 hours). In Coon Creek, 25 juvenile Chinook were collected exclusively from the Gladding Road and Garden Bar Road crossing sites, with a catch per unit effort of 3.99 fish / hour (total effort was 6.26 hours). Additionally, three adult Chinook salmon were observed spawning at the Gladding Road site in December 2004 (CDFG 2008).

In Bear River, the fall run occurs only occasionally when heavy rains and dam spillage provide adequate flows (Reynolds et al. 1993, as cited in Yoshiyama et al. 2001). At these times, the run may number in the “hundreds” (Reynolds et al. 1993, as cited in Yoshiyama et al. 2001).

The California Department of Fish and Game has conducted periodic adult Chinook salmon surveys in Dry Creek at least as far back as 1963, primarily upstream of the confluences with Secret and Miners ravines (ECORP 2003). The fall-run adult Chinook salmon population in the Dry Creek watershed was estimated to be just over 1,000 in 1964, with the majority of spawning occurring in Secret and Miners ravines. Since the late 1990’s, adult Chinook salmon populations in Secret Ravine have averaged about 160 fish per year (ECORP 2003). From 1997 to 2002, outmigrating juvenile accounts from Secret Ravine averaged approximately 15,000 per year (Ayres et al. 2003).

Although there are not enough quantitative data to estimate population sizes, historical evidence summarized by Bailey (2003) provides evidence for the existence of a continued Chinook and steelhead run in Auburn Ravine. Additionally, anecdotal evidence presented in Bailey (2003) suggests the existence of “half-pounders” in Auburn Ravine; smaller, but sexually mature males and females that return from the ocean after just one year. Although there was insufficient data to support conclusions about the status of fish populations in Antelope Creek, fall-run Chinook salmon have been documented spawning in Antelope Creek over the last 40 years; therefore, fall-run Chinook are believed to persist in the creek (Bailey 2003). Even less fisheries data are available for Coon Creek and Miners Ravine, however, both fall-run Chinook and steelhead runs are believed to persist in the watershed (County of Placer 2002; Bailey 2003). Fall-run and spring-run Chinook were stocked in Doty Ravine three times in the mid-1980s and data suggests that fall-run Chinook salmon do use the stream for spawning in certain years (Bailey 2003).

One-day winter counts of live and moribund Chinook adults and redds performed by the Dry Creek Conservancy (2009) indicate a negative trend in all Dry Creek watershed tributaries surveyed (Miners

Ravine, Secret Ravine, Antelope Creek, Linda/Cirby Creek, and the main stem of Dry Creek). Each year between 2003 and 2008, almost without exception, fewer adults and redds are observed in each of the Dry Creek watershed's main reaches (Dry Creek Conservancy 2009). Although there aren't enough data from other watersheds in western Placer County to confirm this trend, it is certainly likely to be the case given the current status of all Sacramento River fall-run Chinook populations (see discussion in California Status and Trends section above). Factors contributing to the decline of Chinook salmon in Secret Ravine are thought to include increased sediment, altered flow regimes, reduced access to habitat, and toxicity (Ayres et al. 2003).

As part of the Placer County Legacy Program, two concrete structures (i.e., Nevada Irrigation District Gaging Station in the City of Lincoln and the Nevada Irrigation District Hemphill Dam in Placer County) impeding salmon movement in the Auburn Ravine watershed have been modified to allow fish passage (County of Placer 2013). With the successful modification of the Nevada Irrigation District Gaging Station, nearly 300 Chinook salmon ascended the structure in November and December 2012 (County of Placer 2013). In response to Chinook salmon observations upstream of the Nevada Irrigation District Gaging Station, a rotary screw trap was deployed in Auburn Ravine at the Aitken Ranch site in January 2013. In April 2013, twenty five juvenile fall-run Chinook salmon were collected in Auburn Ravine at Hemphill Dam approximately 8 miles upstream of the rotary screw trap (CDFW 2014). Additional fall-run size Chinook salmon were also captured at the rotary screw trap location (CDFW 2014).

Chinook salmon were also found at the Hidden Falls Park after new gravel was placed as part of the construction of a new bridge over Coon Creek (County of Placer 2013). Additional fall-run sized Chinook salmon were observed in Coon Creek near McCourtney Road in May 2015 (Haas pers. comm.).

Natural History

The habitat requirements, ecological relationships, life history, and threats to Central Valley fall/late fall-run Chinook salmon described below are summarized in diagram form in the Envirogram 10 Fall-Run Chinook Salmon.

Habitat Requirements

Chinook salmon depends on suitable water temperature and substrate for successful spawning and incubation. Although the suitability of gravel substrates for spawning depends largely on fish size, a number of studies have determined substrate sizes that represent the most suitable conditions. Generally, Chinook salmon require substrates of 0.1–5.9 inches, whereas steelhead prefer substrate no larger than 3.9 inches (Bjornn and Reiser 1991).

The quality of spawning habitat is also correlated with intra-gravel flow. Low intra-gravel flow may provide insufficient dissolved oxygen, contribute to growth of fungus and bacteria, and result in high levels of metabolic waste. High percentage of fines in gravel substrates can substantially limit intra-gravel flow, affecting the amount of spawning gravel available in the river (Healey 1991). Raleigh et al. (1986) concluded that optimal gravel conditions would include less than 5–10% fine sediments measuring 0.12 inch or less in diameter. In addition, alevins of Chinook salmon, steelhead, and coho salmon have been observed in laboratory studies to have difficulty emerging when gravels exceeded 30–40% fine sediments (Phillips et al. 1975 as cited in Bjornn and Reiser 1991; Waters 1995).

Water depth is one factor affecting spawning gravel selection (Raleigh et al. 1986; Bjornn and Reiser 1991). Minimum water depths at redd areas (i.e., gravel nests) vary with fish size and water velocity,

because these variables affect the depth necessary for successful digging (Healey 1991). In general, water should be at least deep enough to cover the fish during spawning. Burner (1951, as cited in Healey 1991 and Bjornn and Reiser 1991) observed Chinook salmon spawning in water as shallow as 0.16 foot; Vronski (1972 as cited in Healey 1991) found Chinook salmon spawning in water depths of 23.6 feet. Thompson (1972, as cited in Bjornn and Reiser 1991), who also studied water depth requirements for spawning, found Chinook salmon spawning in depths less than 0.8 foot.

Flow velocity also affects spawning gravel selection; however, the range in water depth and velocity is very broad (Healey 1991). Healey found water velocities of 0.98–6.2 feet/second reported in the literature. Studies in northern California found that Chinook salmon from the Yuba and Sacramento rivers preferred velocities of 1.55–2.95 feet/second and 0.9–2.7 feet/second respectively (CDFG 1991).

Survival of Chinook salmon eggs and larvae during incubation declines as water temperatures increase to 53.6–60.8ºF (Myrick and Cech 2001).

Rearing habitat for salmonids is defined by environmental conditions such as water temperature, dissolved oxygen, turbidity, substrate, area, water velocity, water depth, and cover (Bjornn and Reiser 1991; Healey 1991; Jackson 1992). Environmental conditions and interactions among individuals, predators, competitors, and food sources determine habitat quantity and quality and the productivity of the stream (Bjornn and Reiser 1991). Rearing habitat for juvenile Chinook salmon includes riffles, runs, pools, and inundated floodplain.

Use of floodplain habitat by juvenile Chinook salmon has been well documented (California Department of Water Resources 1999; Sommer et al. 2001). Sommer et al. (2001) found that floodplain habitat provides better rearing and migration habitat for juvenile salmon than does the main river channel. The growth rate of Chinook salmon in the Yolo bypass was generally higher than the growth rate in the main channel of the Sacramento River. The faster growth rate in the Yolo Bypass may be attributed to increased prey consumption associated with greater availability of drift invertebrates and warmer water temperatures. Invertebrate production on the floodplain may be stimulated by availability of detritus in the food web, available habitat for benthic invertebrates, and a relatively long hydraulic residence time. Long residence time reduces the rate at which nutrients and drifting invertebrates are flushed out of the system.

Instream and overhead cover, in the form of undercut banks, downed trees, and overhanging ranches is important for juvenile rearing. Streamside riparian vegetation is a primary source of cover. The root systems of riparian vegetation and large organic debris (e.g., fallen logs) in the stream channel provide refuge from predators and high flow conditions (Jones and Stokes 2005).

Survival of juvenile Chinook salmon declines as water temperatures increase to 64.4–75.2ºF (Myrick and Cech 2001; Rich 1987). Juveniles require cooler water temperature to complete the parr-smolt transformation and to maximize their saltwater survival. Successful smolt transformation deteriorates at temperatures of 62.6–73.4ºF (Marine 1997 as cited in Myrick and Cech 2001).

Freshwater migration corridors include river channels, channels through the Sacramento-San Joaquin Delta, and the Bay-Delta estuary. Migration corridors should be generally free from obstructions (passage barriers and impediments to migration), have favorable water quality, and contain natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Reproduction

Central Valley fall-run Chinook salmon spawns from late September to December, with peak spawning taking place during late October and November when water temperatures decrease (Moyle 2002). Fall-run Chinook salmon spawns over gravel (redds) soon after arriving at the spawning grounds. Egg incubation for fall-run Chinook salmon begins in September and can extend to March (Vogel and Marine 1991 as cited in Jones and Stokes 2005). Juvenile fish remain in redds from about 32 days at 61°F to 159 days at 37°F (Healey 1991). Central Valley late fall-run Chinook spawn from December to April, with peak spawning taking place during February and March. Late-fall run Chinook do not feed while migrating and holding in the river, and instead rely on stored body fat reserves for maintenance (Moyle et al. 1995). Egg incubation for late fall-run Chinook salmon occurs from December through June (Vogel and Marine 1991 as cited in Jones and Stokes 2005).

Dispersal Patterns

After emerging from gravel, juvenile Chinook salmon moves downstream, mostly at night. It rears in the mainstem rivers or the Delta before migrating to the ocean.

Longevity

Chinook salmon generally matures at three to four years and can reach five to eight years (Healey 1991). A minority of individuals return to the river as sexually mature two-year-olds (grilse).

Sources of Mortality

Low flows, resulting in warmer water temperatures and decreased dissolved oxygen levels, increase mortality of eggs and juvenile Chinook salmon. Egg survival is reduced when elevated water temperatures reduce oxygen availability in the gravel. Another result of increased temperatures is the threat of heightened predation by nonnative fish species; sublethal temperatures reduce growth of juvenile salmon and may increase potential predators' metabolism, thus increasing the risk of predation by centrarchids and other nonnative fish species adapted to higher water temperatures (U.S. Army Corps of Engineers 2000).

Entrainment at diversions is another source of mortality; low flows can confuse or detain migrating juveniles, resulting in higher entrainment at diversions.

Behavior

Chinook salmon are anadromous (i.e., they migrate from the marine environment into freshwater rivers and stream of their birth) and semelparous (i.e., they spawn and die in the freshwater streams of their birth) (NMFS 1999). While in streams, Chinook salmon is an opportunistic feeder and varies its diet according to seasonal availability. In the summer months, it feeds primarily on drifting aquatic invertebrates, terrestrial insects, and active bottom invertebrates. Individual fish, however, do not usually feed on the full range of food available. Larger fish tend to eat larger prey. Feeding can occur any time of day, but most activity occurs around dusk (Moyle 2002).

After migrating to the ocean, Chinook salmon feeds on estuarine invertebrates and krill. As the juvenile salmon grow, other fish constitute an increasing component of the diet. Chinook salmon's large size and rapid growth in the ocean can be attributed to a diet of fish, squid, and crustaceans. Upon returning to fresh water, adults stop feeding (Moyle 2002).

Chinook salmon occupies the freshwater system from the estuary to stream headwaters, depending on access, water temperature, and perennial flow. The distance that Central Valley fall-run Chinook salmon migrate in the ocean is unknown.

Movement and Migratory Patterns

Fall-run Chinook salmon migrates from the Pacific Ocean to Central Valley rivers from approximately July to December. Within western Placer County stream, migration is dependent on adequate flows and suitable water temperatures, which usually occur following storm events in October or November (Jones and Stokes 2005). Peak spawning for fall-run spawning fish occurs during late October and November, as water cools. Juvenile fall-run Chinook salmon start emigrating towards the Pacific Ocean from January through June, shortly after emerging from the redds. Within western Placer County stream, juvenile Chinook salmon tend to migrate from February through June, with peak migration occurring from March to May (ECORPS 2003). Late fall-run Chinook salmon migrate from the Pacific Ocean to Central Valley rivers from approximately mid-October through mid-April. Peak spawning for late fall-run Chinook salmon occurs in February and March. Juvenile late fall-run Chinook salmon start emigrating toward the Pacific Ocean from April to December, with the primary movement occurring in the winter months. Central Valley Chinook salmon enter the ocean near the Gulf of the Farallones and then distribute north and south along the continental shelf, mostly between Point Conception and Washington (Healey 1991). Chinook salmon migration from freshwater habitats to the ocean may be as long as 373 miles, transiting many different habitats, all with varying natural conditions (Michel et al. 2012).

During a study by Michel et al. (2012) smolt movement rates were found to vary substantially throughout the watershed. The fastest movement rates were seen in the river regions, with the Upper Sacramento River having the fastest rates in the study, potentially due to the faster water velocities which allowed for faster passive transport of actively migrating smolts. The slowest movement rates were seen in the Sacramento-San Joaquin River Delta, which is a highly modified and complex system of sloughs and channels. Smolts entering this region may enter the interior delta, predisposing them to longer routes, higher predation, and risk of entrainment into water pumps, which inevitably leads to higher mortality rates (Perry et al. 2010). Michel et al. (2012) also found that river width-to-depth ratio had a negative relationship with movement rates (i.e., smolts were found to move slower through wider, shallower reaches), flow was positively related to movement rates, and turbidity had a positive relationship with movement rates (perhaps because turbidity dramatically decreases predator efficiency).

Ecological Relationships

The predator/prey relationship between juvenile Chinook salmon and nonnative fish species has a significant effect on mortality of young salmon. Warm water temperatures cause stress and suppress growth; both conditions increase vulnerability to predators. Moreover, because nonnative fish are adapted to warmer water temperatures, their predatory efficiency is increased by the same condition that heightens the vulnerability of juvenile Chinook salmon.

Threats

Degradation and loss of habitat have contributed substantially to the decline of Chinook salmon. Shasta and other dams blocked access to historic spawning and rearing habitat, as it did in the case of steelhead. Zueg et al. (2010) found that extirpation of fall-run Chinook salmon were best predicted by

habitat loss and migration barriers. Other factors affecting abundance include modifications of water temperatures that result from reservoir operations, harvest, entrainment in diversions, contaminants, predation by nonnative species, and interaction with hatchery stock (U.S. Army Corps of Engineers 2000).

Low flows limit habitat area and adversely affect water quality by elevating water temperatures and depressing dissolved oxygen; these conditions stress incubating eggs and rearing juvenile fall-run Chinook salmon. Low flows may affect migration of juvenile and adult salmon; decreased depths can inhibit adult passage, and reduced velocity can impede the downstream movement of juveniles. Low flows in combination with diversions may result in higher entrainment losses (U.S. Army Corps of Engineers 2000).

Smolt mortality is likely a factor affecting fall-/late fall-run Chinook. Small numbers of outmigrants are presumably entrained at every irrigation diversion along the Sacramento River that is operating during the migration period (Moyle et al. 1995). In addition, extensive bank alteration along the migration path reduces the amount of cover available to protect outmigrants from predators (Moyle et al. 1995). Predation on juvenile salmon by nonnative fish has been identified as an important threat to fall- and late fall-run Chinook salmon in areas with high densities of nonnative fish that prey on out-migrating juvenile salmon (Lindley and Mohr 2003).In the Delta, flows drawn through the Delta Cross Channel (DCC) and Georgiana Slough transport a proportion of migrants into the central Delta. The number of juveniles entering the DCC and Georgiana Slough is assumed to be proportional to the volume of flow diverted from the Sacramento River (CDFG 1987). Survival of juvenile Chinook salmon drawn into the central Delta is lower than survival of juvenile Chinook salmon remaining in the Sacramento River channel.

Diversions in the Central Valley associated with the State Water Project and the federal Central Valley Project in the south Delta entrain large numbers of Chinook salmon. The diversions are screened and salmon are “salvaged” from the projects by capturing, trucking, and then releasing them downstream in the Delta; however, both direct (e.g., predation and stress from salvage) and indirect mortality (e.g., changes in hydrology) is likely high due to entrainment associated with these diversions (Moyle et al. 2008).

Artificial propagation programs (i.e., hatchery production) for fall- and late fall-run Chinook salmon in the Central Valley likely present multiple threats to wild Chinook salmon populations, including genetic introgression by hatchery origin fish that spawn naturally and interbreed with local wild populations (NMFS 2014). Interbreeding with hatchery fish may contribute to reduced genetic diversity and introduce maladaptive genetic changes to the wild population.

Context for a Regional Conservation Strategy

Central Valley fall/late fall-run Chinook salmon spawn and rear, or have potential to spawn and rear, in western Placer County, including Bear River, Antelope Creek, Clover Valley Creek, Miners Ravine, Secret Ravine, tributaries to Dry Creek, Coon Creek, Linda Creek, Cirby Creek, Auburn Ravine, and Doty Ravine. The Placer County populations are part of the state’s most abundant fall/late fall-run of Chinook salmon, which occur through the Sacramento, Feather, Yuba, and American rivers. The Plan Area supports habitat for spawning and juvenile salmon. Stressors to Chinook salmon in the Plan Area include passage impediments/barriers affecting adult migration and spawning, low flow conditions, limited instream gravel supply, water temperature and water quality issues from agricultural and urban runoff, loss of

riparian habitat and instream cover, and predation (NMFS 2014). Due to the need for unimpeded access from spawning sites to the ocean, maintenance of migration routes and habitat in the Plan Area has great bearing on the California population throughout downstream riverine systems.

Modeled Species Distribution in the Plan Area

Model Assumptions

Spawning and Rearing Habitat

Modeled spawning and rearing habitat for Central Valley fall/late fall-run Chinook salmon includes riverine, urban riparian, and valley foothill riparian land-cover types in the following river reaches: Bear River, Coon Creek upstream of Gladding Road; Doty Creek (a tributary to Coon Creek) upstream of Crosby Herold Road; Auburn Ravine east of the Highway 65 bridge in the City of Lincoln; and the entirety of Secret and Miners Ravine in the Dry Creek watershed, as well as Linda, Cirby, Clover Valley, and Antelope creeks.

Migration and Rearing Habitat

Modeled migration and rearing habitat for Central Valley fall/late fall-run Chinook salmon includes riverine and valley foothill riparian land-cover types in the following river reaches: Bear River between the western border of the County and Camp Far West Reservoir; the main stem of Coon Creek downstream of the Gladding Road Crossing to the western border of the County; Doty Creek downstream of the Crosby Herold Road crossing; Auburn Ravine downstream of the Highway 65 bridge in the City of Lincoln to the western border of the County, and the main stem of Dry Creek downstream of the confluence with Miners and Secret Ravine to the southern border of the County.

Rationale

Central Valley fall/late fall-run Chinook salmon spawn in stream reaches with flows generally between 7 to 61 in/s (Moyle 2002), depths between 4 and 59 in (Moyle 2002), and temperatures between 30 °F and 55 °F (CDFG 2000, as cited in NMFS 2009). Central Valley fall/late fall-run Chinook salmon typically spawn in sediments dominated by gravels at the tail of pools or in riffles. Gravel-sized sediment is small enough to be moved by the digging action of an adult female Chinook salmon but coarse enough to provide adequate intergravel flow, and therefore oxygenated water, to incubating eggs and aelvin. Pool tails and riffles are those habitat types that provide the best conditions for intergravel flow. In western Placer County streams, these characteristics are found primarily in the upper reaches of the watersheds.

Juvenile Chinook salmon migrate downstream during their first year or two of life, and rearing occurs throughout the watershed. Juvenile Chinook salmon are primarily found in stream reaches dominated by runs, riffles, and pools and/or characterized by complex habitat such as undercut banks, large woody debris, and an intact riparian canopy.

Migration and holding habitat are those corridors through which adult and juvenile Central Valley fall/late fall-run Chinook salmon must travel to get to spawning and rearing grounds. In western Placer County, migration habitat includes the canals, culverts, diversion dams, and hardened stream reaches characteristic of highly urbanized areas.

Rearing habitat in the lower stream reaches of western Placer County is limited to those areas that were able to maintain those remnant habitat characteristics described above. In addition, Central Valley

fall/late fall-run Chinook salmon are also known to take advantage of urbanized stream features such as pools associated with water diversion and flood control structures.

This habitat model uses the spawning, migration, and rearing habitat defined for Central Valley steelhead in the Recovery Plan for Central Valley steelhead (NMFS 2014) for Central Valley fall/late fall-run Chinook salmon. Life history requirements are similar enough between these two species to generalize the application of modeled habitat for Central Valley Steelhead to Central Valley fall/late fall-run Chinook salmon at the level of scale and precision of this habitat model. Occurrence data for Central Valley fall/late fall-run Chinook salmon used to develop this model were generally consistent with the Central Valley steelhead model. Occurrence data are from Dry Creek Conservancy (2009), California Department of Fish and Game (2008), County of Placer (2002), Bailey (2003), ECORP Consulting (2003), and Reynolds et al. (1993, as cited in Yoshiyama et al. 2001).

Model Results

Species Map 10. Central Valley Fall/Late Fall-run Chinook Salmon *Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for Chinook Salmon in the Plan area.

References

Printed References

Ayres, E., Knapp, E., Lieberman, S., Love, J., and Vodopals, K. 2003. Assessment of Stressors on Fall-Run Chinook Salmon in Secret Ravine (Placer County, CA). University of California, Santa Barbara, Donald Bren School of Environmental Science and Management.

Bailey, Randy. 2003. Streams of Western Placer County: Aquatic Habitat and Biological Resources Literature Review. Prepared for Sierra Business Council, December 2003.

Bjornn, T. C., and D. W. Reiser. 1991. Habitat requirements of salmonids in streams. *American Fisheries Society Special Publication* 19:139–179.

California Department of Fish and Game (CDFG). 1987. Estimates of fish entrainment losses associated with the State Water Project and federal Central Valley Project facilities in the south Delta. (DFG Exhibit No. 17, State Water Resources Control Board 1987 Water Quality/Water Rights Proceeding for the San Francisco Bay/Sacramento–San Joaquin Delta, Sacramento, CA.) Sacramento, CA.

_____. 1991. Lower Mokelumne River fisheries management plan. November.

_____. 2008. Summary of 2004 and 2005 fish community surveys in Auburn Ravine and Coon Creek (Placer County). Memorandum to Fisheries Files by James Navicky.

California Department of Fish and Wildlife (CDFW). 2015. Use of Antelope Creek (Dry Creek Drainage, Placer County) by Chinook Salmon and Steelhead Trout. Memorandum to Mr. Robert Chase of the U.S. Army Corps of Engineers. Sacramento, CA. September 29, 2015.

_____. 2014. Completion of the 2013 Auburn Ravine Rotary Screw Trap Monitoring Report. Memorandum.

California Department of Water Resources. 2002. Miners Ravine Habitat Assessment, October 2002. 17 pp. plus appendices.

_____. 1999. Results and recommendations from 1997–1998 Yolo Bypass studies. Draft Report for CALFED. April.

County of Placer. 2002. Auburn Ravine/Coon Creek Ecosystem Restoration Plan. Available at http://www.placer.ca.gov. Accessed June 2009.

County of Placer. 2013. Status Update—Chinook Salmon in the Auburn Ravine Watershed. Memorandum to the County of Placer Board of Supervisors.

Dry Creek Conservancy. 2009. One Day Count. Unpublished data accessed at http://www.drycreekconservancy.org/documents_downloads/index.php on September 19th, 2009.

ECORP Consulting. 2003. Dry Creek Watershed Coordinated Resource Management Plan. Available at: http://www.drycreekconservancy.org/. Accessed June, 2009.

Healey, M. C. 1991. Life history of chinook salmon. Pages 311–394 in C. Groot and L. Margolis (eds.), *Pacific salmon life histories.* Vancouver, BC: University of British Columbia Press.

Jackson, T. A. 1992. Microhabitat utilization by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in relation to stream discharges in the lower American River of California. M.S. thesis, Oregon State University.

Lindley, S.T. and M.S. Mohr. 2003. Modeling the effect of striped bass on the population viability of Sacramento River winter-run Chinook salmon. Fishery Bulletin 101: 321-331.

Michel, C.J., A.J. Ammann, E.D. Chapman, P.T. Sandstrom, H.E. Fish, M.J. Thomas, G.P. Singer, S.T. Lindley, A.P. Klimley, and R.B. MacFarlane. 2012. The effects of environmental factors on the migratory movement patters of Sacramento River yearling late-fall run Chinook salmon (*Oncorhynchus tshawytscha*). Environmental Biology of Fishes 96(2); 257-271.

Mills, T. J., and F. Fisher. 1994. Central Valley anadromous sport fish annual run-size, harvest, and population estimates, 1967 through 1991. Inland Fisheries Technical Report. California Department of Fish and Game, Sacramento, CA.

Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish of Special Concern in California (Second Edition). Prepared for the State of California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova. Final Report for Contract No. 2128IF.

Moyle, P. B. 2002. *Inland fishes of California* (second edition). Davis, CA: University of California Press.

Moyle, P.B., Israel, J.A., and Purdy, S.E. 2008. Salmon, Steelhead, and Trout in California: Status of an Emblematic Fauna. University of California, Davis Center for Watershed Sciences. Report commissioned by California Trout.

Myrick, C. A., and J. J. Cech., Jr. 2001. Temperature effects on Chinook salmon and steelhead: a review focusing on California's Central Valley populations. Davis, CA: University of California Press.

National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS). 1999. Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionary Significant Units (ESUs) in California. Federal Register, Vol. 64. No. 179, pp. 50394-50415.

NMFS. 2004. Endangered and Threatened Species; Establishment of Species of Concern List, Addition of Species to Species of Concern List, Description of Factors for Identifying Species of Concern, and Revision of Candidate Species List Under the Endangered Species Act. Federal Register, Vol. 69, No. 73, pp. 19975-19979.

NMFS. 2009. What caused the Sacramento River fall Chinook stock collapse? Work Group Report. Agenda Item H.2.B. Draft copy accessed at http://www.pcouncil.org/bb/2009/0409/H2b_WGR_0409.pdf on September 19th, 2009.

_____. 2014. Recovery Plan for the Evolutionary Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Sacramento, California.

Pacific Fishery Management Council. 2010. Review of 2009 Ocean Salmon Fisheries. (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 101, Portland, Oregon 97220-1384.

Perry, R.W., J.R. Skalski, P.L. Brandes, P.T. Sandstrom, A.P. Klimley, A.A. Ammann, and B. MacFarlane. 2010. Estimating survival and migration route probabilities of juvenile Chinook salmon in the Sacramento-San Joaquin River Delta. North American Journal of Fisheries Mangemetn 30: 142-156.

Raleigh, R. F., W. J. Miller, and P. C. Nelson. 1986. *Habitat suitability index models and instream flow suitability curves: chinook salmon*. U.S. Fish and Wildlife Service Biological Report 82(10.122).

Sommer, T. R , M. L. Nobriega, W. C. Harrell, W. Batham, and W. J. Kimmerer. 2001. Floodplain rearing of juvenile chinook salmon: evidence of enhanced growth and survival. *Canadian Journal of Fisheries and Aquatic Sciences* 58:325–333.

U. S. Army Corps of Engineers. 2000. Biological data report of steelhead and chinook salmon. Guadalupe River flood control project, downtown San Jose, CA. Prepared for National Marine Fisheries Service, Santa Rosa, CA.

Waters, T. F. 1995. *Sediment in streams – sources, biological effects and control*. American Fisheries Society Monograph 7. Bethesda, MD.

Yoshiyama, R. M., E. R. Gerstung, F. W. Fisher, and P. B. Moyle. 1996. Historical and present distribution of chinook salmon in the Central Valley drainage of California. *Sierra Nevada Ecosystem Project: Final report to Congress*. Volume III: *Assessments, commissioned reports, and background information*. Davis, CA: University of California Centers for Water and Wildland Resources.

_____. 2001. Historical and present distribution of chinook salmon in the Central Valley. Pages 71-176 *in* R. Brown, ed. *Contributions to the biology of Central Valley salmonids*. CDFG Fish Bulletin 179.

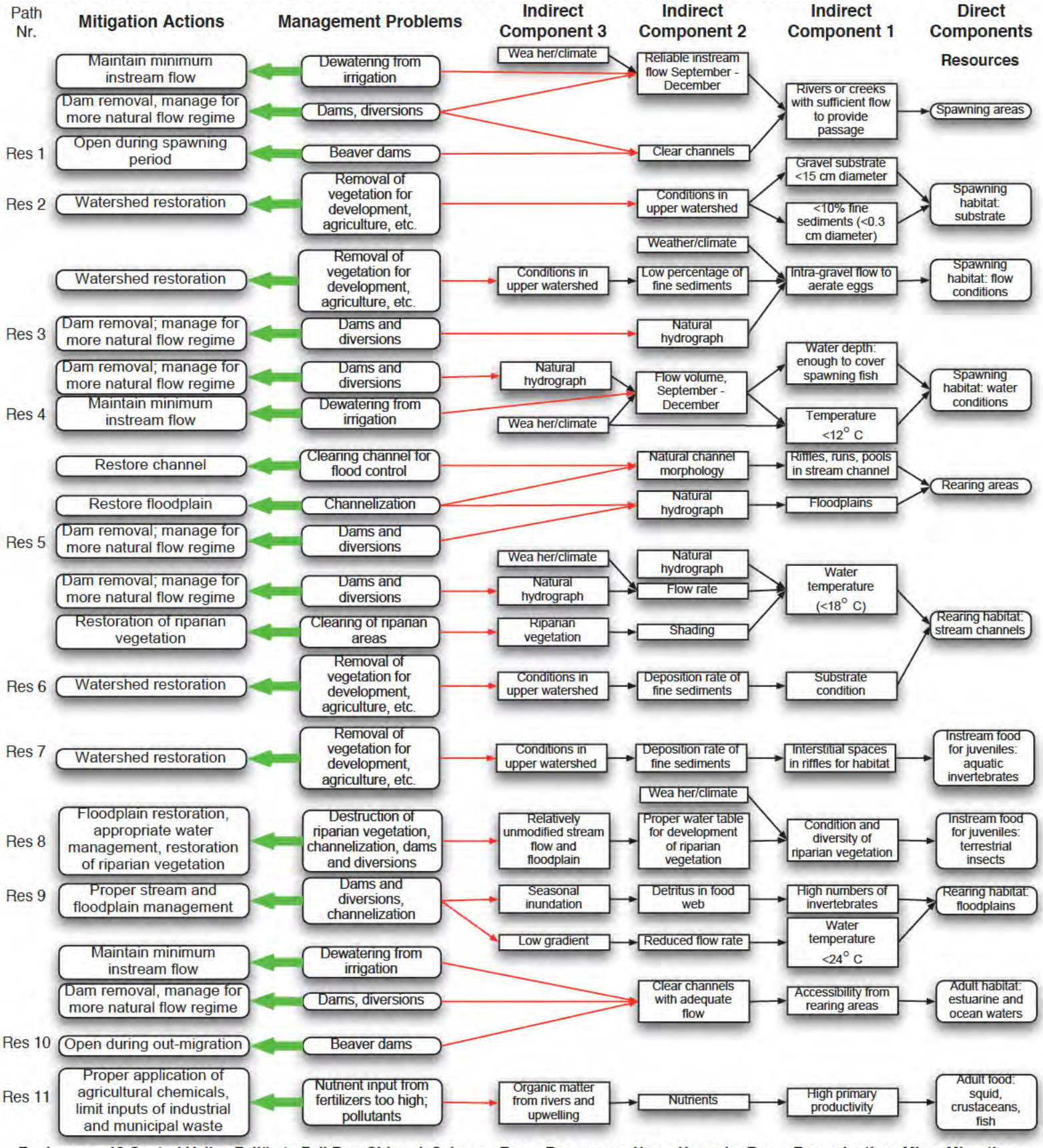
Zeug, S.C., L.K. Albertson, H. Lenihan, J. Hardy, and B. Cardinale. 2010. Predictors of Chinook salmon extirpation in California's Central Valley. Fisheries Management and Ecology 18(1): 61-71.

Personal Communications

Haas, Gary. Placer County Fish Survey. Placer County Planning Services Division. May 6, 2015 – email.

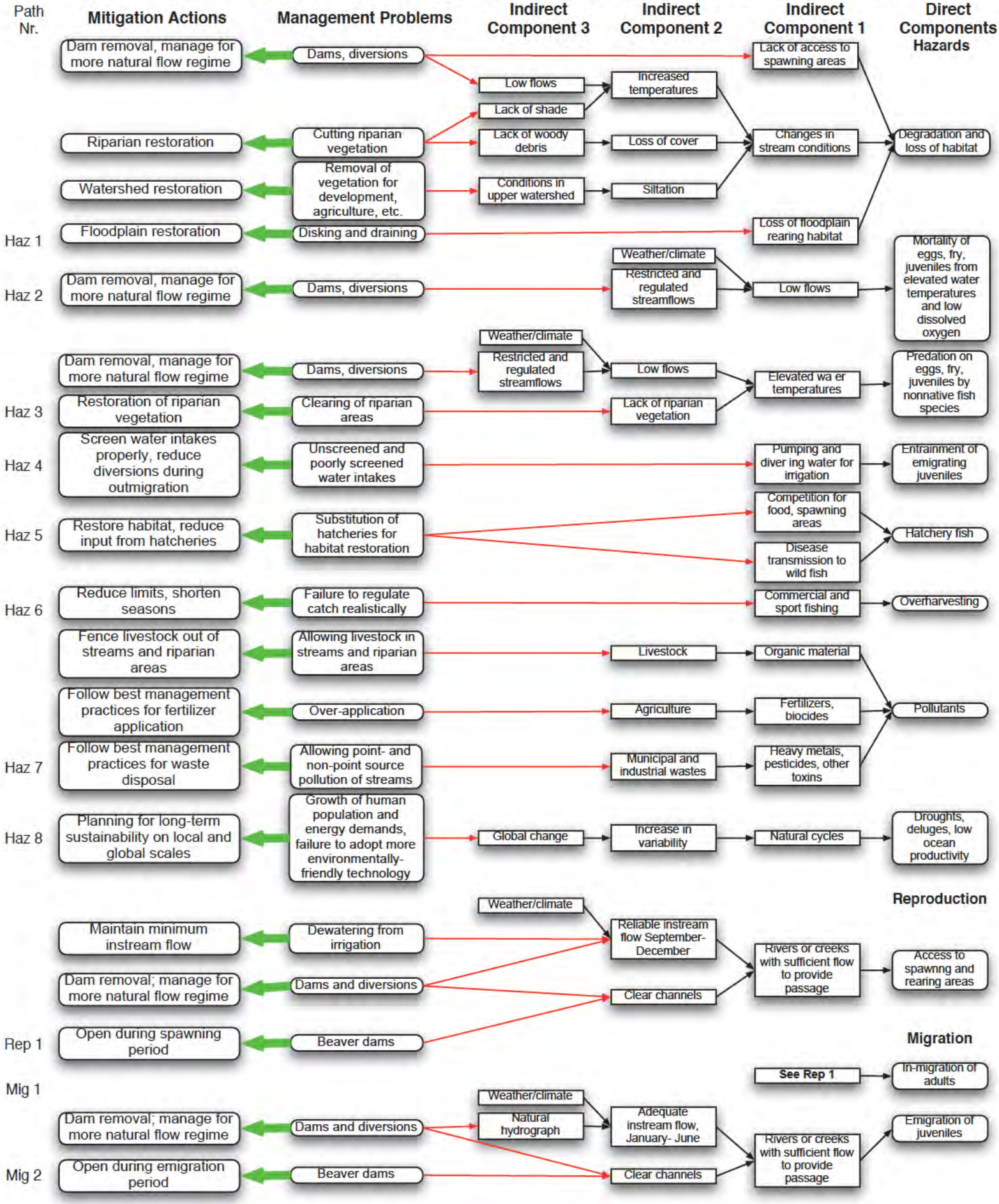
Bates, Gregg. Email to Loren Clark, Placer County Community Development Resource Agency. October 13, 2015.

Envirogram 10 Central Valley Fall-Run Chinook Salmon, *Oncorhynchus tshawytscha*



Envirogram 10 Central Valley Fall/Late Fall Run Chinook Salmon. Res = Resources; Haz = Hazards; Rep = Reproduction; Mig = Migration.

Envirogram 10 Central Valley Fall-Run Chinook Salmon, *Oncorhynchus tshawtscha* (continued 2)



Envirogram Narrative

Central Valley Fall/Late Fall-Run Chinook Salmon (*Oncorhynchus tshawytscha*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Spawning areas for the Central Valley fall/late fall-run Chinook salmon are in tributaries of the Sacramento River. The fish enter these streams from the mainstem river, requiring clear channels with adequate flow for access, particularly from September to December. Dams and diversions, dewatering from irrigation, and beaver dams often make this access problematic. Dam removal, maintaining minimum instream flow, managing for a more natural flow regime, and opening up beaver dams in spawning streams improve access. None of these options is without cost; for example, beaver dams are very useful for restoring floodplains and wetlands.

Res2: Central Valley fall/late fall-run Chinook salmon have specific requirements for spawning substrate. The gravel needs to be smaller than 5.9 inches in diameter, and fine sediments (<0.1 inch in diameter) need to be less than 10% of the substrate. Proper substrate conditions depend to a large extent on conditions in the upper watershed; sedimentation resulting from logging, development, agriculture, or other activities degrades spawning areas. Watershed restoration can help mitigate this problem.

Res3: Water flow through the gravel substrate is important to egg development, and its extent depends on weather, the amount of fine sediments in the substrate (< ca. 10%), and on a natural hydrograph (flow regime). These in turn depend on stream characteristics (see path Res1) and the shape of the upper watershed (path Res2).

Res4: Water depth sufficient to cover spawning fish and temperature (<54 °F) are important to egg deposition and development. These factors are related to flow volume during the spawning season (September through December), which is also dependent on a natural hydrograph. Weather conditions are also a major influence. Dams and diversions that impede normal flow should be removed if possible so that a more normal flow pattern and volume can be re-established.

Res5: Riffles, runs, and pools in stream channels and floodplains provide rearing areas for fry and juveniles. The former depends on natural stream morphology, which often has been altered by channelization and channel clearing. Floodplains also depend upon natural stream morphology and a

natural hydrograph unimpeded by dams and diversions. Floodplain and channel restoration may be necessary to re-create proper conditions.

Res6: For stream channels to provide good rearing habitat, water temperatures have to be less than 64 °F and substrates need to have few fine sediments. Water temperature is a function of flow rate and shading. Flow rate depends on weather and a natural hydrograph; shading is provided by riparian vegetation that is often lost during clearing for agriculture or development. High deposition rates of fine sediments result from surface disturbances in the upper watershed. Restoration of the upper watershed, flow regime, and riparian vegetation are necessary to mitigate these problems.

Res7: Aquatic invertebrates are important food for juveniles. These organisms depend on interstitial spaces in riffles for shelter and feeding habitat, and the presence of these spaces depends on a low deposition rate of fine sediments. High deposition rates of fine sediments result from surface disturbances in the upper watershed. Restoration of the upper watershed is necessary to mitigate this problem.

Res8: Terrestrial insects are also an important food for juveniles. The diversity and abundance of these organisms depends on healthy riparian vegetation, which in turn depends on weather and a proper water table—related to the hydrograph and the condition of the floodplain. Dams and diversions, channelization, and cutting of riparian vegetation should be mitigated by better water management and by floodplain and riparian restoration.

Res9: Floodplains provide better rearing habitat for juvenile salmon than stream channels. Water temperatures can be toward the high end for survival (<75 °F), but these temperatures, along with a large number of invertebrates for food, result in higher growth rates. Water temperatures are higher because of lower gradients and flow rates, and detritus deposited during seasonal inundation provides food for the invertebrates. The creation of dams and diversions and channelization result in loss of floodplains. These practices must be replaced by proper stream and floodplain management if this important habitat component is to be restored in Placer County.

Res10: Estuarine and ocean waters provide habitat for adult Central Valley fall/late fall-run Chinook salmon. To access these areas from rearing habitat requires open channels and adequate flow; the management problems and mitigation actions for these conditions are the same as for path Res1.

Res11: Adult Central Valley fall/late fall-run Chinook salmon feed on crustaceans, squid, and fish. These organisms are plentiful in estuarine and oceanic ecosystems because of the high productivity that results from nutrient inputs coming from upwelling and fresh-water flows. However, excess inputs of nutrients and toxins from agricultural, industrial, and municipal runoff have deleterious effects on these ecosystems, which may negatively affect Central Valley fall/late fall-run Chinook salmon populations. Proper application of agricultural chemicals and limiting the inputs of industrial and municipal wastes can help restore appropriate nutrient cycles.

Hazards

Haz1: The degradation and loss of habitat is probably the greatest hazard faced by the Central Valley fall/late fall-run Chinook salmon. Habitat problems include lack of access to spawning areas, changes in stream conditions, and loss of floodplain rearing habitat. Dams and diversions affect access directly and also result in low flows that lead to elevated temperatures. Cutting riparian vegetation results in loss of shade and increased temperatures along with the loss of woody debris that provides cover for the fish. Removal of vegetation in the upper watershed results in siltation, and disking and draining removes

floodplain rearing habitat. Dam removal, managing for more natural flows, and riparian, watershed, and floodplain restoration are necessary to mitigate these problems.

Haz2: Elevated water temperatures (see path Res6) and low dissolved oxygen resulting from low flows are a hazard for eggs, fry, and juveniles. Low flows can be caused by drought conditions, but they also result from restricted and regulated streamflows caused by dams and diversions. Dam removal and water management for a more natural flow regime can mitigate these problems to some extent.

Haz3: Predation on all life stages by non-native fishes (primarily centrarchids) is another hazard. These introduced species thrive in elevated water temperatures resulting from low flows and lack of riparian vegetation. Low flows can be caused by drought conditions, but they are more likely to result from dams and diversions restricting and regulating streamflow. Loss of riparian vegetation results from clearing riparian areas for agriculture or flood control. Dam removal and water management for a more natural flow regime and riparian restoration can help mitigate these problems.

Haz4: Entrainment of emigrating juvenile Central Valley fall/late fall-run Chinook salmon is another hazard. Entrainment results from unscreened or poorly screened water intakes on irrigation pumps or hydroelectric generators, and it can be partially mitigated by proper screening.

Haz5: Hatchery-raised fish can compete for food and spawning areas and transmit diseases to native salmon. There has been a general tendency in salmon management to substitute hatcheries for habitat restoration; there needs to be a plan that coordinates the two.

Haz6: Overharvesting by commercial and sport fishing, resulting from unrealistic limits, is another hazard. Reduced limits and shortened seasons based on science instead of politics is the only way to deal with this problem.

Haz7: Pollutants, in the form of organic material from livestock, fertilizers and pesticides from agriculture, and heavy metals, pesticides, and other toxins from municipal and industrial wastes, are yet another hazard faced by Central Valley fall/late fall-run Chinook salmon. Livestock should be kept out of streams and riparian zones, particularly during spawning season and when juveniles are present, and over- application of fertilizers and pesticides and other point-source and non point-source pollution can be mitigated to some extent by following best management practices.

Haz8: Natural events, such as droughts, floods, and periods of low ocean productivity have been hazards to Central Valley fall/late fall-run Chinook salmon for millennia. These natural cycles are evidently increasing in both severity and variability because of global changes that result from the growth of the human population, increasing energy demands, and a failure to adopt less environmentally damaging technology. Planning for sustainability at both local and global scales is necessary to ensure that salmon will continue to ascend Placer County's streams.

Reproduction

Rep1: To reproduce, adults require access to spawning and rearing areas. Access depends on adequate flows and clear channels from September to December. Although weather patterns have some influence on these factors, dams and diversions, pumping for irrigation, and beaver dams block the channel and change the hydrograph. Removing these structures or managing for a more normal flow regime and minimum instream flow are necessary to ensure access. Beaver dams impede access, but they also are very useful for restoring floodplains and wetlands. Thus, a beaver management plan must be developed for salmon spawning streams. Other requirements for reproduction are spelled out in Resources.

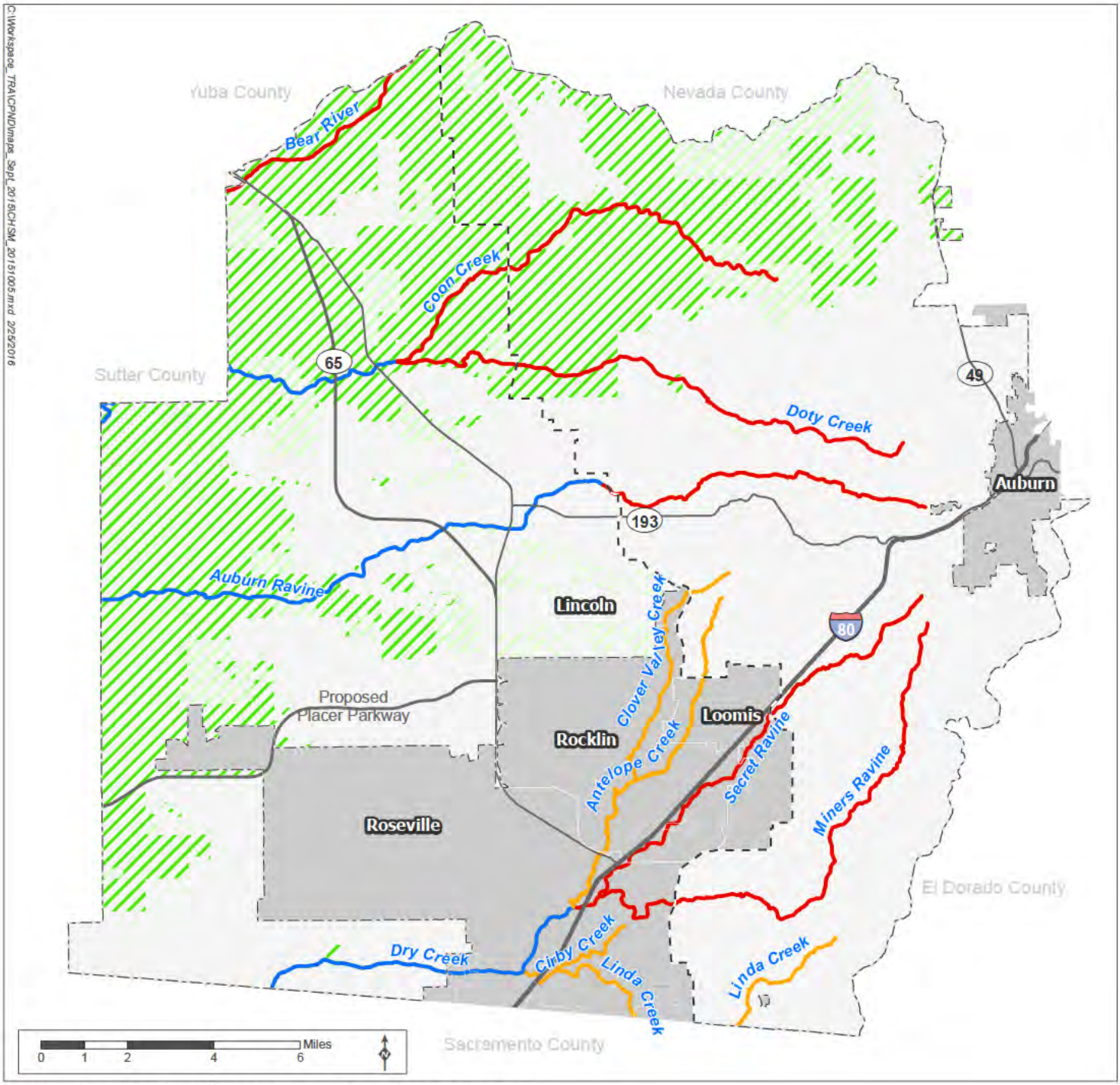
Migration

Mig1: The life history of the Central Valley fall/late fall-run Chinook salmon depends on two types of migration, the immigration of adults to the spawning areas and the emigration of juveniles to estuarine and oceanic waters. The immigration path is the same as path Res1.

Mig2: The emigration of juveniles usually occurs from January to June and depends on weather conditions, adequate flow volumes, and clear channels. The latter two can be disrupted by dams and diversions, so removing those structures or managing for a more normal flow regime may be necessary for fish passage. See path Rep1 for comments on beaver dams.

Summary

The reproductive biology of the Central Valley fall/late fall-run Chinook salmon depends on access to spawning areas, a natural flow regime, proper substrate that is not choked with fine sediments in stream channels, and functional flood plains. Thus, for Placer County to contribute to the recovery of this species, a great deal of stream, riparian, and upper watershed restoration will be required. Success is not guaranteed, however. Events in the Sacramento River, the Delta, and the Pacific Ocean—as well as environmental change on a global scale—also are contributing to the species' decline. Both upstream and downstream conditions must be addressed simultaneously.



Source: Placer County, 2014; MIG | TRA, 2015; NOAA NMFS, 2014; Dry Creek Conservancy 2003-2014; CDFW 2015

Habitat Distribution - Steelhead Recovery Plan

- Spawning
- Rearing and/or Migration
- Spawning - Other Sources
- Non-habitat
- Existing Protected Area
- Reserve Aquisition Area
- Non-participating City
- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 10.

Central Valley Fall/Late Fall-run Chinook Salmon Habitat Distribution

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

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Status

Federal: Threatened (USFWS 1980). Recommended for delisting in the 5-year review (USFWS 2006). A delisting proposal was released by the USFWS (USFWS 2012); however, the proposed rule was withdrawn (USFWS 2014).

State: None

Recovery Plan: Recovery Plan for the Valley Elderberry Longhorn Beetle (USFWS 1984).

Critical Habitat: Critical habitat was established on August 8, 1980. No Valley elderberry longhorn beetle critical habitat occurs within the Plan Area (USFWS 1980).

Distribution

California

Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is endemic to the upland riparian areas of the Central Valley of California (Linsley and Chemsak 1972). Neither subspecies of *Desmocerus californicus* have been observed outside of California. Three species of the genus *Desmocerus* occur in North America.

At the time of its listing, the valley elderberry longhorn beetle was known in only 10 occurrence records at 3 locations in Merced, Sacramento, and Yolo counties (USFWS 2012). The current range of valley elderberry longhorn beetle extends from Shasta County in the north to Fresno County in the south. It is mostly concentrated at elevations below 3,000 feet in the watersheds of the American, San Joaquin, and Sacramento Rivers. The range of valley elderberry longhorn beetle may overlap with that of *D. c. californicus* along the eastern edge of the Coast Ranges and in the southern San Joaquin Valley (Halstead and Oldham 2000). Delineating the ranges of these two taxa will require focused distribution studies because of the species' reclusive nature, short-lived adult forms, and sexual dimorphism.

Placer County Plan Area

Historical

Upland riparian habitat historically occurred along low-elevation creeks, streams, and rivers throughout western Placer County. Valley elderberry longhorn beetle is likely to have occurred in a patchy distribution along Bear River, Coon Creek, Markham Ravine, Auburn Ravine,

Pleasant Grove Creek, Dry Creek, the American River, and associated tributaries that supported *Sambucus* spp. and associated riparian vegetation.

Current

Valley elderberry longhorn beetle is known to occur in the American River watershed below Auburn in the vicinity of Folsom Lake; in the Dry Creek watershed along Secret Ravine Miners Ravine, and Coon Creek; at the Wildlands Sheridan Mitigation Bank; and in the Bear River watershed near Wheatland in Sutter County. The taxon has not been observed in Placer County higher than 640 feet above sea level (CNDDB 2015; USFWS 2012). To date, bore holes and/or adults have been observed at the following locations within the Plan Area (CNDDB 2015):

- In 1992, near Douglas Boulevard two groups of plants were observed with boreholes.
- In 1991 recent exit holes were observed on red elderberry shrubs at two sites along Miners Ravine.
- In 1992, along Linda Creek, at the Granite Bay Golf Club eight elderberry shrubs with exit holes were recorded.
- In 2002, at a mitigation site at Sterling Point Estates, exit holes were observed from 1993 – 2002 at a 1.84 acre mitigation area.
- In 2003, along the Sutter/Placer County Line just north of Bear River Road, four newly emerged adult beetles were observed.
- In 2005, at Redwings Preserve.
- Barr (1991) observed valley elderberry longhorn beetle at two sites along Folsom Lake in 1991, and these locations were found to be still occupied in 2008 (Holyoak and Koch-Munz 2008) and 2010 (Holyoak and Graves 2010).

Old exit holes were also observed in 1991 in oak woodland along Secret Ravine, at a site which is in western Placer County, but outside of the Plan Area.

In addition, there have been several observations outside of, but near, western Placer County (CNDDB 2015):

- South of western Placer County: along the American River; and
- Northwest of western Placer County: along Bear River, Feather River, and Rest Slough.

Population Status & Trends

California

Valley elderberry longhorn beetle habitat is steadily declining with the elimination of upland riparian habitat throughout its historical range. Less than 1% of the original upland riparian habitat remains, mostly distributed in small, isolated fragments (Collinge et al. 2001). In addition, Vaghti et al. (2009) quantified elderberry stem diameters along the Sacramento River and four adjacent rivers outside of Placer County. Blue elderberry saplings and shrubs with stems <2.0 inches in diameter were rare, which suggests a lack of recruitment (Vaghti et al. 2009).

At the time of its listing, the valley elderberry longhorn beetle was known in only 10 occurrence records at 3 locations, including Merced River, American River, and Putah Creek, in Merced, Sacramento, and Yolo counties (USFWS 2012). Currently, it is known from 201 occurrence records at 26 locations, including much of the San Joaquin and Sacramento Valleys from Shasta County in the northern Sacramento Valley to Kern County in the southern San Joaquin Valley (USFWS 2012).

There are insufficient valley elderberry longhorn beetle records to directly assess changes in distribution of the beetle from historical times to the present, although it is probable that beetle habitat was coarsely related to the extent of riparian forests where elderberry is present (USFWS 2012). However, there is no way of knowing which areas of riparian forest were historically occupied by the beetle (USFWS 2012).

There are no long-term population data available for the valley elderberry longhorn beetle. Studies have attempted to provide information relevant to population trends by surveying and comparing the same sites in the Sacramento Valley. In a statewide distribution study, Barr (1991) found 64 (27.8%) of the 230 sites surveyed to have been recently occupied by valley elderberry longhorn beetle. In the Sacramento Valley region, Barr surveyed 79 sites and observed exit holes at 29 (36.7%) (Collinge et. al. 2001). In 1997, Collinge et al. (2001) repeated Barr's methods at 65 sites in 14 watersheds and found evidence of valley elderberry longhorn beetle occupancy at 30 (46.2%) of the 65 sites. Generally Collinge et al. (2001) found fewer occupied groups of elderberry shrubs at each site (on average) because the average density of elderberry shrubs had decreased. However, although a moderate downward trend was observed, this trend should not necessarily be extrapolated to the long-term, rangewide status of the valley elderberry longhorn beetle due to the uncertainties involved in obtaining the results (e.g., not all beetle habitat surveyed by Barr was surveyed by Collinge). In 2005 and 2006, Holyoak and Koch-Munz (Holyoak and Koch-Munz 2008) surveyed 45 sites and found that 20 (44%) were occupied.

When considering the low estimates of valley elderberry longhorn beetles occupancy (Talley et al. 2007), extinction and colonization patterns (Collinge et al. 2001), and the distribution of the beetle over the last 16 years (since 1997), it is apparent that the valley elderberry longhorn beetle is clustered in regional aggregations and locally uncommon or rare (USFWS 2014).

Placer County Plan Area

Although sample size is small within the Plan Area, a few sites are consistently occupied, while other sites are consistently unoccupied. Holyoak and Koch-Munz (2008) re-surveyed two sites near Folsom Lake that had been found to be occupied by Barr (1991), and found that they remained occupied. Collinge et al. (2001) re-surveyed two sites that had been found to be un-occupied by Barr (1991) and found that they remained unoccupied. Holyoak and Koch-Munz (2008) re-surveyed one of those sites in 2005 and 2006, and it still remained unoccupied. As discussed below, this pattern may be due to the beetle's limited dispersal.

Although previous occupancy of a site can predict current occupancy, within-site populations can vary from year-to-year. Yearly monitoring at the mitigation site at Sterling Pointe Estates – where elderberry and native tree seedlings were planted – revealed that although the site was occupied for several consecutive years, the population varied between years (CNDDB 2015); four exit holes were found in 1992, one hole in 1996, and two holes in 2002.

Natural History

The habitat requirements, ecological relationships, life history, and threats to valley elderberry longhorn beetle described below are summarized in diagram form in the Envirogram 11 Valley Elderberry Longhorn Beetle.

Habitat Requirements

Habitat for valley elderberry longhorn beetle consists of elderberry shrubs (*Sambucus* sp.) occurring in upland riparian forests or elderberry savannas adjacent to riparian vegetation (Barr 1991). Valley elderberry longhorn beetle is found most frequently and most abundantly in areas that support significant riparian zones (Talley et al. 2007). In Collinge et al. (2001) valley elderberry longhorn beetle exit holes were consistently found to occur in clumps of elderberry bushes rather than in isolated bushes, in elderberry branches 2-4 inches in diameter, and in branches less than 3 feet above the ground. Collinge et al. (2001) also found that plants in isolated drainages are less likely to support valley elderberry longhorn beetle populations than plants with connectivity to other habitat. Talley et al. (2007) found that, in general, density of elderberry shrubs, shrub size, number of stems, and range of branch sizes were the most influential predictors of valley elderberry longhorn beetle presence. Increased local population size of beetles was associated with higher elderberry density and the presence of larger, more mature plants (Talley et al. 2007). Valley elderberry longhorn beetle utilizes two species of elderberry plants: blue elderberry (*Sambucus mexicana*) and red elderberry (*Sambucus racemosa* var. *microbotrys*). Valley elderberry longhorn beetle does not seem to select one species over the other (Barr 1991).

Individual valley elderberry longhorn beetle rely on the same elderberry plant (or clump of plants) throughout the life cycle. Adults feed on the elderberry leaves and flowers. Mating pairs are typically observed on an elderberry shrub, eggs are laid on the stem or leaves of an elderberry plant and the larval and pupal stages develop within the elderberry stem pith (i.e., dead woody material) (Barr 1991; Talley pers. comm.).

Holyoak and Koch Munz (2008) surveyed 30 mitigation sites – four that occur within Placer County and three that occur within the Plan Area. They also surveyed 16 nearby natural sites – two of which occur within the Plan Area. When considering the factors that influence whether a site is suitable for the beetle's host plant, Holyoak and Koch-Munz (2008) found that within the mitigation sites, elderberry health and growth were positively correlated with the amount of total nitrogen in soils and less strongly correlated with other soil nutrients and soil moisture. In a related study, they found that elderberry grew more rapidly in sites closer to riparian areas, indicating that such sites should be favored for mitigation sites (Koch-Munz and Holyoak 2008). Fremier and Talley (2009) found that elderberry shrubs were more frequent at intermediate elevations above the floodplain, but also their location was influenced by the width of the floodplain. The wider the floodplain, the higher the elderberry shrubs.

When considering beetle occupancy of host plant habitat, Koch-Munz and Holyoak (2008) found that valley elderberry longhorn beetle populations were denser in sites with moderate levels of dead stems on elderberry shrubs and with moderate damage to elderberry stems and bark. They concluded that this may indicate that the beetle responds to stressed shrubs, which are likely to contain elevated levels of nitrogen. In addition, they found that beetle density increases with the size and age of mitigation sites. They conclude that this is because it takes approximately seven years to develop the basal stem diameters that have been linked to successful beetle colonization.

Talley et al. (2007) found that beetle occupancy was higher in the lower alluvial plain (11.2%) and the mid-elevation riparian corridor (10.5%) than in the upper riparian terrace (8.7%) or the non-riparian scrub (2.9%) of the American River. Talley et al. (2007) also found that the number of exit holes was more than twice as high in the non-riparian scrub than in other habitat types.

Elderberry usually co-occurs with other woody riparian plants, including Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), various willows (*Salix* spp.), wild grape (*Vitis californica*), blackberry (*Rubus* spp.), and poison-oak (*Toxicodendron diversilobum*) (USFWS 1984; Collinge et al 2001).

Reproduction

Valley elderberry longhorn beetle adults are active during the flowering period of the host elderberry plant, usually from March through June (USFWS 2012). The adults feed on the plants' leaves and flowers, and the females lay hundreds of eggs on the plant stems and leaves. Larvae emerge within a few days and burrow into the plant stem that are at least 1 inch in diameter (USFWS 2012). The larva feeds downward through the stem pith, excavating a distinct feeding chamber filled with frass and shredded wood (Barr 1991). After 1–2 years, the larva chews a hole (i.e., exit hole) to the stem surface, but plugs the hole up again from within using wood shavings and returns to the chamber to pupate (Halstead and Oldham 1990). This allows the beetle to eventually exit the stem after it becomes an adult, as adults are not wood borers (USFWS 2012). When the host plant begins to flower, the pupa emerges as an adult and exits the chamber through a characteristic exit hole 0.15–0.4 inch in diameter (Barr 1991).

Dispersal Patterns

Dispersal may be limited by the fact that adults are short-lived and must remain close to elderberry plants for food and to lay eggs (Halstead and Oldham, 1990; Collinge et al. 2001).

Collinge et al. (2001) found that it is rare for valley elderberry longhorn beetle to colonize new sites, even if occupied sites occur within the same drainage, and that they probably never colonize new sites if the nearest occupied sites are in different drainages. This pattern implies that even when an individual valley elderberry longhorn beetle disperses from its host plant to colonize new habitat, it only travels along the riparian corridor within its home drainage. Most remaining elderberry habitat and riparian vegetation exist in small isolated patches; the distance between valley elderberry longhorn beetle populations and unoccupied valley elderberry longhorn beetle habitat limits the species' ability to successfully colonize new sites.

Longevity

Valley elderberry longhorn beetle eggs hatch in approximately 3 days. The larval and pupal stages combined will span 1 - 2 years. Adult males live only for a few days, and adult females persist approximately 3 - 4 weeks. The majority of a valley elderberry longhorn beetle's life span is spent within the stem of the host plant (Barr 1991; Collinge et al. 2001; Talley pers. comm.).

Sources of Mortality

Any activity that damages the host elderberry plant could result in valley elderberry longhorn beetle mortality. Valley elderberry longhorn beetle larvae are vulnerable to such actions as pesticide application, trimming, dewatering, flooding, and Argentine ant invasion (Huxel 2000; Collinge et al.

2001; Talley pers. comm.). In addition, the beetle is likely prey to insectivorous birds, lizards, and European earwigs (*Forficularia auricularia*) (Klasson et al. 2005, unpublished report cited in USFWS 2006).

Behavior

Valley elderberry longhorn beetle larvae feed on the soft tissues in the center of the elderberry plant. Larvae leave shredded wood and grass behind as they create feeding chambers in the stem. Pupae do not feed. The pupae undergo metamorphosis within an enlarged pupal chamber. Adult beetles feed on the nectar, flowers, and leaves of the host plant or those of another elderberry plant close to the host plant. The emergence of the adult beetle from the elderberry stem creates a characteristic round to oval exit hole 0.15 to 0.4 inch in diameter (Barr 1991; Colinge et al. 2001; Talley pers. comm.).

Movement and Migratory Patterns

The majority of a valley elderberry longhorn beetle's life span is spent within the stem of the host plant (Collinge et al. 2001). Hanks (1999) found that valley elderberry longhorn beetle can complete its entire lifecycle on one individual host plant, even if the host plant is damaged or weakened.

As discussed above, dispersal may be limited by the fact that adults are short-lived and must remain close to elderberry plants for food and to lay eggs.

Ecological Relationships

Valley elderberry longhorn beetle is a specialized herbivore that feeds exclusively on elderberry shrubs. The larval form is a nonlethal parasite on red and blue elderberry shrubs. The adult form is also a pollinator of red and blue elderberry shrubs.

Elderberry shrubs may be affected (directly or indirectly) by the stem-boring activity of valley elderberry longhorn beetle larvae. Arnold (1990) reported that 20% of elderberry shrubs examined that had more than two exit holes died from a fungal disease. Although this ecological relationship is not well documented for valley elderberry longhorn beetle, other longhorn beetles (*Cerambycidae*) have been shown to indirectly transport disease-causing fungi and bacteria between host plants (Hanks 1999).

Threats

The greatest threats to the persistence of valley elderberry longhorn beetle are habitat loss and fragmentation, flood management, pesticide and herbicide use, and exotic species invasion (USFWS 1984; Huxel 2000; Collinge et al. 2001). Urban and agricultural development, aggregate mining, and flood control practices (e.g., damming and channel maintenance) have damaged or eliminated a large percentage of the upland riparian forests that once occurred in California, reducing and fragmenting the available habitat for valley elderberry longhorn beetle (Barr 1991).

The beetle likely is the prey of insectivorous birds, lizards, and European earwigs (Klasson et al. 2005, unpublished report cited in USFWS 2006). These three common predators move freely up and down elderberry stems searching for food, and earwigs may be common in riparian areas and lay eggs in dead elderberry shrubs.

Invasion of the exotic Argentine ant (*Linepithema humile*) into riparian habitats may present a threat to the distribution and survival of valley elderberry longhorn beetle (USFWS 2012). Although Argentine

ants can invade new sites through colonization by queens and/or workers, they can also invade new sites through the soil of potted plants that have been grown or stored at sites with Argentine ant invasions (Holway et al 2003). Huxel (2000) surveyed 15 sites in the Putah Creek watershed and 15 sites in the American River watershed for presence of *L. humile*, native ant species, and valley elderberry longhorn beetle. Results of the Putah Creek survey showed the presence of Argentine ant to have a negative relationship with valley elderberry longhorn beetle presence and showed native ant species to have a positive relationship with valley elderberry longhorn beetle presence. Although results of the American River survey showed no significant relationships, Huxel et al. (2003) observed that the invasion of Argentine ant into the American River watershed was relatively recent (<5 years). Holyoak and Koch-Munz (2008) found that the frequency of Argentine ants was not related to the frequency of valley elderberry longhorn beetle per shrub. However, they recommend caution when interpreting their results because they did not use bait traps to detect ants. In addition, there was a good deal of flooding of sites prior to sampling in 2006, which might have disrupted ant populations. The average number of recent beetle exit holes per elderberry shrub was found to be lower for shrubs with Argentine ants (Holyoak and Graves 2010 as cited in USFWS 2014). The Argentine ant may interfere with adult mating and breeding behavior or prey on valley elderberry longhorn beetle larvae (Huxel et al. 2003; USFWS 2014).

The magnitude and population-level importance of pesticide effects on the beetle remains uncertain, and merits empirical study (USFWS 2006). However, broad-spectrum insecticides are likely toxic to the beetle. In addition, many herbicides may harm or kill its host elderberry plants, and many other broad-spectrum pesticides may be toxic to the beetle and/ or its host plant (USFWS 2006).

Invasive plants pose a particular threat to the valley elderberry longhorn beetle because of the elderberry's intolerance of competition for light, water and nitrogen (Vaghti et al. 2009). Based on vegetation associations, Vaghti et al. (2009) found that non-native fig (*Ficus carica*), Himalayan blackberry (*Rubus armeniacus*), brome (*Bromus* spp.), and giant reed (*Arundo donax*) are of particular concern. In addition, black walnut (*Juglans hindsii*) may compete with elderberry plants for light, and Bermuda grass (*Cynodon dactylon*) may compete with elderberry plants for water and nutrients (Vaghti et al 2009).

Dust is listed in the valley elderberry longhorn beetle recovery plan as a threat to the valley elderberry longhorn beetle. However, Talley et al (2006) found that neither elderberry density nor valley elderberry longhorn beetle density differed with distance from dirt surfaces.

Context for a Regional Conservation Strategy

Valley elderberry longhorn beetle is known from three watersheds and one mitigation bank within western Placer County. Populations in the state are scattered throughout the Central Valley, with Placer County located in the middle to upper distribution of the species' north-south range. Gains in elevation within the County prohibit colonization further east than the western portion of the County. In the region, valley elderberry longhorn beetle has been recorded in counties north and south of western Placer County, such as Yuba and Sutter Counties to the north, Sacramento, El Dorado, and Amador Counties to the south, as well as Yolo County to the east. The Placer County populations are not significant in terms of the range of the species within California. However, due to the severe reduction in suitable riparian habitat for valley elderberry longhorn beetle, protection of remaining habitat, including that in Placer County, is important for the species conservation and restoration. As valley elderberry longhorn beetle will often spend their entire life on the same plant, or disperse to near-by elderberries in the same drainage, protection of occupied plants and connectivity of occupied drainages is of highest

priority. Landscape-scale studies of the valley elderberry longhorn beetle have indicated that large patches of habitat, even when unoccupied, are likely important to maintain the possible metapopulation structure of the beetle (Talley 2007).

Modeled Species Distribution in the Plan Area

Model Assumptions

Year-round Habitat

Modeled habitat for valley elderberry longhorn beetle is defined as valley oak woodland and riverine/riparian below 650 feet elevation.

Rationale

Habitat for valley elderberry longhorn beetle consists of elderberry shrubs (*Sambucus* spp.) occurring in upland riparian forests or elderberry savannas adjacent to riparian vegetation. In Placer County, valley elderberry longhorn beetle has not been observed higher than 640 feet above sea level. The presence of host elderberry plants could not be determined from the land-cover data; therefore, modeled habitat for valley elderberry longhorn beetle is likely an overestimate of occupied habitat. Habitat restoration and enhancement actions will include planting (and transplanting) elderberry to suitable sites thereby increasing the extent of occupied and suitable habitat over the term of the PCCP permit.

Model Results

Species Map 11. *Valley Elderberry Longhorn Beetle Modeled Habitat Distribution and Occurrence* shows the modeled potential habitat for valley elderberry longhorn beetle within the Plan Area. The documented occurrences of valley elderberry longhorn beetle generally correspond to modeled year-round habitat. In some cases, locations of documented occurrences did not occur on modeled habitat, possible because habitat features (i.e., elderberry shrubs) did not always correspond with the mapped land-cover type (i.e., riverine/riparian and valley oak woodland).

References

Printed References

Arnold, R. A. 1990. Status surveys and habitat suitability studies for the threatened delta green ground beetle, the threatened valley elderberry longhorn beetle, and several candidate insects for the PGT-PG&E pipeline expansion project. Final report. Prepared for Pacific Gas and Electric Company, San Ramon, CA.

Barr, C. B. 1991. The distribution, habitat, and status of the valley elderberry longhorn beetle *Desmocerus californicus dimorphus* Fisher (Insecta: coleoptera: cerambycidae). U.S. Fish and Wildlife Service. Sacramento, CA.

California Natural Diversity Database. 2015. RareFind 3 (November 2015). Sacramento, CA: California Department of Fish and Wildlife.

Collinge, S. K., M. Holyoak, C. B. Barr, and J. T. Marty. 2001. Riparian habitat fragmentation and population persistence of the threatened valley elderberry longhorn beetle in Central California. Biological Conservation. 100: 103-11.

Fremier, A. K, and T. S Talley. 2009. Scaling riparian conservation with river hydrology: lessons from blue elderberry along four California rivers. Wetlands 2(1): 150–162.

Hanks, L. M. 1999. Influence of the larval host plant on reproductive strategies of cerambycid beetles. *Annual Review of Entomology* 44:483–505.

Halstead, J.A., and J.A. Oldham. 1990. Revision of the nearctic Desmocerus Audinet-Seville with emphasis on the federally threatened valley elderberry longhorn beetle (Coleoptera: cerambycidae). Environmental Section Staff Report, Kings River Conservation District, Fresno, CA.

Halstead, J. A., and J. A. Oldham. 2000. New distributional records for the valley elderberry longhorn beetle *Desmocerus californicus* Horn (Coleoptera: Cerambycidae). *Pan-Pacific Entomologist* 76(1):74–76.

Holway, D. A. L., L. Lach, A. V Suarez, N. D Tsutsui, and T. J Case. 2003. The causes and consequences of ant invasions. Annual Review of Ecology and Systematics 33: 181–233.

Holyoak M., and M. Koch-Munz. 2008. The effects of site conditions and mitigation practices on success of establishing the valley elderberry longhorn beetle and its host plant, blue elderberry. Environmental Management 42(3): 444–457.

Huxel, G. R. 2000. The effect of the Argentine ant on the threatened valley elderberry longhorn beetle. *Biological Invasions* 2:81–85.

Huxel, G. R., M. Holyoak, T. S. Talley, and S. Collinge. 2003. Perspectives on the recovery of the threatened Valley elderberry longhorn beetle. Pages 457-462 in P. M. Faber, editor. California Riparian Systems: Processes and Floodplain Management, Ecology and Restoration. Riparian Habitat Joint Venture, Sacramento, CA.

Koch-Munz, M., and M. Holyoak. 2008. An evaluation of the effects of soil characteristics on mitigation and restoration involving blue elderberry, Sambucus mexicana. Environmental Management 42(1): 49–65.

Linsley, E. G., and J. A. Chemsak. 1972. Cerambycidae of North America, Part VI, No. 1. Taxonomy and classification of the subfamily Lepturinae. *University of California Publications in Entomology* 69:1–13.

Talley, T.S. 2007. Which spatial heterogeneity framework? Consequences for conclusions about patchy population distributions. Ecology 88(6): 1476-1489.

Talley, T. S, E. Fleishman, M. Holyoak, D. D Murphy, and A. Ballard. 2007. Rethinking a rare-species conservation strategy in an urban landscape: The case of the valley elderberry longhorn beetle. Biological Conservation 135(1): 21–32.

Talley, T. S, M. Holyoak, and D. A Piechnik. 2006. The effects of dust on the federally threatened Valley elderberry longhorn beetle. Environmental Management 37(5): 647–658.

USFWS. 1980. Listing the Valley Elderberry Longhorn Beetle as a Threatened Species with Critical Habitat. Federal Register Vol.45, No. 155, Friday; August 8, 1980, pp. 52083-52807.

_____. 1984. Recovery plan for the valley elderberry longhorn beetle. Portland, OR.

_____. 1996. Mitigation guidelines for the valley elderberry longhorn beetle. Sacramento, CA.

_____. 1999. Conservation Guidelines for the Valley Elderberry Longhorn Beetle. Sacramento, CA.

_____. 2006. Valley Elderberry Longhorn Beetle 5-Year Review: Summary and Evaluation. Sacramento, CA. Published in Federal Register Vol 72, No. 30, Wednesday February 14, 2007 pp. 7064-7068.

_____. 2012. Endangered and Threatened Wildlife and Plants; Removal of the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened Wildlife; Proposed Rule. Federal Register Vol. 77, No. 191, Tuesday, October 2, 2012, pp. 60238-60276.

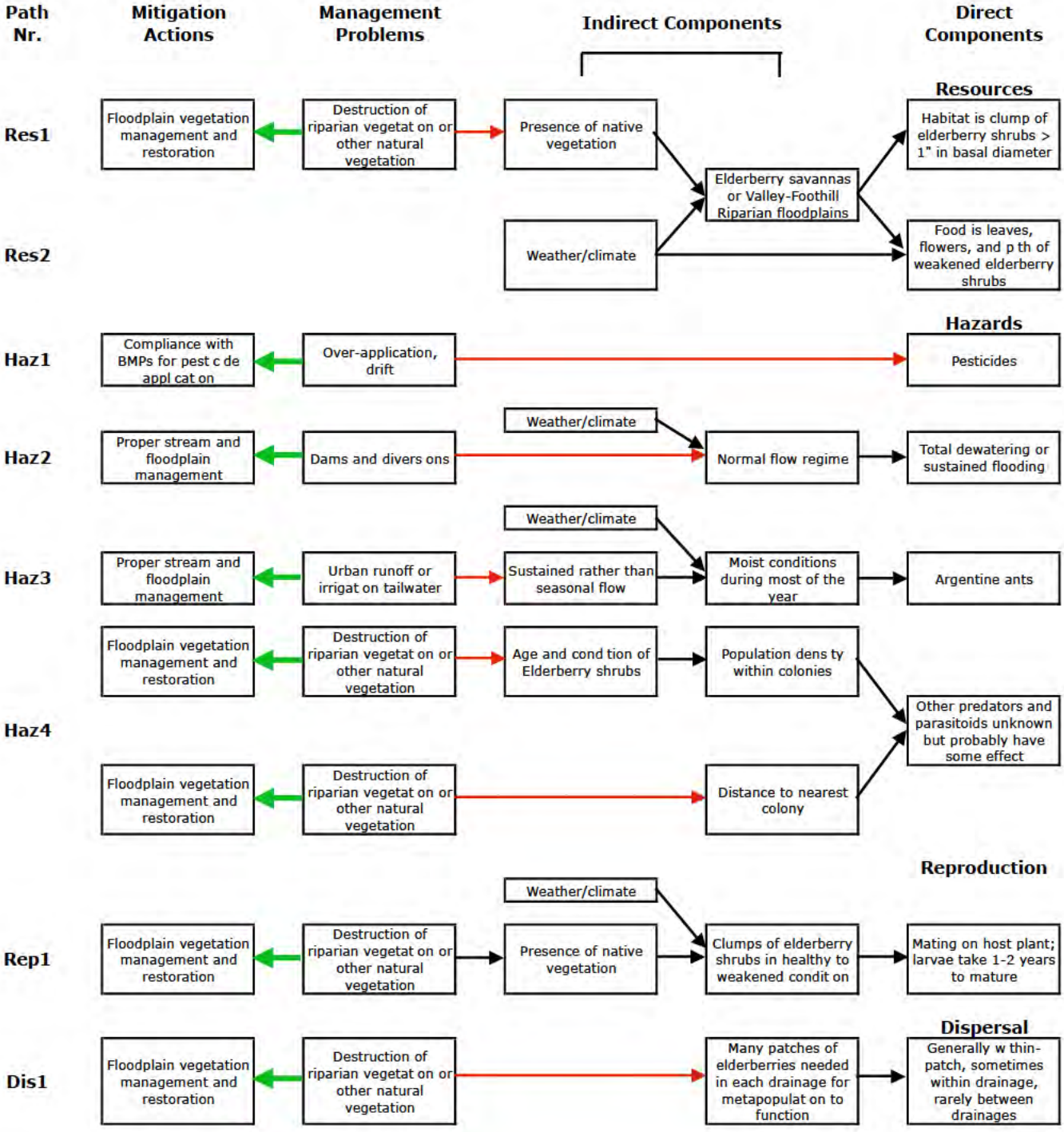
_____. 2014. Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened Wildlife. Federal Register Vol. 79, No. 180, Wednesday, September 17, 2014, pp. 55874-55917.

Vaight, M. G., M. Holyoak, A. Williams, T. S. Talley, A. K Fremier, S. E. Greco. 2009. Understanding the Ecology of Blue Elderberrry to Inform Landscape Restoration in Semiarid River Corridors. Environmental Management 43:28-37.

Personal Communications

Talley, Theresa S. Graduate Student, University of California, Davis. Department of Environmental Science and Policy. April 15 and 19, 2002 – telephone conversations.

Envirogram 11 Valley Elderberry Longhorn Beetle, *Desmocerus californicus dimorphus*



Envirogram 11 Valley Elderberry Longhorn Beetle. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram Narrative

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1**:** The habitat and resource needs of valley elderberry longhorn beetle are quite simple; clumps of elderberry shrubs (two species—blue and red elderberry—no evidence of preference) with a basal diameter >1 inch. Two plant communities support elderberries—valley foothill riparian and elderberry savanna. The condition of the shrubs depends on weather conditions and climate trends along with the extent of destruction to riparian vegetation. The loss of elderberry plants can be mitigated by an active floodplain vegetation management and restoration plan.

Res2**:** Valley elderberry longhorn beetle feeds as adults on the leaves and flowers, and the larvae mine and pupate in the pith. This path is the same as Res1.

Hazards

Haz1**:** Drift from improper pesticide application in adjacent agricultural areas is a potential hazard to valley elderberry longhorn beetle. Compliance with best management practices regarding pesticide use and application can reduce this threat.

Haz2**:** Dewatering and flooding resulting from a change in the normal flow regime injures or kills elderberry shrubs. While these events can result from unusual weather conditions, dams and diversions are responsible for most of these problems in Placer County. Proper stream and floodplain management should reduce this problem to some extent.

Haz3**:** Argentine ants evidently prey on one or more life stages of valley elderberry longhorn beetle. These invasive exotics require high soil moisture during most of the year, and an unusually wet year or persistent urban runoff or irrigation tailwater can create appropriate conditions. Allowing the surface soil to dry out during the summer in valley foothill riparian with elderberry and elderberry savanna probably mimics pre-settlement conditions and may help limit colonization by Argentine ants.

Haz4**:** Adult valley elderberry longhorn beetles, with their warning coloration, are probably not preyed on extensively by vertebrates. However, the larvae and pupae may have a complex of fly and wasp parasitoids that can build up during high population densities. The best way to deal with this is to

maintain a large number of suitable patches of elderberry shrubs within each drainage. The patches should be far enough apart so that colonization by the beetle is possible but not so close that the parasitoids can find new colonies immediately. Spacing will have to be determined by experimental methods incorporated into an adaptive management framework.

Reproduction

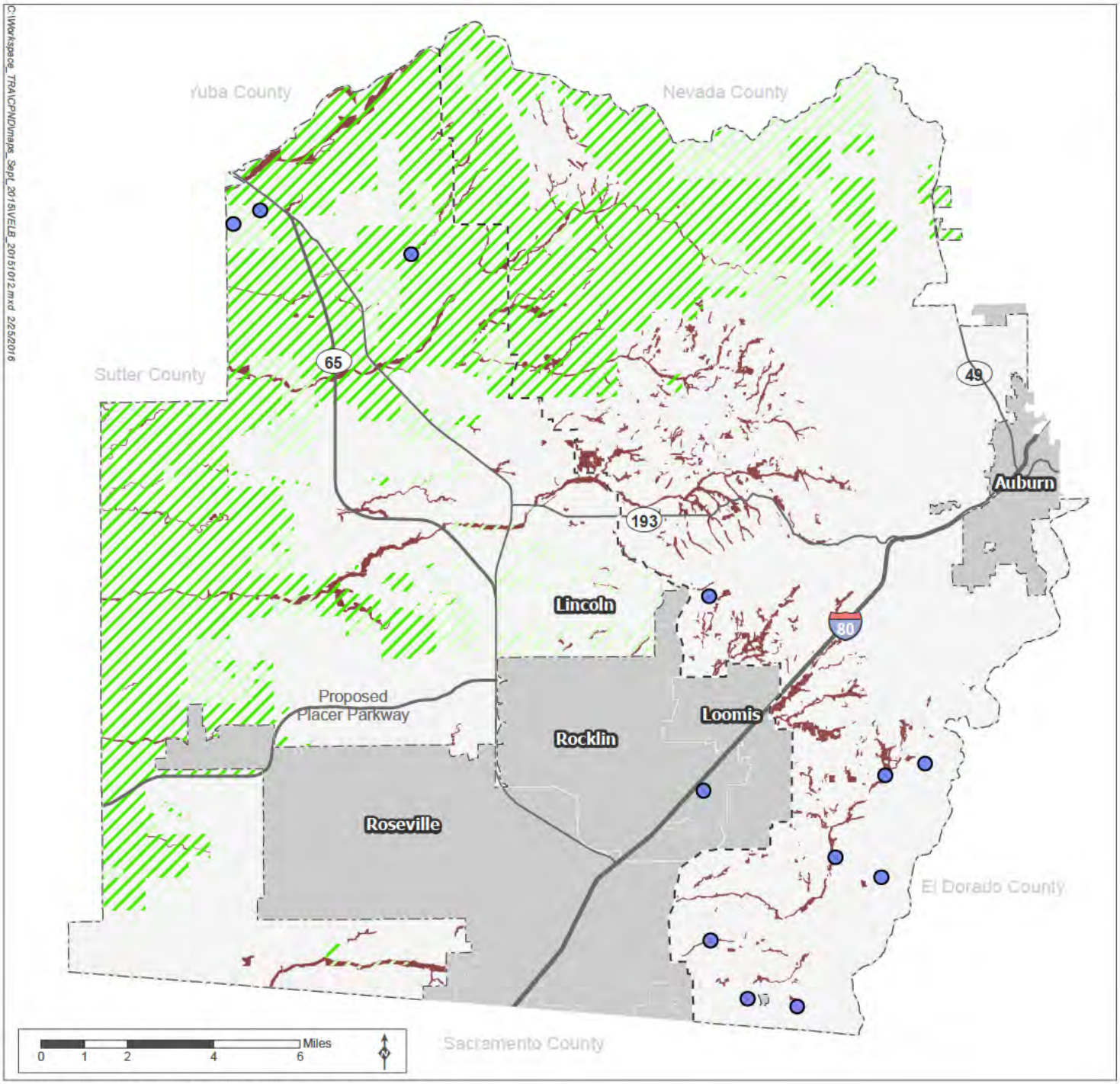
Rep1**:** Valley elderberry longhorn beetle mates on the host plant and the females oviposit on the same or nearby plants. Plants in somewhat weakened condition may be preferred, and plant condition is determined by weather patterns and climate trends and by the overall state of riparian or savanna vegetation. Finding mates should be no problem unless the colony is very sparse. Maintaining or restoring clumps of elderberry shrubs of the proper configuration and spacing should be a component of the floodplain vegetation management plan in the PCCP.

Dispersal

Dis1**:** Valley elderberry longhorn beetle is a very poor disperser, usually moving only within the same clump of elderberry shrubs. Occasional inter-patch dispersal takes place among adjacent patches, but movement between drainages never has been observed. Again, a floodplain vegetation management and restoration plan under the PCCP needs to restore elderberry shrubs in the appropriate patch configuration and structure to ensure the persistence of a metapopulation in each drainage.

Summary

Restoring elderberry savanna and riparian vegetation with elderberry shrubs is the key to recovery of the valley elderberry longhorn beetle in Placer County. However, valley elderberry longhorn beetle is a poor disperser and may need help to colonize restored areas. Maintaining the historic flow regime that allows soil to dry out during the summer may help protect this species from an invasive predator, the Argentine ant.



Source: Placer County, 2014; MIG | TRA, 2015; CNDDB, 2015; Restoration Resources, 2005

Occurrences
- Precise Location
- General Location

Habitat Model
- Year-round Habitat
- Non-habitat

- Existing Protected Area
- Reserve Aquisi ion Area
- Non-participating City
- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 11.
Valley Elderberry Longhorn Beetle
Modeled Habitat Distribution and Occurrence

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

© Dwight Harvey.
http://www.fws.gov/sacramento/es/recovery_plans/vp_recovery_plan_links.htm

Status

Federal: Threatened (USFWS 1994)

State: None

Critical Habitat: Critical habitat has been designated for vernal pool fairy shrimp (USFWS 2003; USFWS 2005a). Critical habitat for vernal pool fairy shrimp is not present in the Plan Area.

Recovery Plan: Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005). The Plan Area is within the Western Placer County Core Recovery Area (Zone 2) (USFWS 2005b).

Distribution

California

Vernal pool fairy shrimp is endemic to California (Eng et al. 1990). The historical range includes annual grasslands of the Great Central Valley. Currently, the species ranges from Red Bluff in Shasta County south to Tulare County. Disjunct populations also occur on the Santa Rosa Plateau, Santa Barbara County, Ventura County, the Coast Ranges of Monterey County, Riverside County, and the South Coast ranges (Eng et al. 1990; Eriksen and Belk 1999).

Vernal pool fairy shrimp have been reported from the following California Vernal Pool Regions: Northwest Sacramento Valley, Northeast Sacramento Valley, Southeast Sacramento Valley, Solano-Colusa, Livermore, Central Coast, Carrizo, San Joaquin Valley, South Sierra Foothills, and Western Riverside County (California Department of Fish and Game 1998). The California Natural Diversity Database (CNDDB) (2015) lists 738 occurrences of vernal pool fairy shrimp statewide.

Placer County Plan Area

Historical

The historical distribution of vernal pool fairy shrimp can only be inferred from the historical distribution of its habitat. Annual grasslands of western Placer County, particularly within the Great Valley ecoregion, probably supported a patchy distribution of vernal pool fairy shrimp.

Current

Numerous populations of vernal pool fairy shrimp occur in the Plan Area, which is within the Southeastern Sacramento Valley Vernal Pool Region (USFWS 2007; CNDDB 2015). The majority of extant populations in the Plan Area occur in vernal pools of the northern hardpan and north volcanic mudflow types. These vernal pool types are common to the areas surrounding the Placer County cities of Roseville, Lincoln, and Rocklin within or in close proximity to the Western Placer County core recovery area (USFWS 2007). The most westerly edge of Placer County is primarily converted to rice production and does not contain much vernal pool habitat. The vernal pool fairy shrimp has been recorded from

approximately 10 privately or publicly-owned vernal pool, wetland mitigation, or open-space preserves within western Placer County (USFWS 2007). Four of the CNDDB occurrences include multiple records at the Wildlands Inc., Orchard Creek Conservation Bank (CNDDB 2015), where this species has been recorded from 2 of 170 vernal pools surveyed within the conservation bank (USFWS 2007). The vernal pool fairy shrimp has also been observed within the Plan Area at the Redwing Preserve east of Sheridan off of Rioso Road (Restoration Resources 2011) and the Silvergate Mitigation Bank (formerly known as Wildlands Mitigation Bank) south of Wheatland along Riosa Road (Restoration Resources 2010).

Population Status & Trends

California

As of November 2015, the CNDDB listed 738 occurrences of vernal pool fairy shrimp in California (CNDDB 2015). Although vernal pool fairy shrimp are widely distributed, they are locally uncommon throughout their historical range (Eng et al. 1990). In general, the vernal pool fairy shrimp has a sporadic distribution within the vernal pool complexes, with most pools being uninhabited by the species (USFWS 2007). Helm (1998) found vernal pool fairy shrimp in 16.3 percent of pools sampled across 27 counties. Where vernal pool fairy shrimp co-occur with other shrimp species, they are always outnumbered by the other species (Eriksen and Belk 1999).

Placer County Plan Area

Numerous populations of vernal pool fairy shrimp occur in the Plan Area (CNDDB 2015). Several nature preserves and mitigation banks have been established in the Plan Area with the partial goal of preserving habitat for vernal pool fairy shrimp. These preservation areas include Wildlands, Inc.'s, Aitken Ranch Mitigation Bank, Wildlands Mitigation Bank, and Orchard Creek Preservation Area; Eastridge Southern Wetland Preserve; Sterling Pacific Assets' Lincoln Crossing Mitigation Site; Mariner Vernal Pool Conservation Bank, managed by Westervelt Ecological Services; and the City of Roseville's Woodcreek Compensation Area (Jones & Stokes 2004, CNDDB 2015).

Natural History

The habitat requirements, ecological relationships, life history, and threats to vernal pool fairy shrimp described below are summarized in diagram form in Envirogram 12 Vernal Pool Fairy Shrimp.

Habitat Requirements

Vernal pool fairy shrimp inhabit rain-filled ephemeral pools (i.e., vernal pools) that form in depressions, usually in grassland habitats (Eng et al. 1990). Vernal pool fairy shrimp can also inhabit a variety of seasonal wetland habitats (Eng et al. 1990; Helm 1998). Vernal pool fairy shrimp inhabit alkaline pools, ephemeral drainages, pools on rock outcrops, ditches, stream oxbows, stockponds, vernal pools, vernal swales, and other seasonal wetlands. Pools must fill frequently and persist long enough for the species to complete its lifecycle, which takes place entirely within vernal pools. Pools occupied by vernal pool fairy shrimp often have grass or mud bottoms and clear to tea-colored water; they are often in basalt flow depression pools in unplowed grasslands. Water chemistry is key in determining fairy shrimp occurrence; alkalinity, total dissolved solids (TDS), and pH are some of the most important factors (Eriksen and Belk 1999). The species is typically associated with smaller and shallower vernal pools

(typically about 6 inches deep) that have relatively short periods of inundation (Helm 1998) and relatively low to moderate TDS and alkalinity (Eriksen and Belk 1999). Occupied habitats range in size from rock outcrop pools as small as 1 square yard to large vernal pools up to 11 acres. The maximum potential water depth of occupied habitat ranges from 1.2 to 48 inches (Helm 1998; Eriksen and Belk 1999).

Vernal pools are characterized by a specific flora endemic to the hydrology and soil composition of the habitat. Vernal pool fairy shrimp and other fairy shrimp species have been observed in depressions filled with water that do not meet the definition of vernal pools (Helm 1998; Stone pers. comm.). Examples of non–vernal pool habitats are roadside ditches, wheel-ruts left by off-highway vehicles or other heavy equipment, and railroad toe-drains (Helm 1998). Vernal pool fairy shrimp are not found in riverine, estuarine, or other permanent waters that support fish (USFWS 1994; Eriksen and Belk 1999).

Reproduction

Male vernal pool fairy shrimp visually seek out female vernal pool fairy shrimp. The male grasps the female between the last pair of phyllopods and the brood pouch with specialized second antennae. Sperm are released directly into the female's brood pouch during copulation. Following insemination, the female releases eggs from lateral pouches into the ovisac, where the eggs are fertilized (Eriksen and Belk 1999).

Following fertilization, embryonic and cyst development begins. Embryonic development ceases when the late gastrula stage is reached. At that point, metabolism slows and a halted embryo is isolated from the environment by development of a many-layered membranous shell. The embryo and the shell comprise the cyst, or resting egg. Females carry cysts in a brood sac. Cysts are dropped to the pool bottom or remain in the female's brood sac until the female dies. Cysts are capable of withstanding heat, cold, and prolonged desiccation. When occupied pools fill with water in the same or subsequent seasons, some, but not all, of the deposited cysts may hatch. When temporary pools dry, offspring persist in suspended development as cysts in the pool substrate until the return of winter rains and appropriate temperatures allow some of the cysts to hatch (Eriksen and Belk 1999). The egg bank in the soil may comprise cysts from several years of breeding. When the vernal pools fill with rainwater and the water temperature drops below 50ºF, the resting eggs hatch into small nauplii. The early stages of vernal pool fairy shrimp develop rapidly into adults, reaching maturity in as little as 18 days (Eriksen and Belk 1999). However, the time to maturity and reproduction is temperature-dependent, varying between 18 and 147 days (Helm 1998). Immature and adult shrimp are known to die off when water temperatures rise to approximately 75ºF (Helm 1998).

Dispersal Patterns

Vernal pool fairy shrimp disperse locally during extremely wet years when individual pools in a complex spill into or are connected with adjacent pools. Long-distance dispersal can result from cysts being carried on the wind and on the bodies or in the guts of larger animals. Cysts, including those still in brood sacs, can pass undamaged and undigested through the digestive tracts of birds (Proctor et al. 1967 cited in Eriksen and Belk 1999); subsequent deposition of fecal matter can result in the inoculation of a new site. Cysts trapped in mud can adhere to the feet and feathers of waterfowl and the hooves and fur of grazing mammals and be transported to the dried mud of different vernal pool complexes (Eriksen and Belk 1999). Cysts may also be transported between pools in the digestive tracts of amphibian predators such as frogs and salamanders (Rogers pers. comm.).

Longevity

Vernal pool fairy shrimp can achieve reach maturity as few as 18 days after hatching. However, the time to maturity and reproduction is temperature-dependent, varying between 18 and 147 days (Helm 1998). In colder water temperatures (less than 57ºF), individuals have been observed to require 41 days to mature (Helm 1998). Based on laboratory observations, Helm (1998) determined the mean longevity to be 90 days. Field observations indicate that vernal pool fairy shrimp typically persist only 10–12 weeks (Eriksen and Belk 1999; Stone pers. comm.).

Sources of Mortality

The primary threats to vernal pool fairy shrimp are destruction, modification, or curtailment of habitat or range due to urban development; water supply/flood control projects; landfill projects; road development; and agricultural land conversion (USFWS 2007).

Another source of mortality to vernal pool fairy shrimp is predation. The final rule noted that predation of vernal pool crustaceans by nonnative bullfrogs (*Rana catesbeiana*) potentially increased the threat of predation beyond that found naturally (USFWS 2007). Vernal pool crustaceans lack predator-avoidance mechanisms, so they may be particularly susceptible to predation by visual predators (USFWS 2007). Bullfrogs, fish, and crayfish have been noted as potential threats to the species (USFWS 2007). Mosquitofish (*Gambusia affinis*) are also known to occur in significant numbers on vernal pools where the aquatic community or the habitat has been disturbed or degraded (USFWS 1994). Introduced mosquitofish have been shown to significantly reduce fairy shrimp abundance when introduced into pools with active shrimp (Leyse et al. 2004 as cited in USFWS 2007). In addition, both adult fairy shrimp and diapausing cysts can be crushed by foot traffic and off-highway vehicles (Hathaway et al. 1996).

Behavior

Vernal pool fairy shrimp are omnivorous filter feeders that indiscriminately filter particles of the appropriate size from their surroundings. The diet consists of bacteria and plant and animal particles, including suspended unicellular algae and metazoans (Eriksen and Belk 1999).

Adults use eleven pairs of legs, or phyllopods, for locomotion, to filter suspended food particles from the environment, and for respiration. Vernal pool fairy shrimp typically swim in a 'zig-zag' or 'figure-eight' pattern with the phyllopods oriented toward the water surface (i.e., they swim on their backs).

Movement and Migratory Patterns

The presence of vernal pool fairy shrimp adults coincides with the filling and drying pattern of the vernal pool habitats. Adult populations are typically present from mid-December through mid-March (Eriksen and Belk 1999). Resting cysts are always present in an occupied pool basin.

Ecological Relationships

Fairy shrimp is prey for migratory waterfowl, amphibians, predatory diving beetles (*Coleoptera: Dytiscida*e), water boatmen (*Hemiptera: Corixidae*), and vernal pool tadpole shrimp. Large freshwater branchiopods in California serve as an important source of protein and energy for migratory waterfowl (Eriksen and Belk 1999). Many vernal pools occur along the Pacific flyway; the use of these pools as resting and feeding grounds by migratory birds is well documented (Silveira 1998*;* Sterling pers. comm.).

Vernal pool fairy shrimp rarely co-occur with other fairy shrimp species, but when they are found in mixed assemblages they are never the most abundant species (USFWS 1994). The two species most likely to co-occur with vernal pool fairy shrimp are California linderiella (*Linderiella occidentalis*) and vernal pool tadpole shrimp (*Lepidurus packardi*). Only very rarely do vernal pool fairy shrimp co-occur with other *Branchinecta* species (Eriksen and Belk 1999).

Threats

The greatest threats to the persistence of vernal pool fairy shrimp are habitat loss and degradation resulting from urban development and agriculture. Vernal pools occur in large, flat, open grasslands that are ideal for a number of economic uses, including airports, military bases, rice and grain fields, cattle grazing, aggregate mining, and urban development.

Within the range of vernal pool fairy shrimp, cities that are rapidly expanding into vernal pool habitat where the shrimp are found include, but are not limited to, White City/Medford in Oregon, and Redding, Chico, Yuba City/Marysville, Roseville, Lincoln, Sacramento, Vacaville, Livermore, Los Banos, Paso Robles, and Hemet in California (USFWS 2007). Growth in Placer County around the City of Roseville and Lincoln is resulting in the loss and fragmentation of an important region of high density vernal pool habitat (USFWS 2007).

Conversion of vernal pool habitat to intensive agriculture continues to contribute to the decline in vernal pools (USFWS 2007). Agricultural conversion primarily threatens vernal pool fairy shrimp in the Northwestern Sacramento Valley, Southeastern Sacramento Valley, San Joaquin Valley, Solano-Colusa, Southern Sierra Foothills, and Carrizo Vernal Pool Regions (USFWS 2007).

Vernal fairy shrimp are also threatened by the encroachment of non-native annual grasses and altered hydrology (USFWS 2007). Non-native grasses maintain dominance at pool edges, sequestering light and soil moisture, promoting thatch build-up, and shortening inundation periods (USFWS 2007). Although the mechanism responsible for the change in inundation is not documented, reduction in inundation period is thought to be due to increased evapo-transpiration at the vernal pools (Marty 2005).

Both lack of grazing and excessive grazing can cause an increase in organic matter in vernal pool habitat that can eliminate the natural vernal pool invertebrate community and promote opportunistic non-native, invasive annual grass species that out compete the obligate vernal pool species (USFWS 2007). In addition, cattle increase water turbidity, deplete water levels in the vernal pools, and can directly damage vernal pool tadpole shrimp cysts with their hooves (USFWS 2007). Conversely, some vernal pools need a certain amount of grazing in order to keep them from being overgrown with non-native plants that generate deep thatch layers on the pool substrate (USFWS 2007). Cessation of cattle grazing has been found to exacerbate the negative effects of invasive nonnative plants on vernal pool inundation period, presumable due to the positive effects of grazing on evapo-transpiration rates (USFWS 2007). Vernal pool inundation has been reduced by 50 to 80 percent in the southeastern Sacramento Valley when grazing is discontinued (Marty 2005).

Context for a Regional Conservation Strategy

Vernal pool fairy shrimp are known from 18 populations in the Plan Area, and may also exist in additional locations that have not been surveyed. The majority of extant populations in the Plan Area occur in vernal pools of the northern hardpan and north volcanic mudflow types. These vernal pool

types are common to the areas surrounding the Placer County cities of Roseville, Lincoln, and Rocklin within or in close proximity to the Western Placer County core recovery area (USFWS 2007). The most westerly edge of Placer County is primarily converted to rice production and does not contain much vernal pool habitat. The vernal pool fairy shrimp has been recorded from approximately 10 privately or publicly-owned vernal pool, wetland mitigation, or open-space preserves within western Placer County (USFWS 2007). Four of the CNDDB occurrences include multiple records at the Wildlands Inc. Orchard Creek Conservation Bank (CNDDB 2015), where this species has been recorded from 2 of 170 vernal pools surveyed within the conservation bank (USFWS 2007). The vernal pool fairy shrimp has also been observed within the Plan Area at the Redwing Preserve east of Sheridan off of Riosa Road (Restoration Resources 2011) and the Silvergate Mitigation Bank (formerly known as Wildlands Mitigation Bank) south of Wheatland along Riosa Road (Restoration Resources 2010).

In the region, vernal pool fairy shrimp is found in vernal pool complexes north and south of the Placer County populations, including Yuba, Butte, Sutter, Sacramento, Yolo and Solano counties, among others. There is an absence of suitable habitat to the east, and thus the western Placer County populations probably represent the furthest eastward range of the species for the area. Within California, the greatest concentration of known populations occurs within the vernal pool complexes of western Placer County and Sacramento County. For conservation of vernal pool fairy shrimp within the Plan area, acquisition and conservation of vernal pool habitat and associated uplands and supporting hydrological systems is of highest priority.

The Plan Area is within the Western Placer County Core Recovery Area (Zone 2) identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b; USFWS 2007). There are multiple sites within this core area that are protected for the benefit of vernal pool species, including the Orchard Creek Vernal Pool Conservation Bank, Twelve Bridges Preserve, Sheridan Conservation Bank, and Yankee Slough Conservation Bank. The U.S. Air Force's Lincoln Communication Facility, which is part of the McClellan Air Force Base, is now part of the 220-acre Western Placer Schools Conservation Bank (USFWS 2007).

Modeled Species Distribution in the Plan Area

Model Assumptions

Year-round Habitat

Modeled year-round habitat for vernal pool fairy shrimp is defined by all densities of vernal pool grassland complex.

Rationale

Vernal pool fairy shrimp inhabits vernal pools that form in depressions, usually in grassland habitats. Pools must fill frequently and persist long enough for this species to complete its lifecycle, which takes place entirely within vernal pools. Not all mapped vernal pools and vernal pool grassland complexes have pools that provide suitable habitat features for vernal pool fairy shrimp; the level of detail necessary to identify microhabitat features (e.g., size and depth of pools, water chemistry) suitable for vernal pool fairy shrimp are not captured in the GIS land-cover data. Therefore, modeled habitat may overestimate suitable habitat available for vernal pool fairy shrimp.

Model Results

Species Map 12. *Vernal Pool Fairy Shrimp Modeled Habitat Distribution and Occurrence* shows the modeled habitat for vernal pool fairy shrimp in the Plan Area. Modeled habitat occurs in the western, Valley portion of the Plan Area, largely below 200 feet elevation. The documented occurrences of vernal pool fairy shrimp corresponds well with modeled habitat.

References

Printed References

California Department of Fish and Game. 1998. California vernal pool assessment, preliminary report. May. Available: http://maphost.dfg.ca.gov/wetlands/vp_asses_rept/index.htm. Accessed: January 15, 2003.

California Natural Diversity Database. 2015. RareFind, Version 3.1.0. (November 2015). Sacramento, CA: California Department of Fish and Wildlife.

Eng, L. L, D. Belk, and C. H. Eriksen. 1990. Californian anostraca: distribution, habitat, and status. Journal of Crustacean Biology 10(2):247-277.

Eriksen, C. H., and D. Belk. 1999. *Fairy shrimps of California's puddles, pools, and playas*. Eureka, CA: Mad River Press.

Hathaway, S. A., D. P. Sheehan, and M. A. Simovich. 1996. Vulnerability of branchiopod cysts to crushing. *Journal of Crustacean Biology*. 16(3):448–452.

Helm, B. 1998. The biogeography of eight large branchiopods endemic to California. Pages 124–139 in C. W. Witham, E. Bauder, D. Belk, W. Ferren, and R. Ornduff (eds.), *Ecology, conservation, and management of vernal pool ecosystems – proceedings from a 1996 conference*. Sacramento, CA: California Native Plant Society.

Jones and Stokes. 2004. Placer County Natural Resources Report: A scientific assessment of watersheds, ecosystems and species of the Phase 1 planning area. Sacramento, California. 259 pages.

Marty, J.T. 2005. Effects of cattle grazing on diversity in ephemeral wetlands. Conservation Biology 19: 1626-1632.

Restoration Resources. 2010. Silvergate Mitigation Bank (Formerly known as Wildlands Mitigation Bank): Listed Vernal Pool Branchiopod Wet Season Survey 90-Day Report. Prepared for the USFWS.

Restoration Resources. 2011. Redwing Preserve: Listed Vernal Pool Branchiopod Wet Season Survey 90-Day Report. Prepared for the USFWS.

Silveira, J. G. 1998. Avian uses of vernal pools and implications for conservation practice. Pages 92–106 in C. W. Witham, E. Bauder, D. Belk, W. Ferren, and R. Ornduff (eds.), *Ecology, conservation, and*

management of vernal pool ecosystems – proceedings from a 1996 conference. Sacramento, CA: California Native Plant Society.

U.S. Fish and Wildlife Service (USFWS). 1994. Federal Register Final Rule; determination of endangered status for the Conservancy fairy shrimp, longhorn fiary shrimp and the vernal pool tadpole shrimp; and threatened status for the vernal pool fairy shrimp. 59 FR 48136.

USFWS. 2003. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon. Federal Register Vol. 68, No. 151, 2003, pp. 46684-46867.

USFWS. 2005a. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon; Evaluation of Economic Exclusions from August 2003 Final Designation. Federal Register Vol. 70, No. 154, 2005, pp. 46924-46999.

USFWS. 2005b. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, Oregon. xxvi +606 pages.

USFWS. 2007. Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) 5 year review: Summary and Evaluation. Sacramento, California. 74 pages.

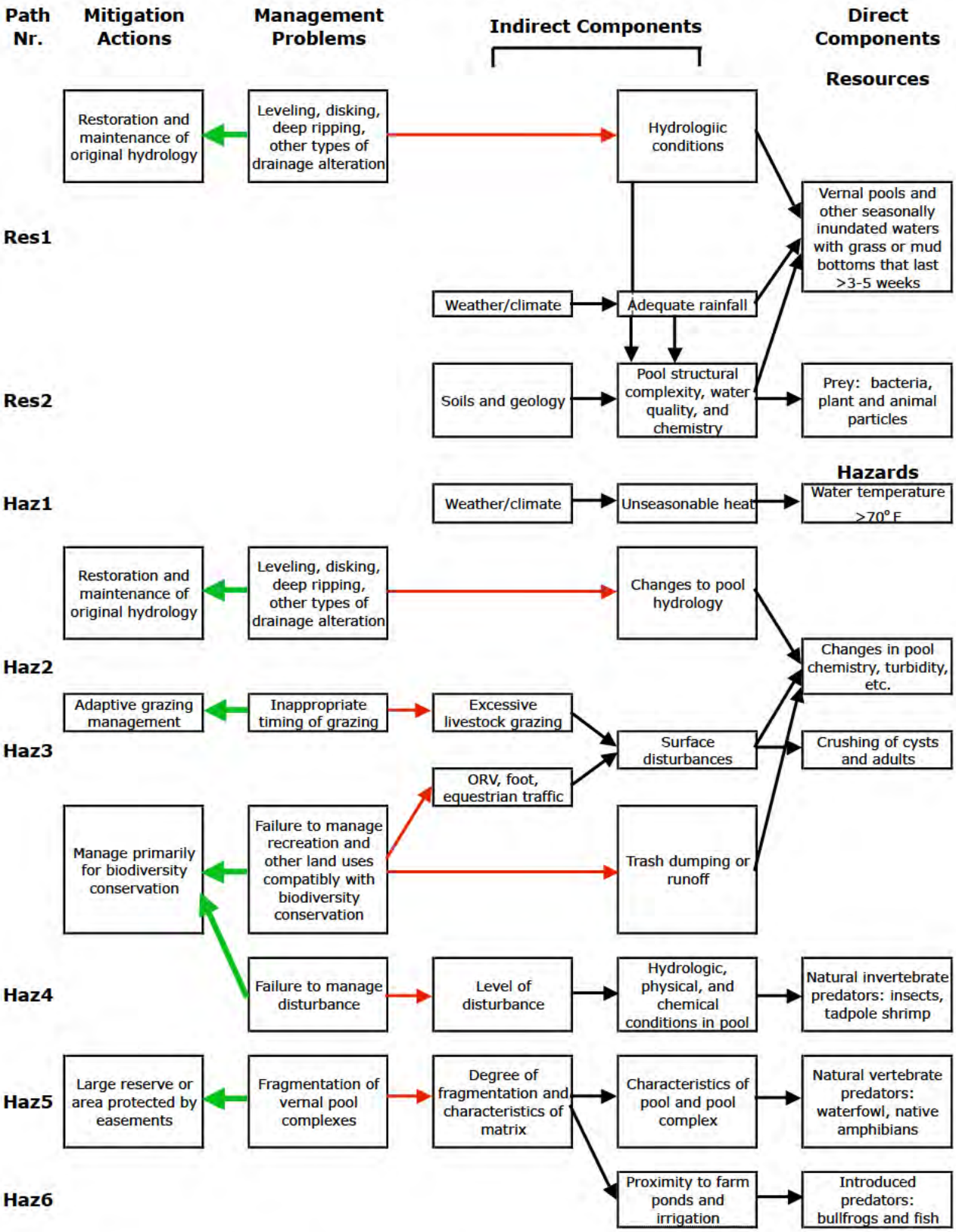
Personal Communications

Rogers, D. C. Invertebrate Ecologist. EcoAnalysts, Inc. December 2002 – telephone conversation.

Sterling, John. Wildlife Biologist. Jones & Stokes. January 2003 – meeting.

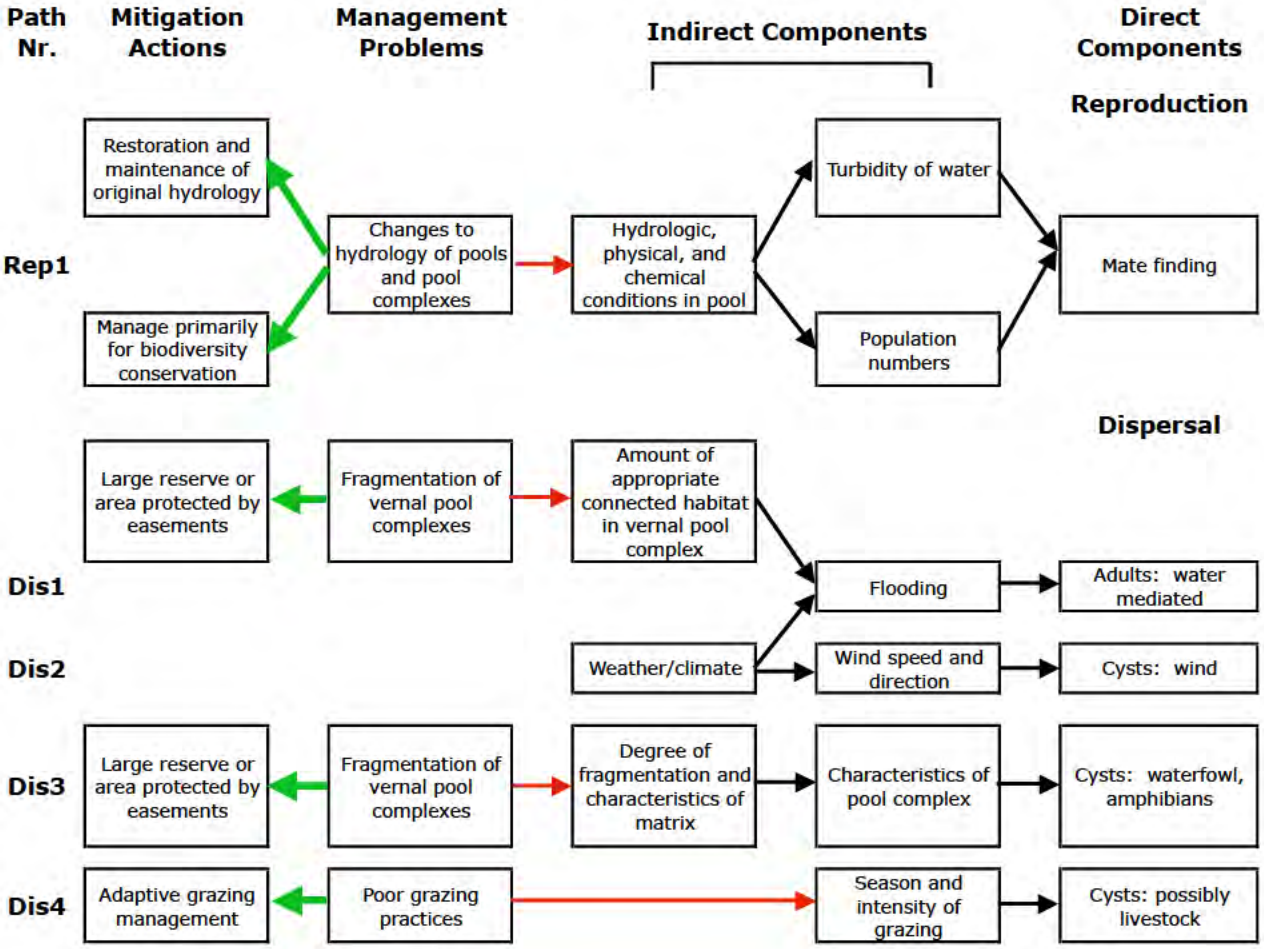
Stone, Patrick. Invertebrate Ecologist. Jones & Stokes. 1999–2002. Field surveys.

Envirogram 12 Vernal Pool Fairy Shrimp, *Branchinecta lynchi* (page 1)



Envirogram 12 Vernal Pool Fairy Shrimp. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram 12 Vernal Pool Fairy Shrimp, *Branchinecta lynchi* (page 2)



Envirogram Narrative

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Vernal pool fairy shrimp are most commonly found in vernal pools and other seasonally inundated waters with grass or mud bottoms that last long enough for them to complete their life cycle (>3-5 weeks). Such waters are usually associated with natural hydrologic conditions; waters that have been modified by leveling, disking, deep ripping, and other types of drainage alterations are generally not suitable, and such water bodies must be restored to their natural hydrologic conditions. Adequate rainfall, a function of weather and climate, is necessary to fill the pools to the appropriate depth, and the structural complexity of the pool and its water quality and chemistry also influence its suitability for vernal pool fairy shrimp.

Res2: Vernal pool fairy shrimp feed on bacteria and plant and animal particles. Abundant and diverse prey species depend on the structural complexity of the pool and its water quality and chemistry, which in turn are influenced by the soils and geological formations in which the pool occurs as well as by hydrologic conditions and the amount and timing of rainfall.

Hazards

Haz1: Vernal pool fairy shrimp are killed by water temperatures >70 °F, which can occur during periods of unseasonable heat. (A warming climate with an increasing frequency of extreme weather events could result in increasing problems of this kind in the future).

Haz2: Changes in pool chemistry and turbidity can be detrimental to vernal pool fairy shrimp. These changes can result from modifications to pool hydrology as a result of drainage alteration and from surface disturbances caused by excessive livestock grazing or recreational use. They also can result from trash dumping or runoff from various sources. Restoration of the original hydrologic conditions and close management of grazing, recreation, runoff, and dumping are necessary to preserve appropriate conditions for this species. This is best achieved by managing vernal pool complexes primarily for biodiversity conservation.

Haz3: Crushing of cysts in dry pools result from surface disturbances such as livestock grazing and ORV, foot, or equestrian traffic. Adults can be crushed by cattle in shallow pools that are drying out. Management primarily for biodiversity conservation is the best mitigation for these hazards.

Haz4: The abundance of natural invertebrate predators such as insects and tadpole shrimp depends on the hydrologic, physical, and chemical conditions in a pool. Excessive disturbance can create conditions that create unnaturally high densities of these predators.

Haz5: Natural vertebrate predators of vernal pool fairy shrimp include waterfowl and native amphibians. The presence of these species depends upon the characteristics of the individual pool and the pool complex, which in turn are determined by the degree of fragmentation of the complex and the characteristics of the surrounding area. Fragmentation and location of the pool complex may result in abnormally high or low densities of these predators in certain pools, which could be a benefit or a disaster to a vernal pool fairy shrimp population.

Haz6: If pool complexes are located near farms and irrigation structures, introduced predators such as bullfrogs and fish could be introduced into a pool, which would inevitably result in local extirpations. Large, unfragmented pool complexes, located well away from farm ponds and irrigation ditches and managed primarily for biodiversity conservation are the best management option to control these hazards.

Reproduction

Rep1: Successful reproduction by vernal pool fairy shrimp depends on finding mates, which is largely dependent upon the turbidity of the water and the numbers of individuals in a pool. Both of these factors are related to the hydrologic, physical, and chemical conditions in the pool. Any alteration to the hydrology of the pool or pool complex can make conditions unsuitable for reproduction. Restoring the original hydrology and managing a pool complex primarily for biodiversity conservation is the best way to preserve the conditions needed for reproduction.

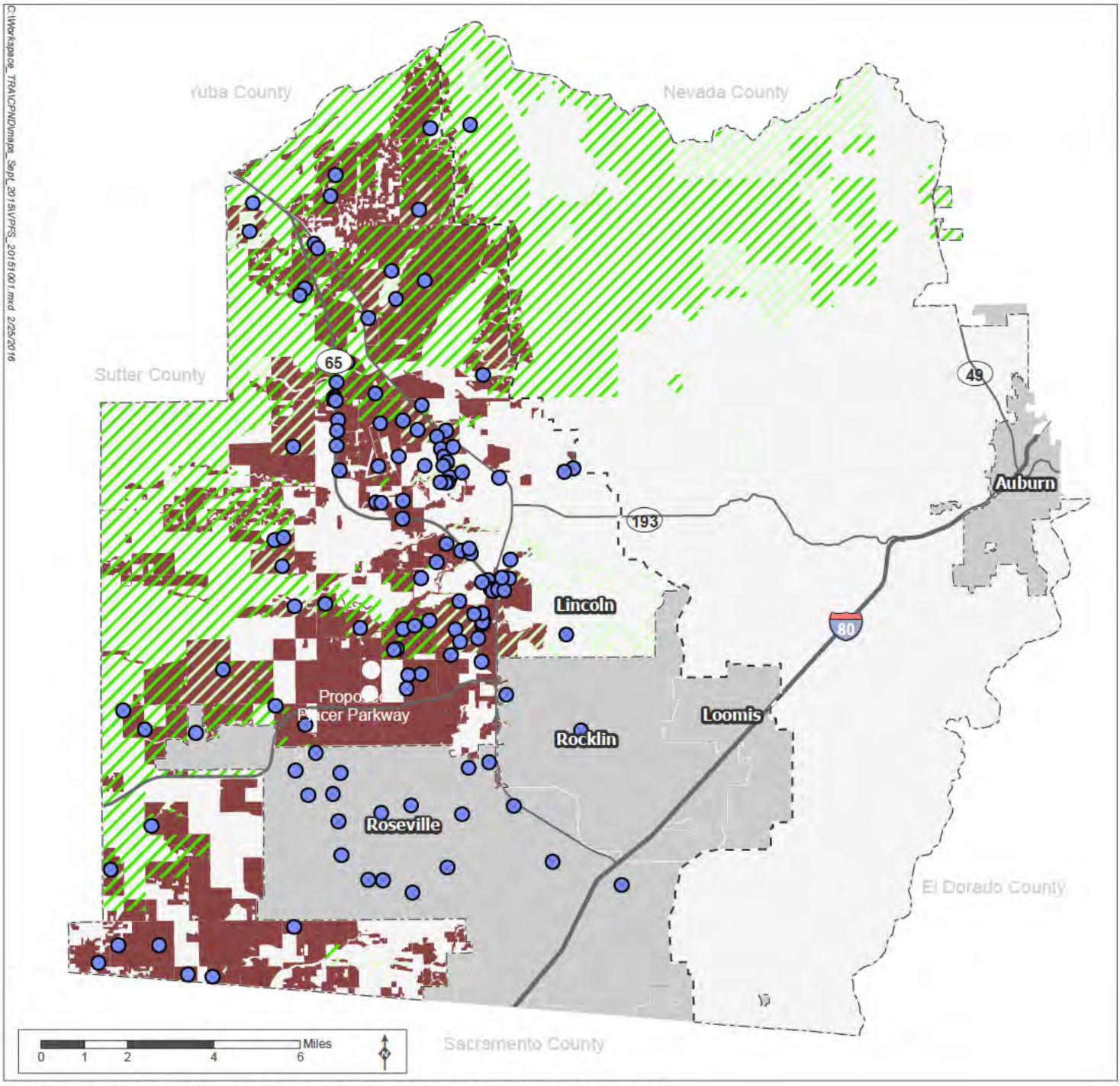
Dispersal

Dis1: Adults can disperse from pool to pool during periods of flooding caused by abundant rainfall, provided that there are appropriate pools to disperse to. Such dispersal is not very likely in small or highly fragmented vernal pool complexes.

Dis2: Cysts can be transported by the wind from dry pools; successful dispersal depends on wind speed and direction.

Dis3: Cysts also can be transported in the guts of waterfowl or amphibians. Success in this mode of dispersal depends on where the cysts are deposited. The chances of a cyst arriving in a suitable location are enhanced considerably in a large, unfragmented pool complex. Dis1 and 3 are facilitated by establishing large reserve areas and managing them primarily for biodiversity conservation.

Dis4: Cysts possibly may be transported by livestock, attached to mud on their hooves. This event would depend on livestock being in the right place at the right time and in densities that are not likely to result in excessive surface disturbance. Adaptive grazing management within a reserve must consider all these factors.



Species Map 12.

Vernal Pool Fairy Shrimp Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Vernal Pool Tadpole Shrimp
(*Lepidurus packardi*)

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Status

Federal: Endangered (USFWS 1994)

State: None

Critical Habitat: Critical habitat has been designated for vernal pool tadpole shrimp (USFWS 2003; USFWS 2005a). Critical habitat for vernal pool tadpole shrimp is not present in the Plan Area.

Recovery Plan: Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b). The Plan Area is within the Western Placer County Core Recovery Area (Zone 2) (USFWS 2005b).

Distribution

California

Vernal pool tadpole shrimp (*Lepidurus packardi* Simon, 1886) is endemic to the Central Valley of California (USFWS 1994; Helm 1998; Rogers 2001; USFWS 2005b). Rogers (2001) determined that specimens from southern Oregon and the California Central Valley that were originally described as *L. packardi* were, in fact, *Lepidurus cryptus*, a recently described species of tadpole shrimp.

The historical range of vernal pool tadpole shrimp in California includes annual grasslands of the Great Central Valley. Today the species has a patchy distribution from Shasta County in the north to Tulare County in the south, with disjunct populations occurring in Alameda and Contra Costa Counties (USFWS 2007; California Natural Diversity Database 2015).

Vernal pool tadpole shrimp have been reported from the following California Vernal Pool Regions: Northwest Sacramento, Northeast Sacramento, Southeast Sacramento, Solano-Colusa, San Joaquin Valley, South Sierra Foothill, and Central Coast (USFWS 2007). The California Natural Diversity Database (2015) lists 309 occurrences of vernal pool tadpole fairy shrimp in California. These occurrences have been documented in 20 counties, including Alameda, Butte, Colusa, Contra Costa, Fresno, Glenn, Kings, Merced, Placer, Sacramento, San Benito, San Joaquin, Shasta, Solano, Stanislaus, Sutter, Tehama, Tulare, Yolo, and Yuba counties. Sacramento County contains the greatest amount of the known occurrences (USFWS 2007).

Placer County Plan Area

<u>Historical</u>

The historical distribution of vernal pool tadpole shrimp can only be inferred from the historical distribution of its habitat. Annual grasslands of western Placer County, particularly within the Great Valley ecoregion, probably supported a patchy distribution of vernal pool tadpole shrimp (Rogers pers. comm.).

Current

There are four recent occurrences of vernal pool tadpole shrimp in the Plan Area. In 1996, vernal pool tadpole shrimp, was found at the U.S. Air Force Lincoln Communications Facility where at least four vernal pools of a 236-pool complex supported vernal pool tadpole shrimp (36 pools were surveyed). Nearby, a population was found on the West Placer School District property, between Markham Ravine and Auburn Ravine. In 2006, twenty shrimp were observed on the site's 9.38 acres of naturally occurring wetlands and swales (California Natural Diversity Database 2015). Vernal pool tadpole shrimp has been found at Woodcreek Oaks Mitigation Site between Kasenburg Creek and the south branch of Pleasant Grove Creek; adults were observed in one pool on this site in 1995; however, this occurrence may be extirpated (USFWS 2007). In 2003, Helm Biological Consulting found vernal pool tadpole shrimp near the intersection of Watt Avenue and Baseline Road (Helm 2012).

Population Status & Trends

California

Vernal pool tadpole shrimp distribution has been greatly reduced from historical times as a result of widespread destruction and degradation of its vernal pool habitat (USFWS 2005b). Vernal pool habitats in the Central Valley are reduced from their former area and the remaining habitats are more fragmented and isolated than during historical times (Holland 1998). As of October 2015, the California Natural Diversity Database (CNDDB) listed 309 extant occurrences of vernal pool tadpole shrimp in California. Although vernal pool tadpole shrimp is widely distributed in California, it is now locally uncommon throughout the historical range (Helm 1998; Eriksen and Belk 1999).

Placer County Plan Area

The CNDDB lists three occurrences of vernal pool tadpole shrimp (CNDDB 2015) and other surveys have found vernal pool tadpole shrimp within the Plan Area (Helm 2012). Several nature preserves and mitigation banks have been established in the Plan area with the partial goal of preserving habitat for vernal pool tadpole shrimp. These preservation areas include Wildlands, Inc.'s, Aitken Ranch Mitigation Bank, Wildlands Mitigation Bank, and Orchard Creek Preservation Area; Eastridge Southern Wetland Preserve; Sterling Pacific Assets' Lincoln Crossing Mitigation Site; and the City of Roseville's Woodcreek Compensation Area (Jones & Stokes 2004, CNDDB 2015).

Natural History

The habitat requirements, ecological relationships, life history, and threats to vernal pool tadpole shrimp described below are summarized in diagram form in the Envirogram 13 Vernal Pool Tadpole Shrimp.

Habitat Requirements

Vernal pool tadpole shrimp occur in a variety of natural and artificial seasonally inundated habitats (Helm 1998). They require seasonally aquatic habitats that are wet for at least seven weeks and dry in summer (Gallagher 1996). Helm (1998) observed vernal pool tadpole shrimp occurring in vernal pools (natural, artificial, and constructed), seasonal wetlands (natural and artificial), alkaline pools, clay flats, vernal swales, stockponds, railroad right-of-way pools, roadside ditches, and road rut pools resulting

from vehicular activity. Occupied pools and wetlands typically have highly turbid waters or aquatic vegetation that may provide shelter from predators (USFWS 1994; USFWS 2007; Stone pers. comm.). Although vernal pool tadpole shrimp have been reported to occur in turbid water (USFWS 2007), it is possible that the vernal pool tadpole shrimp actually causes the turbidity since it has been found to be a bioturbator (Croel and Kneitel 2011). Vernal pool tadpole shrimp have been collected in vernal pools ranging in size from 6.5 square feet to 88 acres (Helm 1998).

Reproduction

Vernal pool tadpole shrimp may be hermaphroditic (i.e., individuals have both male and female reproductive organs) (Rogers 2001). Diapausing cysts (eggs) occurring in the dry pool bottom hatch within 3 weeks of inundation (Ahl 1991). The hatched neonate is a metanauplius that undergoes several molts, each gaining additional phyllopod appendages until reaching sexual maturity. This process takes approximately 6–7 weeks depending on temperature and food availability (Ahl 1991; Gallagher 1996; Helm 1998). Reproduction occurs throughout the ponding season, when females average 0.39–0.47 inch in carapace length (Ahl 1991). Vernal pool tadpole shrimp have relatively high reproductive rates (USFWS 2005b). Ahl (1991) found that fecundity increases with body size; large females (greater than 0.8 inch carapace length) could deposit as many as 6 clutches ranging from 32 to 61 eggs per clutch in a single wet season. Laboratory studies conducted by Ahl (1991) revealed that eggs can hatch during the same ponding event in which they were laid without intervening dehydration. The remaining unhatched cysts settle to the pool substrate and contribute to the cyst bank for subsequent wet seasons. Optimal hatching temperature occurs between 50 and 59 degrees Fahrenheit (ºF) with hatching rates becoming significantly lower at temperatures above 68 ºF (Ahl 1991).

Dispersal Patterns

Vernal pool tadpole shrimp disperse locally during extremely wet years when individual pools in a complex spill into or are connected with adjacent pools. Long-distance dispersal can result from cysts being carried on the wind and on the bodies or in the guts of larger animals. Cysts, including those still in brood sacs, can pass undamaged and undigested through the digestive tracts of birds (Proctor et al. 1967 cited in Eriksen and Belk 1999); subsequent deposition of fecal matter can result in the inoculation of a new site. Cysts trapped in mud can adhere to the feet and feathers of waterfowl and the hooves and fur of grazing mammals and be transported to the dried mud of different vernal pool complexes (Eriksen and Belk 1999). Cysts may also be transported between pools in the digestive tracts of amphibian predators such as frogs and salamanders (Rogers pers. comm.).

Longevity

Vernal pool tadpole shrimp is considered a long-lived species (USFWS 2005b). Adults are often present and reproductive until the pools dry up in the spring (USFWS 1994). Vernal pool tadpole shrimp continue to grow throughout their lives, periodically molting their shells (USFWS 2005b). Helm (1998) found that vernal pool tadpole shrimp took a minimum of 25 days to mature and the mean age at first reproduction was 54 days. Other researchers have observed that vernal pool tadpole shrimp generally take between 3 and 4 weeks to mature (Ahl 1991).

Sources of Mortality

The greatest sources of mortality to vernal pool tadpole shrimp are predation and desiccation. Tadpole shrimp are left exposed when their habitat dries up. In addition, both adult shrimp and diapausing cysts can be crushed by foot traffic and off-highway vehicles (Hathaway 1996).

Behavior

Vernal pool tadpole shrimp are filter feeders and opportunistic predators on aquatic insect larvae, segmented worms (*Oligochaeta*), water fleas (*Cladocera*), seed shrimp (*Ostracoda*), copepods (*Copepoda*), fairy shrimp (*Anostraca*), and other vernal pool tadpole shrimp. This species hunts by moving along the pool bottom or aquatic vegetation, stirring up the muddy substrate, and capturing prey items with its phyllopods to direct them into the feeding groove or mouth (Rogers pers. comm.). This feeding behavior and predator avoidance leads to vernal pool tadpole shrimp being most often observed at the pool bottom.

Ecological Relationships

Vernal pool tadpole shrimp are preyed on by migratory waterfowl, amphibians, predatory diving beetles (*Coleoptera: Dytiscidae*), water boatmen (*Hemiptera: Corixidae*), and other vernal pool tadpole shrimp. Large freshwater branchiopods in California serve as an important source of protein and energy for migratory waterfowl (Eriksen and Belk 1999). Many vernal pools occur along the Pacific flyway; the use of these pools as resting and feeding grounds by migratory birds is well documented (Silveria 1998; Sterling pers. comm.).

Vernal pool tadpole shrimp commonly co-occur with vernal pool fairy shrimp (*Branchinecta lynchi*), Conservancy fairy shrimp (*Branchinecta conservatio*), and California linderiella (*Linderiella occidentalis*) (Helm 1998; Stone pers. comm.). Vernal pool tadpole shrimp are bioturbators and may affect other plant and animal communities in the vernal pool ecosystem by creating turbid water (Croel and Kneitel 2011).

Threats

The greatest threats to the persistence of vernal pool tadpole shrimp are habitat loss and degradation resulting from urban development and agriculture. Vernal pools occur in large, flat, open grasslands that are ideal for a number of economic uses including airports, military bases, rice and grain fields, cattle grazing, aggregate mining, and urban development.

Vernal pool tadpole shrimp are also threatened by the encroachment of non-native annual grasses and altered hydrology (USFWS 2005b; USFWS 2007). Timing, frequency, and length of inundation of vernal pools are critical to vernal pool species. Modification of the watershed surrounding the pools can allow non-native plants and/or opportunistic invertebrates to become established or eliminate the vernal pool habitat altogether (Roger 1998 as cited in USFWS 2007). Hydrology can be altered through direct means (e.g., construction of roads) or indirect means (e.g., diversions of overland flow), both of which result in decreased runoff to the vernal pool complexes and cause the pools to either not fill or to dry prematurely (USFWS 2007). Changes in upland hydrology that results in shorter inundation periods is of particular concern in vernal pool tadpole shrimp due to the species requirement for nearly two months to reach maturity (Helm 1998).

Both lack of grazing and excessive grazing can cause an increase in organic matter in vernal pool habitat that can eliminate the natural vernal pool invertebrate community and promote opportunistic non-native, invasive annual grass species that out compete the obligate vernal pool species (Roger 1998 as cited in USFWS 2007). In addition, cattle increase water turbidity, deplete water levels in the vernal pools, and can directly damage vernal pool tadpole shrimp cysts with their hooves (USFWS 2007). Conversely, some vernal pools need a certain amount of grazing in order to keep them from being overgrown with non-native plants that generate deep thatch layers on the pool substrate (USFWS 2007).

In addition, parasitic castration by flukes (*Trematoda*) has been identified as a major limiting factor for some vernal pool tadpole shrimp populations, such as at the Vina Plains in Tehama County (Ahl 1991).

Context for a Regional Conservation Strategy

Vernal pool tadpole shrimp are known from four populations in the Plan Area, and may also exist in additional locations that have not been surveyed. In the region, vernal pool tadpole shrimp is found in vernal pool complexes north and south of the Placer County populations, including Yuba, Butte, Sutter, Sacramento, Yolo and Solano counties, among others. There is an absence of suitable habitat to the east, and thus the western Placer County populations probably represent the furthest eastward range of the species for the area. Within California, the greatest concentration of known populations occurs within the vernal pool complexes of Sacramento County. The Plan Area is within the Western Placer County Core Recovery Area (Zone 2) identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b; USFWS 2007). There are multiple sites within this core area that are protected for the benefit of vernal pool species, including the Orchard Creek Vernal Pool Conservation Bank, Twelve Bridges Preserve, Sheridan Conservation Bank, and Yankee Slough Conservation Bank. The U.S. Air Force's Lincoln Communication Facility, which is part of the McClellan Air Force Base, is now part of the 220-acre Western Placer Schools Conservation Bank (USFWS 2007). For conservation of vernal pool tadpole shrimp within the Plan Area, acquisition and conservation of vernal pool habitat and associated uplands and supporting hydrological systems is of highest priority.

Modeled Species Distribution in the Plan Area

Model Assumptions

Year-round Habitat

Modeled year-round habitat for vernal pool tadpole shrimp is defined by all densities of vernal pool grassland complex.

Rationale

Vernal pool tadpole shrimp inhabits vernal pools that form in depressions, usually in grassland habitats. Pools must fill frequently and persist long enough for this species to complete its lifecycle, which takes place entirely within vernal pools. Not all mapped vernal pools and vernal pool grassland complexes have pools that provide suitable habitat features for vernal pool tadpole shrimp; the level of detail necessary to identify microhabitat features (e.g., size and depth of pools, water chemistry) suitable for vernal pool tadpole shrimp are not captured in the GIS land-cover data. Therefore, modeled habitat may overestimate suitable habitat available for vernal pool tadpole shrimp.

Model Results

Species Map 13. *Vernal Pool Tadpole Shrimp Modeled Habitat Distribution and Occurrence* shows the modeled habitat for vernal pool tadpole shrimp in the Plan Area. Modeled habitat occurs in the western, Valley portion of the Plan Area, generally below 200 feet elevation. The documented occurrences of vernal pool tadpole shrimp falls within the modeled habitat.

References

Printed References

Ahl, J. S. B. 1991. Factors affecting contributions of the tadpole shrimp, (*Lepiduris packardi*), to its oversummering egg reserves. *Hydrobiologia* 212:137–43.

Eriksen, C. H., and D. Belk. 1999. *Fairy shrimps of California's puddles, pools, and playas*. Eureka, CA: Mad River Press.

California Department of Fish and Game. 1998. California vernal pool assessment, preliminary report. May. Available: http://maphost.dfg.ca.gov/wetlands/vp_asses_rept/index.htm. Accessed: January 15, 2003.

California Natural Diversity Database. 2015. RareFind, Version 3.1.0. (October, 2015). Sacramento, CA: California Department of Fish and Wildlife.

Croel, R.C. and J.M. Kneitel. 2011. Ecosystem-level effects of bioturbation by the tadpole shrimp *Lepidurus packardi* in temporary pond mesocosms. Hydrobiologia. DOI 10.1007/s10750-011-0620-9.

Gallagher, S. P. 1996. Seasonal occurrence and habitat characteristics of some vernal pool branchiopoda in northern California, USA. *Journal of Crustacean Biology* 16(2):323–329.

Hathaway, S. A., D. P. Sheehan, and M. A. Simovich. 1996. Vulnerability of branchiopod cysts to crushing. *Journal of Crustacean Biology*. 16(3):448–452.

Helm, B. 1998. The biogeography of eight large branchiopods endemic to California. Pages 124–139 in C. W. Witham, E. Bauder, D. Belk, W. Ferren, and R. Ornduff (eds.), *Ecology, conservation, and management of vernal pool ecosystems – proceedings from a 1996 conference*. Sacramento, CA: California Native Plant Society.

Helm, B. 2012. Draft federally listed large branchiopods occurrences in western Placer County, California. Prepared for Placer County Community Development Resource Agency and Salix Consulting.

Jones and Stokes. 2004. Placer County Natural Resources Report: A scientific assessment of watersheds, ecosystems and species of the Phase 1 planning area. Sacramento, California. 259 pages.

Rogers, D.C. 2001. Revision of the neartic *Lepidurus* (Notostraca). *Journal of Crustacean Biology* 21(4): 991–1006.

Silveria, J. G. 1998. Avian uses of vernal pools and implications for conservation practice. Pages 92–106 in C. W. Witham, E. Bauder, D. Belk, W. Ferren, and R. Ornduff (eds.), *Ecology, conservation, and management of vernal pool ecosystems – proceedings from a 1996 conference*. Sacramento, CA: California Native Plant Society.

U.S. Fish and Wildlife Service (USFWS). 1994. Federal register final rule; determination of endangered status for the Conservancy fairy shrimp, longhorn tadpole shrimp and threatened status for the vernal pool fairy shrimp. Federal Register Vol. 59 September 19, 1994 48136 (59 FR 48136).

_____. 2003. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon. Federal Register Vol. 68, No. 151, 2003, pp. 46684-46867.

_____. 2005a. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon; Evaluation of Economic Exclusions from August 2003 Final Designation. Federal Register Vol. 70, No. 154, 2005, pp. 46924-46999.

_____. 2005b. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, Oregon. xxvi +606 pages.

_____. 2007. Vernal Pool Tadpole Shrimp (*Lepidurus packardi*) 5 year review: Summary and Evaluation. Sacramento, California. 46 pages.

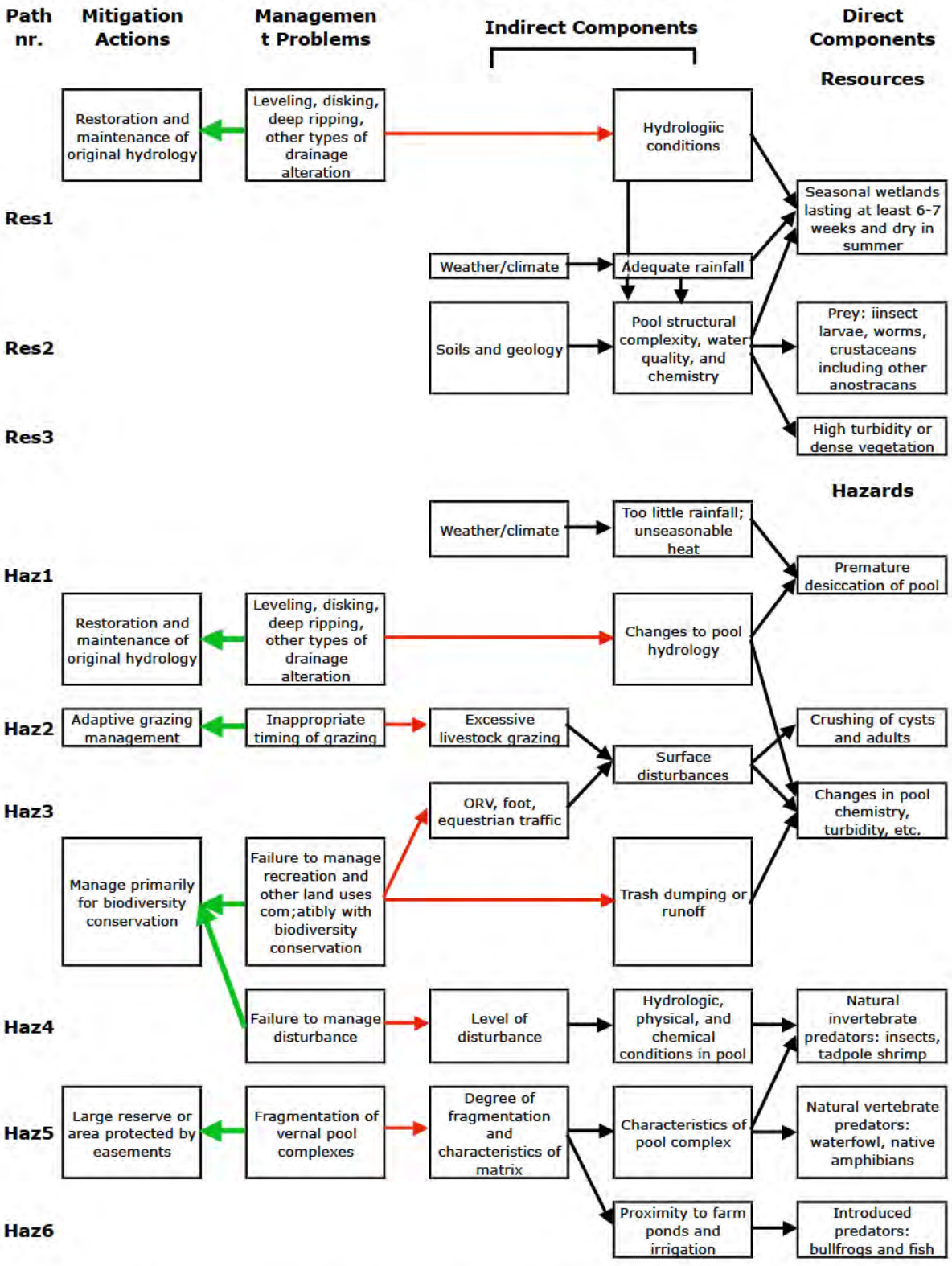
Personal Communications

Rogers, D. Christopher. Personal communication. December, 2002.

Sterling, John. Wildlife Biologist. Jones & Stokes. January 2003 – meeting.

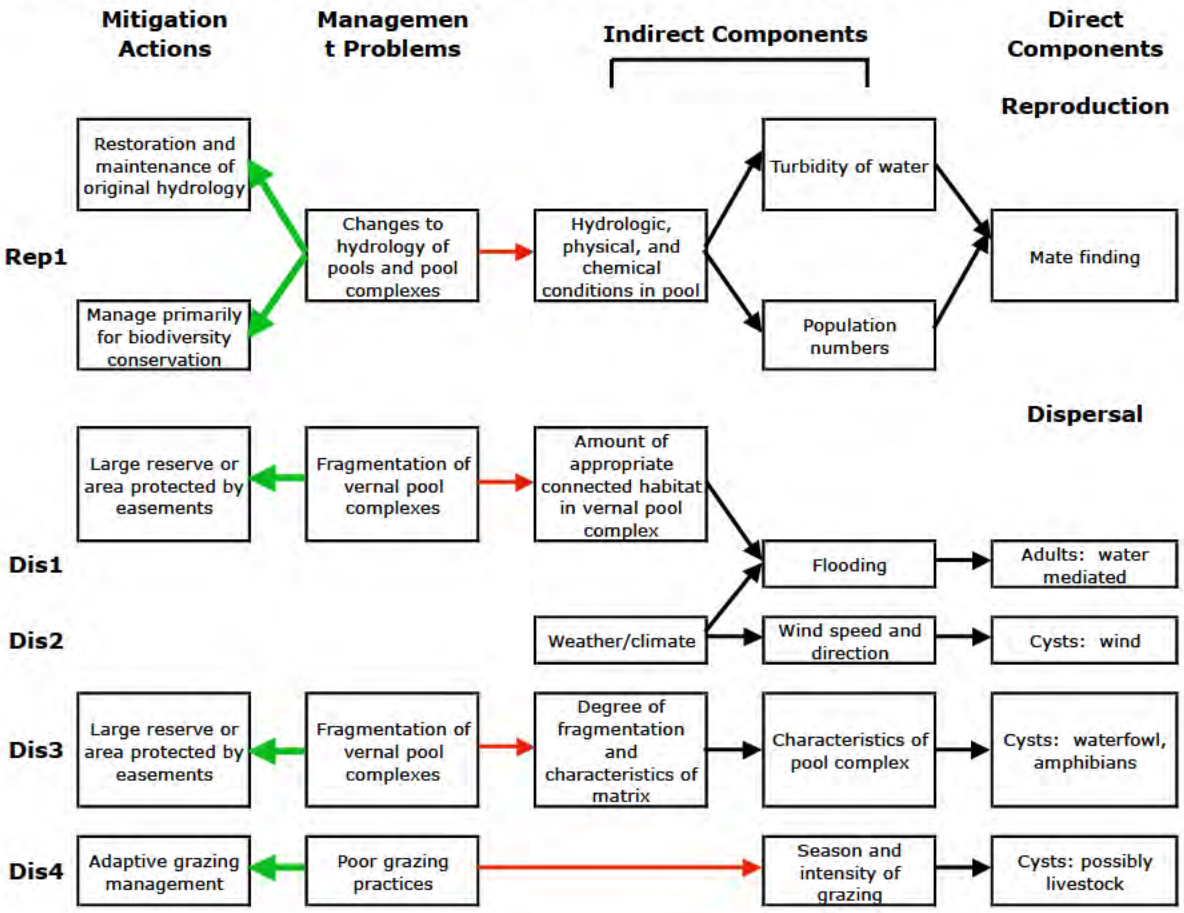
Stone, Patrick. Invertebrate Ecologist. Jones & Stokes. 1999–2002. Field surveys.

Envirogram 13 Vernal Pool Tadpole Shrimp, *Lepidurus packardii* (page1)



Envirogram 13 Vernal Pool Tadpole Shrimp. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram 13 Vernal Pool Tadpole Shrimp, *Lepidurus packardii* (page 2)



Envirogram Narrative

Vernal Pool Tadpole Shrimp (*Lepidurus packardii*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Vernal pool tadpole shrimp is found in vernal pools and seasonal wetlands that last long enough for it to complete its life cycle (at least 6-7 weeks) and dry up in summer. Such waters are often but not necessarily associated with natural hydrologic conditions; waters that have been modified by leveling, disking, deep ripping, and other types of drainage alterations often are not suitable. Altered water bodies should be restored to their natural hydrologic conditions if they are to support this species. Adequate rainfall, a function of weather and climate, is necessary to fill the pools to the appropriate depth, and the structural complexity of the pool and its water quality and chemistry also influence its suitability for the vernal pool tadpole shrimp.

Res2**:** Vernal pool tadpole shrimp feeds on small invertebrates such as insect larvae, worms and other crustaceans. Abundant and diverse prey species depend on the structural complexity of the pool and its water quality and chemistry, which in turn are influenced by the soils and geological formations in which the pool occurs as well as by hydrologic conditions and the amount and timing of rainfall.

Res3**:** Vernal pool tadpole shrimp requires pools with high turbidity or dense vegetation, probably to protect them from vertebrate predators.

Hazards

Haz1: Vernal pool tadpole shrimp are killed by premature desiccation of the pool, which can result from too little rainfall or unseasonable heat. (A warming climate with an increasing frequency of extreme weather events could create more problems in this regard in the future). Premature desiccation also can result from changes to pool hydrology, discussed in Res1 above.

Haz2: Crushing of cysts in dry pools result from surface disturbances such as livestock grazing and ORV, foot, or equestrian traffic. Adults also may be crushed by livestock in shallow pools that are drying out. Management primarily for biodiversity conservation is the best mitigation for these hazards.

Haz3: Changes in pool chemistry and turbidity can be detrimental to vernal pool tadpole shrimp. These changes can result from modifications to pool hydrology as a result of drainage alteration and from

surface disturbances caused by excessive livestock grazing or recreational use. They also can result from trash dumping or runoff from various sources. Restoration of the original hydrologic conditions and close management of grazing, recreation, runoff, and dumping are necessary to preserve appropriate conditions for this species. This is best achieved by managing vernal pool complexes primarily for biodiversity conservation.

Haz4: The abundance of natural invertebrate predators such as insects and other tadpole shrimp depends on the hydrologic, physical, and chemical conditions in a pool. Excessive disturbance can create conditions that result in unnaturally low or high densities of these predators, either to the benefit or detriment of the vernal pool tadpole shrimp population.

Haz5: Natural vertebrate predators of vernal pool tadpole shrimp include waterfowl and native amphibians. The presence of these species depends upon the characteristics of the individual pool and the pool complex, which in turn are determined by the degree of fragmentation of the complex and the characteristics of the surrounding area. Fragmentation and location of the pool complex may result in abnormally low or high densities of these predators in certain pools, which could be an advantage or a disaster to a vernal pool tadpole shrimp population.

Haz6: If pool complexes are located near farms and irrigation structures, introduced predators such as bullfrogs and fish could be introduced into a pool, which would inevitably result in local extirpations. Large, unfragmented pool complexes, located well away from farm ponds or irrigation ditches and managed primarily for biodiversity conservation are the best management option to control these hazards.

Reproduction

Rep1: Successful reproduction of vernal pool tadpole shrimp depends on finding mates, which is largely dependent upon the turbidity of the water and the numbers of individuals in a pool. Both of these factors are related to the hydrologic, physical, and chemical conditions in the pool. Any alteration to the hydrology of the pool or pool complex can make conditions unsuitable for reproduction. Restoring the original hydrology and managing a pool complex primarily for biodiversity conservation is the best way to preserve the conditions needed for reproduction.

Dispersal

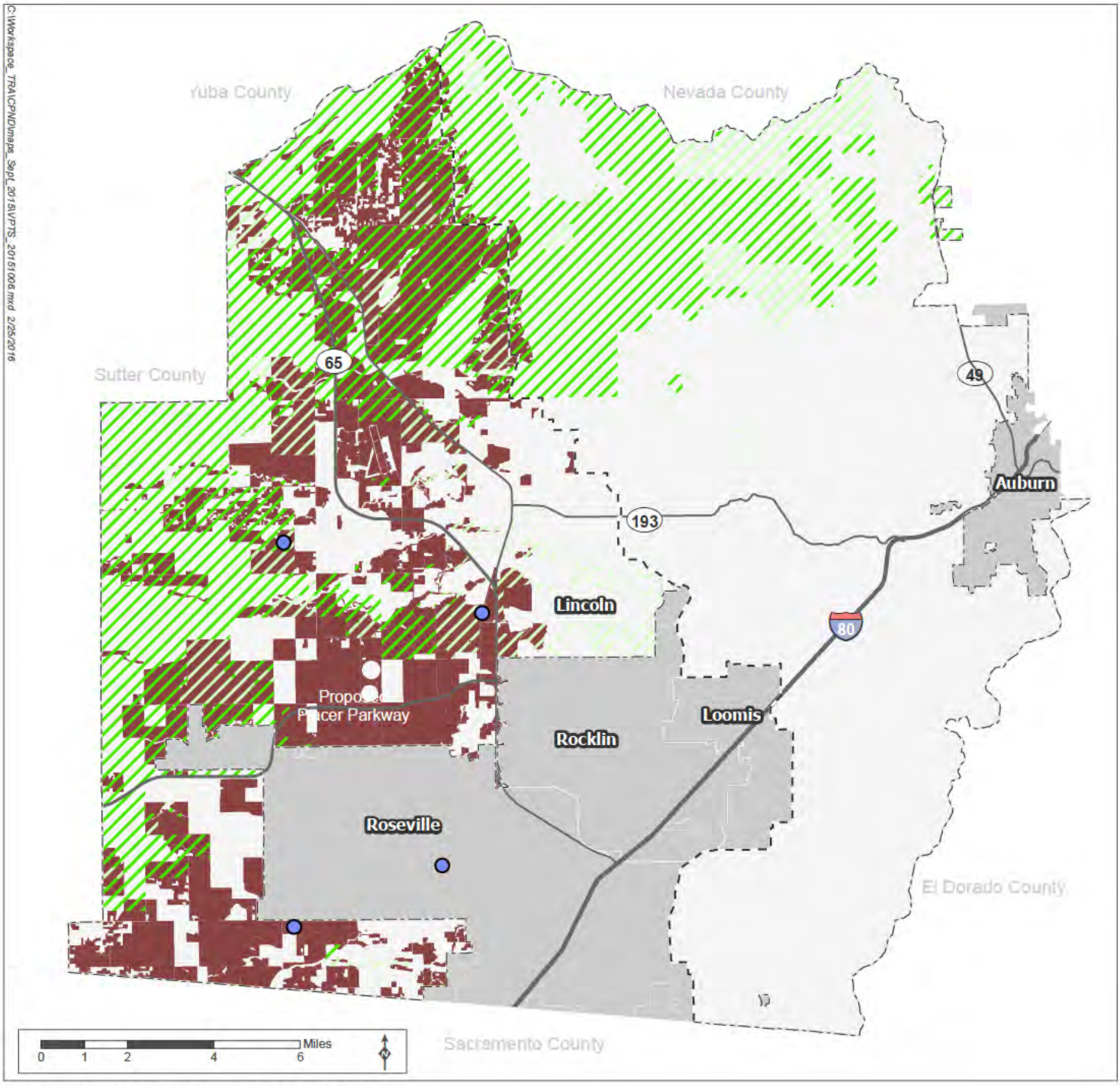
Dis1: Adults can disperse from pool to pool during periods of flooding caused by abundant rainfall, provided that there are appropriate pools to disperse to. Such dispersal is not very likely in small or highly fragmented vernal pool complexes.

Dis2: Cysts can be transported by the wind from dry pools; successful dispersal depends on wind speed and direction.

Dis3: Cysts also can be transported in the guts of waterfowl or amphibians. Success in this mode of dispersal depends on where the cysts are deposited. The chances of a cyst arriving in a suitable location are enhanced considerably in a large, unfragmented pool complex. Dis1 and Dis3 are facilitated by establishing large reserve areas and managing them primarily for biodiversity conservation.

Dis4: Cysts may be transported by livestock, attached to mud on their hooves. Successful dispersal in this manner would depend on livestock moving from pool to pool just as they were drying out. Because high densities of livestock are likely to result in excessive surface disturbance, adaptive grazing

management within a reserve must consider all the costs and benefits of using livestock as dispersal agents.



Source: Placer County, 2014; MIG | TRA, 2015; Helm Biological, 2003; CNDDB 2015

Occurrences
- Precise Location
- General Location

Modeled Habitat
- Vernal Pool Complex
- Modeled as Non-habitat

- Existing Protected Area
- Reserve Aquisition Area
- Non-participating City
- Major Road
- Valley/Foothill Divide
- Area A Boundary

Species Map 13.

Vernal Pool Tadpole Shrimp Modeled Habitat Distribution and Occurrence

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Conservancy Fairy Shrimp (*Branchinecta conservatio*)

© Larry Serpa

Status

Federal: Endangered (USFWS 1994)

State: None

Critical Habitat: Critical habitat has been designated for Conservancy fairy shrimp (USFWS 2003; USFWS 2005a). Critical habitat for Conservancy fairy shrimp is not present in the Plan Area.

Recovery Plan: Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b). The Plan Area is within the Western Placer County Core Recovery Area (Zone 2) (USFWS 2005b).

Distribution

California

Conservancy fairy shrimp is endemic to California (Eng et al. 1990). Its historical range is the annual grasslands of the Central Valley. Currently, the species ranges from the Vina plains of Butte and Tehama counties south to the Grasslands Ecological Area in Merced County. A disjunct population occurs in the Los Padres National Forest in Ventura County (USFWS 2007; USFWS 2012).

Conservancy fairy shrimp has been reported from the following California vernal pool regions: northeast Sacramento Valley, Solano-Colusa, Livermore, San Joaquin Valley, South Sierra Foothills, and Santa Barbara (USFWS 2005). Currently, 10 populations of Conservancy fairy shrimp are known to be present in California, including Vina Plains in Butte and Tehama counties; Sacramento National Wildlife Refuge in Glenn County; Mariner Ranch in Placer County; Yolo Bypass Wildlife Area in Yolo County; Jepson Prairie in Solano County; Mapes Ranch in Stanislaus County; University of California Merced area in Merced County; Highway 165 in Merced County; Sandy Mush Road in Merced County; and Los Padres National Forest in Ventura County (USFWS 2012).

Placer County Plan Area

Historical

The historical distribution of Conservancy fairy shrimp is not known and can only be inferred from the historical distribution of its habitat (USFWS 2007). Annual grasslands of western Placer County, particularly within the Central Valley ecoregion, probably supported a patchy distribution of Conservancy fairy shrimp.

Current

There is a single occupied vernal pool with Conservancy fairy shrimp in the Plan Area, which is at the Mariner Conservation Bank within the Southeastern Sacramento Valley vernal pool region (USFWS 2007; Hemmen pers. comm.).

Population Status & Trends

California

Conservancy fairy shrimp are rare, and at the time of listing, six widely separated populations of this species were known (USFWS 1994). Due to its rarity and a lack of monitoring, little is known about current population status and trends. Extensive surveys for fairy shrimp throughout the range of Conservancy fairy shrimp have located five additional populations since the species was listed in 1994 (USFWS 2012). Currently, 10 populations of Conservancy fairy shrimp are known to be present in California.

Placer County Plan Area

There is one known occurrence of Conservancy fairy shrimp in the Plan Area. One male was observed in the spring of 2007 at the Mariner Conservation Bank, located west of the City of Lincoln on North Dowd Road (USFWS 2007; Hemmen pers. comm.). Additional surveys in 2008 and 2011 detected this species in higher numbers within the same vernal pool (Helm Biological Consulting 2011 as cited in USFWS 2012). However, to date, the species is still only present in a single vernal pool at the Mariner Conservation Bank. This locality is within the Western Placer County Core Recovery Area (Zone 2) identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b; USFWS 2012). There are multiple sites within this core area that are protected for the benefit of vernal pool species, including the Orchard Creek Vernal Pool Conservation Bank, Twelve Bridges Preserve, Sheridan Conservation Bank, and Yankee Slough Conservation Bank. Conservancy fairy shrimp have not been detected during fairy shrimp surveys at any of the other sites (USFWS 2012).

Natural History

The habitat requirements, ecological relationships, life history, and threats to Conservancy fairy shrimp described below are summarized in diagram form in the Envirogram 14 Conservancy Fairy Shrimp.

Habitat Requirements

Conservancy fairy shrimp inhabits rain-filled ephemeral pools (i.e., vernal pools) that form in depressions, usually in grassland habitats (Eng et al. 1990). Pools must fill frequently and persist long enough for the species to complete its lifecycle, which takes place entirely within vernal pools. Conservancy fairy shrimp inhabit alkaline pools, vernal pools, vernal swales, and other seasonal wetlands. The pools inhabited by Conservancy fairy shrimp, often referred to as playa pools, are usually large and often have turbid water (Vollmar 2002). Playa pools often remain inundated much longer than typical vernal pools (in some cases well into the summer) and can be identified by their large size (typically greater than 60 meters in diameter) (Vollmar 2002). These pools are found on different soil and geologic formations, including Peter's clay on the volcanic Tuscan formation in Tehama County and alluvial Pescadero clay Loam of the basin rim landform of Jepson Prairie. Occupied habitats range in size from claypan vernal pools as small as 36 square yards to large vernal pools up to 89 acres. The maximum potential water depth of occupied habitat ranges from 5 to 19 inches (Helm 1998; Eriksen and Belk 1999; USFWS 2007; California Natural Diversity Database 2009). Conservancy fairy shrimp are not found in riverine, estuarine, or other permanent waters that support fish or temporary non-vernal pool habitats such as roadside ditches or railroad toe-drains.

Reproduction

Male Conservancy fairy shrimp visually seek out females. The male grasps the female between the last pair of phyllopods and the brood pouch with specialized second antennae. Sperm are released directly into the female's brood pouch during copulation. Following insemination, the female releases eggs from lateral pouches into the ovisac, where the eggs are fertilized (Eriksen and Belk 1999).

Following fertilization, embryonic and cyst development begin. Embryonic development ceases when the late gastrula stage is reached. At that point, metabolism slows and a halted embryo is isolated from the environment by development of a many-layered membranous shell. The embryo and the shell comprise the cyst, or resting egg. Females carry cysts in a brood sac. Cysts are dropped to the pool bottom or remain in the female's brood sac until the female dies. Cysts are capable of withstanding heat, cold, and prolonged desiccation. When occupied pools fill with water in the same or subsequent seasons, some, but not all, of the deposited cysts may hatch. The egg bank in the soil may comprise cysts from several years of breeding. When the vernal pools fill with rainwater and the water temperature drops below 50ºF, the resting eggs hatch into small nauplii. The early stages of Conservancy fairy shrimp develop rapidly into adults, reaching maturity in as little as 19 days (Eriksen and Belk 1999; Helm 1998).

Dispersal Patterns

Conservancy fairy shrimp disperse locally during extremely wet years, when individual pools in a complex spill into or are connected with adjacent pools. Long-distance dispersal can result from cysts being carried on the wind and on the bodies or in the intestines of larger animals. Cysts, including those still in brood sacs, can pass undamaged and undigested through the digestive tracts of birds (Proctor et al. 1967 cited in Eriksen and Belk 1999); subsequent deposition of fecal matter can result in the inoculation of a new site. Cysts trapped in mud can adhere to the feet and feathers of waterfowl and the hooves and fur of grazing mammals and be transported to the dried mud of different vernal pool complexes (Eriksen and Belk 1999). Cysts may also be transported between pools in the digestive tracts of amphibian predators such as frogs and salamanders (Rogers pers. comm.). However, due to the size and isolated nature of the existing populations in California, opportunities for recolonization are low (USFWS 2012).

Longevity

Conservancy fairy shrimp can achieve maturity in as few as 19 days after hatching. Based on laboratory observations, Helm (1998) determined that Conservancy fairy shrimp has a mean longevity of 114 days and that it takes an average of 36 days for Conservancy fairy shrimp to reach maturity. Field observations indicate that Conservancy pool fairy shrimp typically persist 10–12 weeks (Eriksen and Belk 1999; Vollmar pers. comm; Helm pers. comm.).

Sources of Mortality

The greatest sources of mortality to Conservancy fairy shrimp are predation and heatstroke. In general, Conservancy fairy shrimp are unable to filter oxygen from their aquatic habitat when water temperatures remain above 70ºF (Eriksen and Belk 1999). In addition, both adult Conservancy fairy shrimp and diapausing cysts can be crushed by foot traffic and off-highway vehicles (Hathaway et al. 1996).

Behavior

Conservancy fairy shrimp are omnivorous filter feeders that indiscriminately filter particles of the appropriate size from their surroundings. The diet consists of bacteria and plant and animal particles, including suspended unicellular algae and metazoans (Eriksen and Belk 1999).

Adults use eleven pairs of legs, or phyllopods, for locomotion, to filter suspended food particles from the environment, and for respiration. Conservancy fairy shrimp typically swim in a 'zig-zag' or 'figure-eight' pattern with the phyllopods oriented toward the water surface (i.e., they swim on their backs).

Movement and Migratory Patterns

The presence of Conservancy fairy shrimp adults coincides with the filling and drying pattern of the vernal pool habitats. Adult populations are typically present from mid-December through mid-March (Eriksen and Belk 1999). Resting cysts are always present in an occupied pool basin.

Ecological Relationships

Conservancy fairy shrimp are preyed upon by waterfowl, amphibians, predatory diving beetles (*Coleoptera:Dytiscidae*), water boatmen (*Hemiptera:Corixidae*), and vernal pool tadpole shrimp. Large freshwater branchiopods in California serve as an important source of protein and energy for migratory waterfowl (Eriksen and Belk 1999). Many vernal pools occur along the Pacific flyway; the use of these pools as resting and feeding grounds by migratory birds is well documented (Silveria 1998; Sterling pers. comm.).

Conservancy fairy shrimp co-occur with vernal pool fairy shrimp (*Branchinecta lynchi)*, California fairy shrimp *(Linderiella occidentalis*), and the vernal pool tadpole shrimp (*Lepidurus packardi*) (King et al. 1996, Helm 1998, Eriksen and Belk 1999). In general, Conservancy fairy shrimp have a large population within a given pool, and is usually the most abundant fairy shrimp when more than one species is present (Helm 1998, Eriksen and Belk 1999). The Conservancy fairy shrimp also co-occurs with several plants found in large vernal pools including Colusa grass (*Neostapfia colusana)* and various Orcutt grass species.

Threats

The greatest threats to the persistence of Conservancy fairy shrimp are habitat loss and degradation resulting from urban development and agriculture. Vernal pools occur in large, flat, open grasslands that are ideal for a number of economic uses, including airports, military bases, rice and grain fields, cattle grazing, aggregate mining, and urban development. Habitat loss is generally the result of agricultural conversion from rangelands to intensive farming, urbanization, aggregate mining, infrastructure (e.g., road and utility) projects, and recreational activities (USFWS 2007). Habitat fragmentation also limits habitat when vernal pools are broken into smaller groups or individual vernal pools and become isolated from each other as a result of human activities (e.g., road development) (USFWS 2005b, 2007). Invasive species, such as perennial pepperweed (*Lepidium latifolium*), also result in loss of vernal pool habitat. Climate change is expected to have an effect on vernal pool hydrology through changes in the amount and timing of precipitation inputs and the rate of loss through evaporation (USFWS 2012). These changes in hydrology will likely affect fairy shrimp species because they are obligate aquatic organisms with life histories dependent on certain hydrologic conditions (Pyke 2005). The suitability of vernal pools for fairy shrimp depends in large part on the timing and duration of wetland inundation since these species are dependent on vernal pools that have sufficient water to remain wet throughout the reproductive phase of the species (USFWS 2012).

Context for a Regional Conservation Strategy

Conservancy fairy shrimp is known from one occurrence in the Plan Area and may exist in additional locations that have not been surveyed. One male was observed in the spring of 2007 at the Mariner Conservation Bank, located west of the City of Lincoln on North Dowd Road (USFWS 2007; Hemmen pers. comm.). Additional surveys in 2008 and 2011 detected this species in higher numbers within the same vernal pool (Helm Biological Consulting 2011 as cited in USFWS 2012). However, to date, the Mariner Conservation Bank is still only present in a single vernal pool. This locality is within the Western Placer County Core Recovery Area (Zone 2) identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b; USFWS 2012). There are multiple sites within this core area that are protected for the benefit of vernal pool species, including the Orchard Creek Vernal Pool Conservation Bank, Twelve Bridges Preserve, Sheridan Conservation Bank, and Yankee Slough Conservation Bank. Conservancy fairy shrimp have not been detected during fairy shrimp surveys at any of the other sites (USFWS 2012).

Conservancy fairy shrimp is sparsely distributed in playa vernal pool complexes north and south of Placer County. Currently, 10 populations of Conservancy fairy shrimp are known to be present in California, including Vina Plains in Butte and Tehama counties; Sacramento National Wildlife Refuge in Glenn County; Mariner Ranch in Placer County; Yolo Bypass Wildlife Area in Yolo County; Jepson Prairie in Solano County; Mapes Rach in Stanislaus County; University of California Merced area in Merced County; Highway 165 in Merced County; Sandy Mush Road in Merced County; and Los Padres National Forest in Ventura County (USFWS 2012).

Modeled Species Distribution in the Plan Area

Species Map 14. *Conservancy Fairy Shrimp Occurrence and Vernal Pool Complex* does not model habitat for Conservancy fairy shrimp because its known distribution is highly restricted in the Plan Area to a single vernal pool and because the type of vernal pool this species typically occurs in (e.g., generally large and turbid pools; Helm 1998; USFWS 2007) is not found in the Plan Area.

References

Printed References

California Natural Diversity Database. 2015. RareFind 3, Version 3.1.0 (October 2015). Sacramento, CA: California Department of Fish and Wildlife.

Eng, L. L, D. Belk, and C. H. Eriksen. 1990. Californian anostraca: distribution, habitat, and status. Journal of Crustacean Biology 10(2):247-277.

Eriksen, C. H., and D. Belk. 1999. *Fairy shrimps of California's puddles, pools, and playas*. Eureka, CA: Mad River Press.

Hathaway, S. A., D. P. Sheehan, and M. A. Simovich. 1996. Vulnerability of branchiopod cysts to crushing. *Journal of Crustacean Biology*. 16(3):448–452.

Helm, B. 1998. The biogeography of eight large branchiopods endemic to California. Pages 124–139 in C. W. Witham, E. Bauder, D. Belk, W. Ferren, and R. Ornduff (eds.), *Ecology, conservation, and*

management of vernal pool ecosystems – proceedings from a 1996 conference. Sacramento, CA: California Native Plant Society.

Pyke, C.R. 2005. Assessing climate change impacts on vernal pool ecosystems and endemic branchiopods. Ecosystems 8: 95-105.

Silveria, J. G. 1998. Avian uses of vernal pools and implications for conservation practice. Pages 92–106 in C. W. Witham, E. Bauder, D. Belk, W. Ferren, and R. Ornduff (eds.), *Ecology, conservation, and management of vernal pool ecosystems – proceedings from a 1996 conference*. Sacramento, CA: California Native Plant Society.

U.S. Fish and Wildlife Service (USFWS). 1991. Endangered and threatened wildlife and plants; 90-day findings and commencement of status reviews for three petitions to list seven species as threatened or endangered. Federal Register Vol. 56, No. 169, August 30, 1991 42968-42970.

_____. 1994. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, and Vernal Pool Tadpole Shrimp; and Threatened Status for the Vernal Pool Fairy Shrimp. Federal Register Vol. 59, No. 180, 1994, pp. 48136-48153.

_____. 2003. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon. Federal Register Vol. 68, No. 151, 2003, pp. 46684-46867.

_____. 2005a. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon; Evaluation of Economic Exclusions from August 2003 Final Designation. Federal Register Vol. 70, No. 154, 2005, pp. 46924-46999.

_____. 2005b. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, Oregon. xxvi +606 pages.

_____. 2007. Conservancy Fairy Shrimp (*Branchinecta conservatio*) 5 year review: Summary and Evaluation. Sacramento, California. 30 pages.

_____. 2012. Conservancy Fairy Shrimp (*Branchinecta conservatio*) 5-year review: Summary and Evaluation. Sacramento, California.

Vollmar, J.E. (Ed.). 2002. Wildlife and rare plant ecology of Eastern Merced County's vernal pool grasslands. Vollmar Consulting, Berkeley, CA.

Personal Communications

Hemmen, Travis. Business Development. Westerveldt Ecological Services. June 9, 2010 – email.

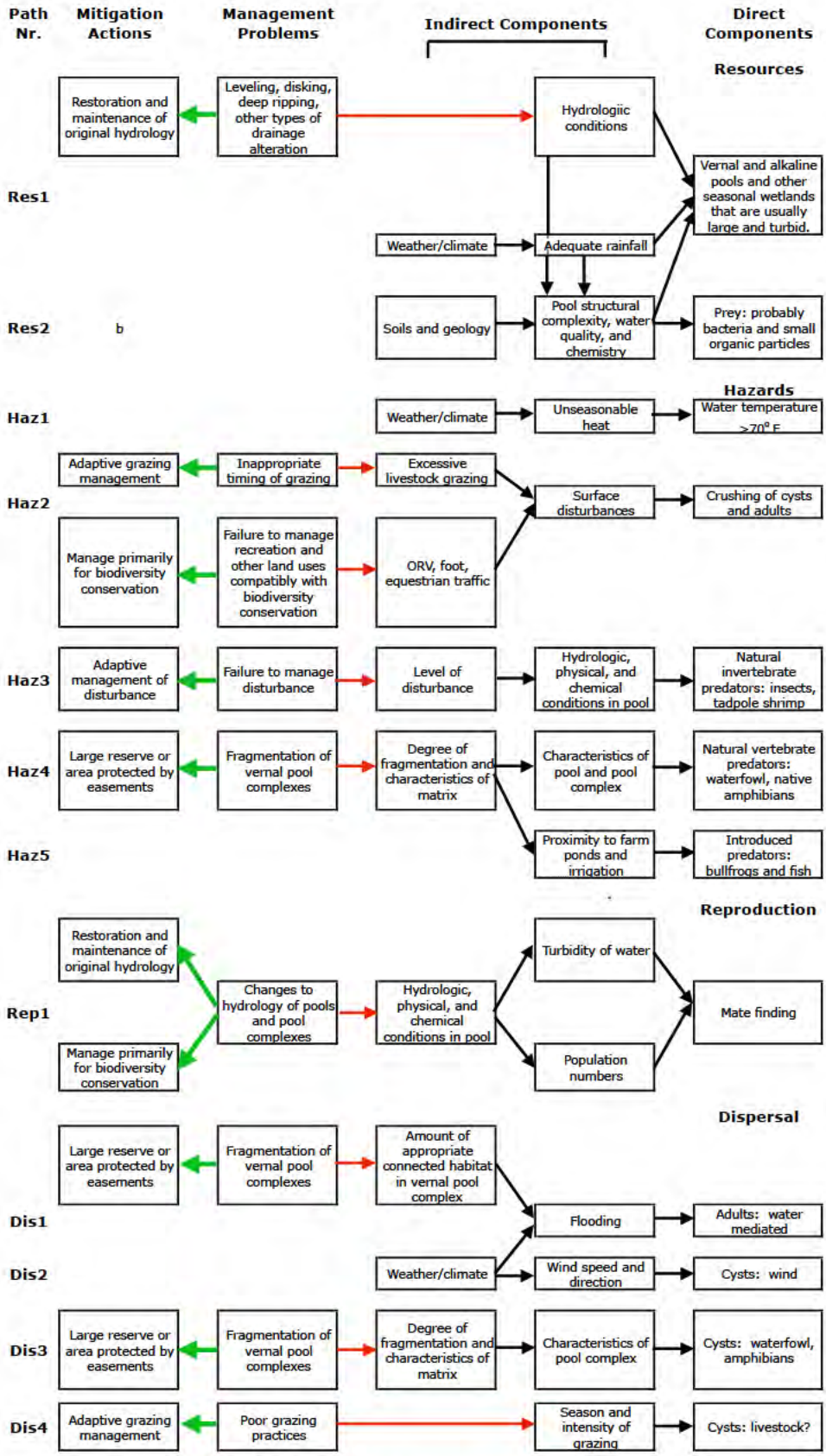
Helm, Brent. Invertebrate Biologist. Helm Biological. July 2009 – telephone conversation.

Rogers, D. C. Invertebrate Ecologist. EcoAnalysts, Inc. May 2009 – telephone conversation.

Sterling, John. Wildlife Biologist. Jones & Stokes. January 2003 – meeting.

Vollmar, John. Wetland Ecologist. Vollmar Consulting. August 18, 2009 – email.

Envirogram 14 Conservancy Fairy Shrimp, *Branchinecta conservatio*



Envirogram 14 Conservancy Fairy Shrimp. Key to abbreviations: Res = Resources; Haz = Hazards; Rep = Reproduction; Dis = Dispersal.

Envirogram Narrative

Conservancy Fairy Shrimp (*Branchinecta conservatio*)

The envirogram was created based on the information provided in the species account. The envirogram is a tool to depict and organize the most important ecological factors that affect a population or group of populations of a particular species. The envirogram consists of Direct Components – components of the environment that directly affect a species' chances to survive and reproduce, and several webs comprised of distal factors (i.e., Indirect Components, Management Problems, and Mitigation Actions) that act in sequence to affect the Direct Components. The Direct Components consist of four major categories: resources, hazards, reproduction, and dispersal. Each of these is subdivided as necessary.

The webs identify the underlying ecological processes or human actions that influence each Direct Component. Distal factors in the web activate proximate components. Each of these pathways in the web are constructed from right to left, with Indirect Components immediately to the left of Direct Components directly affecting the Direct Component, and secondary Indirect Components affecting primary Indirect Components. Management Problems can directly affect the Indirect Components, and Mitigation Actions provide solutions to remedy the Management Problems.

Resources

Res1: Conservancy fairy shrimp are most commonly found in vernal pools, alkaline pools, and other seasonal wetlands that are large and turbid. Such waters are usually associated with natural hydrologic conditions; waters that have been modified by leveling, disking, deep ripping, and other types of drainage alterations are generally not suitable, and such water bodies must be restored to their natural hydrologic conditions to create habitat for this species. Adequate rainfall, a function of weather and climate, is necessary to fill the pools to the necessary depth.

Res2: Conservancy fairy shrimp feed on bacteria and small organic particles. The abundance and diversity of prey items depend on the structural complexity of the pool and its water quality and chemistry, which in turn are influenced by the soils and geological formations in which the pool occurs as well as by hydrologic conditions and the amount and timing of rainfall.

Hazards

Haz1: Conservancy fairy shrimp are killed by water temperatures >70^{o}F, which can occur during periods of unseasonable heat. (A warming climate with an increasing frequency of extreme weather events could result in increasing problems of this kind in the future).

Haz2: Crushing of cysts in dry pools result from surface disturbances such as livestock grazing and ORV, foot, or equestrian traffic; adults also may be crushed by livestock while the pools are still partially filled. Management primarily for biodiversity conservation and managing grazing within this context are the best mitigation strategies for these hazards.

Haz3: The abundance of natural invertebrate predators such as insects and tadpole shrimp depends on the hydrologic, physical, and chemical conditions in a pool. Excessive disturbance can create conditions that create unnaturally high densities of these predators.

Haz4: Natural vertebrate predators of Conservancy fairy shrimp probably include waterfowl and native amphibians. The presence of these species depends upon the characteristics of the individual pool and the pool complex, which in turn are determined by the degree of fragmentation of the complex and

the characteristics of the surrounding area. Fragmentation and location of the pool complex may result in abnormally high or low densities of these predators in certain pools, which could be a benefit or a disaster to a Conservancy fairy shrimp population.

Haz5: If pool complexes are located near farms or irrigation structures, introduced predators such as bullfrogs and fish could be introduced into a pool, which inevitably would result in local extirpations. Large, unfragmented pool complexes, located well away from farm ponds or irrigation ditches and managed primarily for biodiversity conservation are the best management option to control these hazards.

Reproduction

Rep1: Successful reproduction in Conservancy fairy shrimp probably depends on finding mates, which in largely dependent upon the turbidity of the water and the numbers of individuals in a pool. Both of these factors are related to the hydrologic, physical, and chemical conditions in the pool. Any alteration to the hydrology of the pool or pool complex can make conditions unsuitable for reproduction. Restoring the original hydrology and managing a pool complex primarily for biodiversity conservation is the best way to preserve the conditions needed for reproduction.

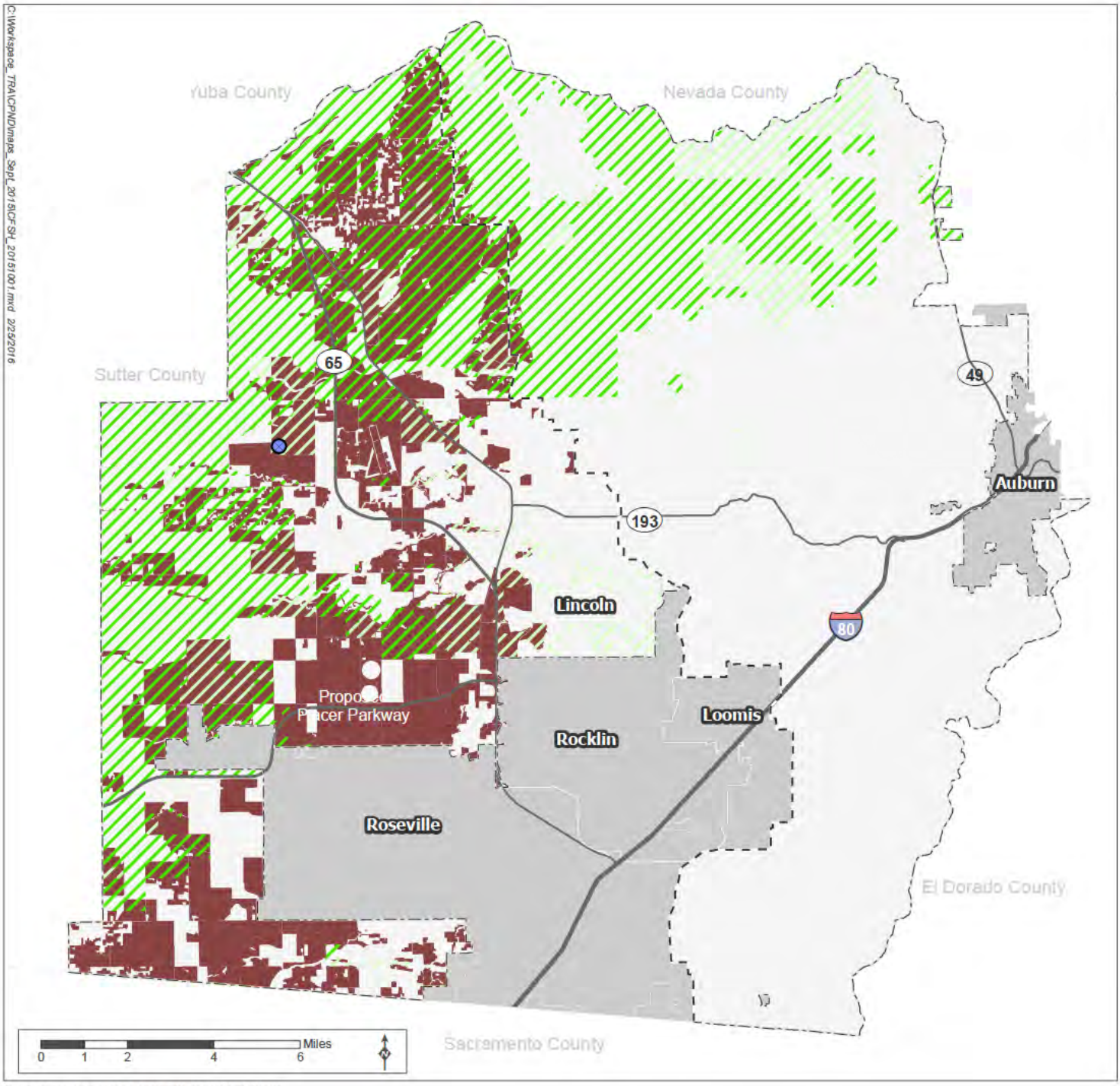
Dispersal

Dis1: Adults can disperse from pool to pool during periods of flooding caused by abundant rainfall, provided that there are appropriate pools to disperse to. Such dispersal is not very likely in small or highly fragmented vernal pool complexes.

Dis2: Cysts can be transported by the wind from dry pools; successful dispersal depends on wind speed and direction.

Dis3: Cysts also can be transported in the guts of waterfowl or amphibians. Success in this mode of dispersal depend on where the cysts are deposited. The chances of a cyst arriving in a suitable location are enhanced considerably in a large, unfragmented pool complex. Dis1 and 3 are facilitated by establishing large reserve areas and managing them primarily for biodiversity conservation.

Dis4: Cysts are possibly transported by livestock, attached to mud on their hooves. This event would depend on livestock being in the right place at the right time and in densities that are not likely to result in excessive surface disturbance. Adaptive grazing management within a reserve must consider all these factors.



Species Map 14.
Conservancy Fairy Shrimp Occurrence and Vernal Pool Complex

Placer County Conservation Program – Western Placer County HCP/NCCP

MIG TRA

Appendix E
PCWA Natural Resource Management Plan

Note to Reader: This is the PCWA's Natural Resource Management Plan in effect as of April 2009. PCWA may update this Plan periodically based on new information, in which case the updated Plan will be used for purposes of HCP/NCCP implementation. All Plan updates will maintain or improve the level of protection of natural resources provided by this version of the Plan.

Natural Resources Management Plan

for Raw Water Distribution System
Operations and Maintenance Activities

Final Draft

April 2009

prepared by MWH

BUILDING A BETTER WORLD

US Army Corps of Engineers

PCWA

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ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	micrograms per liter
315BDD	Boardman Canal near Laird Pump, downstream
315BDU	Boardman Canal near Laird Pump, upstream
ACL	Administrative Civil Liability
ANTC3B	Antelope Creek watershed at Antelope Creek at Midas Avenue
ANTCA	Antelope Canal
ANTCR	Antelope Canal Outlet Release
ANTSTUBCR	Antelope Stub Canal near Antelope Canal
ARPS	American River Pump Station
AUBRAV3	Auburn Ravine below Auburn Ravine Tunnel outlet
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin Rivers
BAUGHMANCR	Baughman Canal Outlet Release
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta
BCTRIB1	Tributary to Miners Ravine from Baughman Canal
B-IBI	benthic index of biotic integrity
BMI	benthic macroinvertebrate
BMP	best management practice
BO	Biological Opinion
BOARDMANCR	Boardman Canal Outlet Release
Ca^{2+}	calcium ion
$CaCO_3$	calcium carbonate
CARP	County Aquatic Resources Program
CCC	Criteria Continuous Concentration
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second

Cl^-	chloride ion
CLVRC3	Clover Valley Creek at Midas Avenue
CLVRC3B	Clover Valley Creek near Argonaut Avenue
CLVRC6	Clover Valley Creek at Rawhide Road
CLVRESR	Clover Valley Reservoir Release to Clover Valley Creek and Antelope Canal
CMC	Criteria Maximum Concentration
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CO_2	carbon dioxide
CTR	California Toxics Rule
CVCWA	Central Valley Clean Water Association
CWA	Clean Water Act
DCC	Dry Creek Conservancy
DFG	California Department of Fish and Game
DO	dissolved oxygen
DPR	Department of Pesticide Regulation
DWR	California Department of Water Resources
EFH	Essential Fish Habitat
EIR	environmental impact report
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
Fe^{2+}	iron
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FR	Federal Register
FRAP	California Department of Forestry and Fire Protection Fire and Resource Assessment Program
FRGCR	Ferguson Canal Outlet Release
FRGTRIB1	Tributary to Miners Ravine from Ferguson Canal
GIS	Geographic Information System
grams/year	grams per year

HANSENR	Hansen Outlet Release
HCO_3^-	bicarbonate ion
HCP	Habitat Conservation Plan
IBI	index of biotic integrity
K^+	potassium ion
MFP	Middle Fork Project
mg/L	milligrams per liter
Mg^{2+}	magnesium ion
$MgCl_2$	magnesium chloride
mgd	million gallons per day
MINERSRV3	Miners Ravine at North Sunrise Avenue
MINERSRV4	Miners Ravine at Auburn-Folsom Road
MINERSRV5	Miners Ravine at Moss Lane
MINERSRV6	Miners Ravine at Dick Cook Road
MINERSRV7	Miners Ravine at Lomida Lane
MND	Mitigated Negative Declaration
mS/cm	milliSiemens per centimeter
MS4	Municipal Separate Storm Sewer System Permits
msl	mean sea level
Na^+	sodium ion
NaCl	sodium chloride
NCCP	Natural Community Conservation Plan
ND	Negative Declaration
ND	No Date
NEPA	National Environmental Policy Act
NID	Nevada Irrigation District
NMFS	National Marine Fisheries Service
NOP	notice of preparation
NPDES	National Pollutant Discharge Elimination System
NPPA	California Native Plant Protection Act

NRMP	Natural Resources Management Plan
NTR	National Toxics Rule
NTU	nephelometric turbidity unit
O&M	operations and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
PCCP	Placer County Conservation Plan
PCFCWCD	Placer County Flood Control and Water Conservation District
PCWA	Placer County Water Agency
PG&E	Pacific Gas and Electric
PO_4	orthophosphate
RWQCB	Regional Water Quality Control Board
SC	specific conductivity
SCWA	Sacramento County Water Agency
SECRETRV2	Secret Ravine at Roseville Parkway
SECRETRV3	Secret Ravine at Rocklin Road
SMD	Sewer Maintenance District
SO_4^{2-}	sulfate ion
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TBEE	butoxyethyl ester
TDS	total dissolved solids
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA-NRCS	U.S. Department of Agriculture Natural Resource Conservation Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UV	ultraviolet
WDY	water delivery year

WHR	California Wildlife Habitat Relationship
WTP	water treatment plant
WWTP	wastewater treatment plant
YANKEECR	Yankee Hill Canal Outlet Release
YB	Yuba-Bear
YB145	Baughman Canal at the Head of Ferguson Canal
YB154	Boardman Canal at the Head of Turner Canal
YB69A	Boardman Canal at Lubeck Road
YB78	Boardman Canal at Powerhouse Road
YB81	Boardman Canal below Mammoth Reservoir
YB96	Boardman Canal below Lake Alta
YB145	Baughman Canal at the Head of Ferguson Canal
YB154	Boardman Canal at the Head of Turner Canal
YHTRIB2	Tributary to Secret Ravine from Yankee Hill Canal

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CHAPTER 1.0
INTRODUCTION

Development of a Natural Resources Management Plan (NRMP) was initiated by Placer County Water Agency (PCWA) and the U.S. Army Corps of Engineers (USACE) for operations and maintenance (O&M) activities within PCWA's raw water distribution system. This NRMP describes natural resources conditions along the PCWA distribution system and in the region, regulatory requirements for system O&M, potential effects of O&M activities on natural resources conditions, and identifies best management practices (BMP) for PCWA O&M activities.

1.1 STUDY AREA LOCATION AND DESCRIPTION

The study area for the NRMP includes the PCWA raw water distribution system, shown in **Figure 1-1,** and natural resources in the region that may be affected by PCWA O&M activities conducted within the raw water distribution system. This includes areas adjacent to canals and reservoirs, as well as drainages and streams used for conveyance of water to PCWA customers, and streams that may receive flow contributions from the canal system through regulated or unregulated releases from canal outlets. Streams in the study area include Canyon Creek, Auburn Ravine, Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine.

1.2 PURPOSE

The purpose of the NRMP is to provide a clear understanding of the regulatory setting for the canal system and receiving waters, and to identify how PCWA canal system O&M activities may affect natural resources conditions within and near the PCWA service area. This plan is intended to help PCWA staff identify BMPs that may assist in minimizing the effects of O&M activities on natural resources conditions.

1.3 REPORT ORGANIZATION

This plan includes the following topics:

- Background, study area location, descriptions, authorization, purpose, scope, and report organization (**Chapter 1**)
- Description of the PCWA raw water distribution system, and systemwide O&M activities (**Chapter 2**)
- Description of the physical and biological resources in the study area (**Chapter 3**)
- Description of the regulatory requirements potentially related to O&M activities (**Chapter 4**)

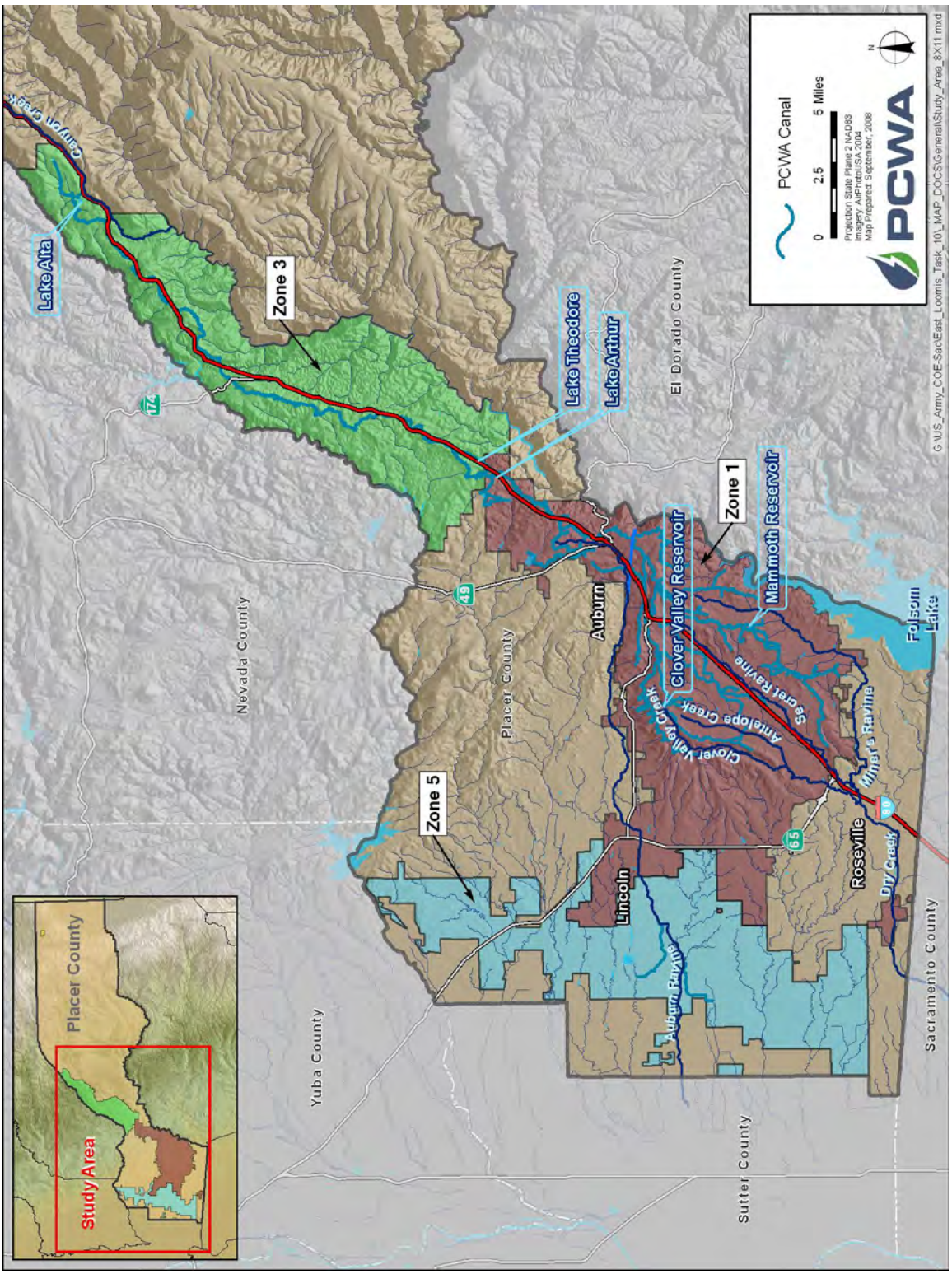

FIGURE 1-1
STUDY AREA

- Description of the potential effects of systemwide operations on natural resources conditions, regulatory framework for operations activities, and potential BMPs to minimize effects of operations activities on natural resources in the study area (**Chapter 5**)

- Description of the potential effects of maintenance activities on natural resources conditions, regulatory framework for maintenance activities, and potential BMPs to minimize effects of maintenance activities on natural resources in the study area (**Chapter 6**)

- Description of the potential effects of interrelated PCWA O&M activities on natural resources conditions, regulatory framework for interrelated PCWA O&M activities, and potential BMPs to minimize effects of interrelated activities on natural resources in the study area (**Chapter 7**)

- A list of the sources used in preparing this report (**Chapter 8**)

This plan is augmented by the following appendices:

- Appendix A – Benthic Macroinvertebrate Data Report
- Appendix B – Water Quality Conditions for Systemwide Operations
- Appendix C – Water Quality Conditions During Maintenance Activities

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CHAPTER 2.0
PCWA RAW WATER DISTRIBUTION SYSTEM

The PCWA water system was established in 1968. Water is marketed through various water contracts and five zones. Currently, PCWA supplies wholesale and retail water to a resident population and employment base of more than 1 million people. A significant amount of raw water irrigates pastures, orchards, rice fields, farms, ranches, golf courses, and is used for other uses. PCWA retails treated water to customers residing in Alta, Colfax, Auburn, Loomis, Rocklin, small portions of Roseville, Penryn, Newcastle, and in the vast unincorporated areas of western Placer County. PCWA also wholesales treated water to the City of Lincoln and several smaller special districts that then retail it to their customers. Raw water is sold to the City of Roseville, San Juan Water District (for the Granite Bay area), and special districts such as the Sacramento Suburban Water District (Sacramento Suburban, formerly Northridge Water District) that provide their own treatment and then retail water to their customers.

The following sections describe sources of PCWA's water supply, PCWA's raw water distribution system, operations of the system, and maintenance activities.

2.1 WATER SOURCES

PCWA's raw water distribution system is physically tied to Pacific Gas and Electric's (PG&E) Drum-Spaulding Project, through multiple power generation facilities, reservoirs, and water purchase points (buy points). PCWA holds water rights up to about 40 cubic feet per second (cfs) on Canyon Creek. Additional raw water supplies are pumped from the American River and delivered to customers in the lower Zone 1 and/or Zone 5 service areas. The following sections describe PCWA's water supply sources.

2.1.1 PG&E Drum-Spaulding Project

PG&E's Drum-Spaulding Project supply originates from the upper Yuba River Basin, augmented by Bowman Lake and Lake Spaulding on the South Yuba River and Rollins Reservoir on the Bear River. The water supply is conveyed primarily via the Drum, Bear River, and Upper Boardman canals. PG&E operates the Drum-Spaulding Project mainly for hydropower purposes. The majority of raw water deliveries to PCWA depend wholly on PG&E operations.

The 1968 PCWA-PG&E Water Supply Contract, as amended in 1996, provides for a maximum annual supply of 100,400 acre-feet of Zone 1 water at specified prices to be delivered through designated points at a total combined delivery rate not in excess of 244.8 cfs. PCWA also has a separate water supply contract with PG&E for an additional 25,000 acre-feet of water for PCWA's Zone 3 service area. PCWA is responsible for supplying reasonably adequate storage to meet the minimum essential requirements of its customers during any interruptions of service from PG&E, and PG&E is not liable for the insufficiency or interruption of water during droughts or as a result of certain natural or human causes.

The PG&E supply is purchased and delivered through the PG&E Towle, Bear River, Wise, and South canals at authorized buy points (points of delivery).

2.1.2 Middle Fork Project and American River Pump Station

The Middle Fork Project (MFP) is a multipurpose project designed to conserve and control waters of the Middle Fork American River, the Rubicon River, and certain tributaries for irrigation, domestic, commercial, and recreational purposes, and for the generation of electricity.

Principal MFP features include two storage reservoirs (French Meadows and Hell Hole), five diversion dams, five hydroelectric power plants, diversion and water transmission facilities, five tunnels, and related facilities. Through its MFP storage rights, PCWA has physical control of more water than it has the right to consumptively divert.

The authorized diversion points for the PCWA MFP supply are at the Auburn Dam site on the North Fork American River and Folsom Lake. When the MFP was constructed in the 1960s, the Auburn Ravine Tunnel and a 50-cfs pumping plant on the North Fork American River were installed to enable PCWA to pump water from the American River. Modifications to the Auburn Ravine Tunnel and removal of the pumping plant occurred later in anticipation of the construction of the Auburn Dam. The current facility at Auburn Dam site is a permanent pumping station installed by the U.S. Department of Interior, Bureau of Reclamation.

The permanent American River Pump Station (ARPS) is used to pump water from the North Fork of the American River into the Auburn Ravine Tunnel. The Auburn Ravine Tunnel discharges into the Auburn Ravine, a natural water course, to deliver raw water to the agricultural customers in the Zone 5 service area. The ARPS has a design capacity of 100 cfs, equivalent to an annual supply of 35,000 acre-feet. Water can be pumped out of the Auburn Ravine Tunnel into the PG&E South Canal through the Auburn Ravine Tunnel Pump Station (up to 100 cfs). This pumped water is mainly used to supply the Foothill Water Treatment Plant (WTP) with raw water during the annual PG&E Bear River canal maintenance, usually beginning in mid-October. Pumped water in excess of the Foothill WTP needs can be diverted for use at the PG&E buy points below Wise Powerhouse. Additional pump facilities are planned for the Auburn Ravine Tunnel Pump Station that will pump water from the Auburn Ravine Tunnel to supply the future Ophir WTP.

2.2 PCWA CANAL SYSTEM

The PCWA canal system contains approximately 165 miles of canals and ditches that carry about 65,000 acre-feet annually to meet the irrigation water demands of about 4,000 customers. The canals also convey raw water to water treatment plants within PCWA service areas. Approximately 51 miles of the entire canal system are lined with gunite, concrete, and/or are contained in pipelines. The remaining canal sections are unlined.

PCWA has established five retail zones for water delivery within Placer County (**Figure 2-1**):

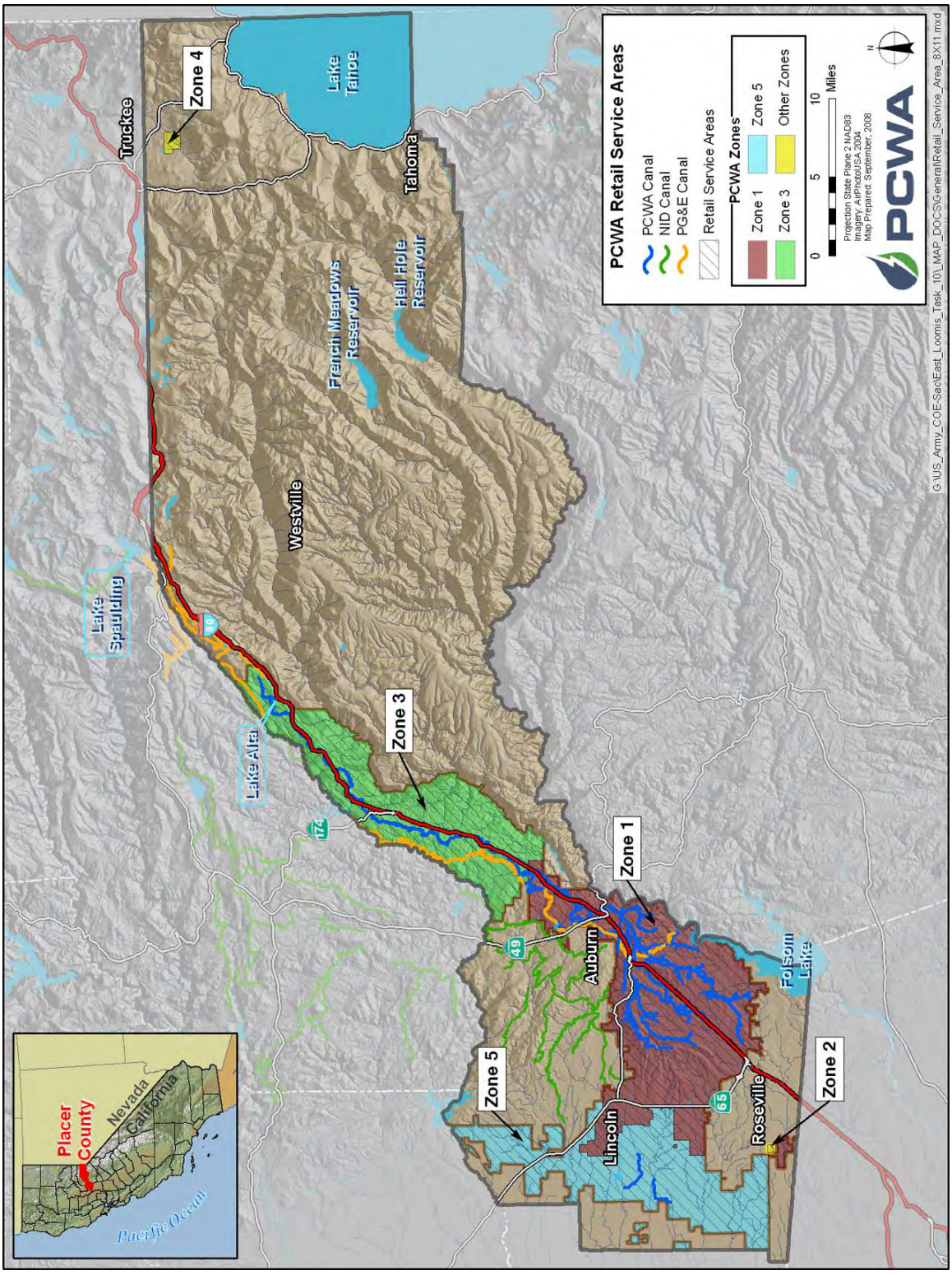

FIGURE 2-1
PCWA RETAIL SERVICE AREA ZONES

- Zone 3 is a water system acquired from PG&E in 1982 that serves the areas along the Interstate 80 corridor extending from Alta to Bowman.

- Zone 1 was created in 1968 to finance the purchase of PG&E's Lower Drum Division Water System. This system provided water service to the communities of Auburn, Bowman, Ophir, Newcastle, Penryn, Loomis, Rocklin, and Lincoln and included five WTPs and associated storage and distribution systems. Zone 1 encompasses approximately 125 square miles. Today, Zone 1 includes territory under the land-use authorities of the Cities of Auburn, Rocklin, Lincoln, a portion of the City of Roseville, the Town of Loomis, and Placer County. Zone 1 is further broken up into Upper Zone 1 and Lower Zone 1 to delineate the higher elevation service areas of Auburn and Bowman from the remaining lower elevation areas.

- Zone 5 was created in 1999 and assumed the boundaries of Placer County Zone 29. It was created to reduce reliance on groundwater supplies by providing surface water for commercial agriculture in the westernmost section of Placer County. Zone 5 is served entirely by raw surface water supplies.

- Zone 2 was created in 1979 and provides retail water service to a small residential development of 47 units located southwest of the City of Roseville. Before 2003, Zone 2 was supplied groundwater by two wells. Zone 2 was connected to the City of Roseville's water supply pipeline in 2003, and now receives water supplies conveyed from Zone 1. Zone 2 is under the land-use authority of Placer County.

- Zone 4 was created in 1996 and is located in the unincorporated Martis Valley portion of eastern Placer County. Zone 4 is served entirely by groundwater.

Since Zone 2 is served by pipeline from Zone 1, and Zone 4 is served entirely by groundwater; these zones are not described or discussed further in this management plan. The remaining zones, described below, receive raw surface water supplies through open canals and pipes, which are mainly gravity fed, and which run from Alta to western Placer County.

2.2.1 Zone 3

PCWA's Zone 3, shown in **Figure 2-2**, is located at the northeastern end of the canal system. The Zone 3 water system consists of a series of ditches, canals, and pipelines that extend approximately 35 miles above PCWA's Lake Theodore to PG&E's Alta Powerhouse. PCWA acquired these facilities from PG&E in 1982. The Boardman Canal is the main conveyance facility in the Zone 3 system.

2.2.2 Zone 1

Figures 2-3 and **2-4** show PCWA's Zone 1 service area. In addition to the PCWA supplies entering Zone 1 from Zone 3, PCWA obtains water supplies to meet customer demands in Zone 1 through purchases from PG&E just above Halsey forebay, and from Rock Creek Reservoir, Wise Canal, and South Canal. A portion of the raw water supply conveyed through Zone 1 is delivered to the Auburn, Bowman, Foothill, and Sunset WTPs for treatment and delivery to retail treated water customers, and the City of Lincoln, a wholesale treated water customer. Water for Zone 5 can be purchased at the designated PG&E buy point Yuba-Bear (YB) 136, below Wise Powerhouse, and diverted into Auburn Ravine for use by customers.

Raw water customers throughout the Zone 1 area are predominantly serviced through the Boardman, Caperton, Antelope, and Dutch Ravine canals, and numerous other canals fed from the Boardman Canal, including the Fiddler-Green, Greeley, Banvard, Sugarloaf, Red Ravine, Barton, Perry, and several other canals. The Dutch Ravine Canal, which receives flows from PG&E's South Canal, may either convey raw water to customers below in Zone 1, or during rare instances, supplement flows in Auburn Ravine for deliveries to raw water customers in the Zone 5 service area. The Auburn Ravine area within lower Zone 1 is shown in greater detail in **Figure 2-5**.

PCWA operates two regulating reservoirs within Zone 1 to manage deliveries to raw water customers. The Clover Valley Reservoir, which receives water flows from the Antelope Canal, releases water to the lower Antelope Canal, as well as the Antelope Stub Canal. Mammoth Reservoir receives water flows from the Boardman Canal, and releases to the Boardman Canal downstream. Several canals receive water flows from the Boardman Canal downstream from Mammoth Reservoir and make deliveries to raw water customers, including the Turner, Yankee Hill, Ferguson, Stallman, and Baughman canals.

The terminus of PCWA's raw water canal system in Zone 1 is the end of the Boardman Canal, located in northeastern Roseville.

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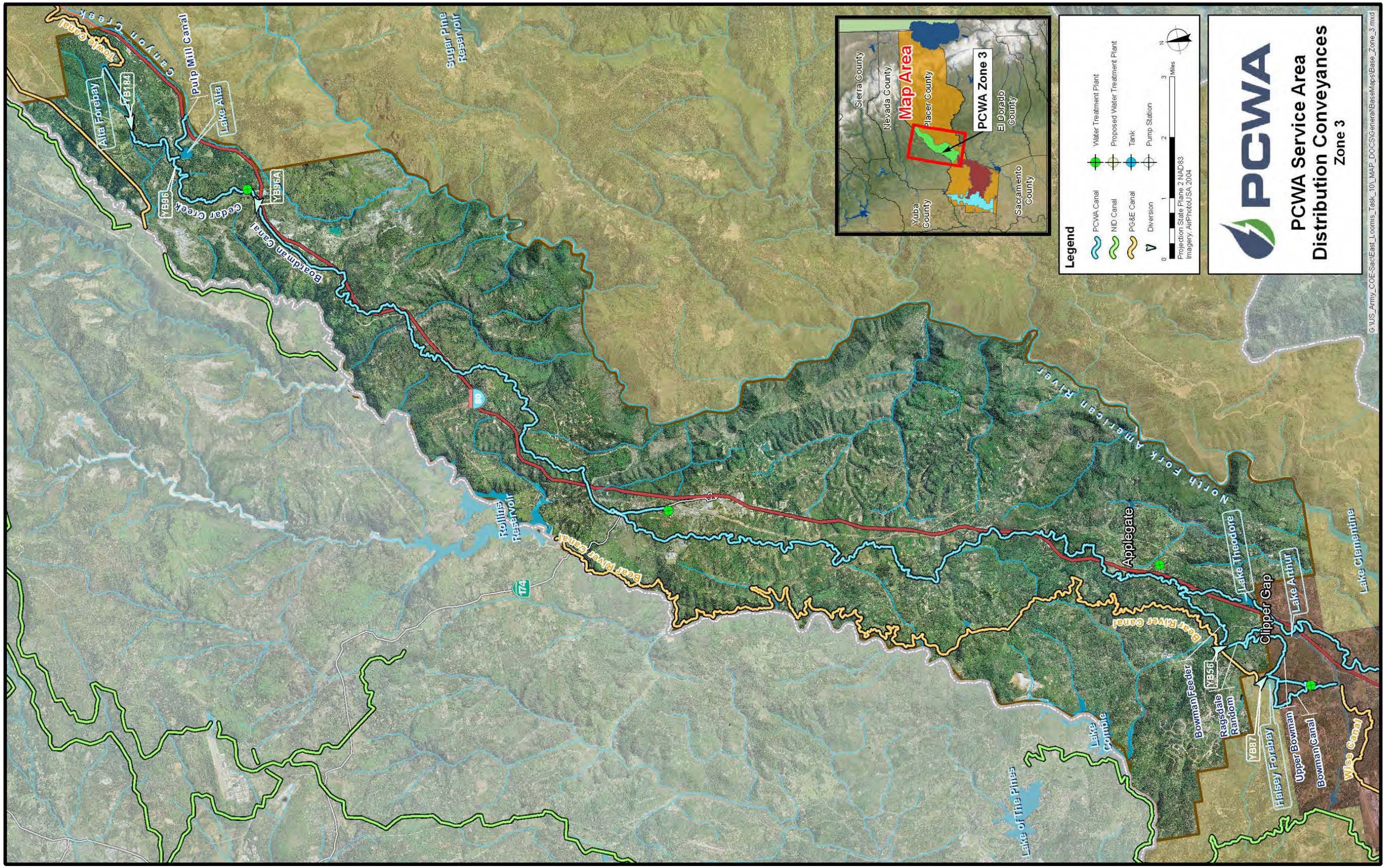

FIGURE 2-2
PCWA ZONE 3 SERVICE AREA AND DISTRIBUTION CONVEYANCES

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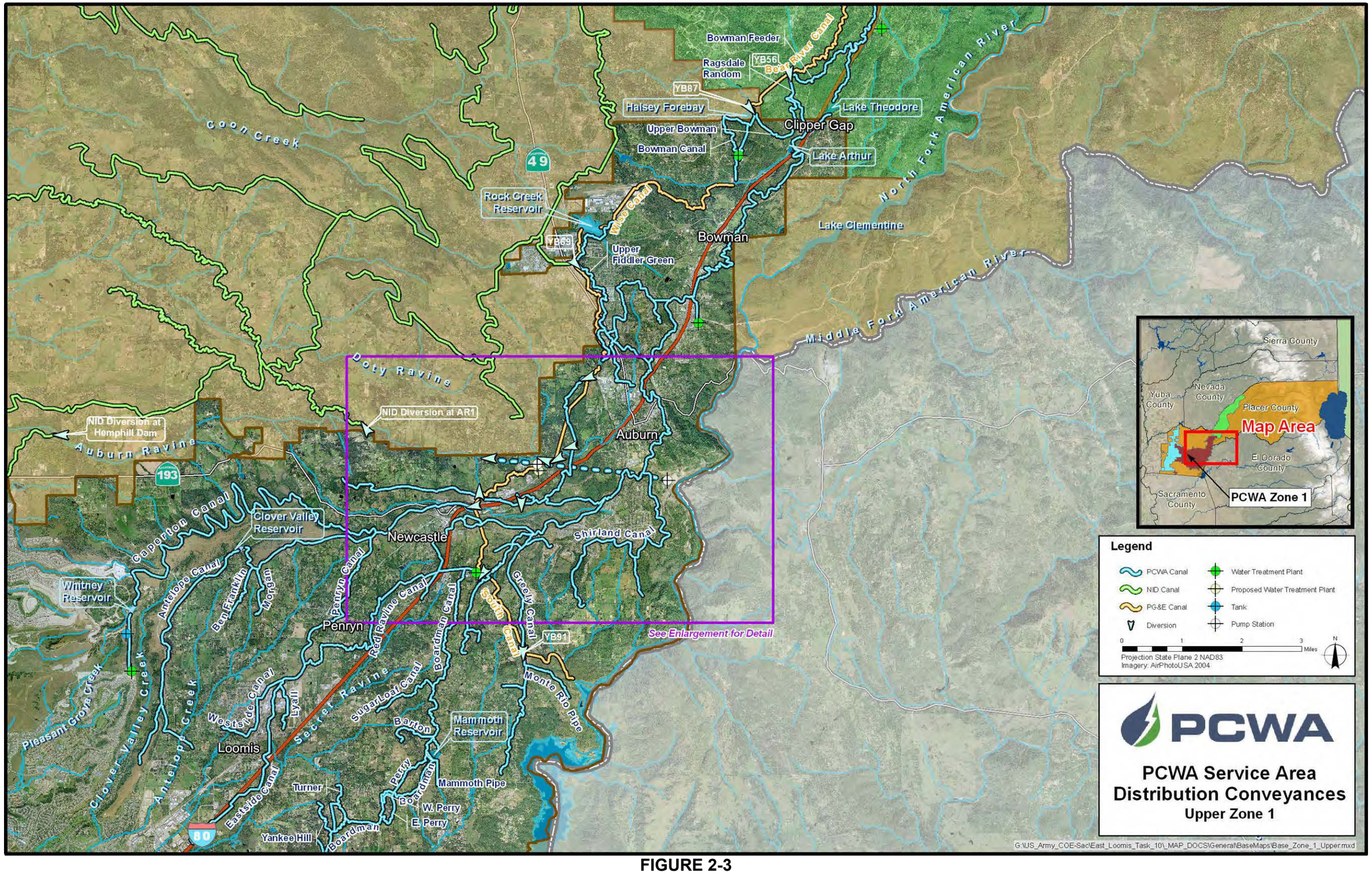

FIGURE 2-3
PCWA UPPER ZONE 1 SERVICE AREA AND DISTRIBUTION CONVEYANCES

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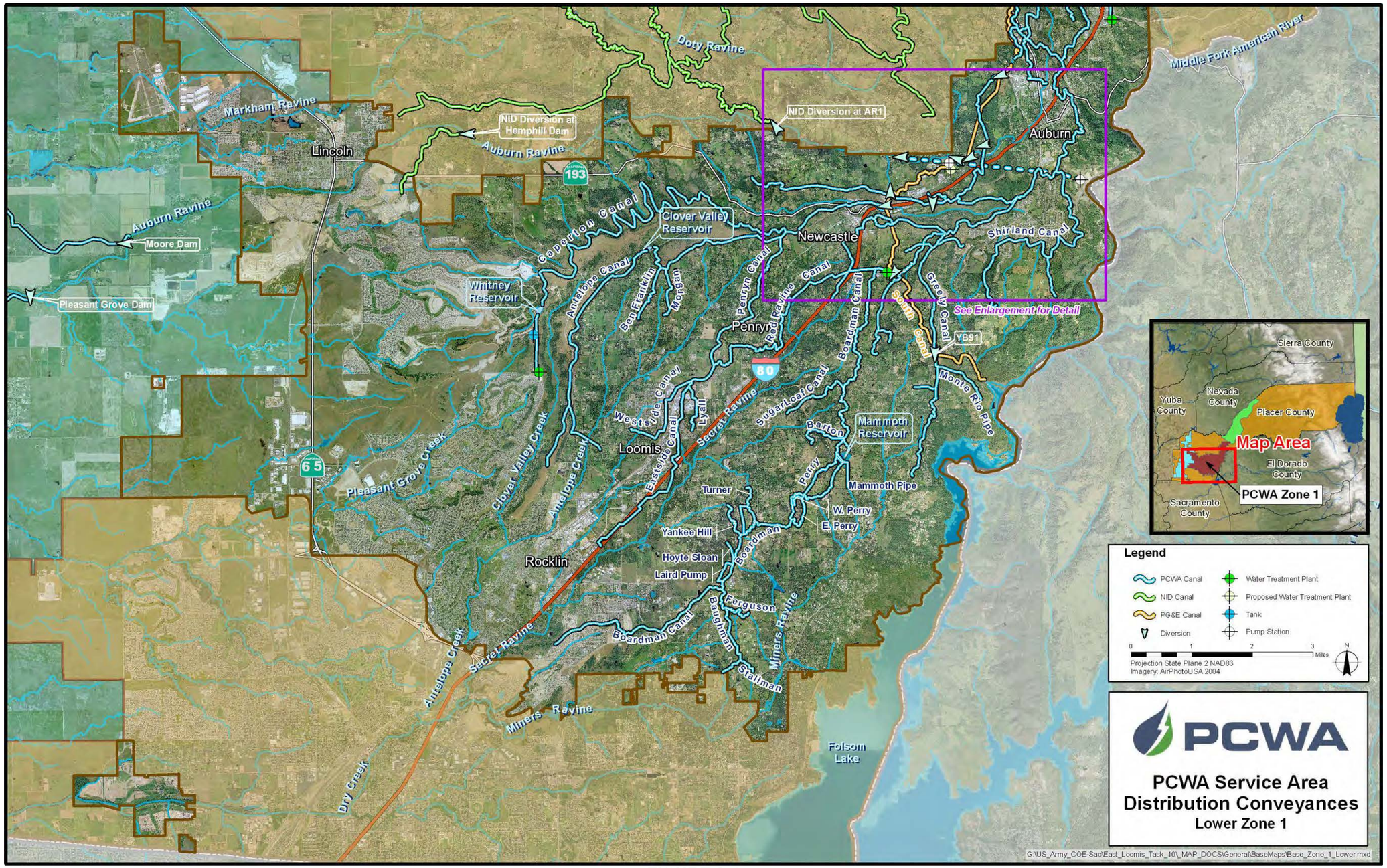

FIGURE 2-4
PCWA LOWER ZONE 1 SERVICE AREA AND DISTRIBUTION CONVEYANCES

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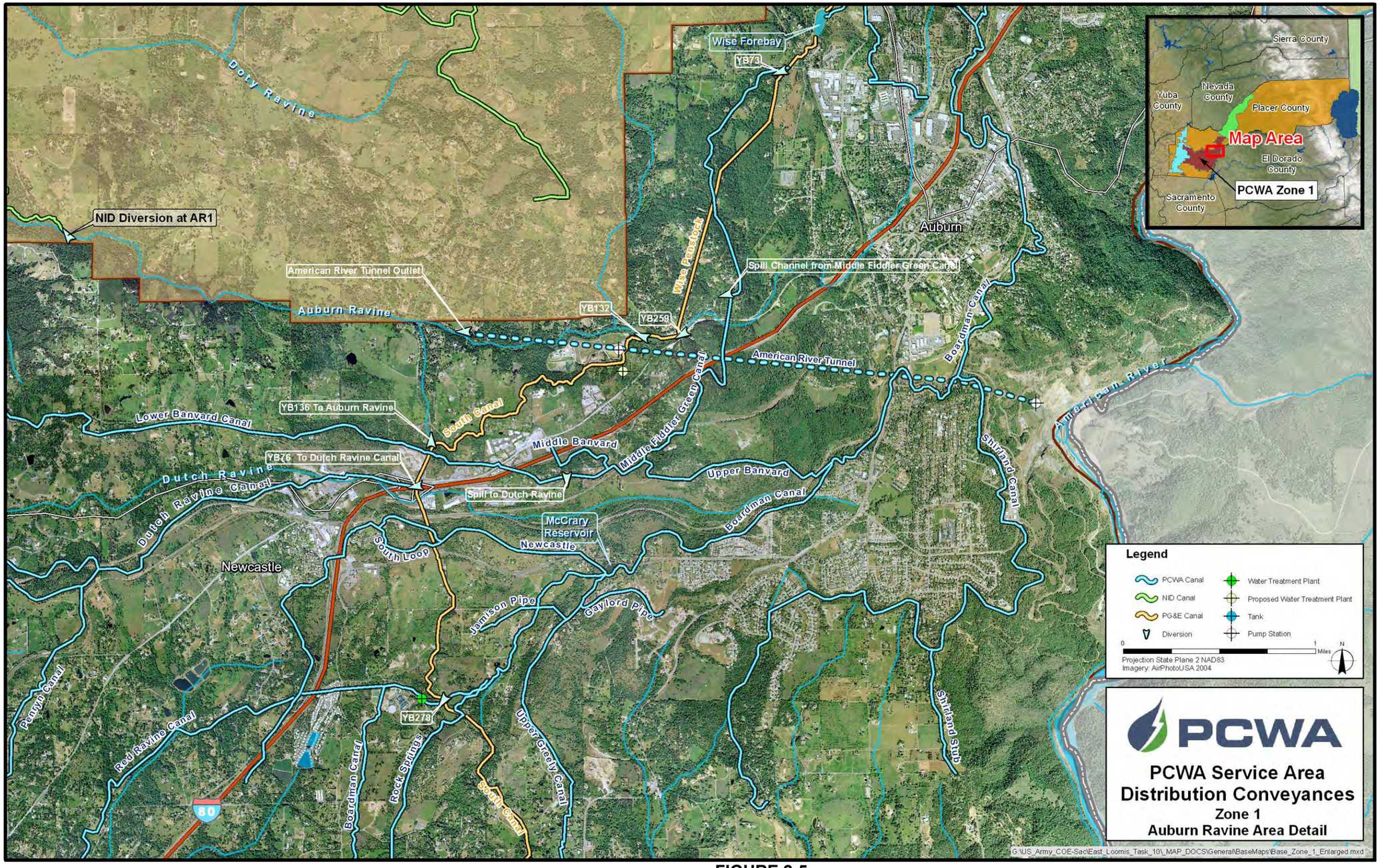

FIGURE 2-5
PCWA LOWER ZONE 1 AUBURN RAVINE AREA DISTRIBUTION CONVEYANCES

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2.2.3 Zone 5

The Zone 5 service area, shown in **Figure 2-6**, receives water deliveries from PG&E conveyed through Auburn Ravine, and delivered to customers along Auburn Ravine and canals used by the PCWA downstream. PCWA water supplies originating from either the South Fork Yuba and/or Bear River watersheds are purchased from PG&E and diverted to Auburn Ravine at a few locations downstream from PG&E Wise Penstock to meet raw water delivery demands in Zone 5. These diversions include the Dutch Ravine Canal, which receives flows from PG&E's South Canal and YB 136. PCWA may also deliver water to Zone 5 customers pumped from the North Fork of the American River through the ARPS and conveyed through the Auburn Ravine. The Nevada Irrigation District (NID) purchases water from PG&E below the Wise Powerhouse for release into Auburn Ravine. NID also releases water to Auburn Ravine from their North Canal, especially during the yearly PG&E outage.

Auburn Ravine is seasonally dammed at Moore Dam, where flows are diverted to Moore Canal for deliveries to PCWA Zone 5 customers. Further downstream, flows are diverted from Auburn Ravine for deliveries to PCWA Zone 5 customers at the Pleasant Grove Dam to the Pleasant Grove Canal. Several NID canals divert flows from Auburn Ravine with temporary and permanent control structures for deliveries to NID customers.

2.3 PCWA RAW WATER DISTRIBUTION SYSTEM OPERATIONS

The majority of the PCWA raw water distribution area is serviced by gravity flow through the canal system, as described above. Reservoirs provide flexibility in operations, allowing capture and storage of flow from portions of the upper system for release, as needed, to portions of the lower system. PCWA monitors regulating gates and staff gages throughout the system, and uses information collected to make decisions on purchase quantities from PG&E at either of the buy points described above, and adjusts deliveries in accordance with water demands and meteorological conditions.

2.3.1 Deliveries

PCWA's delivery schedules are for an entire year, or an irrigation season. The irrigation season is identified as April 15 to October 15. Water is sold to raw water customers by the miner's inch. One miner's inch equates to the flow of water through a 1-inch-square orifice with 6 inches of head, as shown in **Figure 2-7**. The purchase of 1 miner's inch of water for the irrigation season entitles the purchaser to 0.025 cfs, 24 hours a day, from April 15 to October 15. Most PCWA raw water customers receive their water from a service pipe that goes through the canal berm to their service box. Water deliveries to these customers equals the customer's real time raw water demand, with the number of miner's inches purchased being the maximum rate of delivery. Consequently, the actual delivery quantities through the service boxes are typically less than the quantity purchased.

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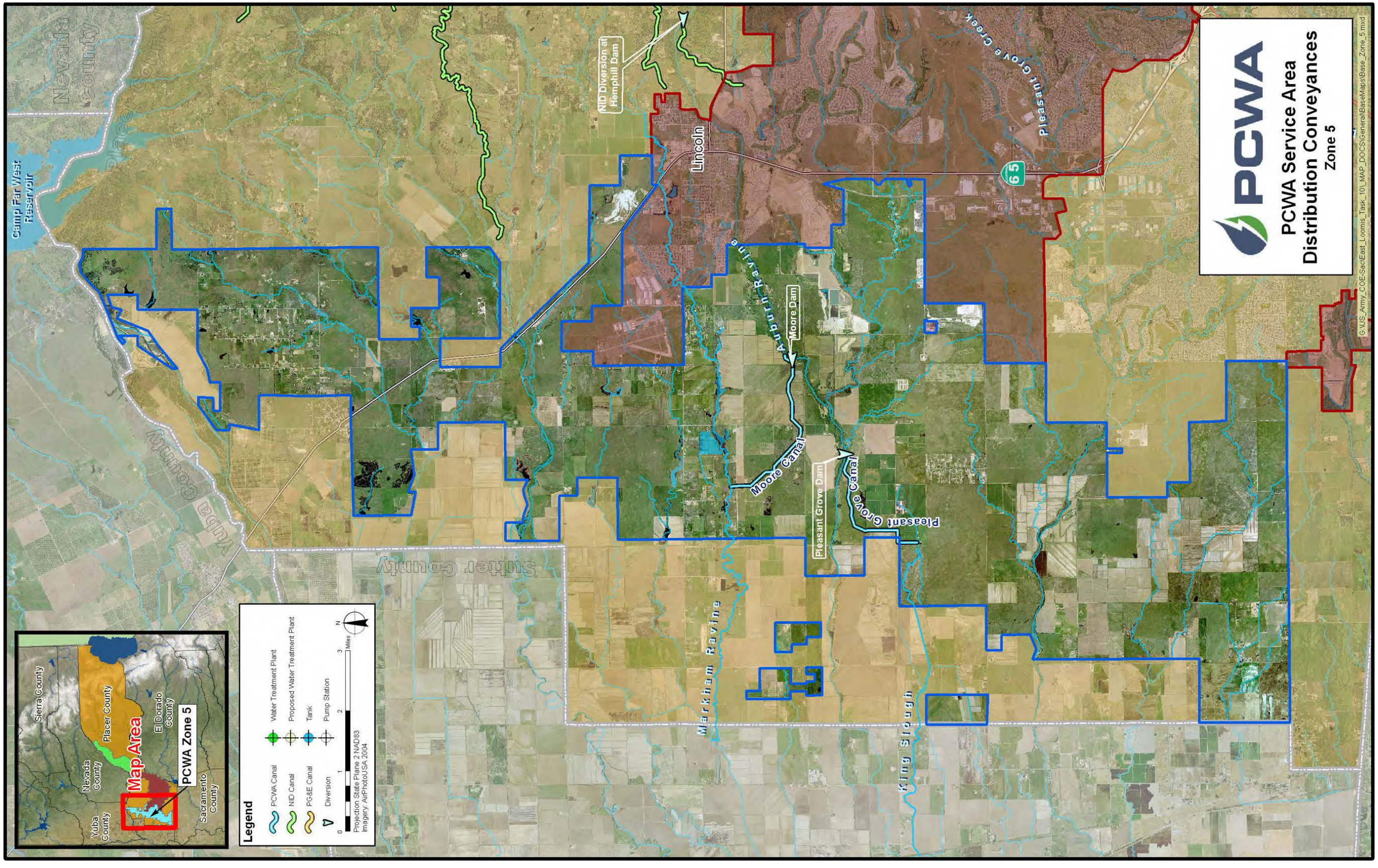

FIGURE 2-6
PCWA ZONE 5 SERVICE AREA AND DISTRIBUTION CONVEYANCES

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Orifices at delivery points may be intentionally or inadvertently removed or replaced, and/or enlarged at locations. Adjusting the size of the delivery orifice alters the rate of flow delivery at the location. Debris accumulation at a delivery orifice also affects the rate of flow, and may lead to decreases in raw water delivery quantities.

Raw water delivery purchases are associated with parcels. New customers in the PCWA service area are permitted to purchase a maximum of 0.5 miner's inch, or 0.0055 cfs, of raw water during the irrigation season, only. If a parcel is sold and service to that parcel is terminated, the new parcel owner is only permitted to purchase 0.5 miner's inch, or 0.0055 cfs, of raw water during the irrigation season.

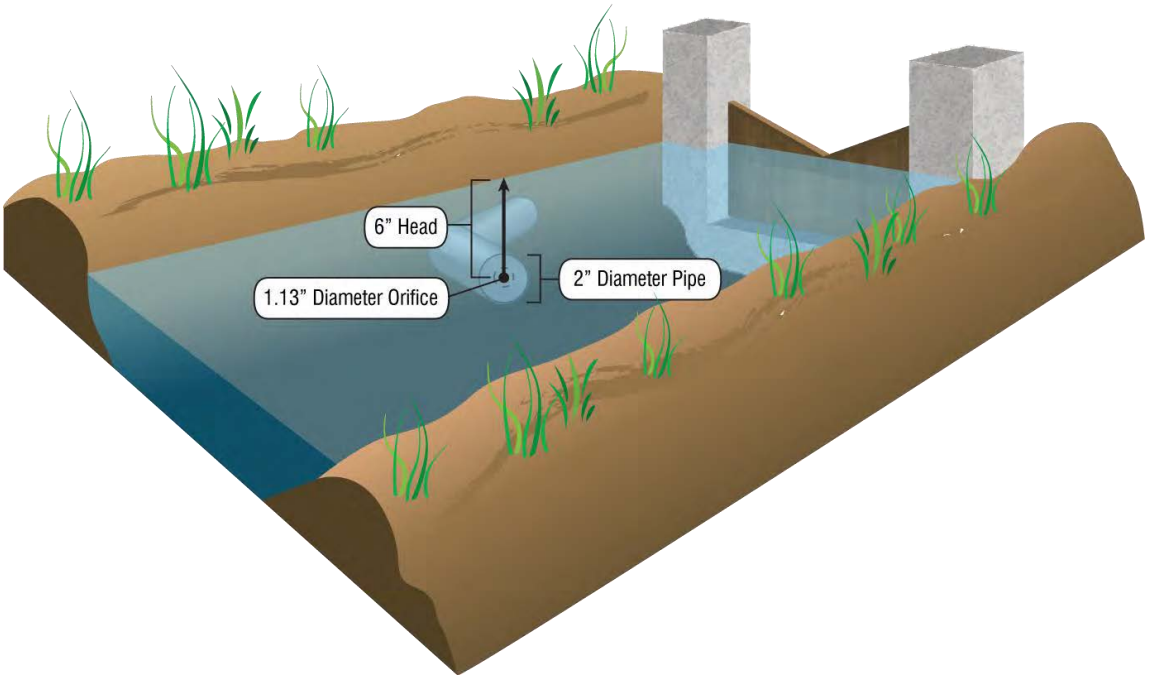

FIGURE 2-7
DELIVERY OF 1 MINER'S INCH TO PCWA CANAL SYSTEM CUSTOMERS

2.3.2 Operations

PCWA's raw water distribution is governed by customer demand and the availability of supplies. Regular operations activities occur on a yearly, seasonal, or more routine basis.

2.3.2.1 Yearly

PG&E implements an annual water delivery outage to PCWA while PG&E conducts maintenance on its system. The outage typically takes place from mid-October to mid-November, reducing water available to PCWA's Zone 1 customers from PG&E's Wise, Bear, and South canals. The amount of water available for raw water delivery depends on customer demands for treated water from PCWA's WTPs. Generally, treated water needs are met before raw water needs. During the PG&E outage, PCWA relies on stored water in surface reservoirs,

water bypassed through Zone 3, and water delivered through the ARPS to supplement flow to the WTPs and to canal customers. Water pumped from the North Fork American River through the ARPS is pumped again at PCWA's Auburn Ravine Tunnel Pump into PG&E's South Canal, and then diverted by PCWA at the Foothill WTP. Flow is greatly reduced in some areas within PCWA's raw water distribution system requiring alternative delivery schedules, such as rotating outages among canals.

2.3.2.2 Seasonal

As described previously, PCWA's delivery schedules are either for an entire year, or for an irrigation season. Depending on the purchased quantity of raw water, the orifice at each delivery point in the system may be changed before each delivery season (winter and summer). PCWA replaces the orifices at delivery points with delivery schedule changes for the irrigation season during the week of April 15, and after the irrigation season during the week of October 15. Schedule changes after the irrigation season take place during PG&E's annual water delivery outages. This activity takes about 1 week to complete, with minimal interruptions to service.

PCWA also performs flood management practices. Portions of the PCWA canal system are likely to receive and convey stormwater runoff during precipitation events, typically during the winter months. During high precipitation events that generate runoff and excess flows within the canal system, blockages along the canal cause overtopping and high water leaks develop. Resulting high canal flows may also cause bank erosion along unlined canals and at canal outlets, and can damage property. During these high precipitation events, PCWA personnel use selected outlet locations along the canals to release excess water for flood management.

2.3.2.3 Routine

Based on meteorological conditions and anticipated customer water demands, PCWA staff make operational decisions on purchase quantities from PG&E, as well as conveyance and storage decisions based on treated and raw water demands. Daily operations include reading water levels and flows at heads and ends of canals, and adjusting flows throughout the canal system, particularly at the reservoirs. Flows within the canals may be adjusted by canal operators through installing check boards, or temporary weirs, to alter head conditions and reduce or decrease diversions. PCWA's reservoirs allow for PCWA staff to make adjustments to outflows with a valve control. A limited number of pumps within the system are regularly visited by PCWA to check their operation and usage. Canal operators also frequently respond to customer requests related to canal deliveries through removing debris near delivery points, and installing or removing check boards to change head conditions at delivery locations.

2.4 PCWA RAW WATER DISTRIBUTION MAINTENANCE ACTIVITIES

PCWA performs scheduled canal maintenance in the canal system as needed and cleans the canal on an annual basis. Maintenance activities include cleaning debris from the canals, lining leaky canal sections, repairing damaged pipes and/or flumes, and controlling vegetative growth in the canals and on the canal berms through algaecide and herbicide applications. Cleaning is

performed during the winter months and is scheduled a month or more in advance. Canal lining is conducted throughout the year. Algaecide and herbicide applications are scheduled in advance and performed on a monthly or as-needed basis during the irrigation season.

2.4.1 Weed and Brush Control

PCWA has an extensive weed and brush control program for their canal distribution system that includes algaecide application to waters within the canals, physical removal of vegetation and/or herbicide applications along canal berms, and herbicide applications on aquatic vegetation in PCWA reservoirs. All algaecides and herbicides are applied by PCWA staff according to Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label instructions and PCWA application plans. Before application, PCWA evaluates the potential impacts to environmental resources, and prepares an environmental compliance document to satisfy California Environmental Quality Act (CEQA) requirements. PCWA's weed and brush control programs are described below. All algaecide and herbicide applications are performed under the supervision of a California Department of Pesticide Regulations (DPR)-certified applicator at PCWA.

2.4.1.1 Physical Removal of Vegetation

PCWA staff periodically mow, disk, trim, and/or remove vegetation along canals. Physical removal of vegetation occurs on an as-needed basis.

2.4.1.2 Algaecide Application

The growth of algae and other submerged aquatic weeds in the canal system can reduce capacity and flow velocity, as well as clog screens, pipes, siphons, and delivery outlets. To control algae and other submerged aquatic weeds, an aqueous copper-based algaecide (Cutrine-Plus®) is applied throughout the system on a monthly basis beginning in April and continuing through the summer delivery season. Copper sulfate, a stronger algaecide, is applied as needed to areas with acute algae growth.

Algae growth within Boardman Canal downstream of Mammoth Reservoir

During 2007, PCWA initiated the application of Algimycin-PWF®, also a copper-based algaecide, at select locations within the canal system upstream of WTPs. Water treated with Algimycin-PWF® does not cause increased chlorine demand, which is often a concern with the use of organic chelated copper algaecides in water treatment facilities (Applied Biogeochemists, 2007).

The aquatic weed control program is conducted under strict guidelines and supervised by a DPR-certified applicator and applied by DPR Qualified Applicators. PCWA maintains an application log for each of the sites shown in **Figures 2-8** to **2-11** and listed in **Table 2-1**. There are 21

established points of algaecide application within the system, with "spot" treatments at other locations as conditions warrant. The uppermost point of application is in the Boardman Canal as it leaves Lake Alta. The rate of application is based on the rate of flow at the point of application for the canal receiving the application and the amount of targeted vegetation growth.

The PCWA logs the following information during each aquatic pesticide application:

- Flow rate
- Application start time
- Application end time
- Pesticide(s) used
- Concentration
- Application rate
- Total amount applied
- Special-status species visually observed
- Environmental observations, including
    - Air temperature
    - Water temperature
    - Wind speed
    - Wind (calm, breezy, or windy)
    - Cloud cover (no clouds, partly cloudy, or overcast)
    - Precipitation (none, foggy, drizzle, rain, or snow)
    - Water clarity (clear water, cloudy water, or murky water)
    - Sample color (none, amber, yellow, green, brown, gray, other)
    - Sample odor (none, fresh algae smell, chlorine, sulfide, or sewage)
    - Other (algae, oily sheen, foam or suds, leaves, or trash)
- Any additional comments

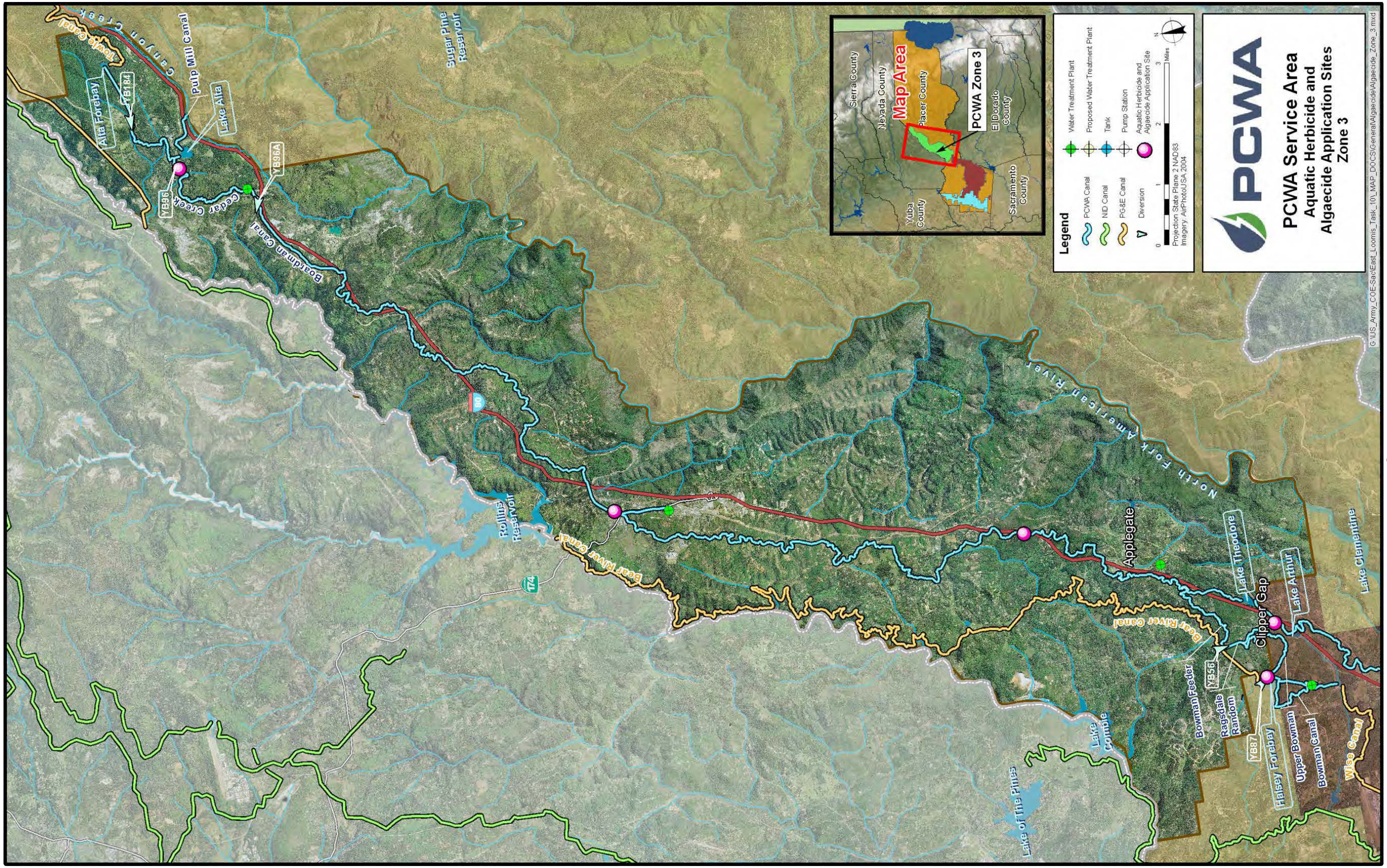

FIGURE 2-8
ZONE 3 AQUATIC HERBICIDE AND ALGAECIDE APPLICATION SITES

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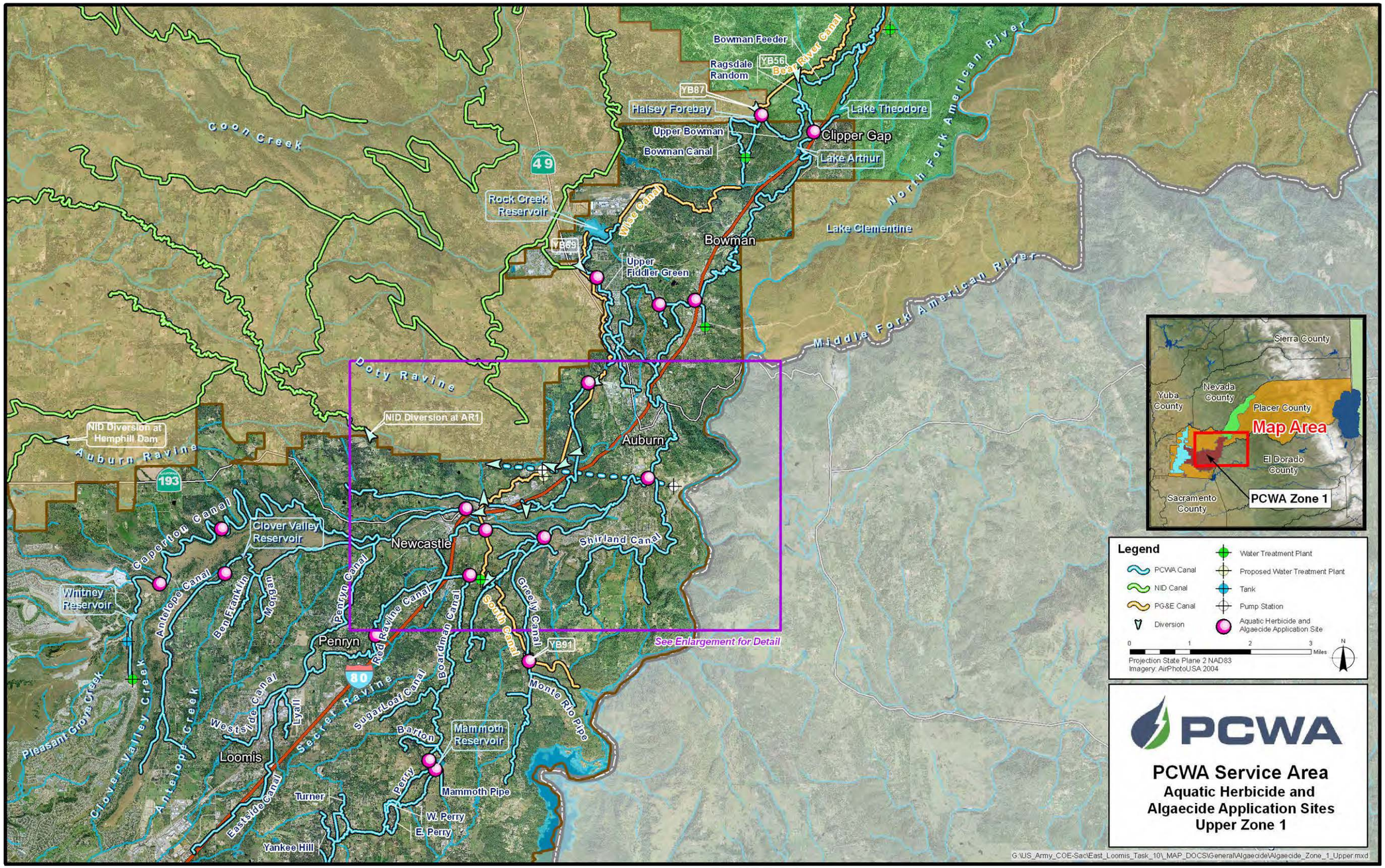

FIGURE 2-9
UPPER ZONE 1 AQUATIC HERBICIDE AND ALGAECIDE APPLICATION SITES

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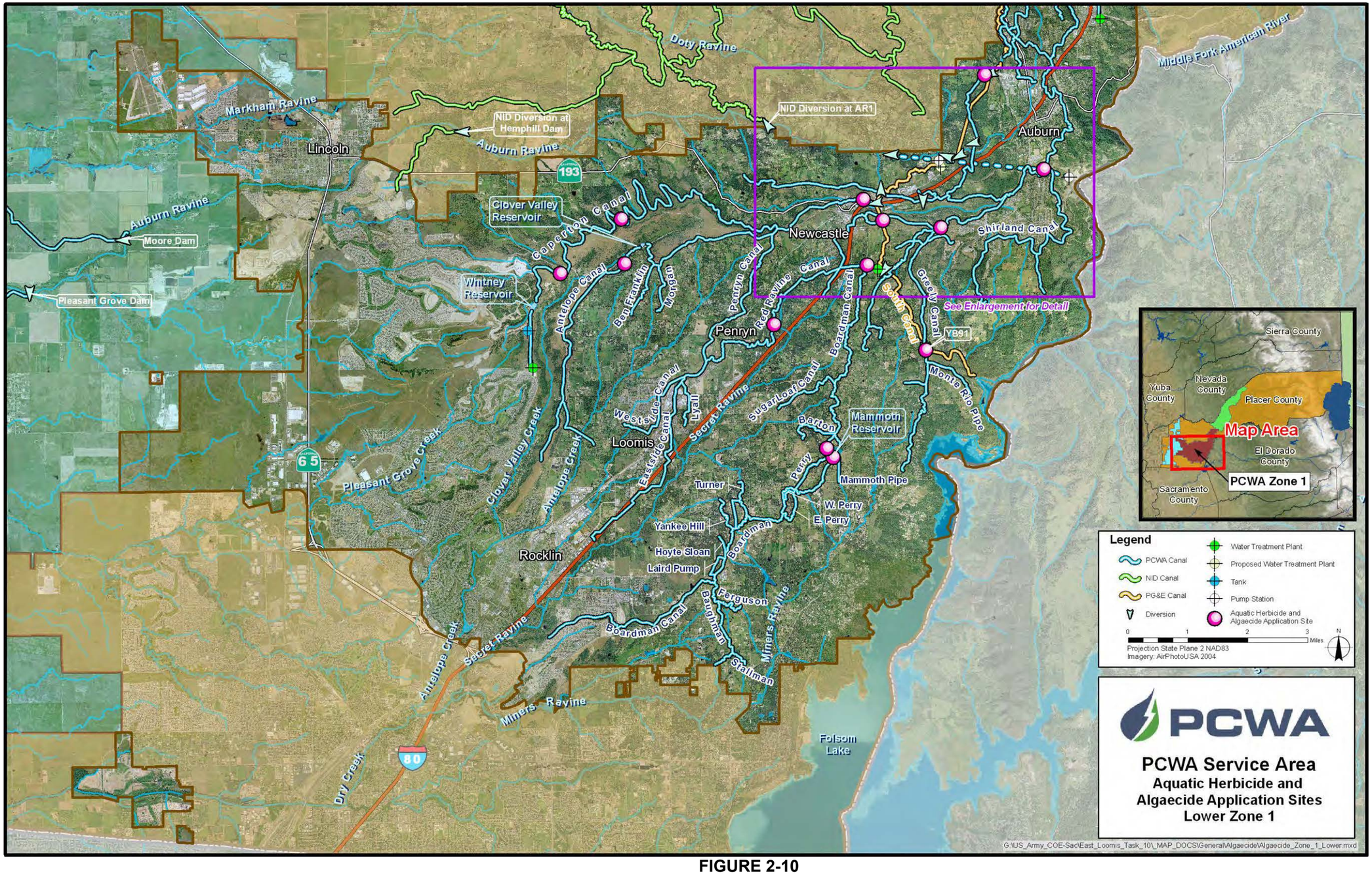

FIGURE 2-10
LOWER ZONE 1 AQUATIC HERBICIDE AND ALGAECIDE APPLICATION SITES

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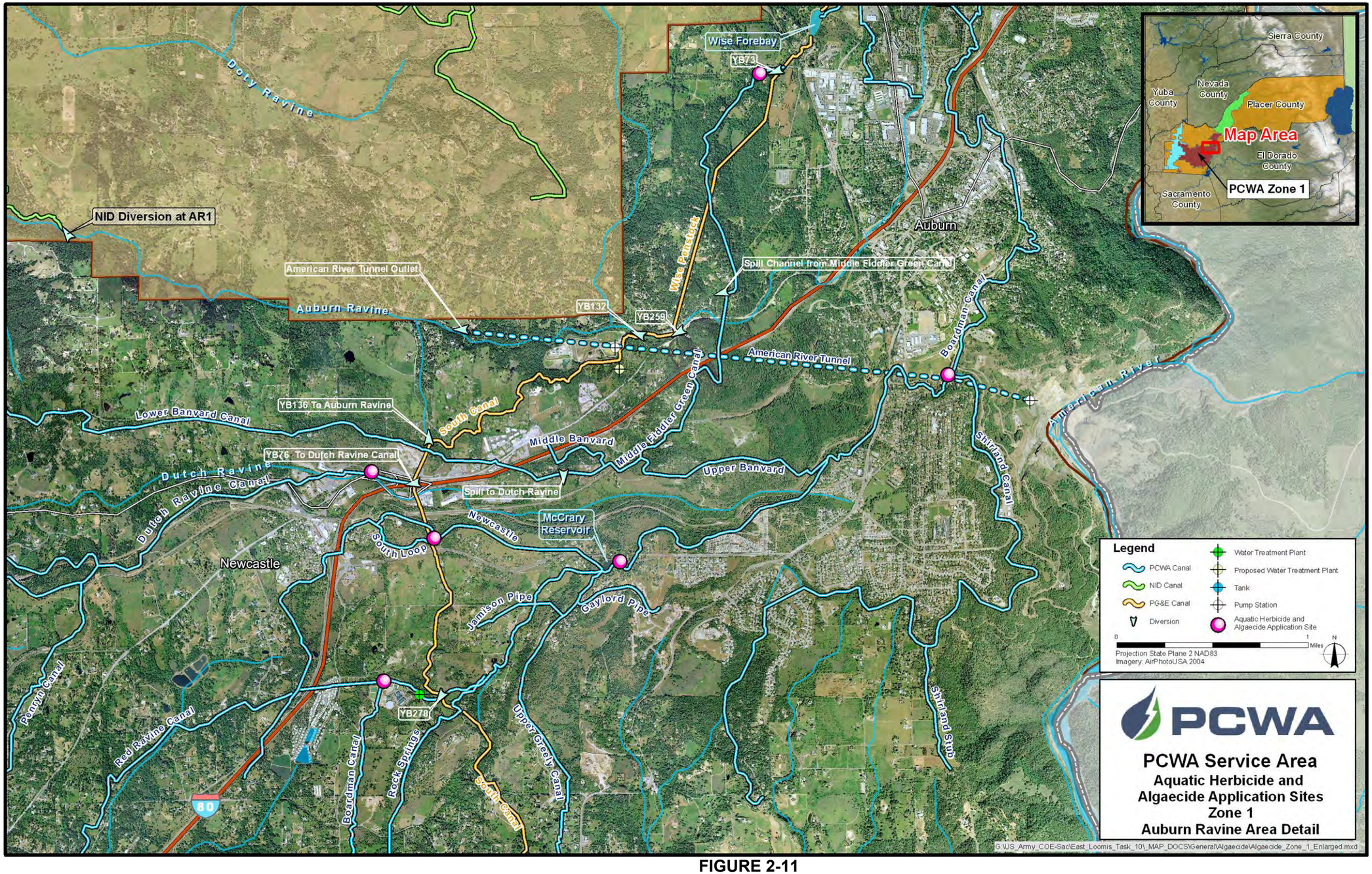

FIGURE 2-11
LOWER ZONE 1 AUBURN RAVINE AREA AQUATIC HERBICIDE AND ALGAECIDE APPLICATION SITES

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TABLE 2-1
PCWA AQUATIC HERBICIDE AND ALGAECIDE APPLICATION SITES

Zone 3 Application Sites	Zone 1 Application Sites
Cedar Creek (YB 96)	Boardman Canal at Luther and Channel Hill Rd (356+05)
Boardman Canal at Colfax Header Box (YB 49)	Bowman Canal (YB 87)
Boardman Canal at Heather Glenn and 49er spill (1289+42)	Freeman and Shockley canals at Luther Rd (22+79)
Boardman Canal at Clipper Gap (YB 179) (Zone 1 application point)	Upper Fiddler Green at RR Spill (85+83)
	Boardman Canal at Foothill Water Treatment Plant (YB 78)
	Middle Fiddler Green Canal at Raccoon Hollow (16+40)
	Shirland Canal at Pacific (YB 147)
	Dutch Ravine Canal at Ridge and Taylor Rd (11+60)
	Boardman Canal at McCrary Reservoir (YB 92)
	Caperton Canal at Clark Tunnel Rd (316+80)
	Caperton Canal below Caperton Reservoir
	Newcastle Canal at Head of South Loop (50+92)
	Lower Greely Canal (YB 91)
	Red Ravine Canal at Gilardi Rd (126+45)
	Lower Antelope Canal and Antelope Stub Canal (194+05)
	Boardman Canal below Mammoth Reservoir (343+22)
	Perry Canal at Mammoth Drive and Hooter Spill (23+51)

Key:
YB = Pacific Gas and Electric Yuba-Bear Buy Point

Copper sulfate, Cutrine-Plus®, and Algimycin-PWF® are toxic to fish. The toxicity to fish varies with the species and their developmental stage, and with the physical and chemical characteristics of the water. Copper toxicity to fish generally increases as water hardness and pH decreases (Pimental 1971). Fish eggs are more resistant than young fish fry to the toxic effects of copper sulfate (Gangstad 1986). Copper will bind to soil particles and organic matter in water and settle out of solution, but it will not degrade chemically or biologically. Cutrine-Plus®, a chelated copper compound contains less copper than copper sulfate and because the copper is gradually released from its chelate, it is less toxic to fish than copper sulfate (Ross and Lembi 1985).

2.4.1.3 Herbicide Application

The growth of plants on canal berms can damage the berm through destabilizing the canal banks, as well as decrease canal flow velocities algal mat buildup can decrease canal flow capacities, and increase the accumulation of debris in the channel. Plant growth is controlled as needed with the application of herbicide. This is typically performed in the late spring at the beginning of the summer delivery season, when plants have emerged. Glyphosate and triclopyr herbicides are used in the PCWA system. Specific herbicides typically include Garlon4™ (triclopyr), Rodeo® (glyphosate), Roundup® (glyphosate), or AquaMaster™ (glyphosate). Applications usually involve a tank mix of herbicides to control the growth of different types of vegetation. PCWA also performs a pre-emergent application on the walking side of berms for the lower portion of the canal system after the first soaking rain of the wet season; sometime between

Herbicide application to aquatic vegetation in Mammoth Reservoir

October and January. The tank mix for pre-emergent applications includes Drexel-Diuron (Diuron-80) or Milestone® (aminopyralid), Roundup® (glyphosate), and Dimension® (dithiopyr). Surfactants are also added to the tank mix to enable herbicide penetration of plant cuticles. R-11®, a non-ionic alkylphenol ethoxylate surfactant, is added to the tank mix whenever glyphosate is used in aquatic systems. Alkylphenol ethoxylates may break down into a variety of metabolites, including nonylphenol (Ferguson et al. 2001). Primary contributors of nonylphenol to the environment are wastewater sources. Under aerobic conditions, nonylphenol tends to break down to inert products (Maguire 1999, Staples et al. 1998). Red Top Mor-Act®, a nonphytotoxic paraffin-based petroleum oil, is also used by PCWA. Both R-11® and Red Top Mor-Act® are manufactured by Wilbur-Ellis Company® (Wilbur-Ellis 1999).

Rodeo® and AquaMaster™ are glyphosate herbicides rated for use near water. AquaMaster™ is applied when the targeted growth occurs on the inside edge of the canal berm and when the potential for some herbicide to reach the water is present, because it dissipates in water by binding to soil particles and organic material or through microbial degradation. AquaMaster™, or Reward® (diquat dibromide), is also applied to aquatic vegetation in Lake Alta, Lake Theodore, Clover Valley Reservoir, and Mammoth Reservoir once per year. These herbicides are also applied to control vegetative growth on the downstream faces of dams at these reservoirs, as needed.

The half-life of glyphosate is highly variable, depending on the environmental conditions. In standing water, the half-life is from 12 days to 10 weeks; in soil, it is from 1 to 174 days. Glyphosate has low toxicity to birds and virtually no toxicity to fish (EXTOXNET 1994). Diquat dibromide is persistent (half-life approximately 1,000 days), toxic to fish and wildlife, tightly adsorbed to soil particles, and is unavailable to soil microbes and for plant uptake (Syngenta 2002).

Garlon4™ is a pyridine-based triclopyr herbicide used for the control of woody plants and annual and perennial broadleaf weeds, and is applied to plants on the outside of the canal berm when the potential exposure to canal water is minimal. Garlon4™ contains triclopyr in the form of butoxyethyl ester (TBEE). TBEE is rapidly converted to triclopyr acid through hydrolysis in both natural water and soil in less than a day (Ganapathy 1997, Somasundaram and Coats 1991, Bidlack 1978). In natural waters, triclopyr is degraded by sunlight with a half-life of about 1.3 days. Oxamic acid is the main photodegradation product in water, with low molecular-weight organic acids as minor products (Ganapathy 1997, Woodburn et al. 1993). TBEE has a tendency to adsorb to organic matter and is relatively immobile. TBEE rapidly hydrolyzes to triclopyr acid with a half-life of 3 hours (Ganapathy 1997, Bidlack 1978), and triclopyr is broken down

through microbial degradation. Aerobic degradation in soil produces the intermediate metabolites (3,5,6-trichloro-2-pyridinol and 3,5,6-trichloro-2-methoxypyridine), that eventually convert to carbon dioxide (CO_2) (Ganapathy 1997, Cryer et al. 1993). Triclopyr is listed as "fairly degradable" in soil at reported half-lives ranging from 12 to 27 days (Ganapathy 1997, Linders et al. 1994). TBEE is classified as very toxic to aquatic organisms, but is rapidly degraded to triclopyr, which has a low toxicity to fish, Daphnia, and algae. Garlon4™ is not classified as harmful to game, wild birds, and animals (Dow AgroSciences 2006).

2.4.2 Cleaning and Flushing

As an open channel system, debris that accumulates in the canals can decrease canal flow capacity by raising water levels within the canal, and clog piped sections and delivery points, causing blockages and subsequent canal overtopping. Accumulated debris in the canals may lead to overflowing canals and/or interruptions to customer deliveries. This debris is cleaned and/or flushed from the canal system on an as-needed basis. PCWA conducts comprehensive canal cleaning activities within their system during winter and spring each year, and requires several months to complete.

Boardman Canal at Hanson Spill dewatered and prepared for cleaning

Debris removal from Baughman Canal

Annual cleaning is performed throughout the raw water distribution system, beginning in early January in the upper (northeastern) portion of Zone 1 and moving downward through the system to the end of Zone 1, then to the upper portion of Zone 3 and moving downward to the end of Zone 3. Canals in PCWA's Zone 5 service area are maintained by South Sutter Water District. During cleaning activities, canal system operations are typically maintained upstream of the canal segment to be cleaned, and water is diverted from the canal segment through an intermediate regulated canal outlet just upstream of the segments being cleaned to dewater the canal. Water deliveries to canal system customers receiving their purchased water downstream from canal segments being cleaned are temporarily interrupted due to the upstream diversions.

Large debris is removed from the channel by machinery (small excavator compact loader), where accessible. Hand crews follow machinery with hand tools to complete debris and accumulated

sediment removal. Where canals are inaccessible to machinery, hand crews alone perform the cleaning. Debris and sediment removed from the canals are typically deposited along canal banks.

After cleaning is completed and before restoring flow to downstream segments, intermediate outlet releases upstream from canal cleaning are closed, and intermediate outlet releases downstream from canal cleaning are opened to flush remaining debris and sediment from the canal. The cleaned canal segments are typically flushed for about 1 hour, but the duration of flushing depends on the length of canal cleaned, amount of debris and sediment remaining in the canal segment, and the flow rate of the water in the canal. After a period of flushing, the outlet release is closed, and canal flows are restored to the system downstream from the cleaned canal segment.

Canal cleaning takes place during normal business hours, and canal flows are restored during the evening, thereby minimizing service interruptions to customers. PCWA Customer Service informs their customers of the expected interruption to service with informational letters distributed through the postal mail in the area affected by canal cleaning activities.

Outlets and siphons may also accumulate debris, and are cleaned year round, as required by debris accumulation and flow restrictions. During the cleaning process, customer delivery points and flow-control structures in canal outlets, and siphons may be removed, and canal flows are conveyed through the outlets and siphons to flush out debris and sediment. Outlet and siphon flushing is typically accomplished in under an hour, but may take longer, depending on the extent of debris and sediment accumulation.

2.4.3 Canal Lining/Guniting

Canal lining is typically performed during winter months, when water demands are lower, to reduce erosion and sloughing of canal banks, improve the efficiency of water delivery in canal segments, and to repair and prevent leaks in canal sections that may cause damage to infrastructure and/or property. Canal sections are also lined outside of winter months in areas that are inaccessible during winter, to address leaks that arise during the year, and to continue canal lining activities that were not completed during winter. Canals are lined with gunite, a dry-mix concrete material blown through a nozzle where water is injected immediately before application. Gunite is applied to canals to reduce seepage from the canal channel to adjacent soils. Small cracks in the gunited canals are repaired with Burke Plug, a hydraulic cement manufactured by Edoco©.

Ponding on landowner property due to seepage visible in background, and recent lining on Baughman Canal

Baughman Canal lining

Water is diverted from the segment to be lined, and the canal segment is dewatered by pumping any remaining water in the canal segment out of the canal and releasing the water to storm drains, ditches, drainage swales, or the ground surface adjacent to the canal. The segment is then cleaned as described above, and reinforced with wire mesh laid into the bottom of the canal before spraying with gunite. Several hundred feet of canal are lined with gunite at a time, and allowed to cure for several hours. Canal flows are restored to the newly lined segments during the evening after the segment has cured. The newly lined canal segment is flushed to remove any accumulated debris and sediment in the canal using the nearest intermediate canal outlet downstream from the lining activities, as described for canal cleaning.

Canal lining requires relatively dry weather and is not performed during or just after heavy rain, as runoff can wash out fresh gunite from the channel. Therefore, the canal-lining schedule, developed a month or more in advance of the activities, is subject to changes and delays according to weather. PCWA Customer Service informs customers of the expected interruption to service with informational letters distributed through the postal mail in the area affected by canal-lining activities.

Before canal-lining activities, PCWA evaluates the potential impacts to environmental resources, and prepares an environmental compliance document to satisfy CEQA requirements.

2.5 AS-NEEDED REPAIR OR REPLACEMENT

Barton Canal pipe replacement

PCWA repairs and/or replaces pipes, flumes, culverts, siphons, outlet structures, flow-control structures, and customer delivery points throughout the PCWA canal system on a scheduled and as-needed basis. These activities may involve minor repairs with minimal disturbance to customer deliveries and minor effects on environmental resources, while others requiring onsite construction may become more involved.

Pipe repair performed on PCWA canal

In all instances of as-needed repair or replacement, PCWA staff members evaluate the potential impacts to environmental resources, and prepare an environmental compliance document to satisfy CEQA requirements.

2.6 OTHER MAINTENANCE PROJECTS

Other maintenance projects performed infrequently by PCWA and not addressed in this report include:

- Sediment removal from reservoirs
- Sediment removal from Canyon Creek
- Dam, reservoir berm, and canal berm maintenance to address problems due to muskrats, beavers, and otters

For these other maintenance projects, PCWA staff members evaluate the potential impacts to environmental resources, and prepare an environmental compliance document to satisfy CEQA requirements.

CHAPTER 3.0
NATURAL RESOURCES SETTING

This chapter presents methodology for defining natural resources settings and describes physical and biological resources conditions in the NRMP study area.

3.1 METHODOLOGY

This section provides the methodology used to describe the natural resources setting of the NRMP study area during routine operations of the PCWA raw water distribution activities system. Operations activities include routine flow adjustments, seasonal adjustments to delivery points, and annual outages due to PG&E operations.

3.1.1 Physical Resources

The following sections describe the methodology for characterizing physical resource conditions in the NRMP study area. Physical resources evaluated for the NRMP include hydrology, water quality, and soil and sediment quality.

3.1.1.1 Hydrology

This section describes the methodology used to describe the hydrology setting of the PCWA raw water distribution area during routine operations activities within the PCWA raw water distribution area.

Information on the hydrology setting was gathered through discussions with PCWA staff, existing literature, and from U.S. Geological Survey (USGS) stream gaging stations. In addition to information obtained through other sources, extensive flow monitoring performed by PCWA in lower Zone 1 provided data that were valuable to developing a better understanding of the roles of the canals in the hydrology of the interrelated stream systems. This understanding is used here to better describe the hydrology of the rest of Zone 1 as well as Zones 3 and 5.

3.1.1.2 Water Quality

This section describes the methodology for characterizing baseline water quality conditions in the PCWA raw water distribution area. Water quality information was obtained from several reports and studies conducted by various organizations. Water quality data was collected in the study area by PCWA, Central Valley Regional Water Quality Control Board (RWQCB), Dry Creek Conservancy (DCC), and the Central Valley Clean Water Association (CVCWA).

PCWA conducted water quality monitoring at sites within the PCWA raw water distribution system, and receiving water tributaries, streams, and ravines on dates during different seasons intended to provide representative samples of baseline conditions within the study area: December 7, 2006, January 29, 2007, May 30, 2007, and August 30, 2007, representing the fall, winter, spring, and summer seasons, respectively. Data collected during these dates are presumed to be representative of routine canal operations, considered to be baseline activities

within the study area. The Central Valley RWQCB collected water quality information for Secret Ravine and Miners Ravine monthly from December 2000 through February 2002. DCC tested Secret Ravine at multiple locations for a suite of water quality constituents between 2001 and 2005. The constituents tested included heavy metals, nutrients, bacteria, pesticide components, and typical water quality parameters such as pH, alkalinity, and hardness. The CVCWA monitored methylmercury from August 2004 through April 2005 in Miners Ravine below the discharge of the Placer County Sewer Maintenance District (SMD) No. 3 tertiary wastewater treatment plant (WWTP).

Sampling locations, times, and water quality parameters, as well as the baseline concept and its seasonal framework, are described in the following sections.

Monitoring Locations

In situ water quality conditions were measured using a handheld multi-meter, and grab samples were obtained at eight locations within the PCWA raw water service area during the 2007 water delivery year (WDY) (October 16, 2006, through October 15, 2007). These locations, listed in **Table 3-1** and shown in **Figures 3-1 through 3-4**, were selected to represent the variety of conditions and physical locations within the watersheds downstream from potential flow contributions from the PCWA canal system, while allowing reliable site access through public rights-of-way or easements.

TABLE 3-1
BASELINE WATER QUALITY MONITORING LOCATIONS IN MAJOR STREAMS AND DRAINAGES IN THE PCWA RAW WATER SERVICE AREA

BASELINE MONITORING LOCATIONS		
Site Description	**Site Identification**	**Site Type**
Zone 3		
Boardman Canal below Lake Alta	YB96	Canal
Zone 1		
Boardman Canal at Powerhouse Road	YB78	Canal
Clover Valley Reservoir Release to Clover Valley Creek and Antelope Canal	CLVRESR	Canal
Boardman Canal below Mammoth Reservoir	YB81	Canal
Yankee Hill Canal Outlet Release	YANKEECR	Canal
Baughman Canal Outlet Release	BAUGHMANCR	Canal
Tributary to Secret Ravine from Yankee Hill Canal	YHTRIB2	Drainage
Secret Ravine at Rocklin Road	SECRETRV3	Stream
Tributary to Miners Ravine from Baughman Canal	BCTRIB1	Drainage
Miners Ravine at Dick Cook Road	MINERSRV6	Stream
Miners Ravine near N. Sunrise Avenue	MINERSRV3	Stream
Auburn Ravine below American River Tunnel outlet	AUBRAV3	Stream
Clover Valley Creek near Argonaut Avenue (at Golf Course)	CLVRC3B	Stream
Antelope Creek at Midas Avenue	ANTC3B	Stream

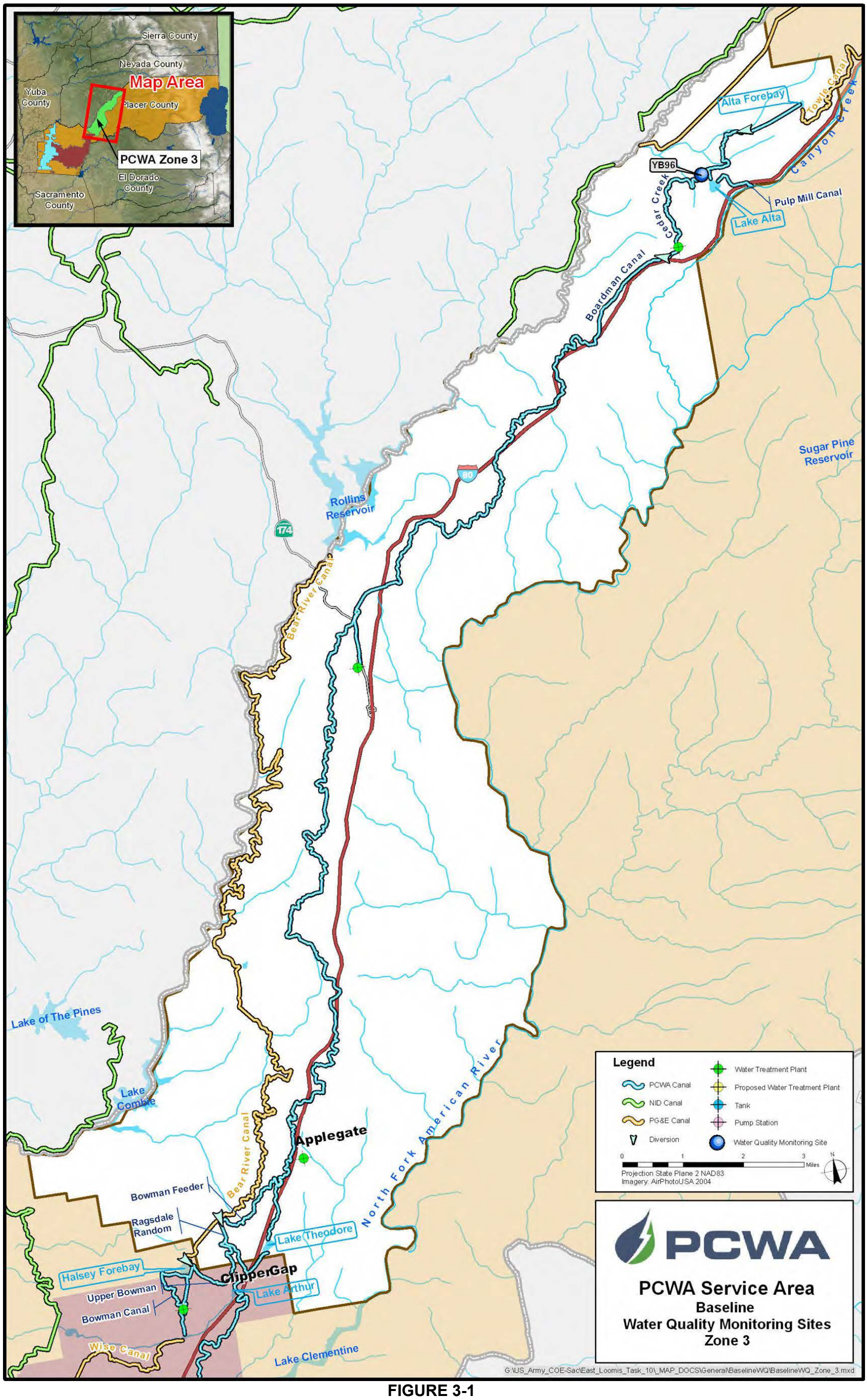

FIGURE 3-1
ZONE 3 BASELINE WATER QUALITY MONITORING SITES

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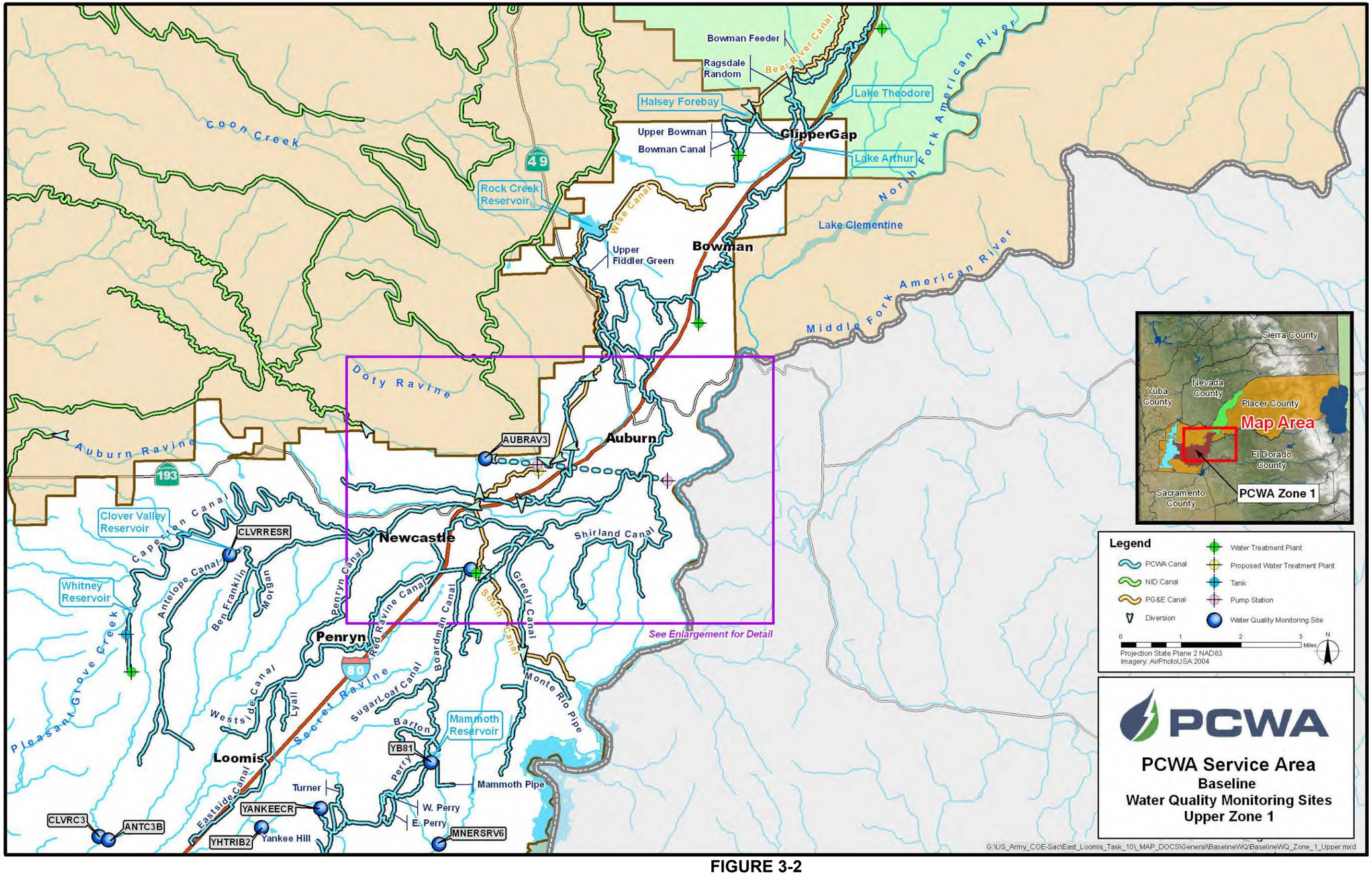

FIGURE 3-2
UPPER ZONE 1 BASELINE WATER QUALITY MONITORING SITES

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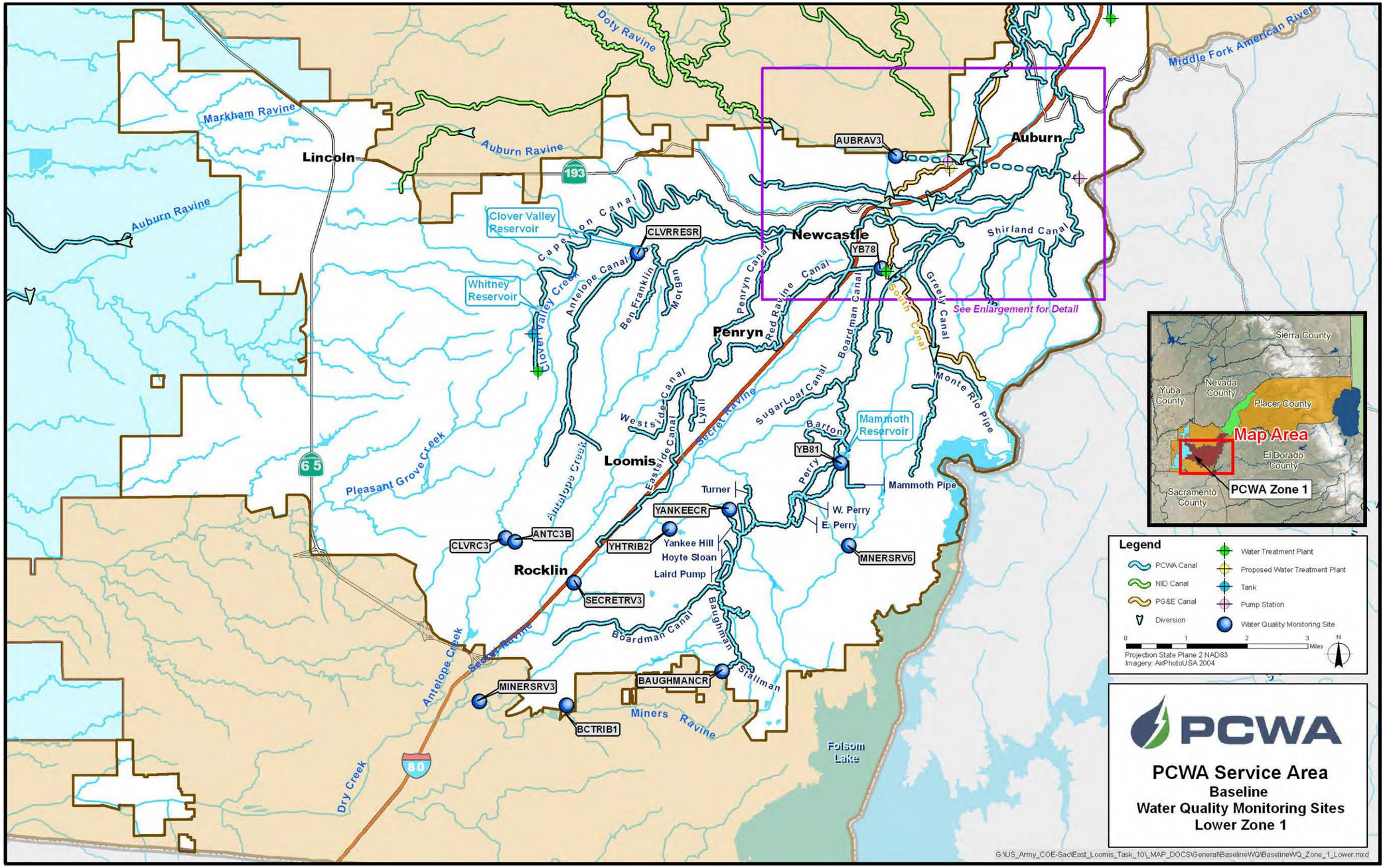

FIGURE 3-3
LOWER ZONE 1 BASELINE WATER QUALITY MONITORING SITES

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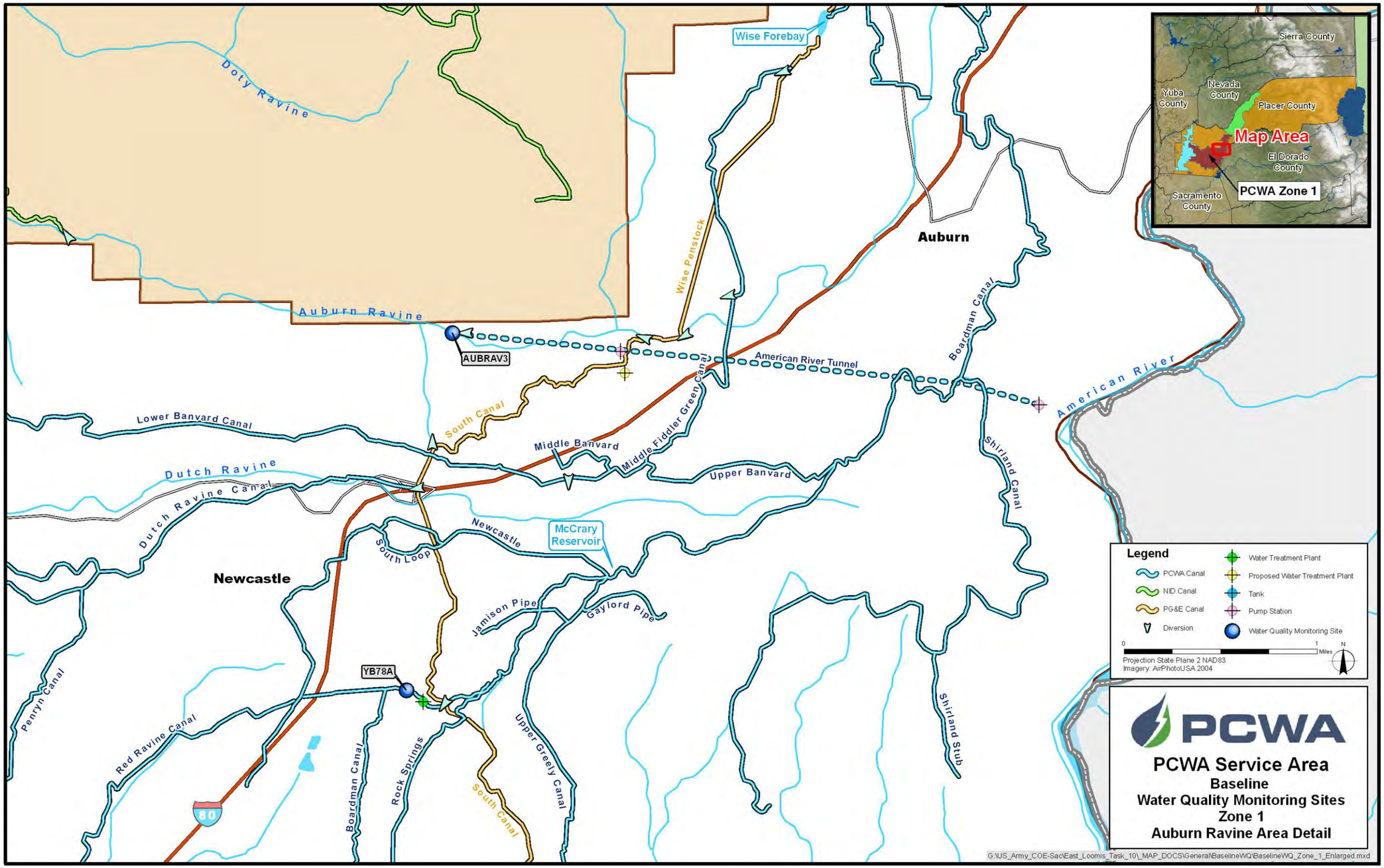

FIGURE 3-4
LOWER ZONE 1 AUBURN RAVINE AREA BASELINE WATER QUALITY MONITORING SITES

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Sample Timing

Samples were collected at each location on a day intended to represent the general background water quality and flow conditions in the system during the fall, winter, spring, and summer seasons.[1] Baseline water quality sampling events avoided days with rainfall on the day of, or during the days preceding, sample collection. Timing of water quality sampling during the day may affect concentrations of certain parameters, including water temperature, dissolved oxygen (DO), and pH due to diurnal temperature changes and biogeochemical processes. As a result, to reduce the potential for differences in water quality at a particular site, measurement and sample collection were conducted at approximately the same time for each of the eight sites during the baseline sampling events.

Fall, winter, spring, and summer baseline water quality was measured on December 7, 2006, January 29, 2007, May 30, 2007, and August 30, 2007, respectively. Each event was scheduled after at least 1 week of dry weather so as to adequately represent baseline canal water quality contributions. Weather on the sampling dates was dry, and no precipitation fell in the sampling areas during the weeks preceding the sampling events except a slight rain event during the week preceding the spring baseline sampling. Weather conditions during and before the baseline sampling events are summarized in **Table 3-2**.

TABLE 3-2
WEATHER CONDITIONS DURING AND BEFORE WATER QUALITY BASELINE MONITORING IN THE PCWA RAW WATER DISTRIBUTION AREA

Season	Date	Weather on Sampling Date		Weather During Preceding Week		
		Maximum Air Temperature (°F)	Total Precipitation (inches)	Maximum Air Temperatures (°F)	Minimum Air Temperatures (°F)	Average Daily Precipitation (inches)
Fall	December 7, 2006	67	0.00	56-68	37-45	0.00
Winter	January 29, 2007	55	0.00	51-65	29-42	0.00
Spring	May 30, 2007	80	0.00	79- 80	52- 54	0.16
Summer	August 30, 2007	98	0.00	89-99	59-75	0.00

Key:
°F = degrees Fahrenheit

Water Quality Parameters

Sampled water quality parameters are shown in **Table 3-3**. A maximum of 22 water quality parameters was measured at each baseline location. Most of the basic physical and chemical water quality parameters, including DO, pH, specific conductivity (SC), water temperature, and turbidity, were measured *in situ* with a Hydrolab Quanta handheld water quality instrument at each sampling location. Water samples were collected and analyzed by MWH Laboratories for the following water quality parameters: alkalinity, total suspended solids (TSS), aluminum,

[1] Periodic water quality measurement and grab samples only provide general qualitative information on water quality of the streams. Continual long-term monitoring is required for a more detailed water quality analysis.

calcium, iron, magnesium, sodium, chloride, sulfate, nitrate, potassium, barium, cadmium, copper, mercury, and zinc. Mercury was measured during the spring only; the remaining 21 parameters were measured during all four seasons. Constituent concentrations measured below the detectable limits for laboratory analyses are provided at the minimum reporting level.

TABLE 3-3
WATER QUALITY PARAMETERS MEASURED DURING BASELINE WATER QUALITY MONITORING IN THE PCWA RAW WATER SERVICE AREA

Water Quality Parameters		
Basic Physical and Chemical Parameters	**Major Ions**	**Trace Elements**
Water Temperature	Calcium	Aluminum
pH	Iron	Barium
Alkalinity	Magnesium	Cadmium
Dissolved Oxygen	Potassium	Copper
Specific Conductivity	Sodium	Mercury
Turbidity	Chloride	Zinc
Total Suspended Solids	Nitrate	
	Sulfate	

Water Temperature and Dissolved Oxygen

Water temperature is an important water quality parameter because it affects water chemistry. Higher temperatures can increase the rate of chemical reactions, which can increase chemical toxicity. Water temperatures reflect seasonal variations in air temperatures, with higher temperatures in spring and summer than in fall and winter. Flow velocity also influences water temperatures because a particle of water in a fast-moving stream is exposed to sunlight for a shorter time than that in a slow-moving stream. Water temperature changes in these streams within the PCWA raw water distribution area are assumed to be affected by changes in canal flows. Water temperatures change as water flows downstream from reservoirs. Inputs from runoff and tributaries can also change downstream water temperatures.

DO is a measure of gaseous oxygen dissolved in a liquid. Waters with higher, relatively stable levels of DO are usually considered healthy ecosystems, supporting many different kinds of aquatic organisms. Extreme DO fluctuations may cause organism stress. DO levels would be expected to be greater in areas with higher flows and colder water temperatures. DO is inversely related to temperature because as water temperature increases, the water has less capacity to hold gases, and DO levels decrease. Therefore, warmer water holds less oxygen than colder water. DO levels typically increase with higher flows due to increased turbulence, which may bring more water into contact with the atmosphere, aerating the moving water. DO levels also naturally fluctuate daily depending on rates of respiration, decomposition, or chemical reactions (decrease), and photosynthesis, or diffusion with surrounding air (increase). Daily maximum DO levels typically occur in the afternoon and daily minimum levels occur in the early morning.

pH, Alkalinity, and Hardness

The parameters pH, hardness, and alkalinity are interrelated. The parameter pH is a measure of dissolved hydrogen ions, or acidity. The pH scale ranges from 0 and 14, with 7.0 defined as neutral; solutions with pH lower than 7.0 are considered acidic, while solutions with pH greater

than 7.0 are considered basic. The lower the pH value, the higher the acidity. Seasonal pH trends within canals can be influenced by biological processes. Respiration occurs primarily in reservoirs within the system, and rates are highest during spring and summer, when aquatic organisms are more active. Rates of photosynthesis are also highest during spring or summer, when the most sunlight is available. Seasonal pH trends within canals can also be influenced by flow volumes and rainfall.

Whereas acidity is the capacity to neutralize bases, alkalinity is a measure of the capacity of water to neutralize strong acid (Snoeyink and Jenkins, 1980). Alkalinity is a bicarbonate concentration. In general, alkalinity concentrations in natural waters are primarily composed of carbonate, bicarbonate (HCO_3^-), and hydroxyl ions (Tchobanoglous and Schroeder, 1985). High alkalinity values will reduce the variation in pH.

Water hardness is the measurement of the total dissolved minerals, primarily calcium and magnesium ions, in water. Water hardness is the total quantity of bases present to absorb acid in water. Calcium and magnesium are the most common sources of water hardness; therefore, water hardness is typically represented as the sum of calcium and magnesium concentrations. A low hardness value can indicate that calcium carbonate ($CaCO_3$) concentrations are low, but high hardness does not necessarily reflect a high calcium concentration. There are two types of hardness: carbonate and noncarbonate. Carbonate hardness is associated with HCO_3^- and carbonates, and noncarbonate hardness is associated with other anions, particularly chloride, and sulfate. Since water hardness was not measured in this study, it is calculated as total hardness using the following equation:

$$\left[\left(\frac{(Ca^{2+})\ mg/L}{(\text{Molecular Weight } Ca^{2+})\ mg/mmol}\right)\text{Number of moles}\right] \times \left[\text{Eq. Wt. of } CaCO_3\ (mg/meq)\right] + \left[\left(\frac{(Mg^{2+})\ mg/L}{(\text{Molecular Weight } Mg^{2+})\ mg/mmol}\right)\text{Number of moles}\right] \times \left[\text{Eq. Wt. of } CaCO_3\ (mg/meq)\right]$$

Water alkalinity and hardness are often reported as an equivalent of the $CaCO_3$ concentration in milligrams per liter (mg/L).

Total Suspended Solids and Turbidity

TSS is a water quality parameter that provides a measurement of particulates in a water sample. Turbidity is an optical measurement of water's ability to scatter light, resulting from the interaction of incident light with particulate material in a water sample, commonly referred to as the cloudiness or haziness of water. Increased turbidity is caused, in part, by TSS in water, but the correlation is spatially and temporally variable.

Specific Conductivity and Ions

SC is a measure of the capacity to transmit electricity through a water sample at 25 degrees Celsius (°C), and typically displays a linear relationship to total dissolved solids (TDS) and salinity of the water. SC is a function of the quantity of dissolved (ionic) constituents, primarily calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), HCO_3^-, sulfate (SO_4^{2-}), and chloride (Cl^-). Freshwater has a low SC compared to that of seawater. Rainwater can increase

SC because it often contains dissolved airborne gases and dust from the air. Agricultural and urban runoff can also increase SC through loading of salts or other dissolved constituents.

Trends in ion concentrations typically follow trends in SC. Major ions include elements that naturally occur in high concentrations and/or nutrients. This study included analyses for several major cations including calcium, iron (Fe^{2+}), magnesium, potassium, and sodium. Calcium is an essential mineral, is common in waters, and contributes to water hardness as $CaCO_3$. Iron is a common element in the regional geology and soils that can leach into water; however, most iron compounds are relatively insoluble in the pH ranges observed in streams. Magnesium occurs widely in rocks and soils, and is a major contributor to water hardness in many water bodies in the form of magnesium carbonates. Potassium is also an essential nutrient and occurs in nature as an ionic salt. Compounds consisting of potassium generally have excellent water solubility. Sodium is a very active ion. Excess sodium in runoff water may affect soils by decreasing rates of infiltration, and result in a build-up of salts on the soil surface.

Major anions evaluated for this study include chloride, nitrate, and sulfate. Chlorides include negatively charged chloride ions and salts containing chloride ions, such as sodium chloride (NaCl) and magnesium chloride ($MgCl_2$). Nitrate is an essential nutrient which, in excessive concentrations, leads to eutrophication of waterways and drinking water toxicity. Eutrophication promotes excessive aquatic plant growth and decay, which decreases DO and the overall water quality of a water body. Major sources of nitrate include fertilizers and sewage. SO_4^{2-} is a major anion in hard water reservoirs, and can be naturally occurring or the result of municipal or industrial discharges. When naturally occurring, SO_4^{2-} is often associated with organic matter decay, rocks or soil containing gypsum and other common minerals, or atmospheric deposition. Point sources include sewage treatment plants and industrial discharges. Fertilizers in runoff also contribute sulfates to water bodies. SO_4^{2-} can interact and precipitate with several parameters, including barium, copper, calcium, and magnesium; these interactions are interdependent with the pH, water temperature, and alkalinity contents in each water sample.

Trace Elements

Elements that typically occur in very low concentrations are referred to as trace elements. At higher concentrations, most trace elements become toxic to plants, animals, or humans. Sources may be natural or urban, agricultural, or municipal. The solubility of most trace elements – whether they adsorb to bottom sediments or remain in the water column – is dependent on oxidation and reduction potential and pH. Water quality monitoring included analyses for the following trace elements: aluminum, barium, cadmium, copper, mercury, and zinc.

Aluminum is one of the most abundant elements in the earth's crust and occurs in many rocks and soils. Many aluminum salts are readily soluble; those that are insoluble will precipitate and settle out of water. Barium is an alkaline earth metal that is primarily insoluble. Barium concentrations in water are often associated with mining activities. Cadmium is a metal commonly associated with wastewater, pesticides, and fertilizers. It is toxic to humans and aquatic species, although toxicity levels vary widely by species.

Copper persists and cycles through ecosystems. It can be dissolved in water, or bound to organic and inorganic materials either in suspension or in sediment. Dissolved copper is known to affect a variety of biological endpoints in fish (e.g., survival, growth, behavior, osmoregulation, sensory function, and others (NMFS 2007, Eisler 1998). Water hardness, alkalinity, pH, and dissolved organic matter tend to alter the bioavailability of dissolved copper to aquatic organisms. Exposure routes other than the water column, such as consumption of contaminated prey items (dietary) or direct contact with contaminated sediments are also important (NMFS 2007). Potential sources of copper in the environment include vehicle emissions and brake pad dust (Drapper et al. 2000), pesticides (EPA 2005a), herbicides, fungicides, algaecides, industrial processes, municipal discharges, mining, and rooftops (Good 1993; Thomas and Greene 1993) (NMFS 2007). Recent studies indicate typical dissolved copper concentrations originating from road runoff from a California study were 3.4 to 64.5 micrograms per liter (µg/L), with a mean of 15.8 µg/L (NMFS 2007).

Mercury is a legacy contaminant present in the source waters of PCWA (Yuba and Bear rivers), associated with hydraulic gold mining activities in the Sierra Nevada and foothill region during the nineteenth century. Methyl mercury, the species of mercury formed during a process known as methylation, is known as the predominant form bioaccumulated in fish, and is toxic to animals and humans. The California Environmental Protection Agency issued a health advisory and report during 2003 on the health effects of eating fish from water bodies in Nevada, Placer, and Yuba counties after high concentrations of mercury were found in samples collected within the Yuba River and Bear River watersheds. NID is currently proposing a pilot project to remove mercury from Lake Combie, a small reservoir on the Bear River.

Zinc is a relatively insoluble metal, and will precipitate from the water column. Zinc is supplied in animal feeds and fertilizers in the form of zinc sulfate, and occurs naturally in the environment. It is also associated with a wide variety of industrial activities, and may be associated with WWTP discharges.

3.1.1.3 Soils and Sediment Quality

Soil and sediment characteristics in the study area were evaluated by reviewing existing reports and studies conducted within the region, and soil survey data for Placer County from the U.S. Department of Agriculture Natural Resource Conservation Service (USDA-NRCS). These survey data comprise soil classifications and soil textures that cover most of Placer County, including the majority of PCWA Zones 1, 3, and 5.

3.1.2 Biological Resources

The following sections describe methodology for characterizing biological resource conditions in the NRMP study area. Biological resources evaluated for the NRMP include terrestrial habitat and species, aquatic habitat and species, as well as special-status species.

3.1.2.1 Terrestrial Habitat and Species

The study area for terrestrial habitat and species includes areas adjacent to canals and reservoirs that may be directly affected by O&M activities. Reservoirs in the analysis are: Clover Valley Reservoir, Mammoth Reservoir, Lake Alta, McCray, Whitney, Caperton, Lake Arthur, and Lake Theodore. In addition, habitats and species along water bodies that serve as conveyances, specifically Auburn Ravine and Canyon Creek, could be affected indirectly by changes in flow, water quality, and sedimentation.

This analysis focuses on habitat types and their associated species. The linear extents of habitat types paralleling all PCWA canals in Zones 1, 3, and 5 and reservoirs that may be affected by O&M activities were evaluated to describe the setting. Habitat types and their associated species are discussed in the following sections.

Existing habitat data used in quantitative analysis were obtained from:

- Placer Legacy Phase 1 prepared by Jones and Stokes Associates for Placer County on May 13, 2003 and last updated April 9, 2007
- California Department of Forestry and Fire Protection Fire and Resource Assessment Program (FRAP) Multi-source Land Cover Data (v02_2) published in 2002

Habitat classifications for both of these sources were assigned based on the California Wildlife Habitat Relationship (WHR) system, with some modifications as appropriate for the study area.

Field reconnaissance-level visits were conducted on December 1 and 2, 2005; September 28 and 29, 2006; and September 13 and 14, 2007, to calibrate and verify habitat mapping for portions of the study area.

Terrestrial habitat types in the study area can be grouped into general categories: forested, shrub-dominated, herbaceous-dominated, agricultural, urban, and barren. The general structure, composition, and wildlife value of habitats within the study area are described below.

Forested

A variety of forested habitat types occurs in the study area. These are summarized in the following categories: valley foothill riparian, Sierra Nevada montane forest, and foothill hardwood woodland.

Valley Foothill Riparian Forest

Valley foothill riparian forests are found in floodplains and lower foothills in seasonally or permanently wet areas. The structure of this habitat is multi-layer, consisting of a mix of trees, shrubs, and vines including valley oak (*Quercus lobata*), cottonwood (*Populus fremontii*), sycamore (*Platanus racemosa*), willow (*Salix* spp.), white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), elderberry (*Sambucus* spp.), California grape (*Vitis californica*), and the nonnative Himalayan blackberry (*Rubus discolor*). Grasses, sedges (*Carex* spp.), rushes (*Juncus* spp.), and forbs, such as mugwort (*Artemesia douglasiana*) and hoary nettle (*Urtica dioica* ssp. *holosericea*), may occur in the understory. This habitat provides cover, forage, and breeding

areas for a number of wildlife species, including numerous species of resident and migratory birds, at least 50 amphibian and reptile species, and large and small mammals (Mayer and Laudenslayer 1988).

Sierra Nevada Montane Forests

Sierra Nevada montane forest types in the study area include conifer-dominated habitats (ponderosa pine [*Pinus ponderosa*], Sierran mixed conifer, Douglas-fir [*Pseudotsuga menziesii*], and closed-cone pine-cypress), and hardwood-dominated habitats (montane hardwood and montane hardwood conifer). Conifer-dominated habitats are multi-layer and contain a variety of species, with conifers typically forming a closed canopy. Sierra Nevada montane forest habitat types generally occur at higher elevations than hardwood habits (Brussard 1999). These habitat types intergrade, with ponderosa pine occurring at lower elevations and Sierran mixed conifer occurring at higher elevations (Placer County Planning Department 2005a). Sierran mixed conifer habitats support coniferous and hardwood species including ponderosa pine, knobcone pine (*Pinus attenuate*), sugar pine (*Pinus lambertiana*), Douglas-fir, white fir (*Abies concolor*), California black oak (*Quercus kelloggii*), incense cedar (*Calocedrus decurrens*), white alder, and bigleaf maple (*Acer macrophyllum*). Common shrub species include deerbrush (*Ceanothus integerrimus*), manzanita (*Arctostaphylos* spp.), chinquapin (*Chrysolepis chrysophylla*), mountain whitethorn *(Ceanothus cordulatus*), sagebrush (*Artemesia* spp.), and gooseberry (*Ribes* spp.). Closed-cone pine-cypress habitat is dominated by knobcone pine and generally occurs in areas with rockier, thinner soil.

Montane hardwood and montane hardwood conifer habitats are dominated by black oak and canyon live oak (*Quercus chrysolepis*). Other common tree species include interior live oak (*Quercus wislizeni*), ponderosa pine, bigleaf maple, Douglas-fir, Pacific madrone (*Arbutus menziesii*), Jeffrey pine (*Pinus jeffreyi*), sugar pine, incense cedar, white fir, and quacking aspen (*Populus tremuloides*). Shrub species include poison oak (*Toxicodendron diversilobum*), ceanothus (*Ceanothus* spp.), manzanita, and mountain mahogany (*Cercocarpus betuloides*) (Placer County Planning Department 2005a).

A variety of wildlife and plant species occur in Sierra Nevada montane forest habitats including cavity-nesting birds, raptors, large mammals, rodents, bats, reptiles, and amphibians.

Foothill Hardwood Woodlands

Hardwood habitat types in the study area include several habitat types: blue oak (*Quercus douglasii*) woodland, oak woodland savanna, interior live oak woodland, and oak foothill pine. These habitats contain a variety of species but are dominated by oaks. Blue oak woodlands are found on drier sites with shallower soils than valley foothill riparian forests. This habitat is generally more open than valley foothill riparian habitats in the study area and grades to oak woodland savanna in some places. Dominant species are blue oak and live oak, with a more open, grassy understory. Shrubs and small trees, including California buckeye (*Aesculus californica*), ceanothus, manzanita, and elderberry may occur, but are generally less dense that in valley foothill riparian forests. Numerous wildlife species use blue oak woodland for nesting and foraging, including acorn woodpecker (*Melanerpes formicivorus*), oak titmouse (*Parus inornatus*), yellow-billed magpie (*Pica nuttalli*), western gray squirrel (*Sciurus griseus*), and

coyote (*Canis latrans*) (Mayer and Laudenslayer 1988). Oak foothill pine habitats contain many similar species to those found in blue oak woodlands, but foothill pine is more common and the shrub layer is generally denser.

Shrub

Shrub-dominated habitats in the study area are primarily foothill chaparral ecosystems. These are areas that generally do not support forested habitats due to rocky/thin soils or steep slopes. Common shrub species in this habitat include chamise (*Adenostoma fasciculatum*), whiteleaf manzanita (*Arctostaphylos manzanita*), and buckbrush (*Ceanothus cuneatus*). Small interior live oaks also frequently occur. This habitat type occurs on a variety of substrates, including serpentine soils, which may support some special status plant species. A number of wildlife species use chaparral for foraging and nesting including rodents, snakes, mountain lion (*Puma concolor*), black bear (*Ursus americanus*), coyote, ringtail (*Bassariscus astutus*), and a variety of bird species such as western scrub-jay (*Aphelocoma californica*), spotted towhee (*Pipilo maculates*), California towhee (*Pipilo crissalis*), American robin (*Turdus migratorius*), Townsend's solitaire (*Myadestes townsendi*), and wrentit (*Chamaea fasciata*).

Herbaceous

Herbaceous habitats in the study area are generally disturbed areas dominated by nonnative species. These areas provide limited wildlife habitat value. Small mammals and some bird species, including western meadowlark (*Sturnella neglecta*) and horned lark (*Eremophila alpestris*), may breed in less disturbed grassland and pasture areas. These habitats also provide foraging areas for snakes, coyotes, and raptors, such as Northern harrier (*Circus cyaneus*), Red-tailed Hawk (*Buteo jamaicensis*), and White-tailed Kite (*Elanus leucurus*).

Annual Grassland

Annual grasslands in California primarily support nonnative species such as wild oat (*Avena fatua*), bromes (*Bromus* spp.), wild barley (*Hordeum marinum*), and fescue (*Festuca* spp.). Annual grasslands often support vernal pools; however, these were not observed in the study area. Vernal pools are found within the southwestern portion of the watershed near the confluence of Secret and Miners ravines, but these are outside of the study area and do not appear to be influenced by the drainages addressed in this analysis.

Vernal Pool Complexes

Vernal pools are small to large depressions, generally in grassland habitat, that are seasonally wet and support an assemblage of species adapted to these conditions. A number of special status plant and animal species occur in vernal pools including vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packa*rdi), California linderiella (*Linderiella occidentalis*), legenere (*Legenere limosa*), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*), dwarf downingia (*Downingia pusilla*), Bogg's Lake hedge-hyssop (*Gratiola heterosepala*), and Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*). Vernal pool complexes are mapped grassland areas that contain individual vernal pools in high, medium, or low densities.

Wetland

Wetlands types in the study area include fresh emergent wetlands and seasonal wetlands. Fresh emergent wetlands support permanently or frequently flooded herbaceous vegetation including cattails (*Typha* spp.), sedges, rushes, and nutsedges (*Cyperus* spp.), and spike-rush (*Eleocharis* spp.). In the study area this habitat may be associated with the margins of artificial ponds, roadside swales, and depressional wetlands. These areas are often isolated, and dominated by nonnative species, such as Johnsongrass (*Sorghum halepense*), dallisgrass (*Paspalum dilatum*), rabbit's foot grass (*Polypogon monspeliensis*), knotweed (*Polygonum* spp.), and dock (*Rumex* spp.). Seasonal wetlands contain some similar species to those found in fresh emergent wetlands, including grasses and sedges. During summer months, seasonal wetlands may support more upland species such as tarweed (*Hemizonia fitchii*), vinegar weed (*Trichostema lanceolatum*), and yellow star-thistle (*Centaurea solstitialis*). Wetlands are used by a number of wildlife species, particularly birds, amphibians, and reptiles. Special status plant species that may occur in wetlands in the study area include hispid bird's-beak (*Cordylanthus mollis* ssp. *hispidus*), dwarf downingia, legenere, Bogg's Lake hedge-hyssop, Ahart's dwarf rush, red-anthered rush (*Juncus marginatus* var. *marginatus*), and Red Bluff dwarf rush.

Agricultural

Agricultural habitat types in the study area include pasture, row crops, rice fields, and unidentified crops. Pasture vegetation is composed primarily of nonnative perennial grasses and legumes such as ryegrass (*Lolium* spp.), fescue, and clover (*Trifolium* spp.). Habitat value may be similar to annual grassland, but is dependent on management. Row crops include wheat, corn, rye, barley, strawberries, and other grains and vegetable crops. Rice fields are seasonally flooded areas that may provide important habitat elements for birds, including shorebirds, water fowl, and raptors. Other species, such as the giant garter snake (*Thamnophis gigas*), may also use rice fields.

Urban

Urban habitats can support trees, shrubs, herbaceous species, or more commonly, a mosaic of these vegetation types interspersed with barren areas (see below). In the study area, urban habitat consists of urban parks, rural residential forested, rural residential, urban/suburban, and urban woodland. Vegetation includes native and nonnative species, including some native forested habitat remnant patches. Urban areas can provide wildlife habitat, the value of which may be determined by vegetative structure and management activities such a pesticide/herbicide applications and mowing and clearing activities. Species using urban habitat types may include western scrub-jay, northern mockingbird (*Mimus polyglottos*), house finch (*Carpodacus mexicanus*), bushtit (*Psaltriparus minimus*), oak titmouse, chestnut-backed chickadee (*Parus rufescens*), California quail (*Callipepla californica*), black-tailed deer (*Odocoileus hemionus*), black-tailed jackrabbit (*Lepus californicus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), California slender salamander (*Batrachoseps attenuatus*), gopher snake (*Pituophis catenifer*), and fence lizard (*Scleporus undulatus*). Special status species, including White-tailed Kite, tricolored blackbird (*Agelaius tricolor*), Swainson's hawk (*Buteo swainsoni*), western pond turtle (*Actinemys marmorata*), and purple martin (*Progne subis*), may also use urban habitats.

Barren

Barren areas include unvegetated disturbed lands (roads, parking lots, gravel pads, and other open areas) and rock outcrop and cliffs. Disturbed lands are dispersed in small areas throughout the study area and provide limited wildlife habitat value. Rock outcrops and cliffs may provide nesting and roosting habitat for some bats, raptors, and other bird species. Some special status plant species, such as Red Hills soaproot (*Chlorogalum grandiflorum*), may occur in rocky outcrops.

3.1.2.2 Aquatic Habitat and Species

This section describes the methodology used to characterize the existing conditions of aquatic resources in streams that may be affected by PCWA O&M activities conducted within the raw water distribution system. These include drainages and streams used for conveyance of water to PCWA customers, and streams that may receive flow contributions from the canal system through regulated or unregulated releases from canal outlets. Streams in the study area include Canyon Creek, Auburn Ravine, Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine.

Descriptions of aquatic biological resources are based on a literature review of studies conducted within the study area and reconnaissance-level site visits along the streams. Documents consulted in the literature review include the following:

- Dry Creek Watershed Coordinated Resource Management Plan (Dry Creek Watershed Council 2003).
- Streams of Western Placer County: Aquatic Habitat and Biological Resources Literature Review (Sierra Business Council 2003).
- Miners Ravine Habitat Assessment (California Department of Water Resources 2002).
- Secret Ravine Adaptive Management Plan (Dry Creek Conservancy 2001).
- Perennial Rearing Habitat for Juvenile Steelhead in the Dry Creek Drainage (Placer County) (California Department of Fish and Game 2001).
- Survey Habitat in Secret Ravine, Tributary to Dry Creek: Anadromous Fish Restoration Program. Document Control No. 11332-8-J113 (U.S. Fish and Wildlife Service 1998).
- Dry Creek, Secret Ravine and Miners Ravine, Placer County. Memorandum to Nick Villa, California Department of Fish and Game, Region 2, Rancho Cordova, California (John Nelson 1997).
- Auburn Ravine/Coon Creek Ecosystem Restoration Plan (Placer County/CALFED 2002).

- Draft Roseville Creek and Riparian Management and Restoration Plan (City of Roseville 2005).
- Clover Valley Large and Small Lot Tentative Subdivision Maps, Draft Environmental Impact Report (City of Rocklin 2006).
- Aquatic Habitat Survey and Fisheries Assessment for Clover Valley (Placer County 2006).
- A Benthic Macroinvertebrate Survey of Secret Ravine: The Effects of Urbanization on Species Diversity and Abundance (De Barruel and West 2003).
- Assessment of Habitat Conditions for Chinook Salmon and Steelhead in Western Placer County, California (Placer County Planning Department 2005b).

Aquatic habitat conditions and species descriptions are focused on fish communities in the study area. Central Valley steelhead and fall-run Chinook salmon are emphasized due to their statuses under the State and Federal Endangered Species Acts (ESA), and the presence of designated Critical Habitat for Central Valley steelhead in the study area. Central Valley steelhead are listed as threatened under the Federal ESA but have no special status under the State ESA. Fall/Late-fall-run Chinook salmon are a Federal Species of Concern and California Species of Special Concern.

California Department of Fish and Game (DFG) is currently working on a program to inventory and perform a landscape-level assessment of fish communities within and across stream systems throughout California, including Auburn Ravine, Secret Ravine, and Miners Ravine, based on an index of biotic integrity (IBI). An IBI assigns scores to predetermined fish community characteristics that are summed and normalized to create an index of the gross ecological health of the stream (Titus et al. 2005). Reference fish assemblages applied to the IBI include Central Valley pikeminnow, hardhead, sucker, deep-bodied fish assemblages (California roach, speckled dace, rainbow trout, riffle sculpin, tule perch) (State Water Resources Control Board [SWRCB] 2005, Moyle 2002), and anadromous species (lamprey, Chinook salmon, steelhead) (SWRCB 2005). Aquatic habitat conditions and species are presented by the presence of fish communities in the study area and 2004-2005 IBI rating results for Auburn, Secret, and Miners ravines.

Benthic macroinvertebrate (BMI) samples were collected during fall 2007 by DCC using the targeted riffle method described in Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California (DFG 2007) at three sites: Auburn Ravine below Auburn Ravine Tunnel outlet, Secret Ravine at Loomis Basin Park, and Miners Ravine below Sierra College Boulevard. BMI analyses are used as indicators of stream health. These organisms live in, on, or near streambed material where hydrophobic chemicals tend to concentrate, and have limited mobility. Therefore, the organisms show cumulative impacts of pollution and habitat degradation over a relatively small spatial area not detected by traditional water quality analyses. A benthic

index of biotic integrity (B-IBI), recently developed by the DFG's Aquatic Bioassessment Laboratory, was applied to BMI analysis results obtained from Auburn, Secret, and Miners ravines. The index is based on BMI samples collected from 275 sites in central and Southern California by the U.S. Forest Service, U.S. EPA, and RWQCBs. The B-IBI provides a method for measuring ecological conditions in streams characterized by seven metrics for comparison with reference streams with an index of BMI assemblages when human disturbance is absent or minimal, and allows categorization of site conditions as "Good," "Fair," or "Poor" (Ode et al. 2005). The seven metrics for the B-IBI assessment include:

- Coleoptera Richness – the total number of Coleoptera taxa present in the subsamples.
- EPT Richness – the total number of taxa from the *Ephemeroptera*, *Plecoptera*, and *Trichoptera* insect orders.
- Predator Richness – total number of taxa categorized as predators.
- Collectors (%) – the percent of individuals present in the subsample categorized as collectors.
- Intolerant Organisms (%) (0-3) – the percent of individuals present in the subsample categorized as having a tolerance value of 0 to 3.
- Non-insect Taxa (%) – The percent of the subsample taxa that are non-insect.
- Tolerant Taxa (%) – The percent of taxa from the subsample that are considered tolerant of stream degradation.

In addition to the BMI analyses conducted for the sites described above, BMI data collected by DCC from sites across the PCWA service area were reviewed for comparison. Data collected by DCC before 2005 using protocols described in the California Stream Bioassessment Procedure were standardized with data collected during fall 2007 for consistency.

3.1.2.3 Special Status Species

This document was prepared with information obtained from species database searches and literature review. Databases and documents consulted include:

- California Natural Diversity Database (CNDDB) Geographic Information System (GIS) layer (CDFG 2008)
- U.S. Fish and Wildlife Service (USFWS) on-line service for information regarding Threatened and Endangered Species final Critical Habitat designation across the U.S. Accessed for Placer County on October 6, 2008. (USFWS 2008)
- On-line Inventory of Rare and Endangered Plants. Accessed for USGS project quadrangles on August 21, 2008. (California Native Plant Society (CNPS) 2008)

- Federal Endangered and Threatened Species that Occur In or May Be Affected by Projects in the Counties and/or USGS 7 1/2 Minute Quadrangles. On-line data accessed for project quadrangles on August 21, 2008 (USFWS 2008)

Project USGS quadrangles are those that contain features (canals and reservoirs) that would be directly affected by operations and maintenance activities, specifically:

- Auburn (Zones 1 and 3)
- Chicago Park (Zone 3)
- Colfax (Zone 3)
- Dutch Flat (Zone 3)
- Gold Hill (Zone 1)
- Greenwood (Zone 3)
- Pilot Hill (Zone 1)
- Pleasant Grove (Zone 5)
- Rocklin (Zone 1)
- Roseville (Zone 5)
- Sheridan (Zone 5)

For purposes of this evaluation, special status species are those that are federally listed (threatened or endangered), species of concern (for aquatic species only), or candidate species; California listed (endangered or threatened) species or species of special concern; and/or species listed on the CNPS inventory of rare and endangered plants. To identify known special status species occurrences in the study area, a GIS layer of PCWA Zones 1, 3, and 5 was overlain on the most recently distributed DFG CNDDB data (this conservatively includes all of Zones 1, 3, and 5, even though most of this area would not be affected). To identify other species that could potentially occur in the study area, databases were queried for known or potential occurrences of special status species in the project USGS quadrangles. Other special status species may have the potential to occur in the study area. Resource agencies should be consulted for information on a site-specific basis.

3.2 PHYSICAL RESOURCES SETTING

The sections below describe physical resources within Zones 3, 1, and 5 of the PCWA raw water distribution area during routine canal operations. Categories of physical resources described are hydrology, water quality, and soil and sediment quality, each of which is organized by watersheds within each PCWA zone.

3.2.1 Hydrology

Hydrology in PCWA's raw water distribution system is affected by release directly from canal outlets and discharge locations, and by return flows from customers. The interrelationship between canals owned by PG&E and PCWA delivers water originating from the Yuba and Bear river systems in varying proportions throughout the raw water distribution system, depending on the season and buy point(s) used. The following sections describe the characteristics that determine the sources and destinations of raw water within Zones 3, 1, and 5 of the PCWA raw water distribution system. These zones are described in the general direction of flow, with Zone 3 representing the upstream zone, and Zone 5 the furthest downstream extent of the system.

3.2.1.1 Zone 3

Hydrology in Zone 3 canals is largely regulated by releases from Lake Alta, a small reservoir near the town of Alta, with a surface area of approximately 20 acres and storage capacity of about 270 acre-feet. Water is conveyed to Lake Alta from PG&E's Alta Powerhouse through the Alta Tailrace, or from PCWA's Pulp Mill Canal, which conveys water from Canyon Creek.

PCWA holds water rights of 40 cfs on Canyon Creek, a tributary to the North Fork American River. PG&E uses Canyon Creek to convey water from PG&E's Drum Forebay to PG&E's Towle Canal, which flows to Alta Forebay. PG&E is required to maintain an instream flow of 1 cfs that is released to Canyon Creek below Pulp Mill Diversion Dam. Canyon Creek flows parallel to Interstate 80 for much of its 10.5-mile length, before turning south to its confluence with the North Fork American River near the town of Dutch Flat (Durham 1998).

The Canyon Creek watershed is small and confined in a steep canyon. Streamflows in Canyon Creek are monitored by USGS at two gaging stations upstream from Pulp Mill Diversion Dam, located upstream and downstream from PG&E's Towle Canal Diversion. USGS Station No. 11426195 (Canyon Creek near Blue Canyon, California) is located upstream of PG&E's Towle Canal Diversion, and reflects streamflow generated within a 0.5-square-mile watershed. USGS Station No. 11426196 (Canyon Creek below Towle Diversion Dam, near Blue Canyon, California) is downstream from PG&E's Towle Diversion, and reflects streamflow for a 1.3-square-mile watershed. Streamflows at these stations are not recorded above 1.2 cfs. Flows at these stations often exceed 1.2 cfs during the winter, but frequently drop below 1 cfs during the summer (USGS, 2007a, 2007b). The hydrology of Canyon Creek is likely representative of other streams in the area, with high flow during winter and spring, and low flow during summer and fall, due, in part, to the small watershed and lack of baseflow contributions from

groundwater. Much of the land in Zone 3 is rural with some agriculture and pasture lands. Urbanization increases at the southern portion of Zone 3 near Zone 1.

PCWA releases water from Lake Alta to Cedar Creek Canal, which conveys water to the Monte Vista WTP and Boardman Canal. Boardman Canal is the main conveyance feature in Zone 3. The canal parallels Interstate 80 through much of the zone, generally following the topographical divide of the North Fork American River watershed to the east and the Bear River watershed to the west.

3.2.1.2 Zone 1

Zone 1 hydrology is primarily affected by the topographical transition from the steep slopes and narrow canyons of Zone 3 to the broad, relatively flat topography of Zone 5. Zone 1 is characterized by gradually decreasing gradients from the upper to lower portions, and by numerous branches of gravity-fed canals that deliver water to customers over a large area. Several Zone 1 streams receive flow contributions from the canal system through regulated or unregulated releases from canal outlets, or are used as conveyance features within the PCWA raw water distribution system. These include Auburn Ravine, Clover Valley Creek, Antelope Creek, Miners Ravine, and Secret Ravine.

Auburn Ravine originates on the north side of the City of Auburn, and has a watershed area of approximately 79 square miles. Upstream from the City of Auburn, the stream is confined within a natural channel, is unimpaired, and receives mostly local watershed contributions to streamflow, with some PCWA contributions that are diverted further downstream. Immediately west of the City of Auburn, the character of the stream changes and Auburn Ravine is used as a conveyance feature for PG&E, NID, and the PCWA canal system.

Auburn Ravine's natural streamflow is supplemented through four primary sources: (1) PG&E Drum-Spaulding Project source water; (2) PCWA deliveries from the North Fork American River through the Auburn Ravine Tunnel; (3) City of Auburn effluent discharges from its WWTP; and (4) Auburn Ravine watershed stormwater runoff. In addition to hydrologic influences of PG&E, NID, and PCWA flow contributions and diversions on Auburn Ravine, NID and PCWA customers indirectly affect Auburn Ravine hydrology through customer return flows (remaining portions of customer water deliveries that return to drainages). Middle Fiddler Green Canal, Lower Banvard Canal, Dutch Ravine Canal, and Caperton Canal are the main PCWA canals that supply customers raw water in the Auburn Ravine watershed.

Instantaneous peak flows in Auburn Ravine are highest in the winter months, ranging from less than 3 cfs to an estimated 100-year flow event exceeding 14,000 cfs near the City of Lincoln. Estimated monthly average streamflow for Auburn Ravine under existing management conditions and historic natural streamflow are provided in **Table 3-4** (Reclamation and PCWA 2002). Flows in Auburn Ravine are lowest during the fall, when NID and PCWA customer demands are low. Auburn Ravine flows can vary substantially on a daily and monthly basis. The supplemental flows described above significantly augment the estimated natural late summer and early fall streamflows. Without the influence of existing water management conditions in the

watershed, Auburn Ravine would remain an intermittent stream carrying only flow originating at its headwaters and runoff from the watershed (Reclamation and PCWA 2002).

TABLE 3-4
ESTIMATED MEAN MONTHLY FLOW FOR AUBURN RAVINE NEAR HIGHWAY 65 BRIDGE

	October	November	December	January	February	March	April	May	June	July	August	September
	Mean Monthly Flow (cubic feet per second)											
Estimated Under Existing Management Conditions[1]	30	39	84	117	120	132	66	88	82	114	99	43
Estimated Natural Streamflow[2]	4.1	11.7	38.2	70.6	50.9	32.3	20.1	2.4	0.2	0.1	0.0	0.0

[1] Source: Eco:Logic Engineering Water Balances; Nevada Irrigation District (NID) Gauge in Auburn Ravine below Highway 65 in City of Lincoln 1999.
[2] Source: City of Auburn 1997 in City of Lincoln 1999.

Clover Valley Creek, a tributary to Antelope Creek (described below), is 7.1 miles in length, and has a watershed area of about 10.2 square miles (Placer and Sacramento Counties 2003). Clover Valley Creek watershed is a tributary of Dry Creek, and comprises approximately 3.6 percent of the Dry Creek watershed (Placer and Sacramento Counties 2003). Clover Valley Creek receives direct flow contributions from the PCWA raw water distribution system in the form of regulated releases at Clover Valley Reservoir and unregulated releases from the end of the Antelope Canal outlet, as well as indirect flow contributions through customer return flows. Additionally, flows to Clover Valley Creek may be augmented by PCWA during storms through overflow releases from Whitney Reservoir. Clover Valley Creek serves as a natural drainage system for the primarily undeveloped Clover Valley area. The level of development within the Clover Valley Creek watershed increases from upstream to downstream, with significant portions of the land adjacent to the upper reaches undeveloped. Estimated peak flows for 10- and 100-year flood events at the Clover Valley Creek confluence with Antelope Creek are approximately 1,650 cfs and 3,050 cfs, respectively (City of Rocklin 2006).

Antelope Creek Watershed

Antelope Creek flows roughly parallel to Interstate 80 for approximately 9.5 miles in the southern portion of Zone 1. Antelope Creek is a tributary to Dry Creek, which in turn is a tributary to the Sacramento River via Steelhead Creek (formerly the Natomas East Main Drain Canal), and has a watershed area of approximately 21.4 square miles. Antelope Creek comprises approximately 11 percent of the Dry Creek watershed (Placer and Sacramento Counties 2003). Its watershed is urbanized with some light agriculture in the uppermost portions (Placer and Sacramento Counties 2003). Antelope Creek receives direct flow contributions from the PCWA raw water distribution system in the form of unregulated releases from the end of the Antelope Stub Canal outlet, indirect flow contributions through customer return flows, and treated effluent

from a sewage disposal pond located a few miles upstream from its confluence with Dry Creek. Antelope Creek also receives treated effluent from a sewage disposal pond located a few miles upstream from its confluence with Dry Creek, north of Highway 65 (Placer County Planning Department 2005b). Flows in Antelope Creek during summer and early fall months are often less than 1 cfs, while potential peak flows for 10- and 100-year flood events at Rocklin Road were calculated by the Placer County Flood Control and Water Conservation District (PCFCWCD) are of approximately 1,430 cfs and 3,490 cfs, respectively (PCFCWCD and Sacramento County Water Agency (SCWA) 1992).

Secret Ravine Watershed

Secret Ravine is a tributary to Miners Ravine, described below. It is 7.8 miles long, flows in a narrow valley underlain by Recent alluvial deposits, and has a watershed area of about 22.3 square miles (Placer and Sacramento Counties 2003). The Secret Ravine watershed comprises approximately 22 percent of the Dry Creek watershed (Placer and Sacramento Counties 2003). Shallow, impermeable soils, granitic bedrock, and a narrow riparian zone characterize the upper watershed of Secret Ravine. The bedrock of the lower watershed is volcanic cap rock. These conditions, coupled with rapid urban and residential development in the watershed, which increases the impervious fraction of land cover, result in rapid surface and subsurface runoff generation, and an increase in peak flows in Secret Ravine.

Secret Ravine flows vary greatly during the year. Flows in Secret Ravine are as low as 0.5 cfs during summer and early fall months, while potential peak flows for 10- and 100-year flood events at Rocklin Road calculated by the PCFCWCD were approximately 1,750 cfs and 3,820 cfs, respectively (Placer County and SCWA 1992). Current summer streamflows are greater than the historic unimpaired flow on Secret Ravine (Placer and Sacramento Counties 2003). Summer flows are most likely attributed to direct flow contributions from the PCWA raw water distribution system in the form of unregulated releases from several PCWA canal outlets, indirect flow contributions through customer return flows, and treated effluent from two sewage disposal ponds located near Interstate 80 and Gilardi Road. Summer flows are two or three times the historic unimpaired flow (Placer County Planning Department 2005b).

Numerous PCWA canals augment flows in tributaries to Secret Ravine through unregulated releases from the ends of canal outlets, including Westside, Lyall, and Eastside canals to the west, and Sugarloaf, Barton, Turner, Yankee Hill, and Boardman canals to the east. Customer return flows also augment streamflow in Secret Ravine. PCWA canal system contributions dominate dry season flows in Secret Ravine (USACE and PCWA 2008). Flows in Secret Ravine at Rocklin Road in Roseville between December 2004 and December 2006 are logarithmically displayed in **Figure 3-5**.

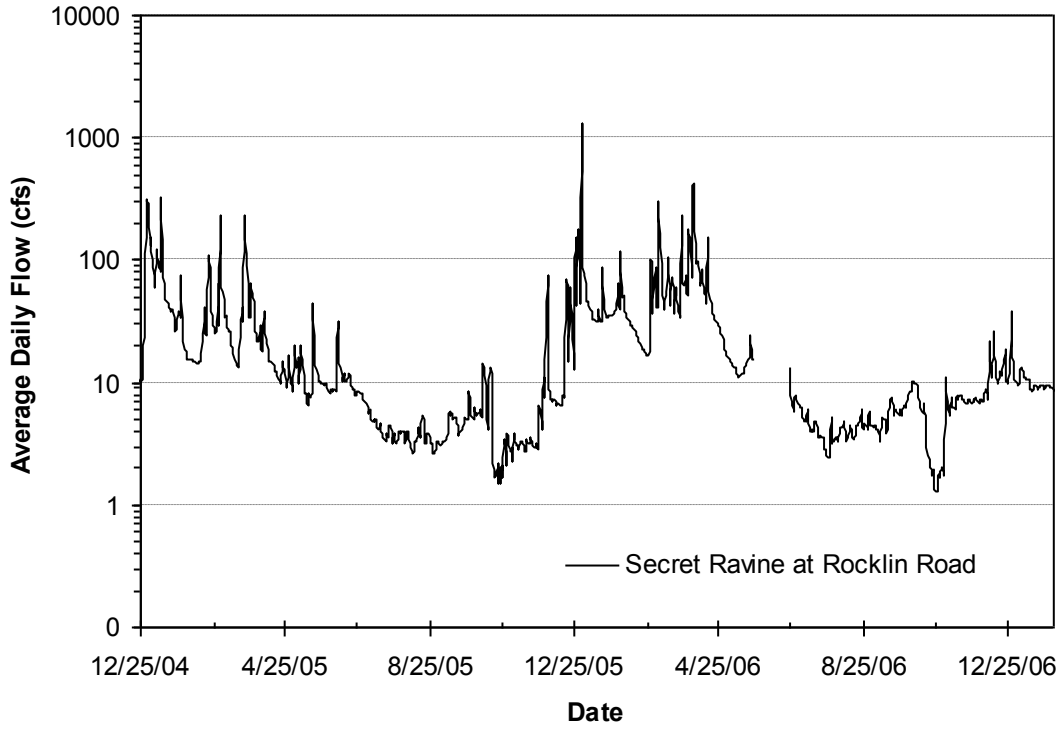

FIGURE 3-5
AVERAGE DAILY FLOWS IN SECRET RAVINE AT ROCKLIN ROAD

Miners Ravine Watershed

Miners Ravine is a tributary to Dry Creek, and is approximately 15.2 miles long, with a watershed area of 20.1 square miles. Miners Ravine watershed represents approximately 20 percent of the Dry Creek watershed. The headwaters for Miners Ravine are in the western foothills of the Sierra Nevada where livestock grazing is common, whereas the downstream portion flows through more developed areas. Similar to Secret Ravine, impermeable soils and shallow depth to bedrock in the Miners Ravine watershed contribute to rapid surface and subsurface runoff generation. Apart from the main channel, the watershed drainage consists of small, intermittent tributaries that only carry low flows and can be expected to flood, on average, every 5 years (Placer and Sacramento Counties 2003).

Summer flows in Miners Ravine are often less than 1 cfs, while peak flows for 10- and 100-year events at Sunrise Avenue were calculated by the Placer County Flood Control and Water Conservation District to be approximately 2,497 cfs and 6,642 cfs, respectively (Placer County and SCWA 1992). Localized flooding often occurs in the Miners Ravine watershed. Fences and other structures within or immediately adjacent to the watercourse and inadequately sized culverts at bridge crossings create flow obstructions, and contribute to issues of flooding in the watershed.

Similar to Secret Ravine, canal system contributions comprise most of the dry weather flows in Miners Ravine (USACE and PCWA 2008). These contributions include customer return flows and unregulated releases from the Lower Greely, Ferguson, and Baughman canals. Additional

inputs include the Placer County SMD No. 3 (National Pollutant Discharge Elimination System ((NPDES)) CA0079367) WWTP. The design flow rate of Placer County SMD No. 3 is 0.75 million gallons per day (mgd) (1.16 cfs), but the facility is currently operating at less than 20 percent design capacity. Under current operations, effluent contributes 2 to 3 percent of total flow during high-flow conditions and less than 10 percent of total flow during low-flow conditions (Placer and Sacramento Counties 2003). Flows in Miners Ravine near North Sunrise Avenue in Roseville between December 2004 and December 2006 are logarithmically displayed in **Figure 3-6**.

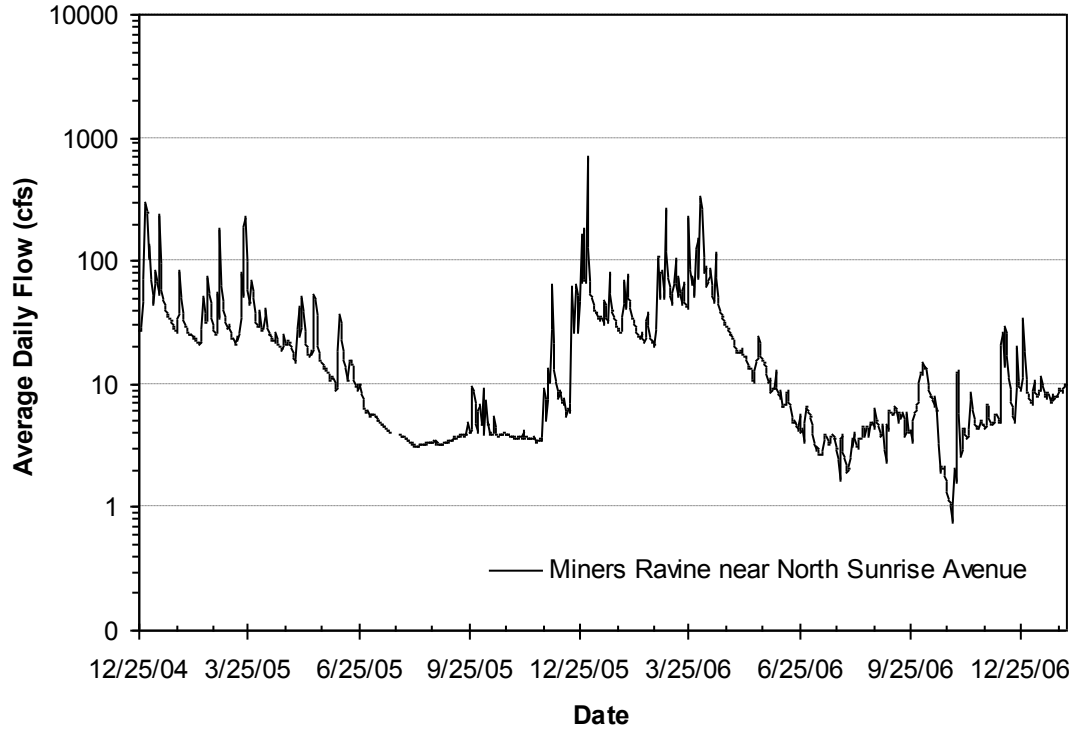

FIGURE 3-6
AVERAGE DAILY FLOWS IN MINERS RAVINE NEAR NORTH SUNRISE AVENUE

3.2.1.3 Zone 5

The Zone 5 service area receives water deliveries diverted from Auburn Ravine. As described above, streamflow in Auburn Ravine is supplemented through diversions from the American, Bear, and Yuba rivers, as well as treated effluent from the City of Lincoln's WWTP. Due to these supplemental sources to flow in Auburn Ravine, monthly average streamflow for Auburn Ravine under existing management conditions vary considerably from estimated natural flow conditions (**Table 3-4**). Up to 50 cfs of water pumped from the North Fork American River are conveyed to Auburn Ravine in Zone 1 by PCWA for diversion in Zone 5. PCWA may also divert water purchased from PG&E at YB 136 for deliveries to Zone 5 customers. Auburn Ravine is seasonally dammed at Moore Dam, where flows are diverted to Moore Canal. Further downstream, flows are diverted from Auburn Ravine at the Pleasant Grove Dam to the Pleasant

Grove Canal. PCWA Zone 5 customers receive deliveries conveyed either directly from Auburn Ravine or diverted to Moore or Pleasant Grove canals. In addition to these diversions to PCWA's Zone 5 service area, several dams and diversions on Auburn Ravine provide for water deliveries to NID customers.

3.2.2 Water Quality

This section presents the results of seasonal water quality monitoring efforts during routine operations, describes general trends observed, and presents some stronger trends and potential relationships among different water quality parameters. As previously mentioned, more extensive sampling would be required to accurately derive quantitative results. Therefore, the information in this section is descriptive and should be used for qualitative discussion purposes only. The data are described below by watershed within each zone, and discussed with respect to basic physical and chemical parameters, major ions, and trace elements.

Water quality is expected to vary over space and time in the PCWA canal and associated stream systems. Spatially, in the upstream areas of the canal system, the canal water is expected to more closely resemble the quality of source water from the Yuba and Bear rivers. As water flows farther downstream through the canal system, it encounters many factors that affect its quality, including debris in the canal channels, irrigation return flows and additional watershed contributions from property along the canals, and water storage in mid-system reservoirs. Water pumped from the American River through the ARPS contributes to flow in the PCWA canal system during certain times of the year, and additional Yuba and Bear supplies can be added to the PCWA system at various points. As water reaches tributaries and streams and flows further from the canal outlets, it encounters many factors characteristic of the stream's watershed that affect its quality, including irrigation return flows, runoff, ponds, tributaries, and in-channel vegetation. Residual constituents from historical activities in the basin, such as hydraulic mining, quarries, a pulp mill, and large agricultural areas, could affect canal and stream water quality.

These water quality results can be compared to Federal and State water quality criteria and objectives stipulated in the National Toxics Rule (NTR), California Toxics Rule (CTR), and Porter-Cologne Water Quality Control Act, described in **Chapter 4**. The U.S. EPA National Recommended Ambient Water Quality Criteria for Freshwater Aquatic Life (NTR) and Criteria for Priority Toxic Pollutants in the State of California (CTR) are shown in **Tables 3-5** and **3-6**, respectively. Normally, two types of limits are presented in the NTR and CTR; chronic and acute. These limits are presented as Criteria Maximum Concentrations (CMC) to protect aquatic organisms from short-term or acute exposures (expressed as 1-hour average or instantaneous maximum concentrations) to pollutants. Criteria Continuous Concentrations (CCC) are intended to protect aquatic organisms from long-term or chronic exposures (expressed as 4-day or 24-hour average concentrations). Of the constituents measured in study area streams, cadmium, copper and zinc have freshwater CMC and CCC limits.

TABLE 3-5
NATIONAL RECOMMENDED AMBIENT WATER QUALITY CRITERIA FOR FRESHWATER AQUATIC LIFE

Parameter	Maximum or Acute Concentration (CMC) (1-hour Average) in µg/L	Continuous or Chronic Concentration (CCC) (4-day Average) in µg/L	Pollutant Type
Aluminum[1]	750	87	Non Priority
Alkalinity[3]		20,000	Non Priority
Cadmium[2]	2.0	0.25	Priority
Copper [2]	13	9	Priority
Iron[3]		1000	Non Priority
Zinc[2]	120	120	Priority
Dissolved Oxygen[3]	Warmwater and Coldwater Matrix (Document N)		Non Priority
TSS and Turbidity[3]	Narrative Statement (Document F)		Non Priority
Temperature[3]	Species-dependent Criteria (Document M)		Non Priority
Hardness[3]	Narrative Statement		Non Priority
pH[3]	6.5-9.5 in pH units		Non Priority

Source:
U.S. EPA 2006.
Notes:
[1] Total recoverable aluminum for waters with pH between 6.5 and 9.0.
[2] Expressed in terms of dissolved metal in water column as a function of hardness (mg/L). The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated based on information in Appendix B- Parameters for Calculating Freshwater Dissolved Metals Criteria
That Are Hardness-Dependent.
[3] U.S. EPA 1986.
Key:
CCC = Criteria Continuous Concentration (estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect)
CMC = Criteria Maximum Concentration(an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect)
µg/L = microgram per liter

TABLE 3-6
CRITERIA FOR PRIORITY TOXIC POLLUTANTS IN THE STATE OF CALIFORNIA (CALIFORNIA TOXICS RULE) FOR SELECT PARAMETERS

Parameter Name	Freshwater CMC (µg/L)	Freshwater CCC (µg/L)
Cadmium[1]		2.2
Copper[1]	13	9
Zinc[1]	120	120

Source: EPA 40 Code of Federal Regulations Part 131
Note:
1 The California Toxics Rule for the maximum concentration for Cadmium does not apply to the Sacramento River
Key:
CCC = Criteria Continuous Concentration
CMC = Criteria Maximum Concentration
µg/ = micrograms per liter l

Under the Porter Cologne Water Quality Control Act, the Water Quality Control Plan for the Sacramento and San Joaquin Rivers (Basin Plan) presents the following designated beneficial uses established for the Sacramento River; Colusa Basin Drain to the "I" Street Bridge, or Hydrologic Unit Number 520 (RWQCB 2007):

- **Municipal Domestic Supply (MUN) -** Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

- **Agricultural Supply (AGR)** for Irrigation – Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

- **Water Contact Recreation (REC-1)** – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, waterskiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

- **Non-contact Water Recreation (REC-2)** – Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

- **Warm and Cold Freshwater Habitat (WARM and COLD) –** Resident does not include anadromous fish. Any segments with both COLD and WARM beneficial use designations will be considered COLD water bodies for the application of water quality objectives.

- **Warm and Cold Migration of Aquatic Organisms (MIGR) –** More specifically referring to striped bass, sturgeon, and shad.

- **Warm and Cold Fish Spawning, Reproduction, and/or Early Development (SPWN)** – More specifically referring to salmon and steelhead.

- **Wildlife Habitat (WILD) -** Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

- **Navigation (NAV) -** Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Of the water quality constituents measured in study area streams, water quality objectives for the Sacramento River watershed, from Keswick Dam to the I Street Bridge in the City of Sacramento, have been established concerning thresholds for the basic parameters of dissolved oxygen, pH, electrical (specific) conductivity, and turbidity (**Table 3-7**), as well as the ions and trace elements of barium, copper, iron, and zinc (**Table 3-8**). This segment of the Sacramento River is also on the 303d list of impaired water bodies for mercury and diazinon, an organophosphate pesticide. Organophosphate pesticides are not used by PCWA and not discussed further in this report.

TABLE 3-7
BASIN PLAN WATER QUALITY OBJECTIVES FOR BASIC PARAMETERS ASSOCIATED WITH BENEFICIAL USES

Parameter	Water Quality Criterion	Units	Applicable Water Bodies
Dissolved Oxygen	>85% saturation (Monthly median of the mean daily DO concentration in mg/L) >75% saturation (95th percentile concentration) 7.0 (Minimum level for waters with designated COLD beneficial uses)	(mg/L)	Surface water bodies outside the legal boundaries of the Delta.
pH[1]	6.5-8.5 Changes in normal ambient pH levels shall not exceed 0.5 in fres waters with designated COLD or WARM beneficial uses		All
Turbidity[2]	Will not increase by greater than 20%		

Source: Central Valley RWQCB, 2007
Notes:
[1] Changes in normal ambient pH levels shall not exceed 0.5 in freshwaters with designated COLD or WARM beneficial uses
[2] Where natural turbidity is between 5 and 50 NTU
Key:
DO = dissolved oxygen
mg/L = milligram per liter

TABLE 3-8
BASIN PLAN WATER QUALITY OBJECTIVES FOR TRACE ELEMENTS ASSOCIATED WITH BENEFICIAL USES

Parameter	Maximum Concentration	Unit
Barium[2]	100	µg/L
Copper[2]	10	µg/L
Iron[2]	0.3	mg/L
Zinc[2]	10	µg/L

Source: Central Valley RWQCB, 2007

Notes:

[1] These concentrations are based on a hardness of 40 mg/L. Where deviations from 40 mg/L of water hardness occur, the objectives (mg/L) shall be determined by the following formula:

$Cu = e^{(0.905)(\text{Ln hardness})-1.612} \times 10^{-3}$

$Zn = e^{(0.830)(\text{Ln hardness})-0.289} \times 10^{-3}$

$Cd = e^{(1.160)(\text{Ln hardness})-5.777} \times 10^{-3}$

[2] Metal objectives are dissolved concentrations

Key:

These objectives are applicable to the Sacramento River from Keswick Dam to the I Street Bridge at City of Sacramento (13, 30); American River from Folsom Dam to the Sacramento River (51); Folsom Lake (50); and the Sacramento-San Joaquin Delta.

mg/L = milligrams per liter

µg/L = micrograms per liter

3.2.2.1 Zone 3

The water quality of Canyon Creek is likely representative of other streams within the western Sierra Nevada montane forest area. Because the creek is located deep within a steep canyon characterized by coarse loam soils, it may be particularly vulnerable to erosion through scouring of the banks from high flows during the wet season, which increases the potential for naturally high sediment loads in streams. Although much of the land around Canyon Creek is rural, water quality conditions may be affected by historic mining activities in the area. Eleven of the 24 major watersheds in the Sierra had portions in which mercury was found, and eight watersheds were found with traces of copper detected (Sierra Nevada Alliance 2006). In addition, 50 percent of these major watersheds were found to have elevated concentrations of nutrients, and 29 percent were found to be affected by pesticides (Sierra Nevada Alliance 2006).

Water quality was evaluated at one site in Zone 3, Boardman Canal below Lake Alta (YB96). Lake Alta is located near the top of the PCWA water delivery system, at an elevation of 3,543 feet above mean sea level (msl). Releases from Lake Alta are delivered to Boardman Canal, which is the main conveyance feature in Zone 3.

The following sections describe water quality conditions observed during PCWA routine operations within the Zone 3 service area at Boardman Canal below Lake Alta (YB96).

Water Temperature and Dissolved Oxygen

Water temperature results for YB96 from baseline water quality monitoring events are shown in **Figure 3-7**. These water temperatures are of the coldest for all canal sampling locations because

this site is the most upstream location within the canal system and is located at an elevation of 3,543 feet msl, which is significantly higher than the other sampling locations.

An inverse relationship between water temperature and DO was observed, shown in **Figure 3-7**, exhibiting higher DO levels when water temperatures were lower. In the PCWA canal system, DO levels were highest in late fall and decreased through winter and into spring. These DO results are of the highest among all canal sampling locations.

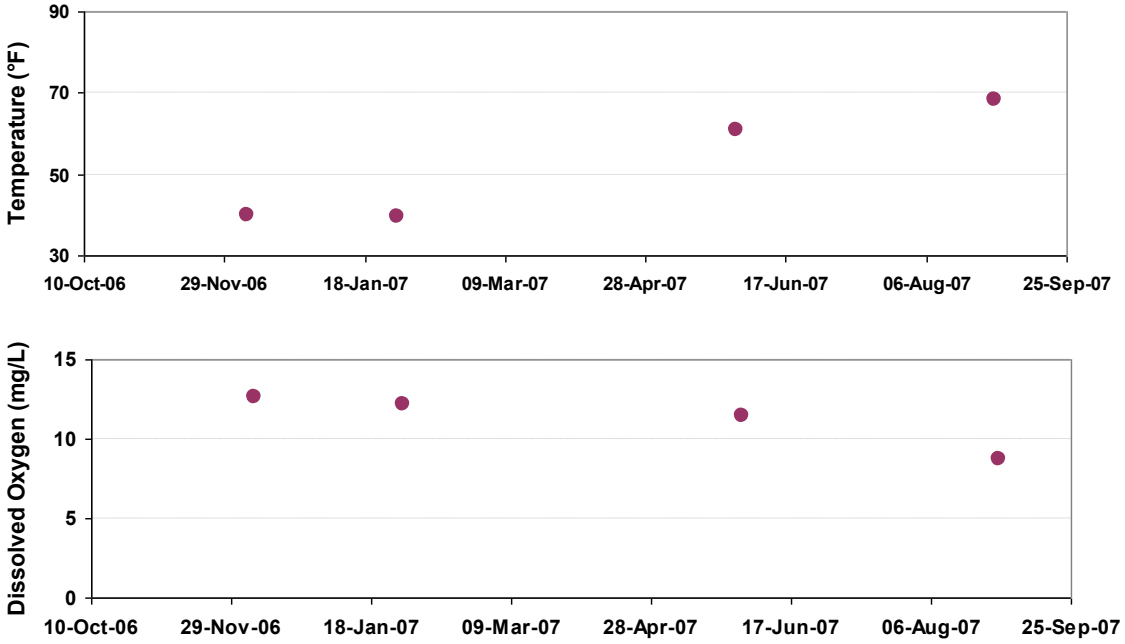

FIGURE 3-7
WATER TEMPERATURE AND DISSOLVED OXYGEN RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

pH, Alkalinity, and Hardness

As shown in **Figure 3-8**, values for pH remained relatively close to the neutral level of 7.0, and were relatively constant in the canal system regardless of season, varying between pH 7.0 and pH 7.58. Results for pH at YB96 were closest to "neutral" among the water quality monitoring sites within the PCWA raw water distribution system.

The geology and soils of the region typically exhibit low pH and low concentrations of $CaCO_3$, a mineral that contributes to alkalinity and raises pH. However, many of the streams in the PCWA raw water service area are associated with xerofluvents, soils with up to pH 8.5, and some of the only soils in Placer County containing $CaCO_3$ (up to 5 percent) (USDA-NRCS 2007). As shown in **Figure 3-8**, alkalinity values at YB96 varied between 14 and 23 mg/L $CaCO_3$, which are similar to the values exhibited at the other canal sampling locations, described below. The highest alkalinity value of 23 mg/L $CaCO_3$ at YB96 is associated with the lowest pH value during the spring sampling event at that site. Calculated hardness values coincide with alkalinity

values, with the exception of the summer sampling event, which was calculated to be lower than the measured alkalinity value. This could indicate the hardness is completely $CaCO_3$-derived.

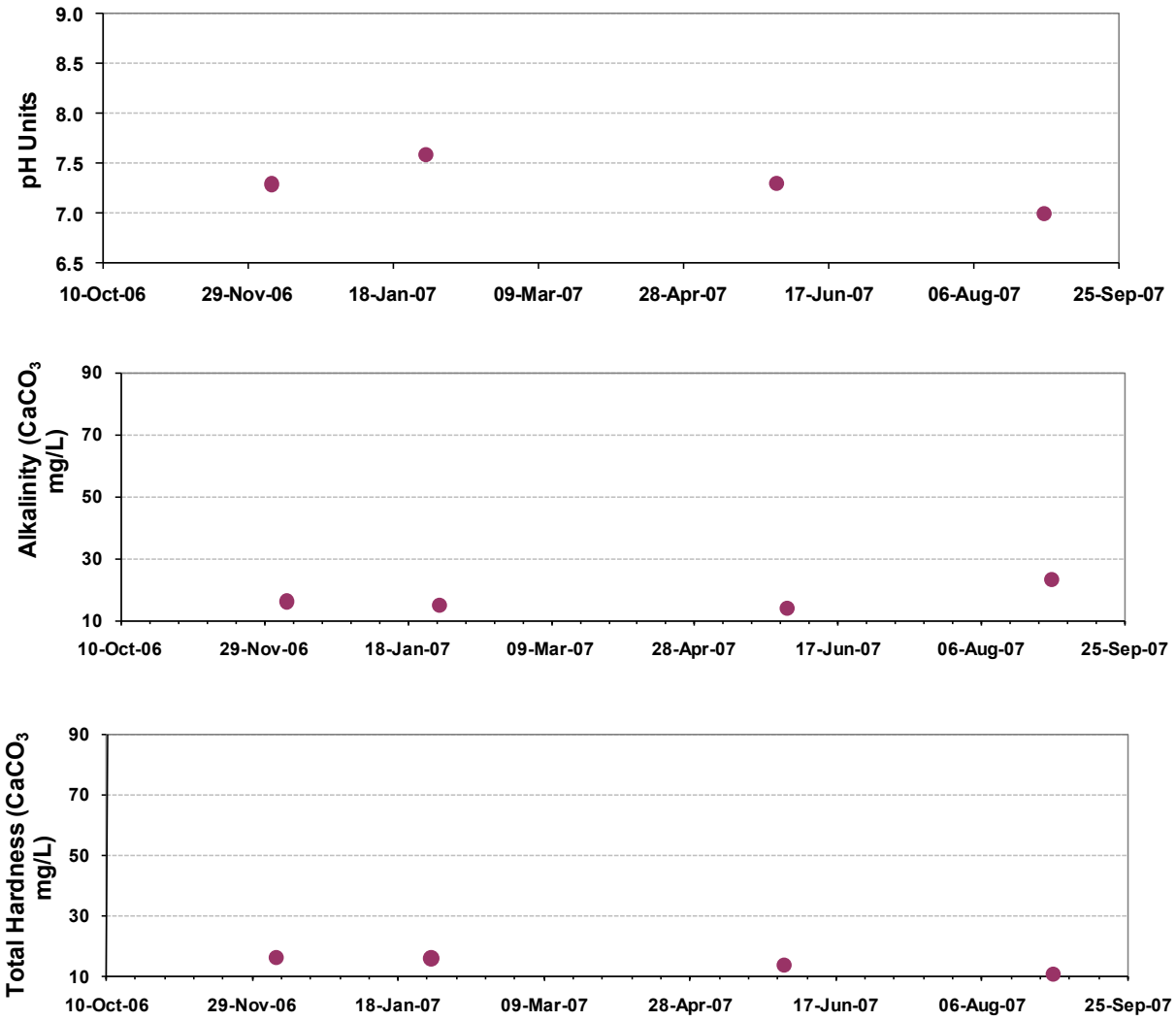

FIGURE 3-8
PH, HARDNESS, AND ALKALINITY RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

Total Suspended Solids and Turbidity

All TSS values at YB96 were below detection limits (10 mg/L) during baseline sampling events. Turbidity was relatively low and constant in the PCWA canal system during routine operations activities. As shown in **Figure 3-9**, turbidity values at YB96 ranged between 8.0 and 15.7 nephelometric turbidity units (NTUs). Overall TSS and turbidity at the Boardman Canal below Lake Alta were low for seasonal baseline sampling events.

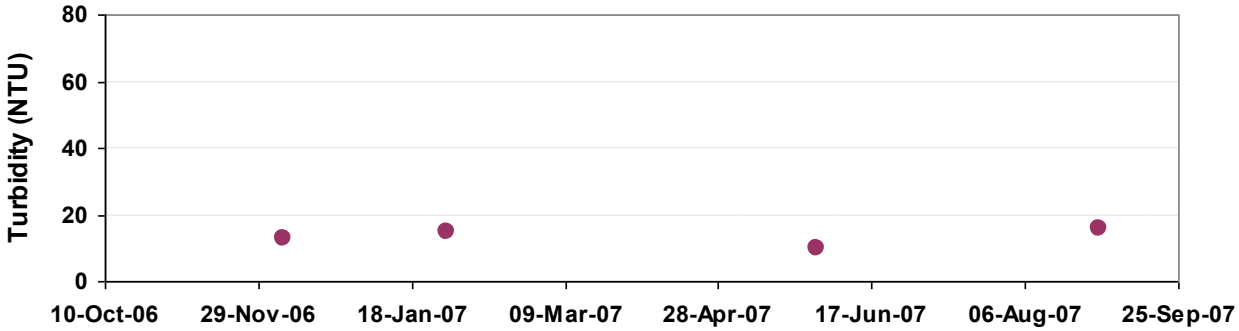

FIGURE 3-9
TOTAL SUSPENDED SOLIDS AND TURBIDITY RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

Specific Conductivity and Ions

SC in water sampled in the Boardman Canal below Lake Alta was highest in fall and winter and decreased in spring and summer, as shown in **Figure 3-10**. With the exception of the summer result, these results were the highest among all other canal sampling locations.

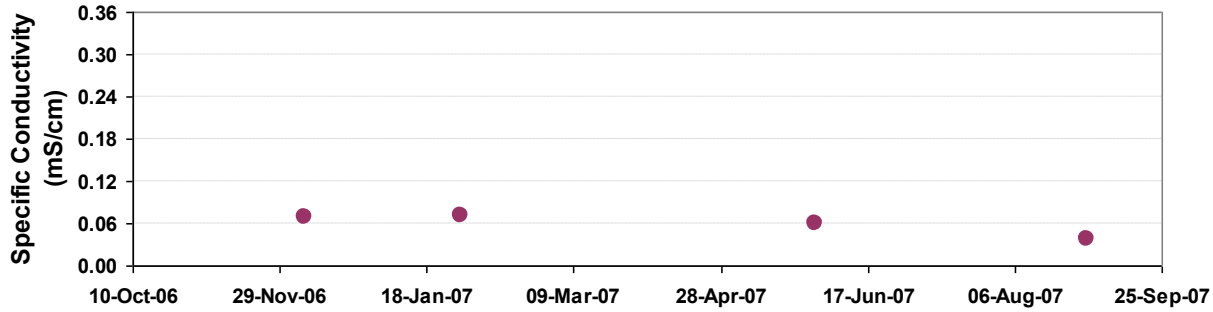

FIGURE 3-10
SPECIFIC CONDUCTIVITY RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

As shown in **Figure 3-11**, calcium concentrations at YB96 display similar trends to that of SC, in which results were higher in fall and winter than in spring and summer. Seasonal calcium results at the Boardman Canal below Lake Alta were very low and ranged from 3.1 to 4.3 mg/L.

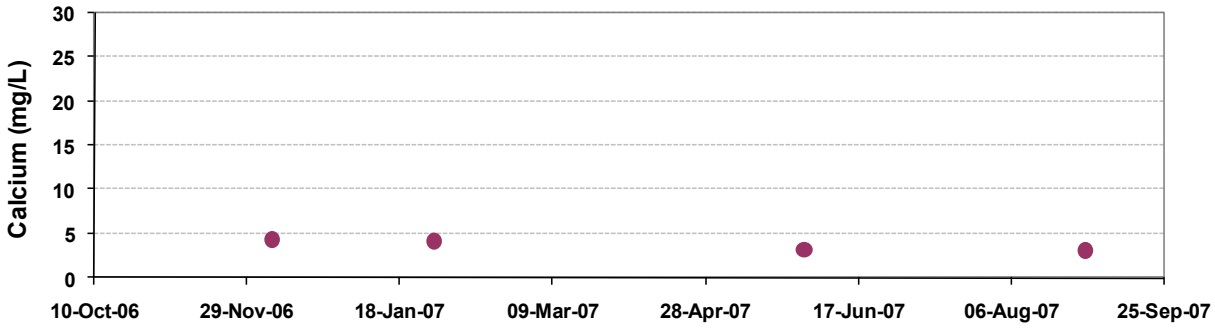

FIGURE 3-11
CALCIUM RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

Iron was low at the YB96 site under routine operations, as shown in **Figure 3-12**. Concentrations ranged from 0.081 to 0.16 mg/L.

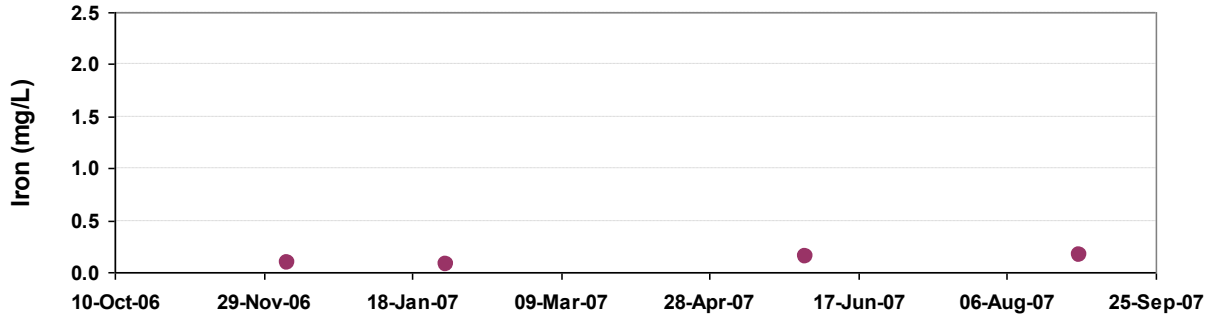

FIGURE 3-12
IRON RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

As shown in **Figure 3-13,** magnesium concentrations observed at YB96 were low, with values ranging from 0.73 to 1.4 mg/L. Results did not vary greatly over different seasons, which is similar to results for calcium.

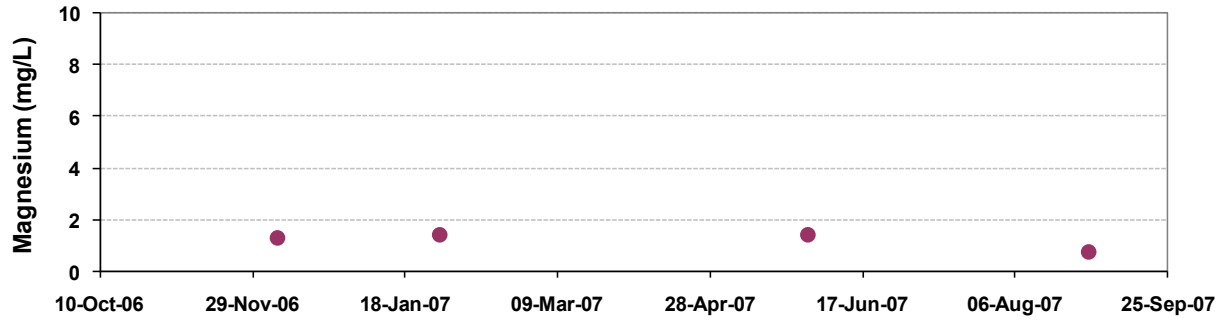

FIGURE 3-13
MAGNESIUM RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

No potassium results were detected, with a detection limit of 1.0 mg/L, at Boardman Canal below Lake Alta during routine canal operations.

Figure 3-14 shows that sodium values range from 2.2 to 6.6 mg/L, with the lowest value in the summer and the highest value in the winter. Although sodium concentrations were very low at the Boardman Canal below the Lake Alta site, they were higher than all other canal sampling locations, with the exception of the summer, which exhibited the lowest value.

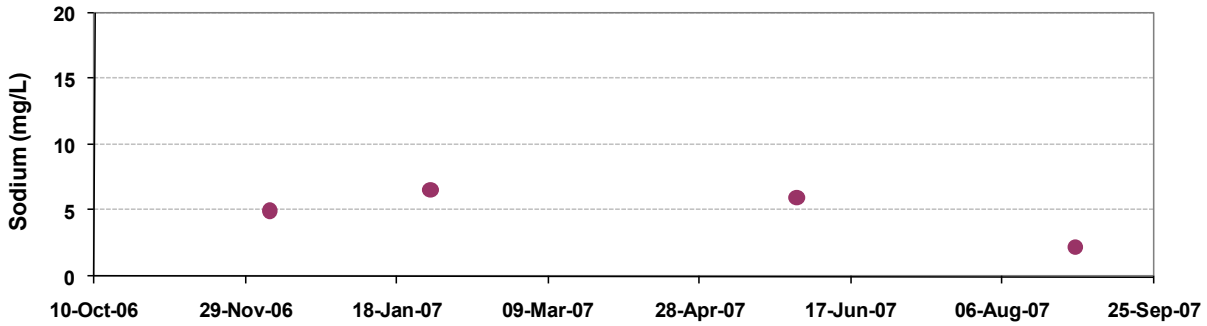

FIGURE 3-14
SODIUM RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

Chloride was present in the canal system at low levels during baseline sampling, as shown in **Figure 3-15**. Observed chloride concentrations at YB96 ranged from 1.9 to 9.5 mg/L. Similar to sodium concentrations at Boardman Canal below Lake Alta, chloride levels were elevated above concentrations in the remainder of the canal system, with the exception of summer baseline samples, when concentrations were lowest.

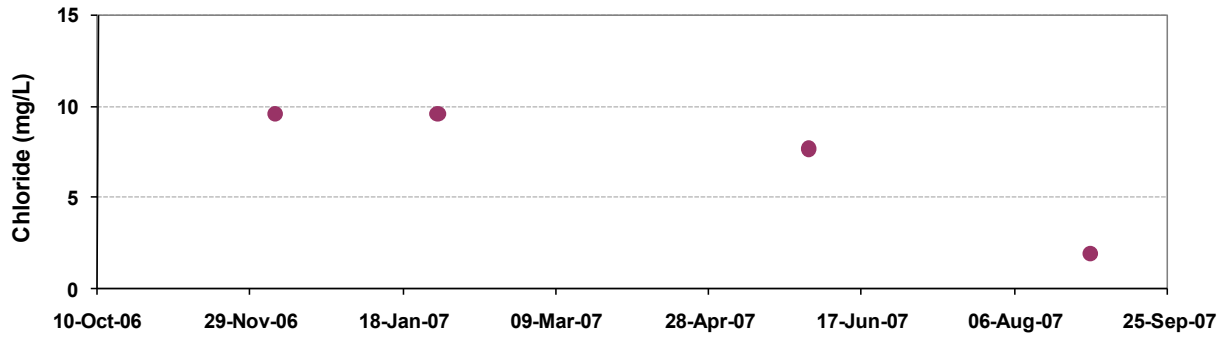

FIGURE 3-15
CHLORIDE RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

Similar to potassium levels, no nitrate was detected at Boardman Canal below Lake Alta under baseline conditions. All results were below the detection limit of 0.1 mg/L.

Concentrations of sulfate are very low at the Boardman Canal below Lake Alta during routine operations. Concentrations were below the detection limit of 0.5 mg/L, with the exception of the winter sampling event, when the result was 1 mg/L.

Trace Elements

Elements that typically occur in very low concentrations are referred to as trace elements. At higher concentrations, most trace elements become toxic to plants, animals, or humans. Sources may be natural or urban, agricultural, or municipal. The solubility of most trace elements – whether they adsorb to bottom sediments or remain in the water column – is dependent on oxidation and reduction potential and pH. Water quality sampling in Zone 3 included analyses for several trace elements: barium, cadmium, copper, iron, mercury, and zinc. The toxicity and potential sources of these individual elements are described below with their observed trends.

Figure 3-16 shows aluminum results for the Boardman Canal below the Lake Alta site. These results are among the lowest of the results at the canal sampling locations.

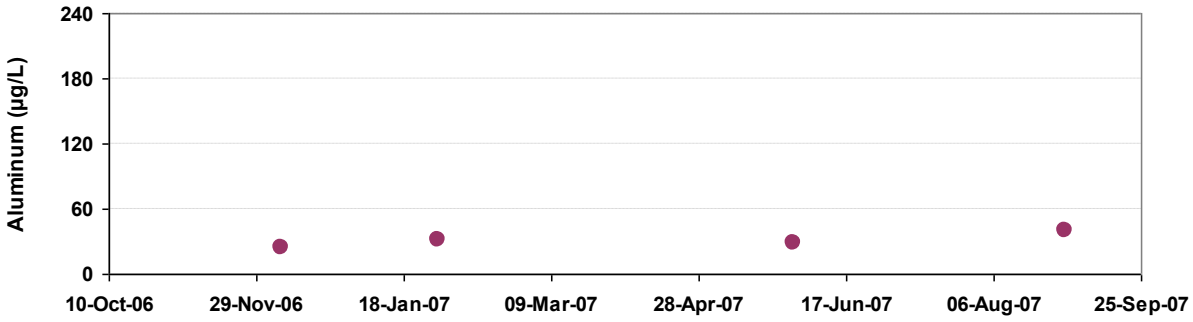

FIGURE 3-16
ALUMINUM RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

Compared to other canal sites evaluated for this study, the highest seasonal barium concentrations were observed at Boardman Canal below Lake Alta; all of which were more than an order of magnitude greater than concentrations at sites evaluated elsewhere in the canal system (**Figure 3-17**).

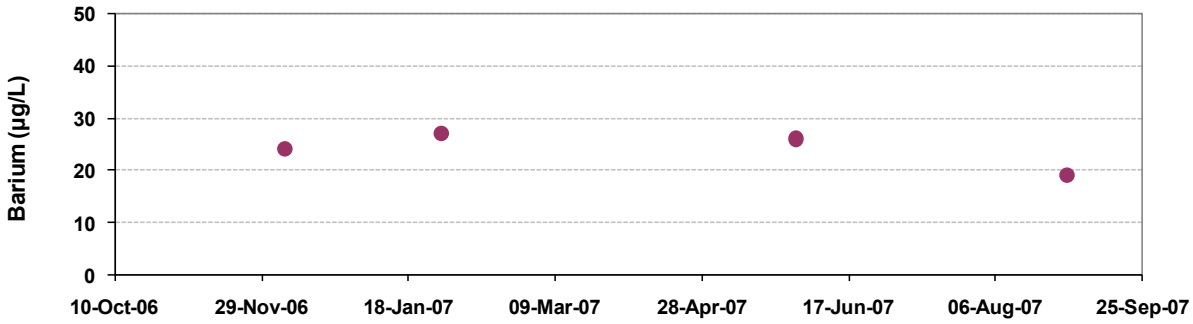

FIGURE 3-17
BARIUM RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

All cadmium, copper, and mercury concentrations measured for baseline sampling events at Boardman Canal below Lake Alta were below the detection limits of 0.5, 2, and 0.2 µg/L, respectively. The only detected result for zinc at Boardman Canal below Lake Alta occurred during the winter sampling event, and exhibited the highest concentration, 22 µg/L, of all the canal sites (**Figure 3-18**). Modifications in laboratory measurement procedures for zinc led to the adjustments to the detection limit during the study period, from 5 to 10 to 20 µg/L.

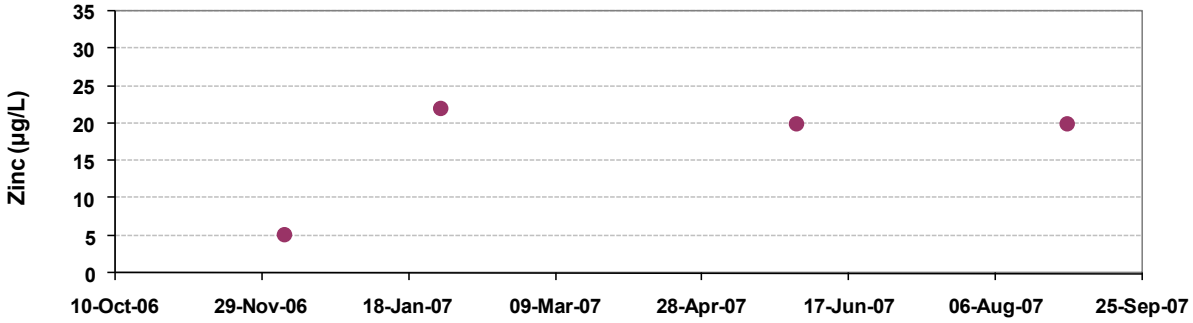

FIGURE 3-18
ZINC RESULTS FROM SEASONAL MONITORING EVENTS AT BOARDMAN CANAL BELOW LAKE ALTA

3.2.2.2 Zone 1

As shown in **Figures 3-2** and **3-3** and listed in **Table 3-1**, five canal sampling locations and nine stream sites were monitored in Zone 1 for baseline sampling events. Water quality results for canal and stream sites are discussed by watershed. Zone 1 watersheds evaluated include Auburn Ravine, Clover Valley Creek, Antelope Creek, Miners Ravine, and Secret Ravine.

Auburn Ravine Watershed

Water quality was evaluated at one sampling location within the Auburn Ravine watershed in Zone 1; Auburn Ravine below Auburn Ravine Tunnel outlet (AUBRAV3).

Water Temperature and Dissolved Oxygen

Water temperature and DO results are shown in **Figure 3-19**. Temperatures at AUBRAV3 display seasonal trends, with lowest temperatures during winter and highest during summer. DO levels remain relatively high throughout the year, ranging between 9.51 to 12.31 mg/L.

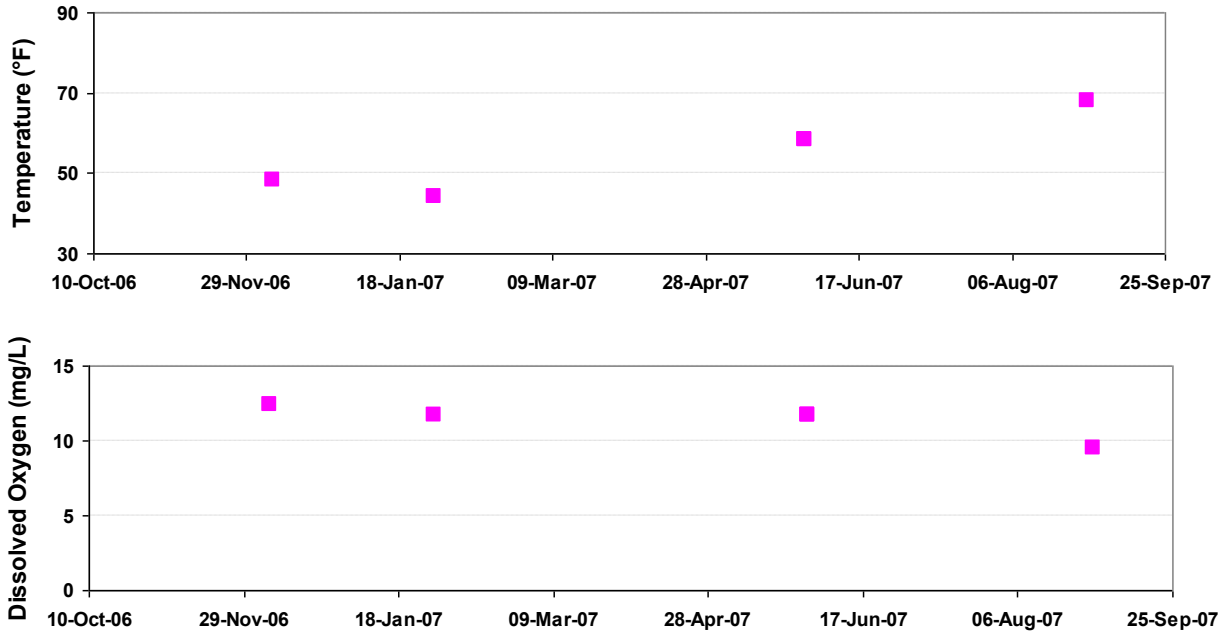

FIGURE 3-19
WATER TEMPERATURE AND DISSOLVED OXYGEN RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Water temperature data collected from other sources include hourly temperature monitoring conducted by Bailey Environmental between April 1999 and August 2003 at Fowler Road, an NID gaging station near Highway 65 in Lincoln, Moore Road, and at Aitken Ranch. Water temperature data from Bailey Environmental show summer values (May 28 to August 4, 2003) ranging from approximately 62 degrees Fahrenheit (°F) to 82 °F, fall values (September 9 to December 28, 2002) ranging from 48 °F to 69 °F, winter values (January 1 to April 27, 2003) ranging from 43 °F to 64 °F, and spring values (May 1 to July 31, 2003) ranging from 50 °F to 73 °F (Sierra Business Council 2003).

Lincoln High School Water Quality Monitoring Program funded by NID, Placer County, and the City of Lincoln, measured high DO values at three different stations along the creek during September 2001, and September and October 2002: Mackenroth Road, Highway 193 Bridge crossing, and the Joiner Parkway Bridge crossing (Sierra Business Council 2003).

pH, Alkalinity, and Hardness

Results for pH, alkalinity, and hardness from AUBRAV3 are shown in **Figure 3-20**. Values for pH at Auburn Ravine below the Auburn Ravine Tunnel outlet ranged from 7.43 to 8.14. Alkalinity values in the streams varied between 25 and 68 mg/L $CaCO_3$, with the highest alkalinity during summer.

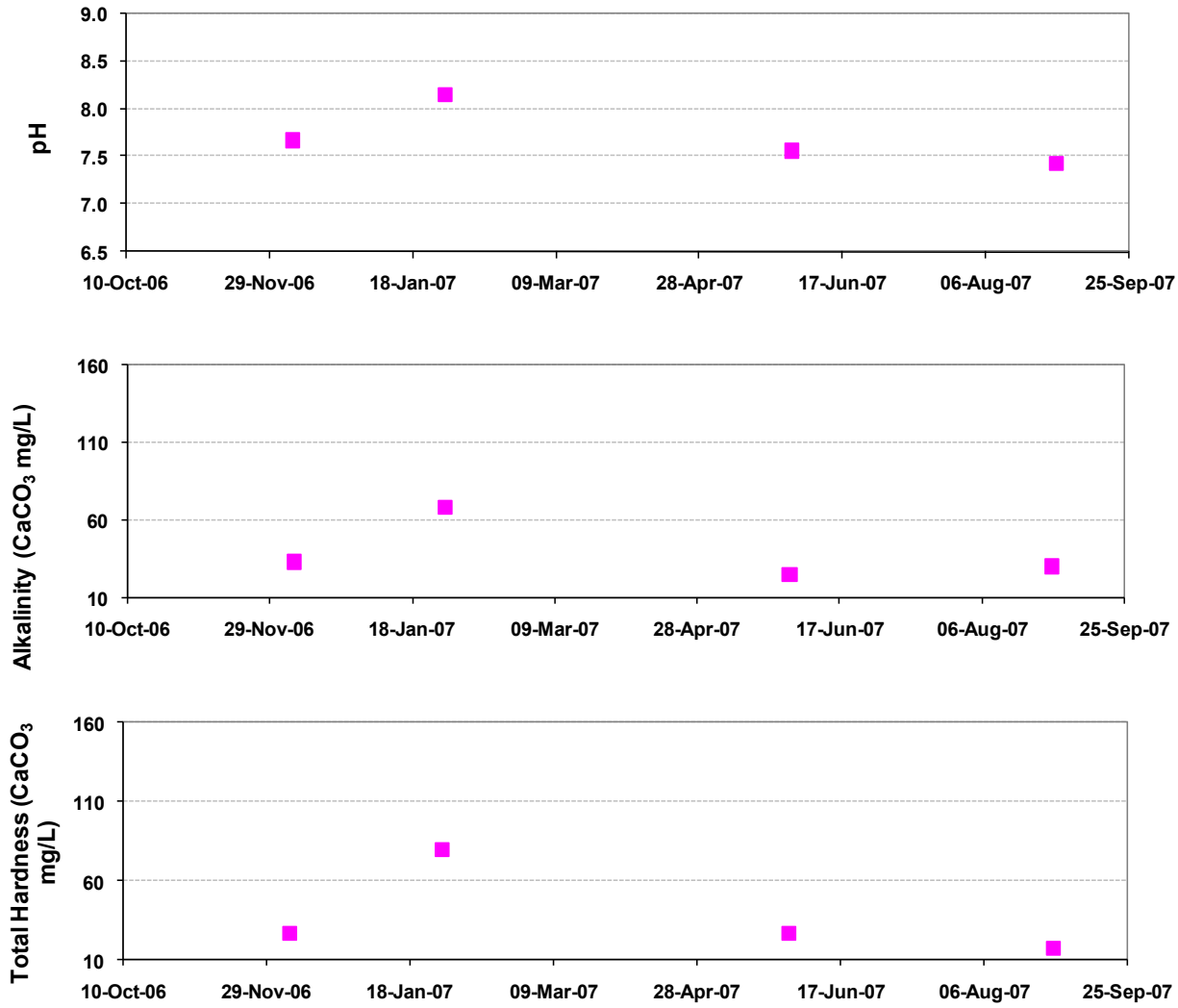

FIGURE 3-20
PH, ALKALINITY, AND HARDNESS RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Data on pH was collected monthly by the California Department of Water Resources (DWR) in the lower portion of the Auburn Ravine watershed reveal a wide range of pH values (5.6 to 7.7). The lower end of this range is considered extremely low for the types of streams found in the Sierra Nevada Foothills (Placer County Planning Department 2003).

Total Suspended Solids and Turbidity

TSS values measured in Auburn Ravine were below detection limit (10 mg/L) during all baseline monitoring events. As shown in **Figure 3-21**, turbidity values measured for AUBRAV3 were all low and consistent during sampling events, with values below 18 NTUs.

Turbidity and TSS in the Auburn Ravine were measured at the Lincoln and Auburn WWTPs under NPDES permit requirements. TSS loads were observed to significantly increase in winter and spring, likely from stormwater runoff. During low flows in Auburn Ravine, turbidity was measured at less than 1 NTU. Turbidity loads of greater than 2 NTUs were measured in the effluent from the Lincoln WWTP during this time (Placer County 2002). Turbidity was also measured in the Auburn Ravine by DWR between January 2001 and January 2002. Turbidity results ranged from 5 to 33 NTUs, with one higher value observed during December 2001 at 136 NTUs.

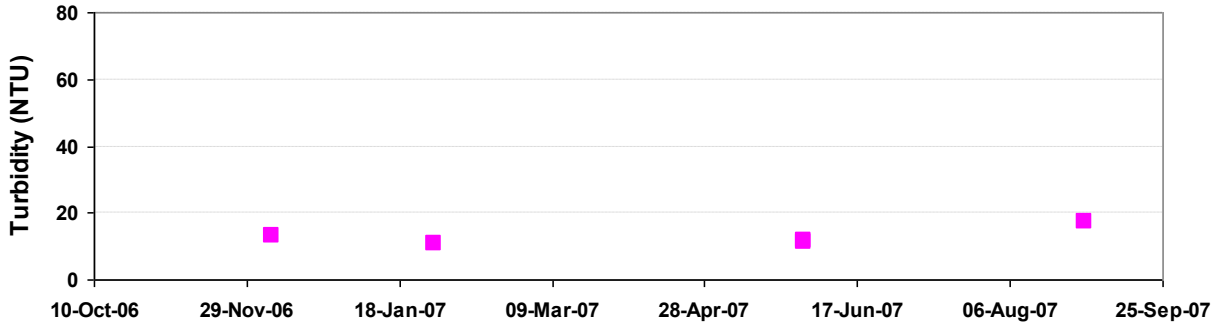

FIGURE 3-21
TURBIDITY RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Specific Conductivity and Ions

SC results for baseline monitoring events at AUBRAV3 were among the lowest of the stream monitoring sites, with the exception of the winter monitoring event, which exhibited the highest SC value across all stream monitoring sites. However, the highest value measured of 0.2 milliSiemens per centimeter (mS/cm) is still considered low (**Figure 3-22**).

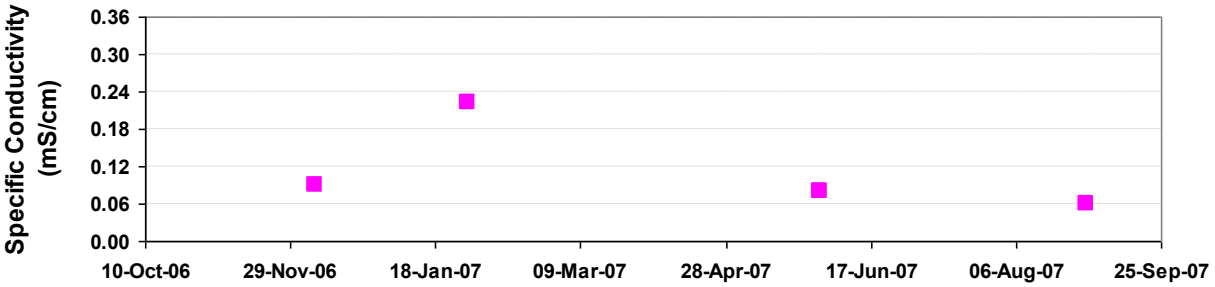

FIGURE 3-22
SPECIFIC CONDUCTIVITY RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Calcium values range from 4.7 mg/L during the summer monitoring event to 16.0 mg/L during the winter event (**Figure 3-23**), and magnesium results range from 1.4 mg/L during the summer monitoring event to 9.7 mg/L during the winter event. Magnesium results display similar trends as for calcium during baseline monitoring events at AUBRAV3, in which seasonal concentrations are highest during the winter monitoring event and lowest during the summer monitoring event (**Figure 3-24**).

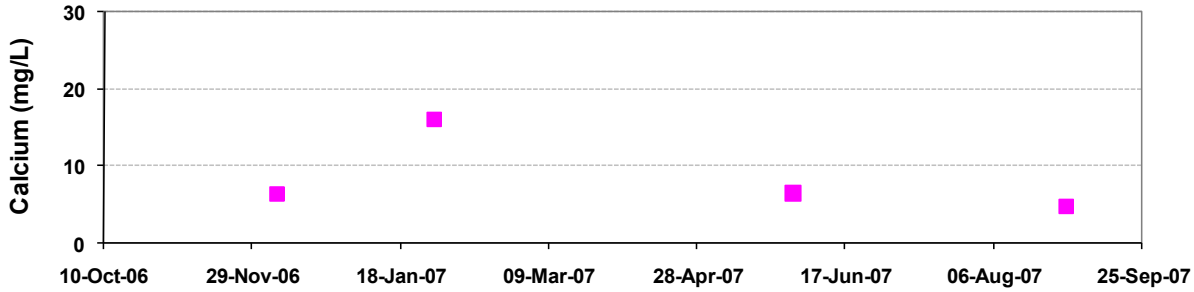

FIGURE 3-23
CALCIUM RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

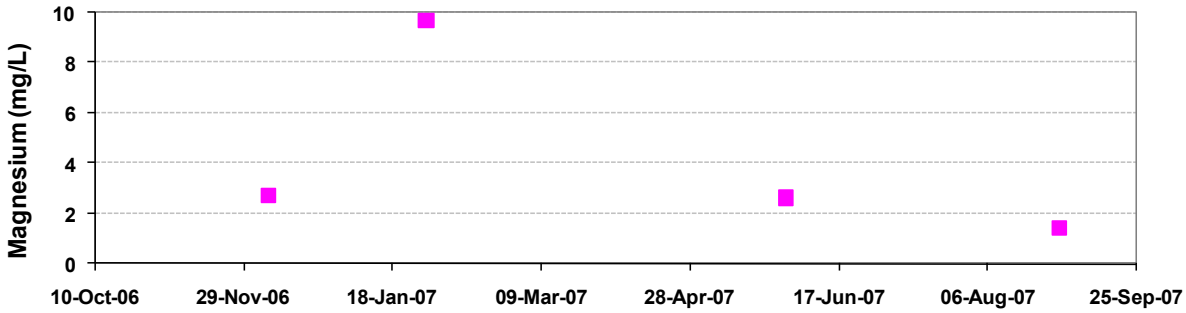

FIGURE 3-24
MAGNESIUM RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Very low iron values were observed at AUBRAV3. As shown in **Figure 3-25**, iron results ranged from 0.08 to 0.21 mg/L.

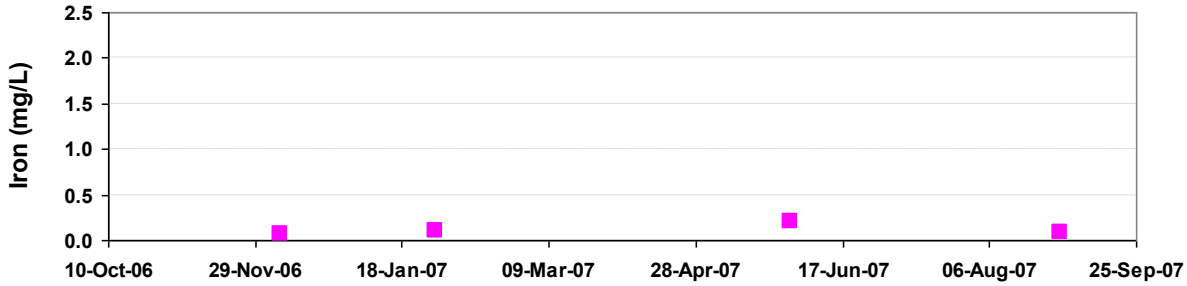

FIGURE 3-25
IRON RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Potassium values at AUBRAV3 were also very low; with concentrations below the detection limit (1.0 mg/L for spring event, 1.4 mg/L for summer event) during the spring and summer monitoring events, to 2.2 mg/L during the winter monitoring event (**Figure 3-26**).

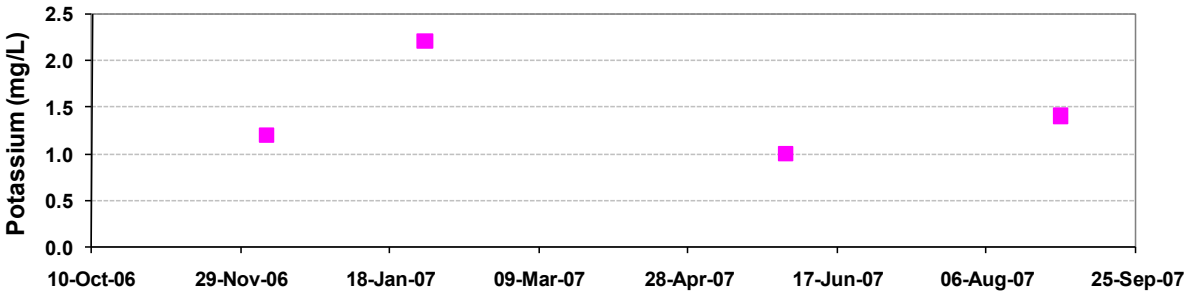

FIGURE 3-26
POTASSIUM RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

As shown in **Figure 3-27**, sodium results ranged from 4.0 to 14.0 mg/L at AUBRAV3. The highest sodium values were observed during the winter monitoring event and the lowest values during the summer monitoring event.

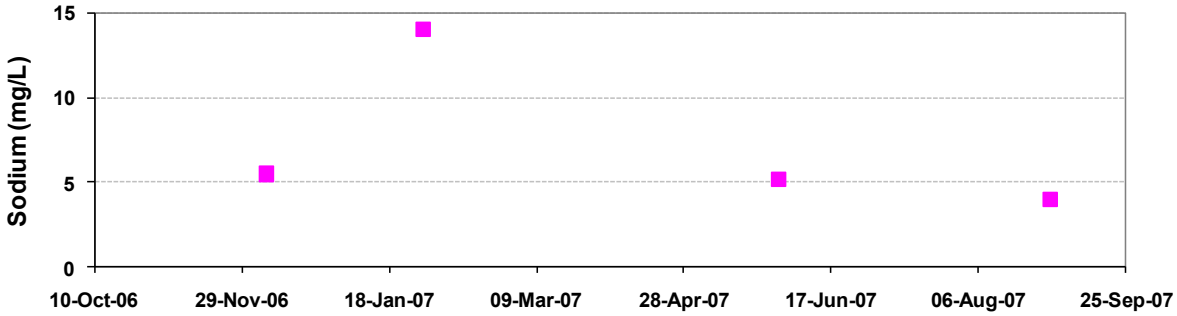

FIGURE 3-27
SODIUM RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Chloride results are similar to those of sodium at AUBRAV3, with values ranging from 3.6 mg/L during the summer monitoring event to 13.0 mg/L during the winter monitoring event (**Figure 3-28**).

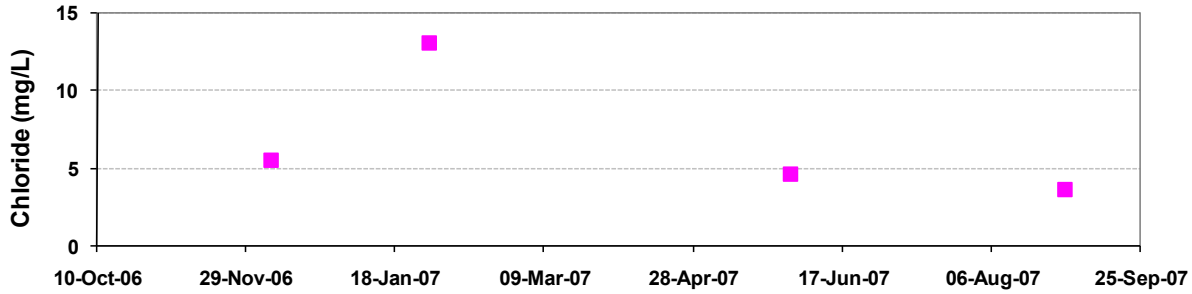

FIGURE 3-28
CHLORIDE RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Sulfate concentrations at AUBRAV3 ranged from 3.3 mg/L during the summer monitoring event to 17 mg/L during the winter monitoring event, as shown in **Figure 3-29**.

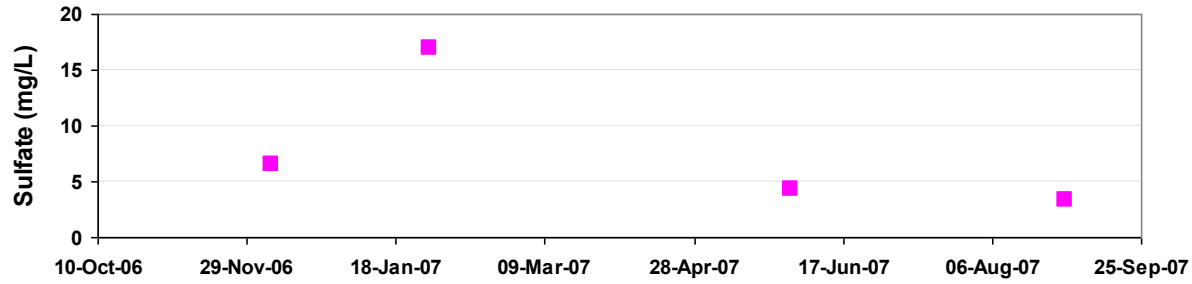

FIGURE 3-29
SULFATE RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

As shown in **Figure 3-30**, nitrate results at the AUBRAV3 monitoring site were very low during baseline sampling events. Nitrate concentrations ranged from the detection limit (0.1 mg/L) during the summer monitoring event to 1.3 mg/L during the winter monitoring event.

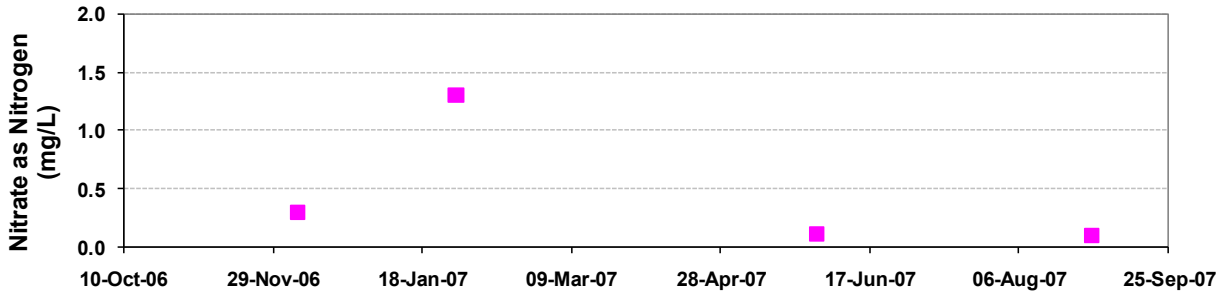

FIGURE 3-30
NITRATE RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Nitrogen and phosphorus were measured at the Auburn WWTP in 1995 (Placer County 2002). Nitrogen and phosphorus levels in Auburn WWTP effluent averaged 0.5 mg/L, and Auburn Ravine downstream from the Auburn WWTP did not show evidence of eutrophication. However, Auburn Ravine downstream from the Lincoln WWTP has been observed to be influenced by both wastewater effluent and stormwater runoff.

Trace Elements

Aluminum results at AUBRAV3 ranged from 40 µg/L during the summer monitoring event to 120 µg/L during the spring monitoring event (**Figure 3-31**).

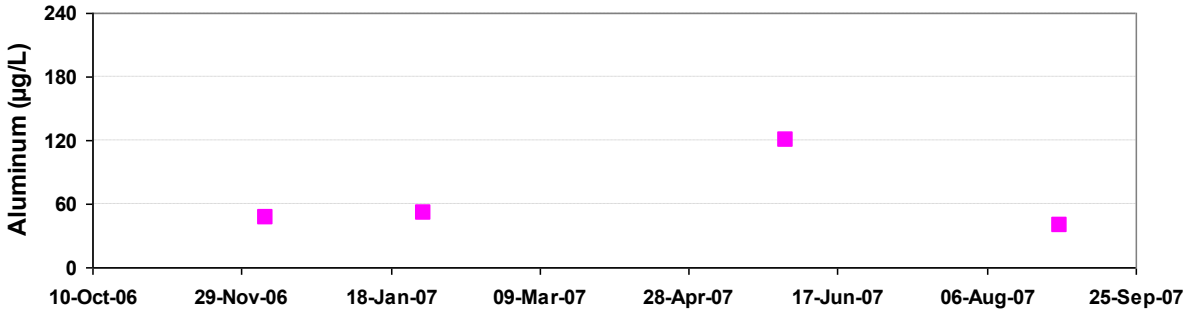

FIGURE 3-31
ALUMINUM RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

There was little variation in barium results at AUBRAV3, with concentrations ranging from 9.5 µg/L during the fall monitoring event to 12 µg/L during the winter monitoring event (**Figure 3-32**).

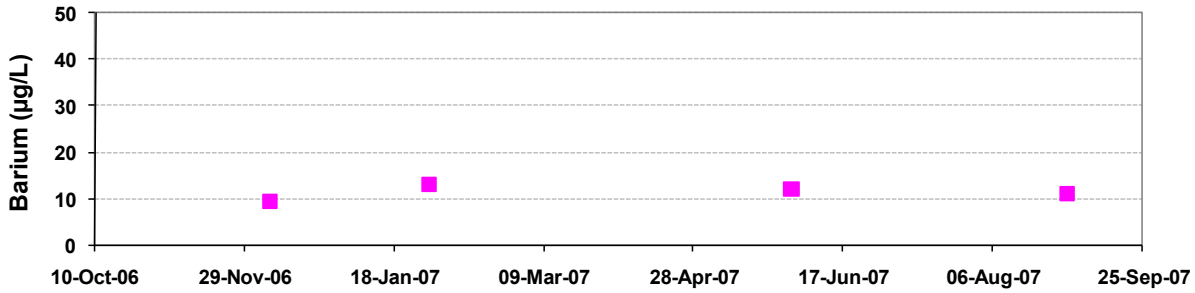

FIGURE 3-32
BARIUM RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Cadmium and mercury concentrations measured during baseline sampling events at AUBRAV3 were below detection limits. All copper concentrations at the AUBRAV3 site were below the detection limit of 2 µg/L, except for the winter monitoring event, during which copper was measured at 2.4 µg/L (**Figure 3-33**). As shown in **Figure 3-34**, zinc concentrations ranged from 9 µg/L during the fall monitoring event to 31 µg/L during the winter monitoring event.

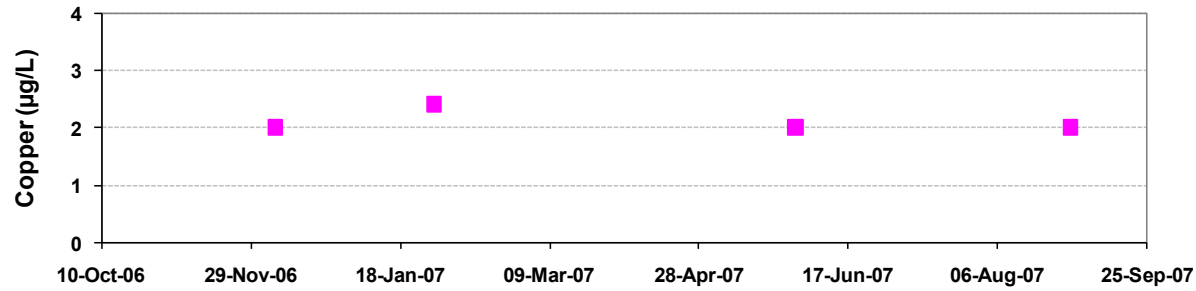

FIGURE 3-33
COPPER RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

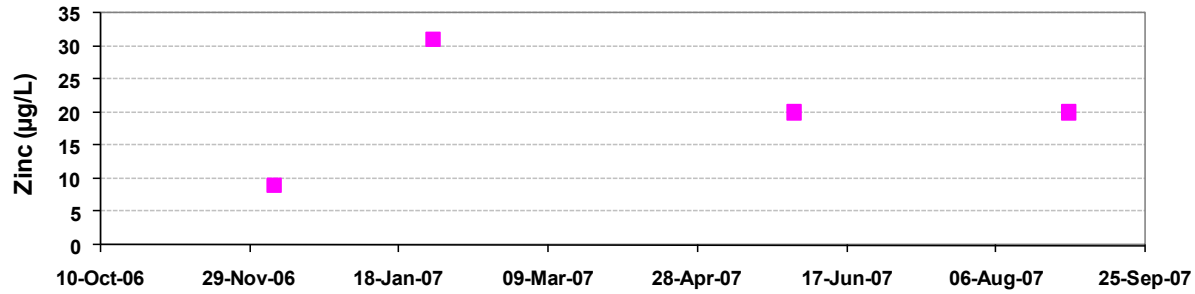

FIGURE 3-34
ZINC RESULTS FROM SEASONAL MONITORING EVENTS AT AUBURN RAVINE BELOW AUBURN RAVINE TUNNEL OUTLET

Data collected by Placer County for the Auburn Ravine/Coon Creek Ecosystem Restoration Plan in 1999 and 2000 show cadmium, copper, and zinc levels in the Auburn Ravine all exceed the CTR standards for aquatic life at various times throughout the year (Placer County 2002).

Copper exceeded CTR standards in June, July, and October 1999 and in January, February, and April 2000.

Clover Valley Creek Watershed

Water quality in the Clover Valley Creek watershed was evaluated at the Clover Valley Reservoir Release to Clover Valley Creek and Antelope Canal (CLVRESR) and at Clover Valley Creek near Argonaut Avenue (CLVRC3B). The monitoring location is upstream from the Sunset Whitney Country Club on Midas Avenue in Rocklin (**Figure 3-3**). Originally, sampling was conducted at a site located at the golf course in the Sunset Whitney Country Club, but the golf course gates lock at sundown, which rendered the site inaccessible during key monitoring periods, so the alternate upstream site was selected for further monitoring.

Water Temperature and Dissolved Oxygen

Water temperature and DO measurements taken at CLVRESR and CLVRC3B during baseline sampling events are shown in **Figure 3-35**. Water temperatures at the two sampling locations are similar and exhibit seasonal trends, ranging from 42ºF during fall to about 76ºF during summer. DO levels at the two locations are also similar, and range from 8.2 mg/L in the summer to 13 mg/L in the fall (**Figure 3-19**).

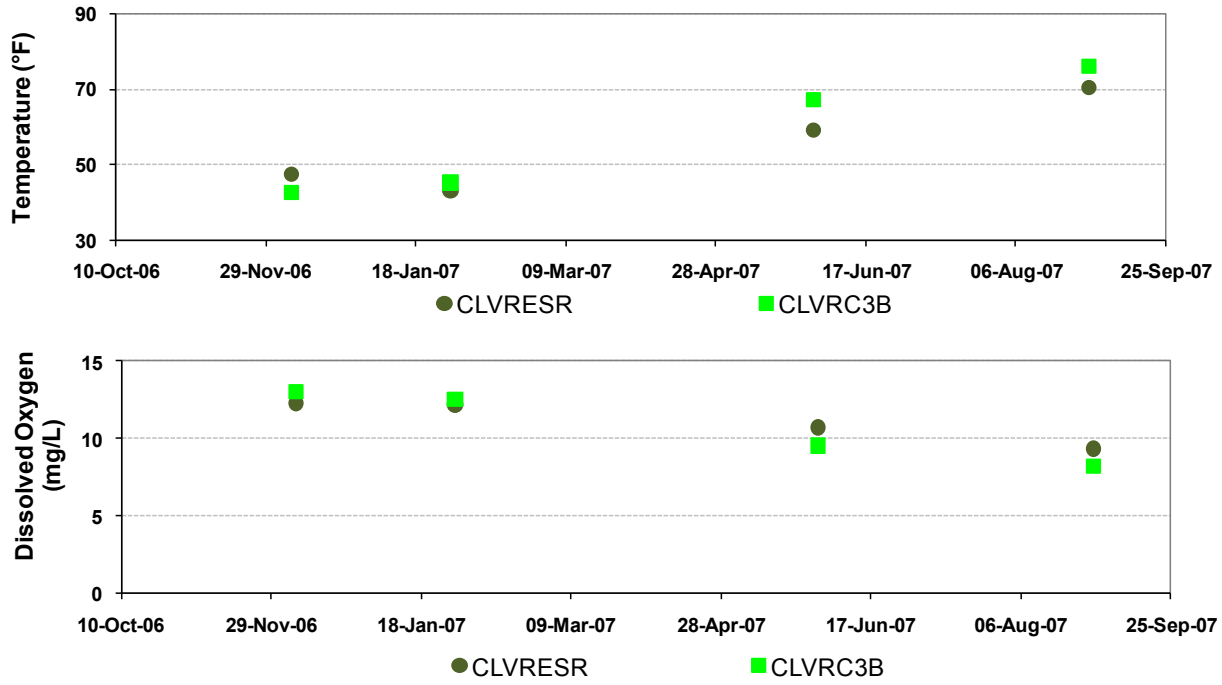

FIGURE 3-35
WATER TEMPERATURE AND DISSOLVED OXYGEN RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

pH, Alkalinity, and Hardness

Figure 3-36 shows pH, alkalinity, and hardness results from baseline water quality monitoring at CLVRESR and CLVRC3B. Measured pH levels at the two locations ranged from 7.1 to 7.9.

Alkalinity results ranged from 14.0 to 45.0 mg/L $CaCO_3$. Calculated hardness values were similar to alkalinity, ranging from 9.5 to 42.4 mg/L $CaCO_3$.

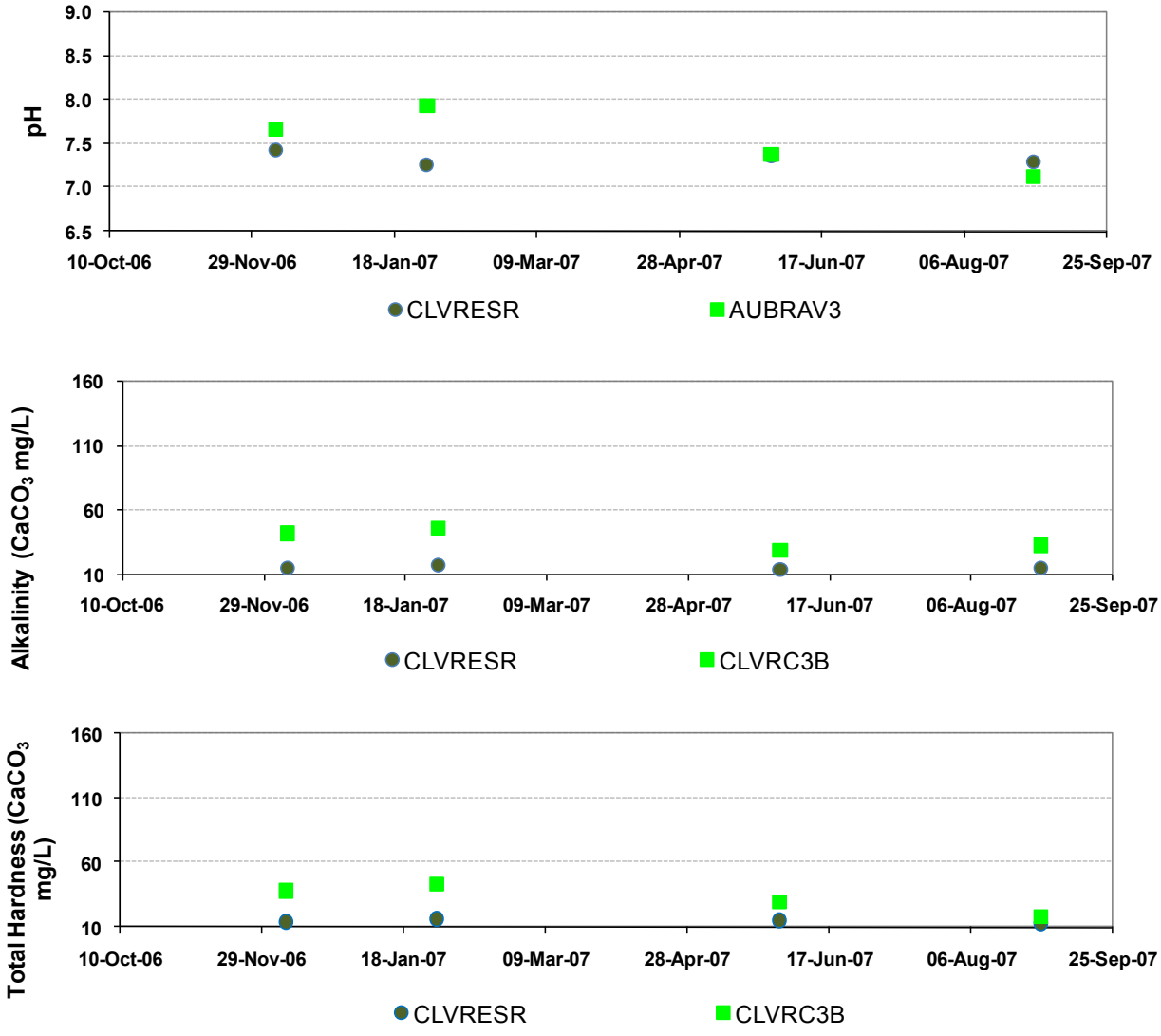

FIGURE 3-36
PH, ALKALINITY, AND HARDNESS RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Data on pH in the Clover Valley Creek watershed were collected by the DCC during a periodic "first flush" monitoring program in between 2001 and 2003. Measured pH values ranged from 7.27 in October 2002 to 7.70 in March 2002, indicating fairly stable pH levels throughout the year.

Total Suspended Solids and Turbidity

TSS values measured at the CLVRESR and CLVRC3B during baseline monitoring events were below the detection limit of 10 mg/L. As shown in **Figure 3-37**, turbidity levels at CLVRESR and CLVRC3B were also low during baseline sampling events, with all turbidity values ranging between 11.8 and 27.4 NTUs.

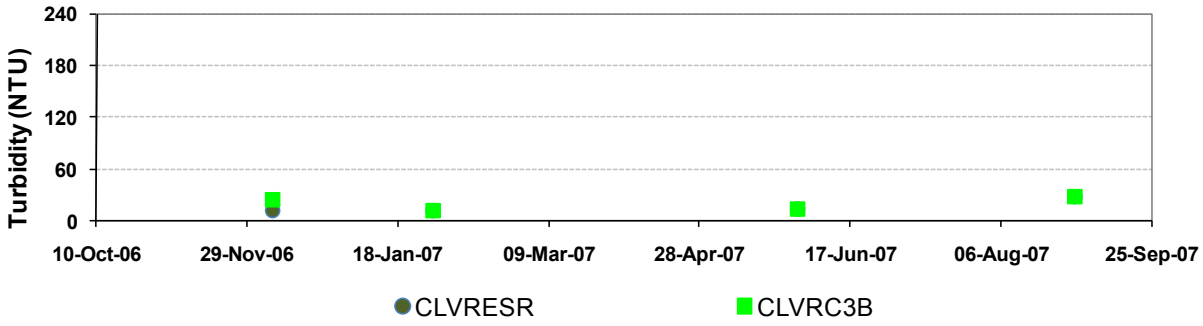

FIGURE 3-37
TURBIDITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Specific Conductivity and Ions

SC values for CLVRESR and CLVRC3B are shown in **Figure 3-38**. Although SC values measured at CLVRESR were consistently lower than CLVRC3B values, they were low at both monitoring locations, ranging from 0.04 mS/cm during the fall monitoring event to 0.11 mS/cm during the winter monitoring event.

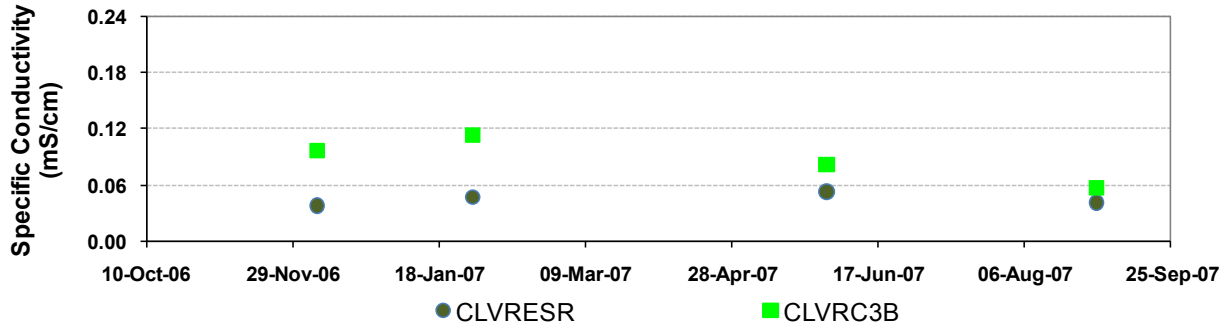

FIGURE 3-38
SPECIFIC CONDUCTIVITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Calcium results at CLVRESR and CLVRC3B followed similar seasonal trends as seasonal specific conductivity levels. As shown in **Figure 3-39**, calcium results ranged from 3.8 mg/L at CLVRESR during the fall monitoring event to 9.9 mg/L at CLVRC3B during the winter monitoring event.

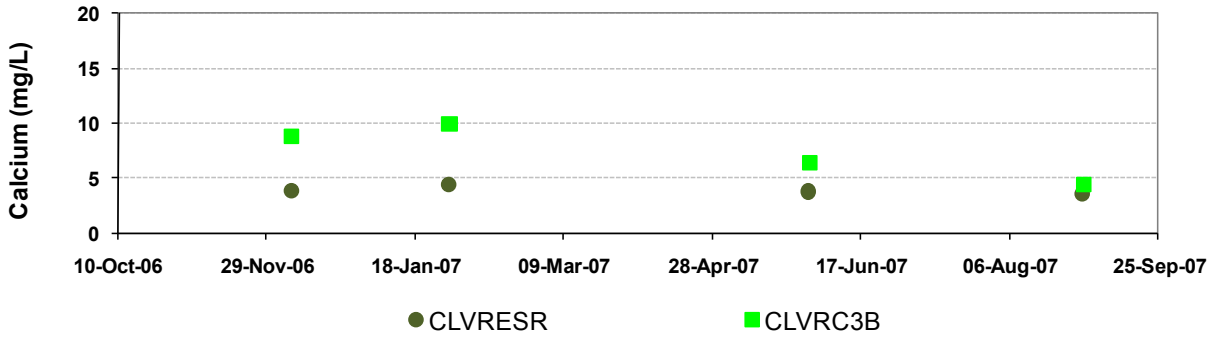

FIGURE 3-39
CALCIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Iron results at CLVRESR and CLVRC3B differed most during the spring monitoring event. **Figure 3-40** shows iron values ranging from 0.06 mg/L during the fall monitoring event to 0.75 mg/L during the spring event.

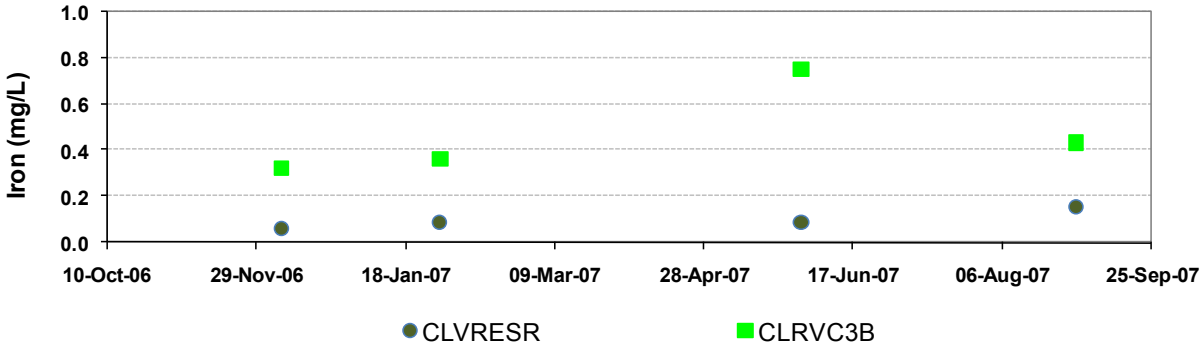

FIGURE 3-40
IRON RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Magnesium results varied from 0.1 mg/L at CLVRESR during the summer monitoring event and 4.3 mg/L at CLVRC3B during the winter event (**Figure 3-41**).

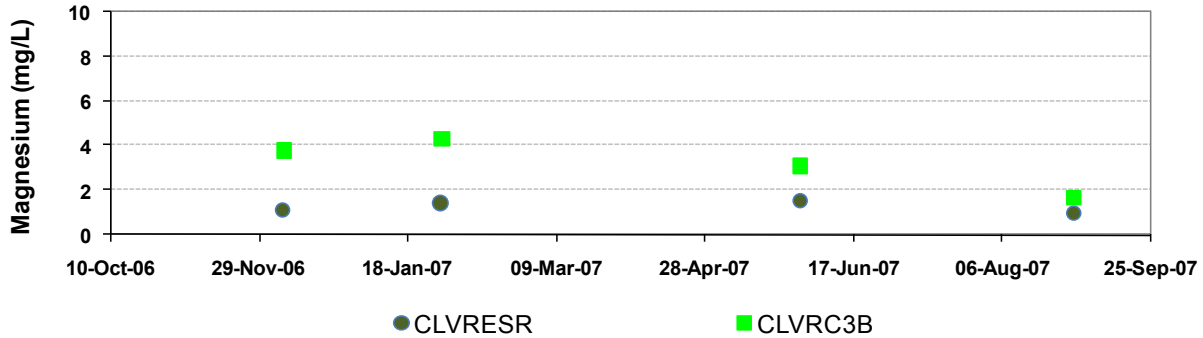

FIGURE 3-41
MAGNESIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

All seasonal potassium results were below the detection limit of 0.1 mg/L and 1.0 mg/L, respectively, at the CLVRC3B monitoring site.

Sodium results at CLVRESR and CLVRC3B ranged from 1.1 to 5.7 mg/L, as shown in **Figure 3-42**.

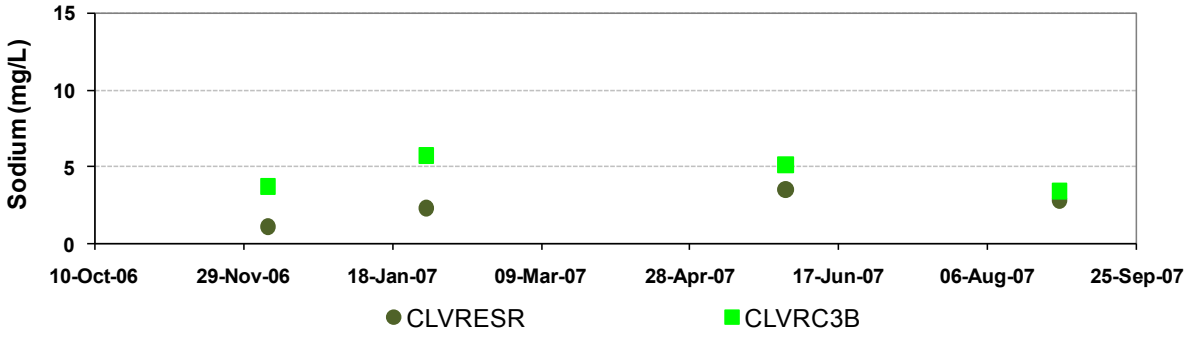

FIGURE 3-42
SODIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Chloride results at CLVRESR and CLVRC3B are similar to those observed for sodium, and ranged from 1.0 to 4.7 mg/L, as shown in **Figure 3-43**.

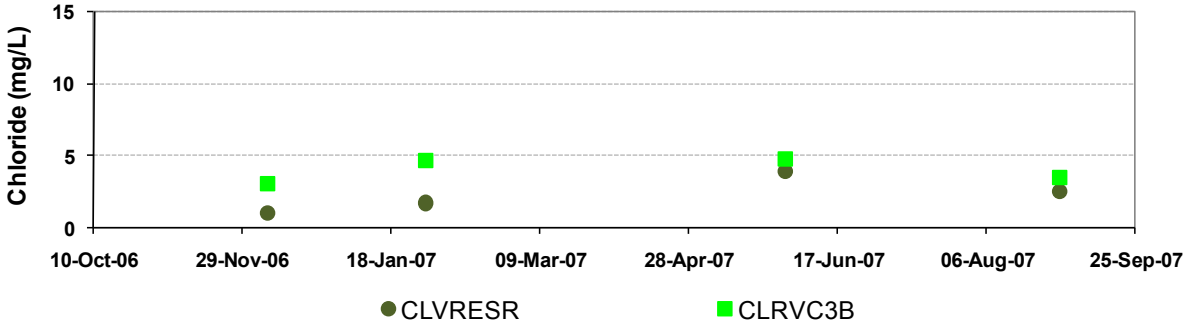

FIGURE 3-43
CHLORIDE RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Similar to potassium results, all seasonal nitrate concentrations were below the detection limit of 0.1 mg/L and 1.0 mg/L, respectively, at the CLVRC3B monitoring site.

Sulfate concentrations at CLVRESR and CLVRC3B ranged from 0.5 mg/L during the fall monitoring event to 5.1 mg/L during the winter monitoring event (**Figure 3-44)**.

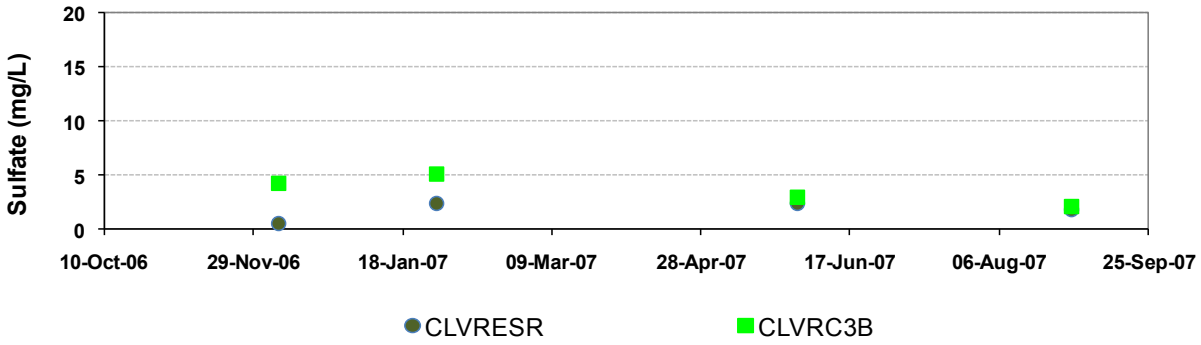

FIGURE 3-44
SULFATE RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Trace Elements

Aluminum concentrations at CLVRESR and CLVC3B varied considerably during the spring monitoring event. As shown in **Figure 3-45,** aluminum concentrations ranged from 25 µg/L during the fall monitoring event to 240 µg/L during the spring monitoring event.

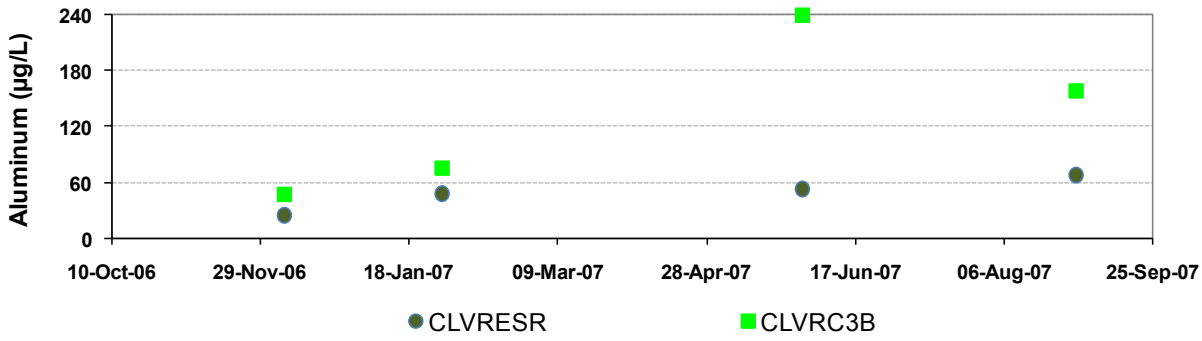

FIGURE 3-45
ALUMINUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Barium concentrations at CLVRC3B were consistently higher than those at CLVRESR, and also among the highest compared to other stream sites monitored within Zone 1. As shown in **Figure 3-46**, barium values measured at these sites range from 11 µg/L at CLVRESR during fall to 42 µg/L at CLVRC3B during winter.

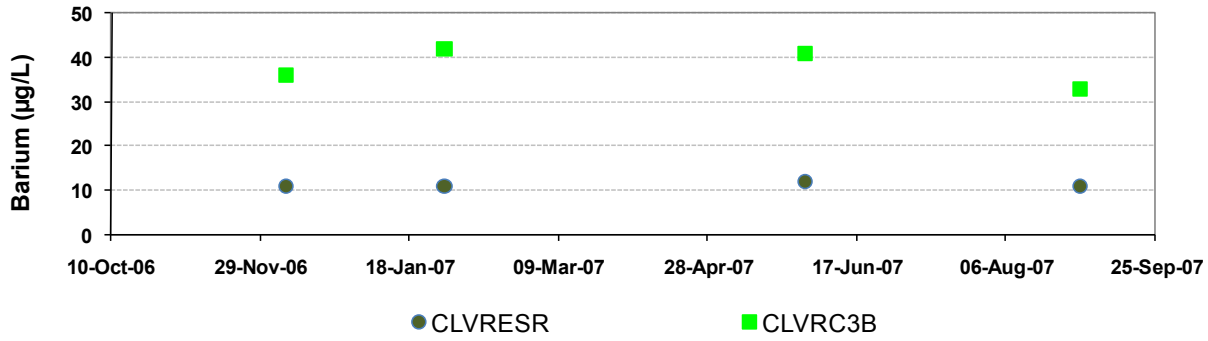

FIGURE 3-46
BARIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Cadmium concentrations at CLVRESR and CLVC3B were below detection limits for all baseline monitoring events.

Copper levels were below the detection limit of 2 µg/L at CLVC3B during the fall and winter sampling events, and were measured at 2.1 and 2.2 µg/L during the spring and summer monitoring events, respectively (**Figure 3-47**).

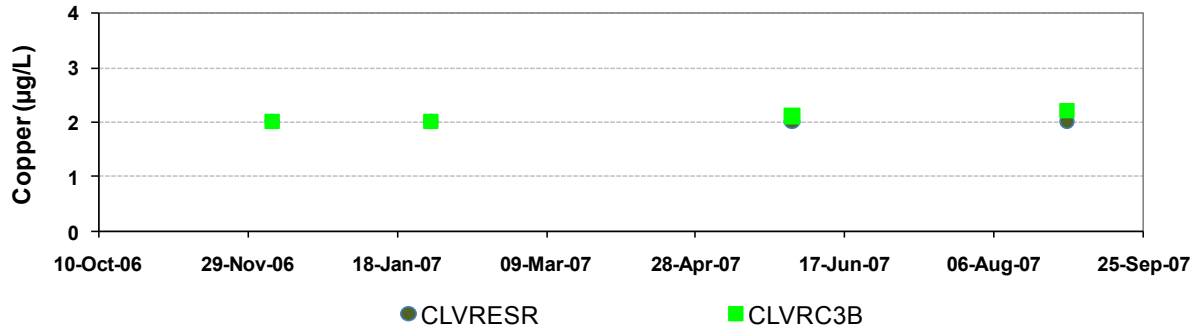

FIGURE 3-47
COPPER RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Similar to cadmium results, mercury concentrations at CLVRESR and CLVC3B were below detection limits for all seasonal monitoring events.

Zinc was only detected at CLVRESR and CLVRC3B during the winter monitoring event (20 and 21 µg/L, respectively), as shown in **Figure 3-48**. According to laboratory results, the detection limits for zinc changed from 5 mg/L in the fall, 10 mg/L in the winter, and 20 mg/L in the spring and summer.

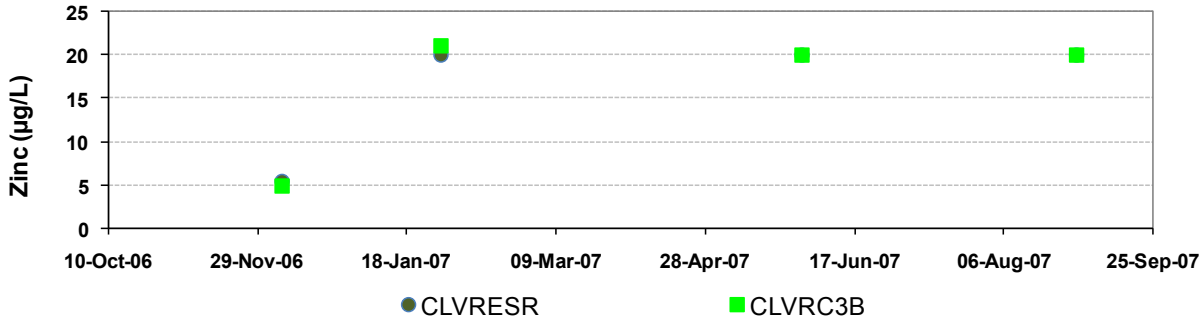

FIGURE 3-48
ZINC RESULTS FROM SEASONAL MONITORING EVENTS IN THE CLOVER VALLEY CREEK WATERSHED

Antelope Creek Watershed

Water quality was evaluated within the Antelope Creek watershed at CLVRESR and Antelope Creek at Midas Avenue (ANTC3B), which is located immediately above Antelope Creek's confluence with Clover Valley Creek.

Water Temperature and Dissolved Oxygen

Water temperature and DO results from monitoring at CLVRESR and ANTC3B are shown in **Figure 3-49**. Seasonal water temperatures at the two monitoring locations ranged from 41.7 to 75.4 ºF. DO results ranged from 8.2 mg/L in the summer to 13.9 mg/L in the fall.

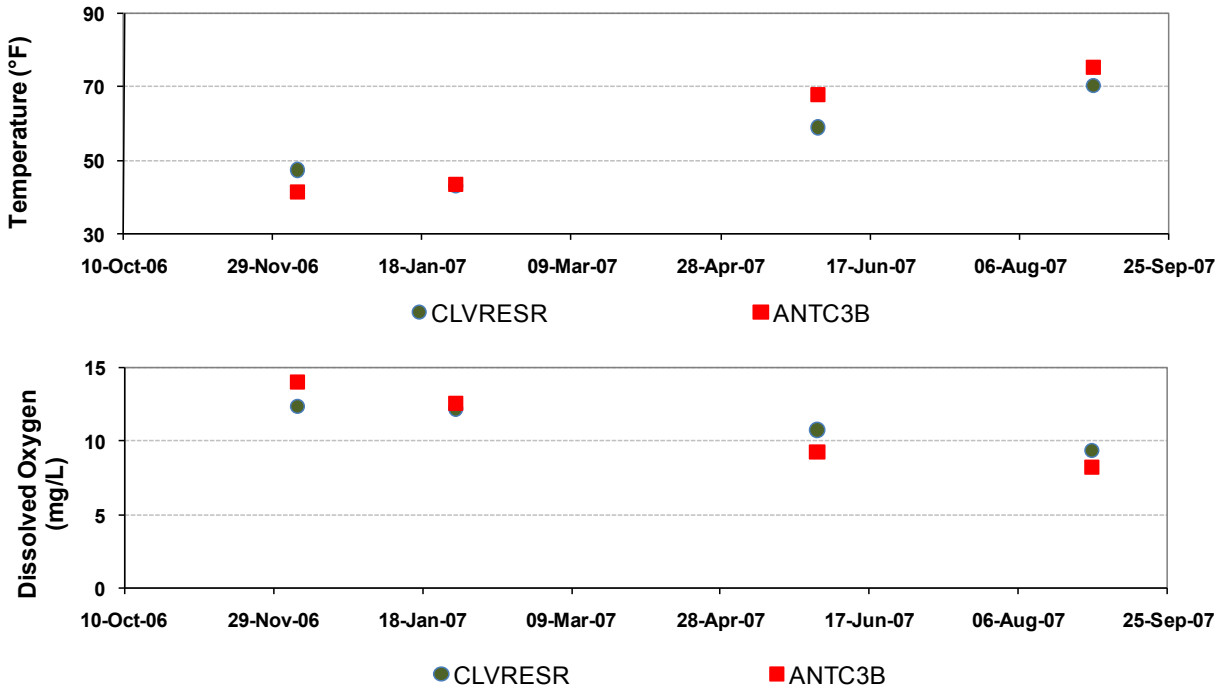

FIGURE 3-49
TEMPERATURE AND DISSOLVED OXYGEN RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Water temperature data collected along Antelope Creek by other sources includes periodic monitoring conducted by the Central Valley RWQCB and DCC. Water temperature was recorded by the Central Valley RWQCB and DCC at Sierra College Boulevard and Sunset Boulevard between December 12, 2000, and April 8, 2003. Water temperature values measured by the Central Valley RWQCB and DCC ranged from 43 °F in January 2001 to 82 °F in June 2001 at the Sunset Boulevard site, and from 43 °F in January 2001 to 75 °F in July 2001 at the Sierra College Boulevard site (Sierra Business Council 2003). Water temperature data were collected by Bailey Environmental between April 1999 and August 2003 at Antelope Creek Drive, 311 Sunset Blvd., and the Myers residence station. Water temperatures in spring (May 29, 2003 to July 30, 2003) ranged from 63 °F to 84 °F (Sierra Business Council 2003).

pH, Alkalinity, and Hardness

Seasonal pH, alkalinity, and hardness results for baseline monitoring at CLVRESR and ANTC3B are shown in **Figure 3-50**. Results for pH indicate little seasonal variation; pH values ranged from 7.0 to 7.8. Alkalinity and hardness values are consistently lower at CLVRESR than ANTC3B. Alkalinity levels range from 14 mg/L $CaCO_3$ at CLVRESR to 55 mg/L $CaCO_3$ at ANTC3B, and calculated hardness values ranged from 12.8 mg/L $CaCO_3$ at CLVRESR to 58.3 mg/L $CaCO_3$ ANTC3B.

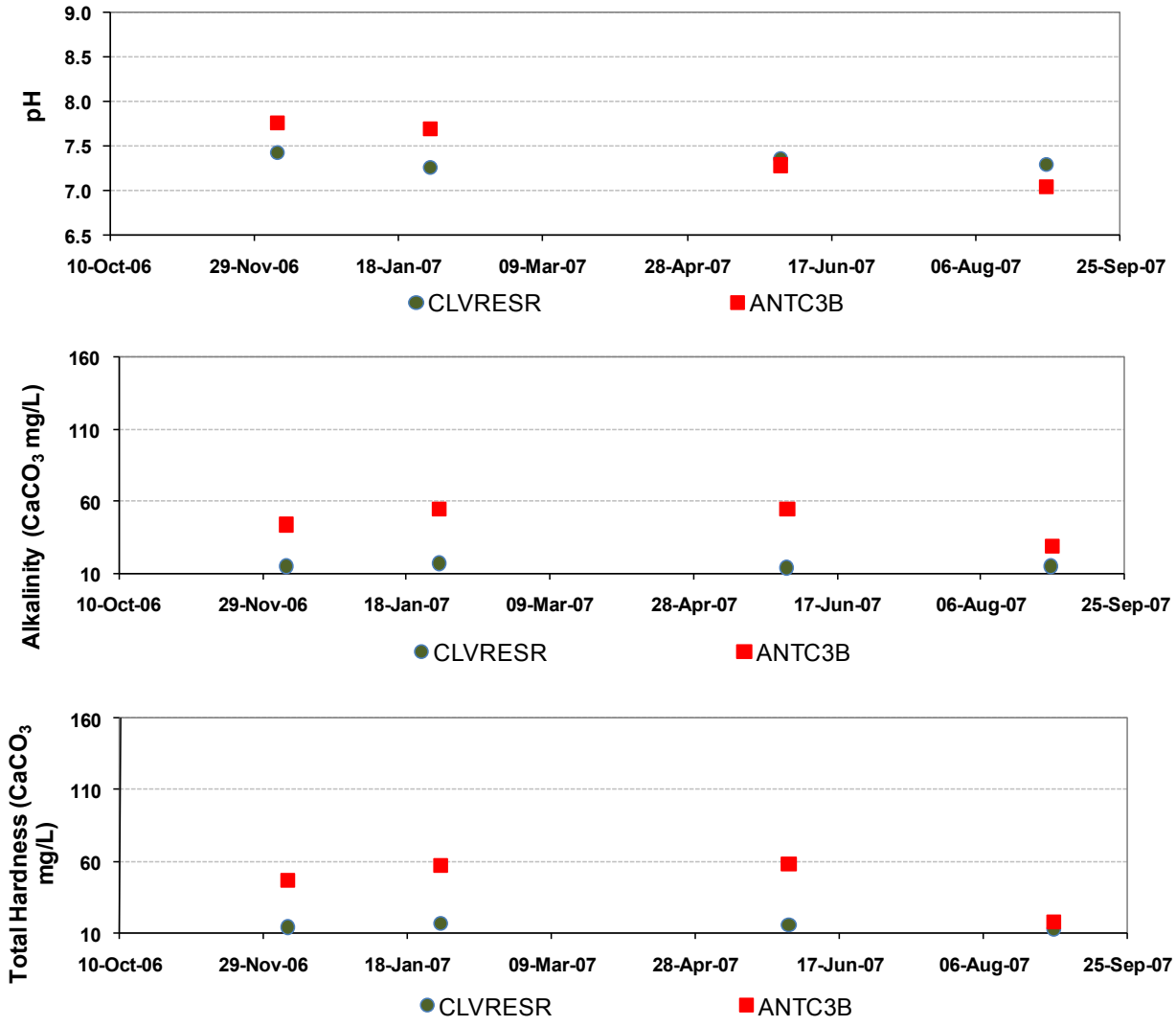

FIGURE 3-50
PH, ALKALINITY, AND HARDNESS RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

The Antelope Creek watershed was monitored by DCC for pH during "first flush" events between 2000 and 2003. Monitoring was conducted at the Sierra College Boulevard, Sunset Boulevard, and Atlantic Avenue sites. Results for pH in Antelope Creek varied widely at the Sierra College Boulevard site, at which pH values ranged from 6.70 in November 2001 to 8.16 in December 2000, and at the Sunset Boulevard site, ranging from 6.5 in February 2002 to 8.65 in July 2001 (Sierra Business Council 2003). Results from the Atlantic Avenue site ranged from 7.08 in November 2002 to 7.77 in March 2003. Although it is difficult to interpret such a limited data set, the pH result is considered relatively high for the creek (Placer County Planning Department 2003).

Total Suspended Solids and Turbidity

TSS values at CLVRESR and ANTC3B were below detection limits (10 mg/L) during all seasonal monitoring events, with the exception of the summer monitoring event, during which TSS was measured at 13 mg/L. As shown in **Figure 3-51**, turbidity values were very similar at the two monitoring locations were low, ranging between 12.2 and 32.9 NTUs.

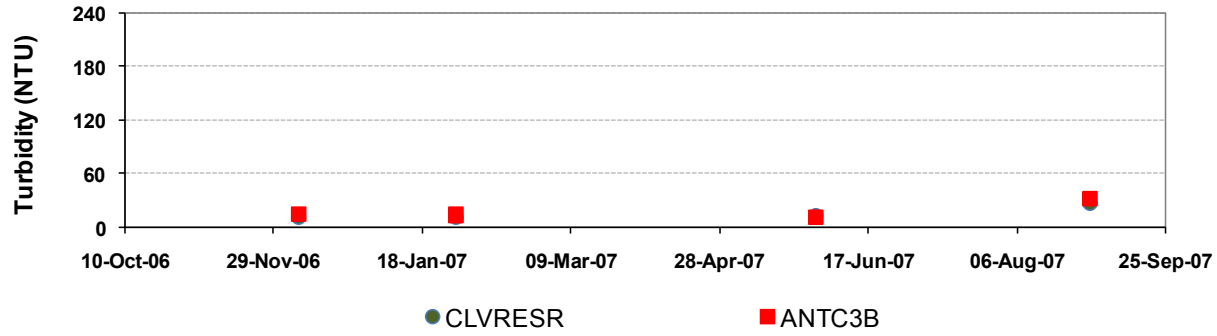

FIGURE 3-51
TURBIDITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Specific Conductivity and Ions

SC values were consistently lower at CLVRESR than at ANTC3B. Overall, SC values ranged from 0.04 mS/cm at CLVRESR during the fall monitoring event to 0.16 mS/cm at ANTC3B during the winter monitoring event (**Figure 3-52**).

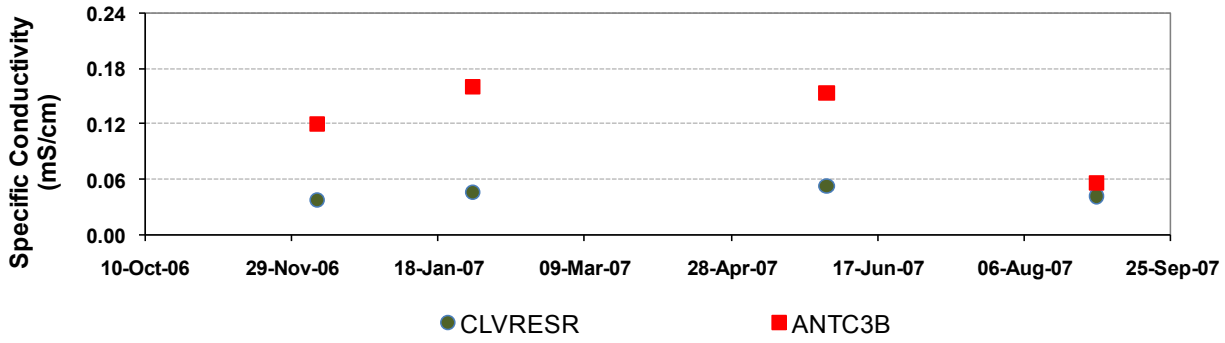

FIGURE 3-52
SPECIFIC CONDUCTIVITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Calcium results at CLVRESR and ANTC3B monitoring locations follow a pattern similar to that of SC. As shown in **Figure 3-53**, calcium results ranged from 3.5 mg/L at CLVRESR during the summer sampling event to 13.0 mg/L at ANTC3B during winter and spring sampling events.

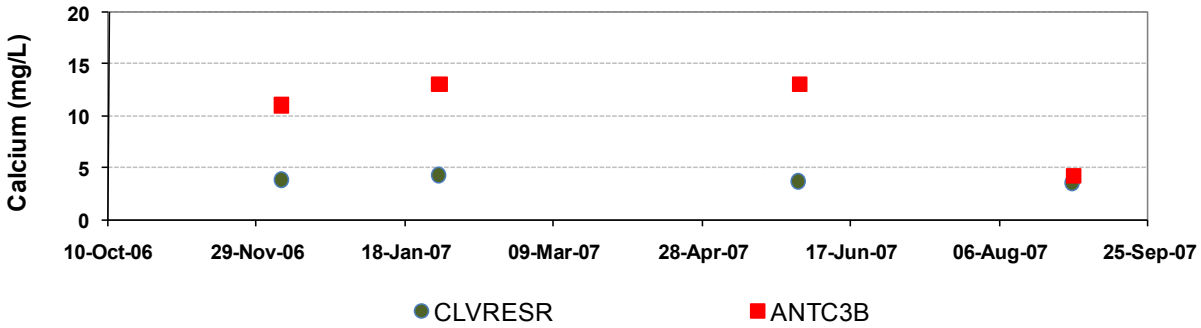

FIGURE 3-53
CALCIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Iron results were consistently higher at ANTC3B than at CLVRESR. As shown in **Figure 3-54**, iron concentrations ranged from 0.06 mg/L at CLVRESR during the fall monitoring event to 0.94 mg/L at ANTC3B during the spring monitoring event.

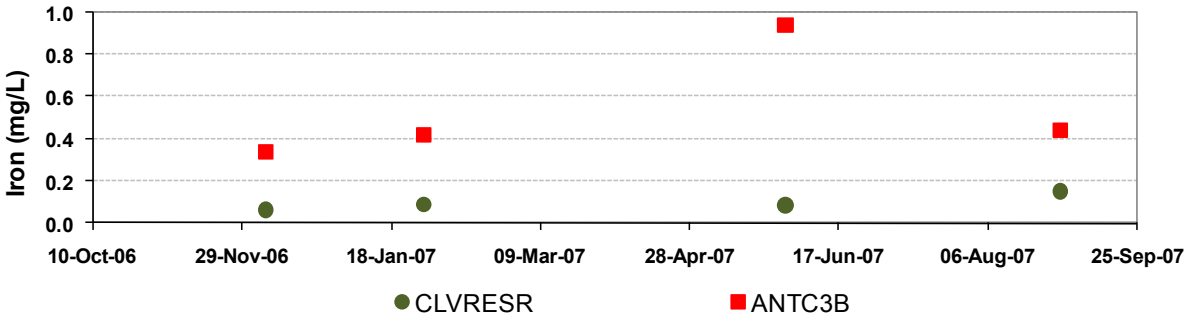

FIGURE 3-54
IRON RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Magnesium concentrations ranged from 0.1 mg/L at CLVRESR during the summer monitoring event to 6.3 mg/L at ANTC3B during the spring monitoring event (**Figure 3-55**).

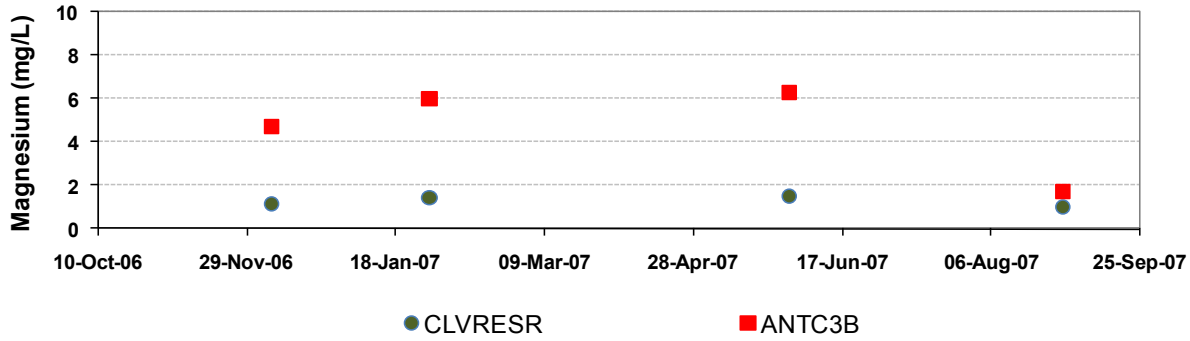

FIGURE 3-55
MAGNESIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Potassium results for CLVRESR and ANTC3B during baseline sampling events were also low, as shown in **Figure 3-56**.

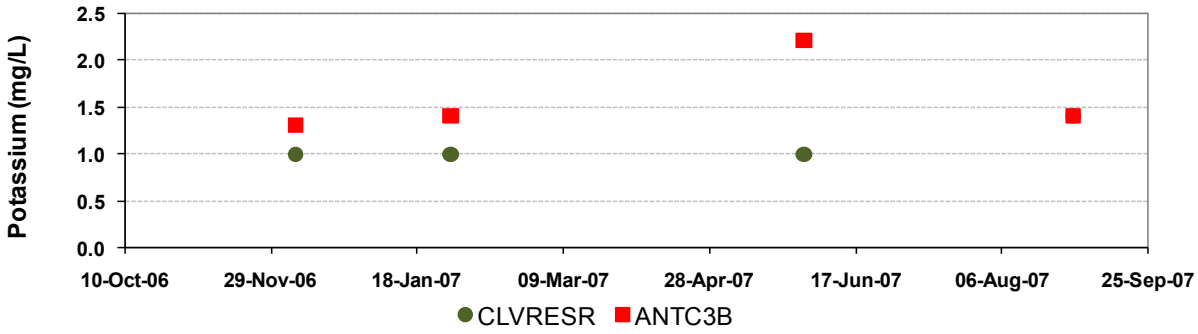

FIGURE 3-56
POTASSIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Sodium results for CLVRESR and ANTC3B display similar trends as at the other stream monitoring sites; results are higher during the winter and spring monitoring events than during the fall and summer events. **Figure 3-57** shows sodium results ranging from 1.1 mg/L at CLVRESR during the fall monitoring event to 8.0 mg/L at ANTC3B during the spring monitoring event.

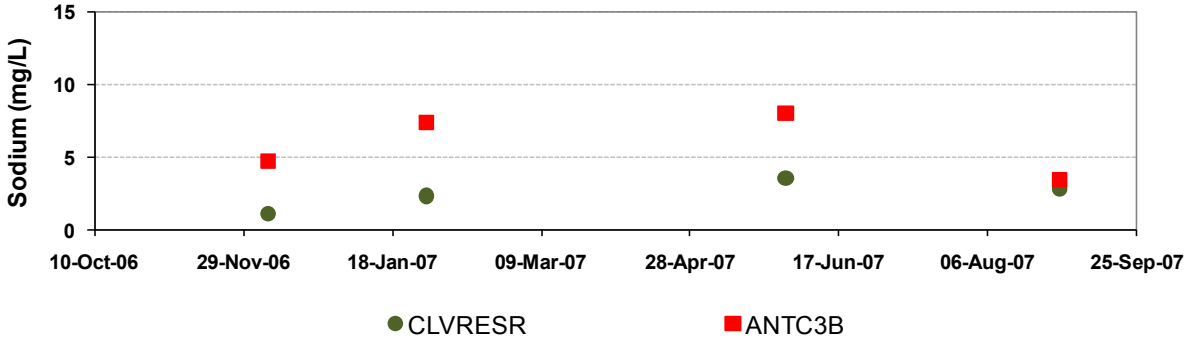

FIGURE 3-57
SODIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Chloride results ranged from 1.0 mg/L at CLVRESR during the fall monitoring event to 7.1 mg/L at ANTC3B during the winter monitoring event (**Figure 3-58**).

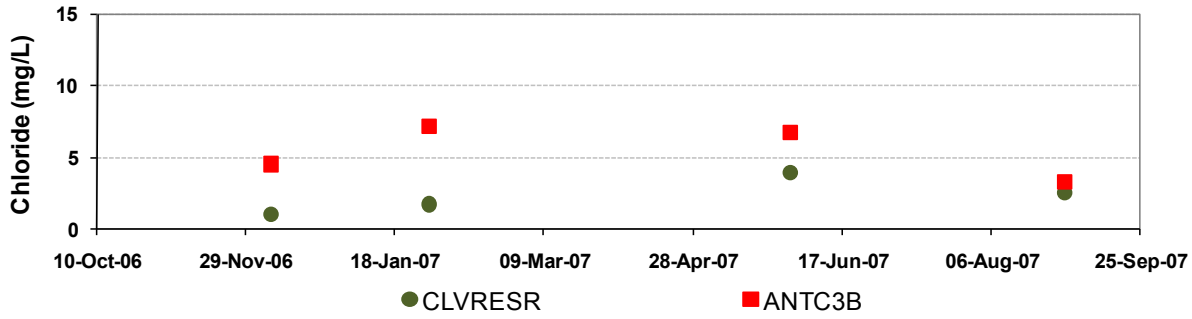

FIGURE 3-58
CHLORIDE RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

No nitrate was detected at CLVRESR and nitrate levels at ANTC3B were very low during baseline monitoring events. As shown in **Figure 3-59**, nitrate results ranged from the detection limit (0.1 mg/L) during the summer monitoring event to 0.24 mg/L during the spring monitoring event.

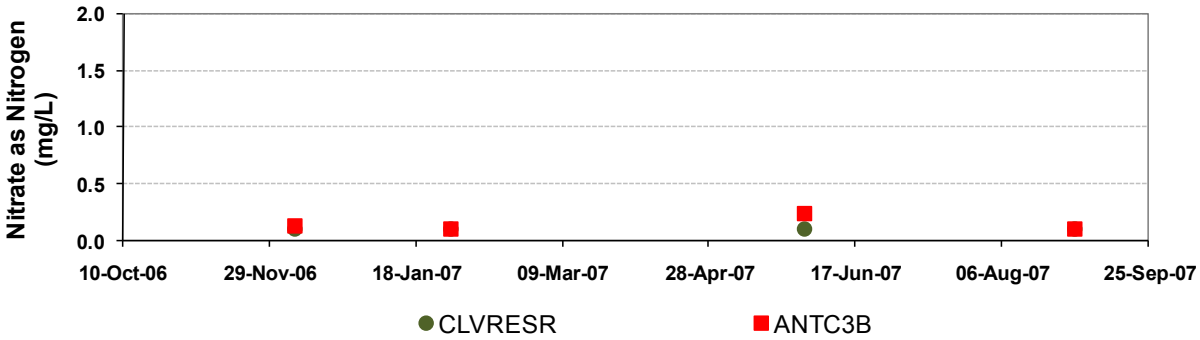

FIGURE 3-59
NITRATE RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Nitrate and orthophosphate (PO_4) were measured by the DCC and Central Valley RWQCB in the Antelope Creek watershed. Although overall nitrate and phosphate values were low, data suggest that the nitrate-to-phosphate ratio is lower than the biologically desirable ratio of 10:1 (Placer County Planning Department 2003).

As shown in **Figure 3-60**, sulfate levels ranged from 0.5 mg/L at CLVRESR during the fall monitoring event to 8.7 mg/L at ANTC3B during the spring monitoring event.

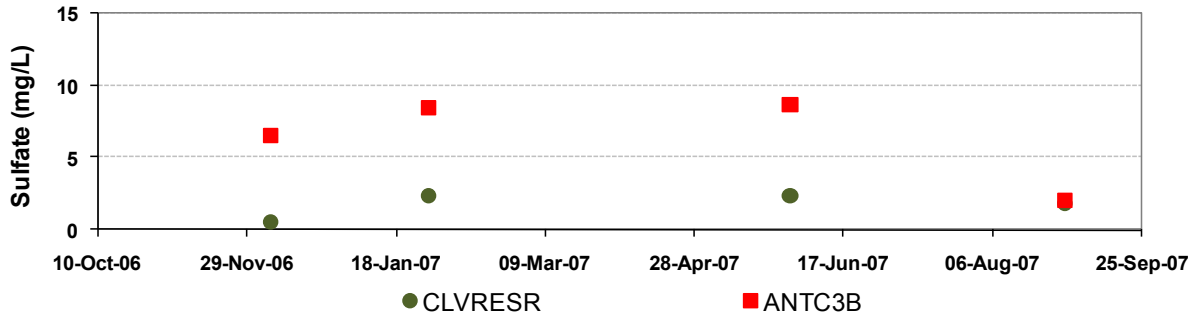

FIGURE 3-60
SULFATE RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Trace Elements

Aluminum results at ANTC3 were consistently higher compared to values measured at CLVRESR, and displayed a particularly high value during the spring monitoring event. Aluminum concentrations at both monitoring locations ranged from 25 µg/L at CLVRESR during the fall monitoring event to 160 µg/L during the spring monitoring event (**Figure 3-61**).

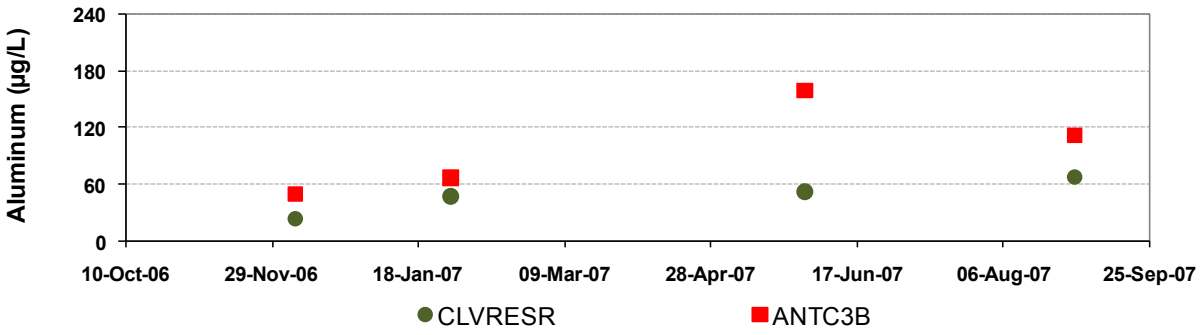

FIGURE 3-61
ALUMINUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Barium concentrations at ANTC3B were consistently higher than at CLVRESR during seasonal monitoring events. As shown in **Figure 3-62**, barium results ranged from 11 µg/L at CLVRESR during the fall, winter and summer monitoring events to 40 µg/L at ANTC3 B during the spring monitoring event.

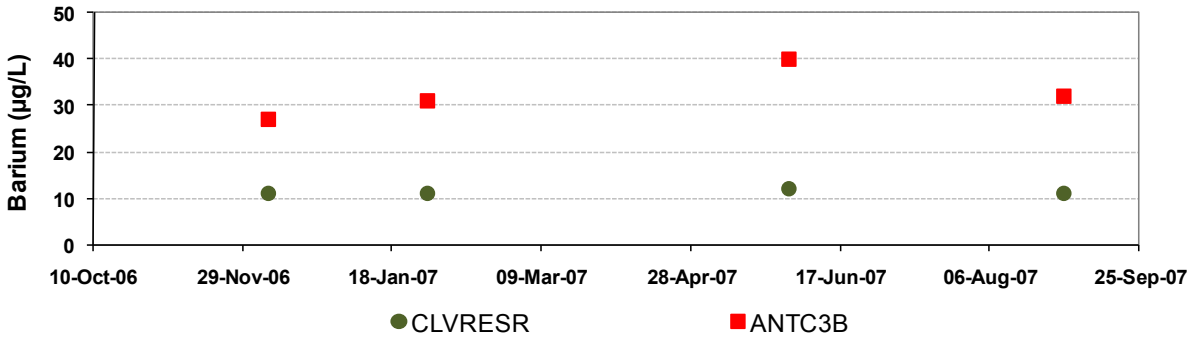

FIGURE 3-62
BARIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

Cadmium concentrations at ANTC3B were below detection limits for baseline sampling events. Copper was only detected at CLVRESR and ANTC3B during the spring and summer monitoring events, and ranged from 2.1 to 4.5 µg/L (**Figure 3-63**).

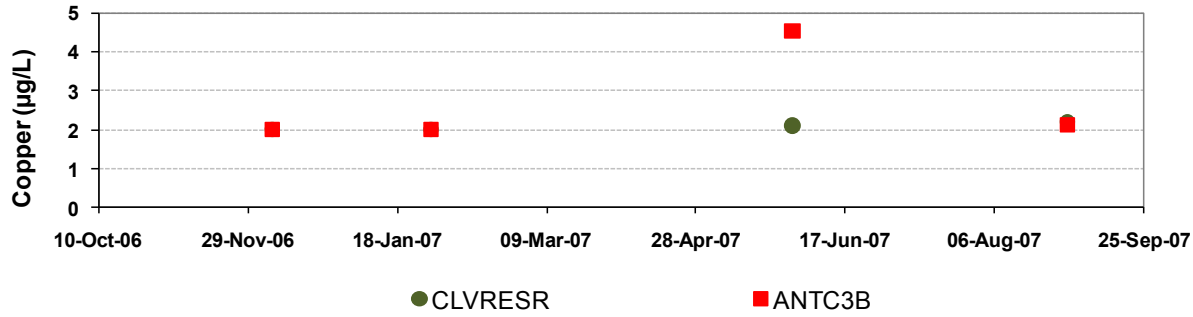

FIGURE 3-63
COPPER RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

As shown in **Figure 3-64,** zinc was only detected at CLVRESR and ANTC3B during the winter monitoring event (at 20 µg/L 19 µg/L, respectively). Seasonal copper trends were similar to those of other stream monitoring sites. Mercury concentrations at ANTC3B were below detection limits for baseline sampling events.

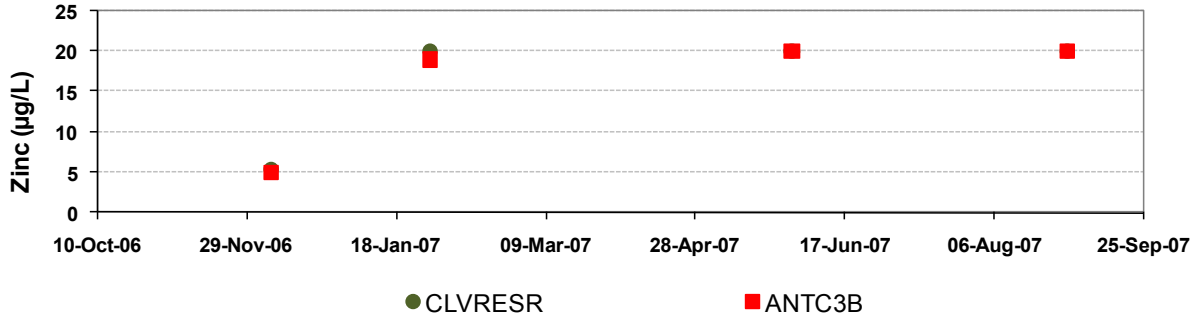

FIGURE 3-64
ZINC RESULTS FROM SEASONAL MONITORING EVENTS IN THE ANTELOPE CREEK WATERSHED

DCC and the Central Valley RWQCB measured trace elements at three different locations in the Antelope Creek watershed in 2001. Barium results ranged from 50 to 60 μg/L and zinc levels ranged from 7 to 3.9 μg/L (Sierra Business Council 2003). Copper levels were detected at 7 μg/L, which is above the CTR chronic water quality standard of 5 μg/L.

Secret Ravine

Five baseline water quality monitoring sites were evaluated within the Secret Ravine watershed:

- **Boardman Canal at Powerhouse Road (YB78)**: Located near the town of Auburn at an elevation of 1,300 feet. This site is the next monitoring location downstream from Boardman Canal below Lake Alta (YB96).

- **Boardman Canal below Mammoth Reservoir (YB81**): PCWA regulates flow releases from Mammoth Reservoir to the Boardman Canal, and lower portions of the PCWA raw water distribution system (East Loomis basin).

- **Yankee Hill Canal Outlet Release (YANKEECR**): A canal south of Mammoth Reservoir that stems from the Boardman Canal to the northwest. Unregulated releases from this canal flow into an unnamed tributary that contributes flows to Secret Ravine.

- **Tributary to Secret Ravine from Yankee Hill Canal (YHTRIB2):** Located along the unnamed tributary receiving unregulated releases from the Yankee Hill Canal outlet YHTRIB2 near Barton Road, upstream from its confluence with Secret Ravine. The site is at the downstream edge of Indian Creek Country Club.

- **Secret Ravine at Rocklin Road (SECRETRV3**): Located just east of Interstate 80. This site has been monitored by DCC for the past few years.

Water Temperature and Dissolved Oxygen

Figure 3-65 shows water temperature and DO results from water quality monitoring at the five sites during baseline sampling events. Water temperature results exhibited a broad seasonal range at the locations, ranging from 41.2 ºF at YB78 in the winter to 83.1 ºF at YHTRIB2 during the summer monitoring event. DO levels also ranged seasonally from 7.2 mg/L at YHTRIB2 in the summer to 14.1 mg/L at SECRETRV3 in the fall.

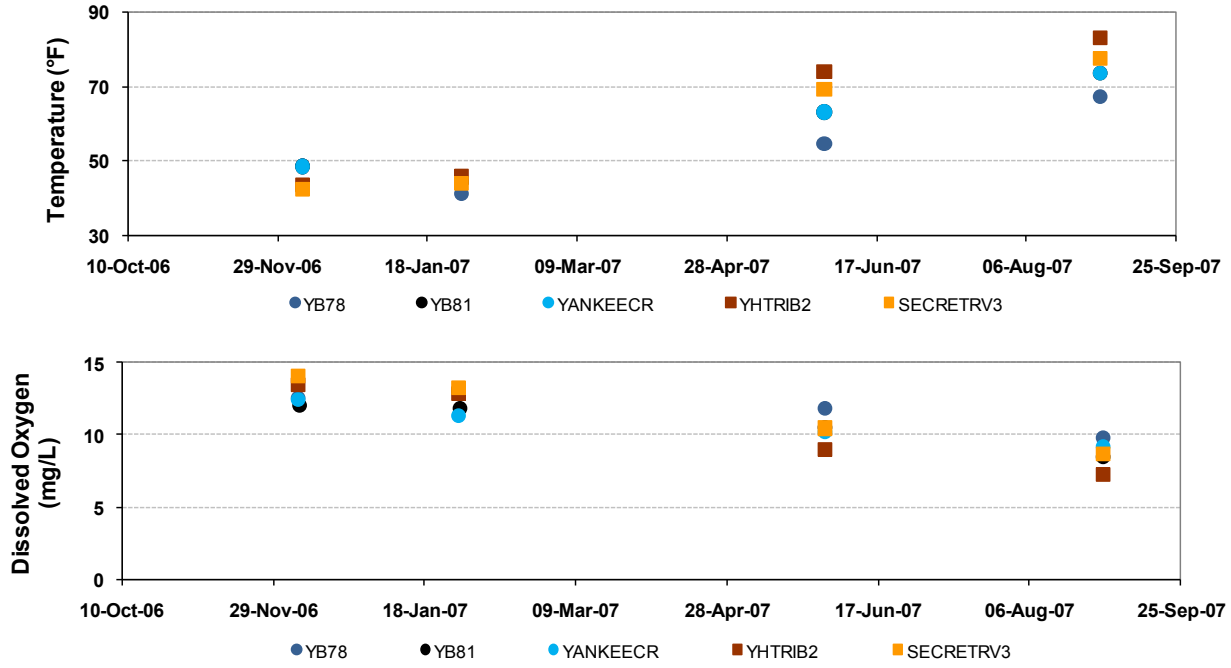

FIGURE 3-65
TEMPERATURE AND DISSOLVED OXYGEN RESULTS FROM SEASONAL MONITORING EVENTS IN SECRET RAVINE WATERSHED

DCC collected temperature data at multiple locations along Secret Ravine between 2001 and 2005 (Sierra Business Council 2003). Water temperature results from DCC studies found average summer water temperatures ranged from 57 ºF to 84 ºF and average winter water temperatures ranged from 45 ºF to 64 ºF. Water temperatures were recorded by the DFG in 1984 at two monitoring locations on Secret Ravine: Rocklin Road and Brace Road. Water temperatures ranged from 50 ºF in February 1984 to 64 ºF in late May 1984. The Central Valley RWQCB collected water quality information at Loomis Basin Park on a monthly basis from December 2000 through February 2002 (Sierra Business Council 2003). Water temperature results from the Central Valley RWQCB study found average summer temperatures ranged from 54 ºF to 86 ºF and average winter water temperatures ranged from 41 ºF to 66 ºF.

DO data were collected by DCC during a periodic "first flush" and/or quarterly monitoring program upstream from Rocklin Road at the Secret Ravine confluence with Miners Ravine. DO levels measured during this program in 2002 and 2003 were within a reasonable range of expected values and did not raise concerns (Sierra Business Council 2003).

pH, Alkalinity, and Hardness

Figure 3-66 shows baseline pH, alkalinity, and hardness results for sites monitored in the Secret Ravine watershed. Consistently higher pH values were observed at SECRETRV3 compared to the other monitoring locations, with the exception of YANKEECR during the summer baseline monitoring event. Overall, pH results for all sites ranged from 7.1 to 8.4.

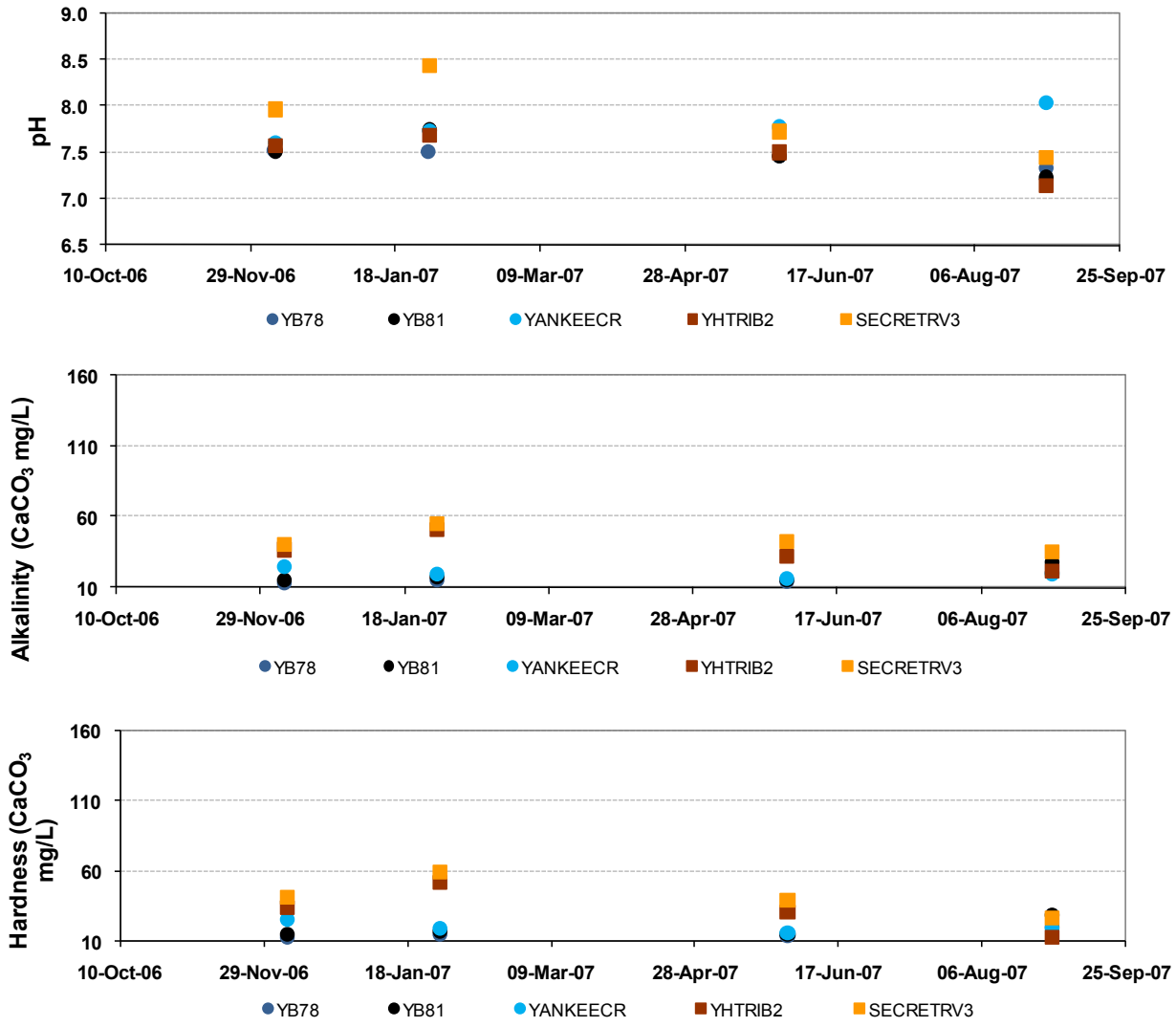

FIGURE 3-66
PH, HARDNESS, AND ALKALINITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Wide fluctuations in pH values were found during sampling conducted by the Central Valley RWQCB. Although the total magnitude of annual change is within an acceptable range for water quality considerations, the fluctuations occur rapidly, particularly during the fall. Monthly sampling between December 2000 and February 2002 at Loomis Basin Park ranged from 8.3 in December 2000 to 6.7 in November 2001 (Sierra Business Council 2003).

Total Suspended Solids and Turbidity

TSS values were below detection limits (10 mg/L) at all locations in the Secret Ravine watershed during all baseline monitoring events. Turbidity values at the five monitoring locations, shown in **Figure 3-67**, ranged between 10.2 and 65.9 NTUs during seasonal monitoring events, with the exception of a measured value of 218 NTU at YB78, which may be an outlier due to sampling procedures or a large object in the water affecting the signal of the optical turbidity sensor.

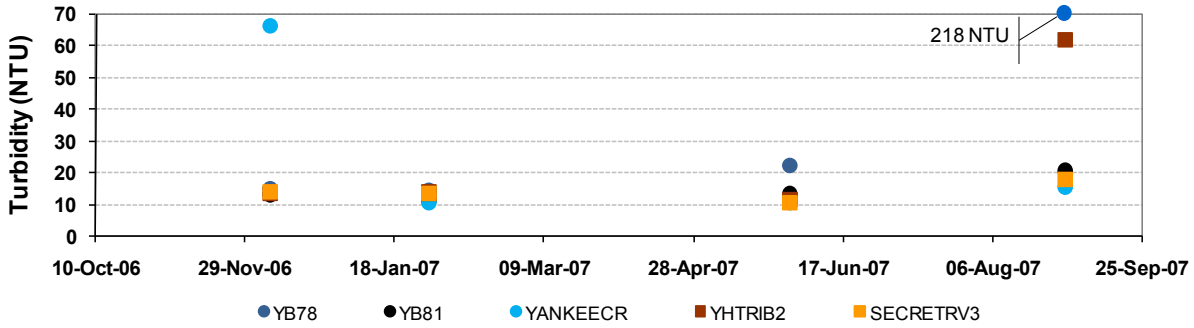

FIGURE 3-67
TURBIDITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Specific Conductivity and Ions

Values for SC at YHTRIB2 and SECRETRV3 ranged from 0.05 and 0.08 mS/cm, whereas they ranged from 0.04 and 0.05 mS/cm at canal locations monitored within the Secret Ravine watershed (**Figure 3-68**).

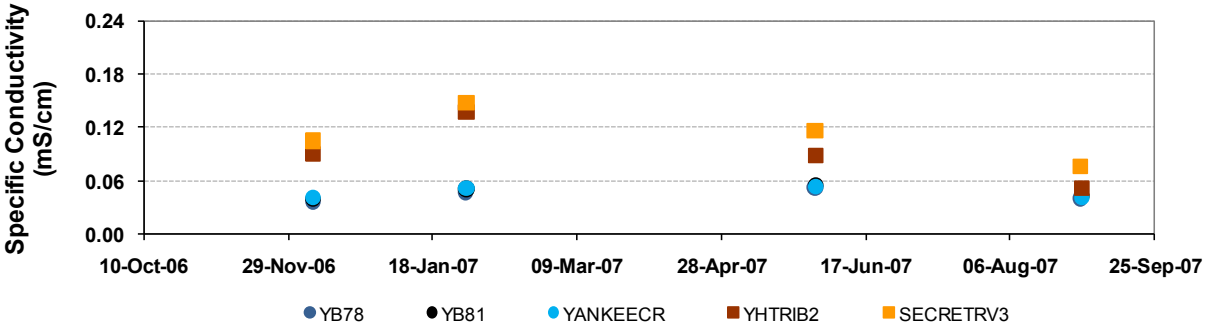

FIGURE 3-68
SPECIFIC CONDUCTIVITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Similar to trends observed for SCs, calcium concentrations at YHTRIB2 and SECRETRV3 were consistently higher than at the canal monitoring locations. Calcium values ranged from 3.6 to 12 mg/L at YHTRIB2 and SECRETRV3, and from 3.6 to 3.8 mg/L at canal sites (**Figure 3-69**).

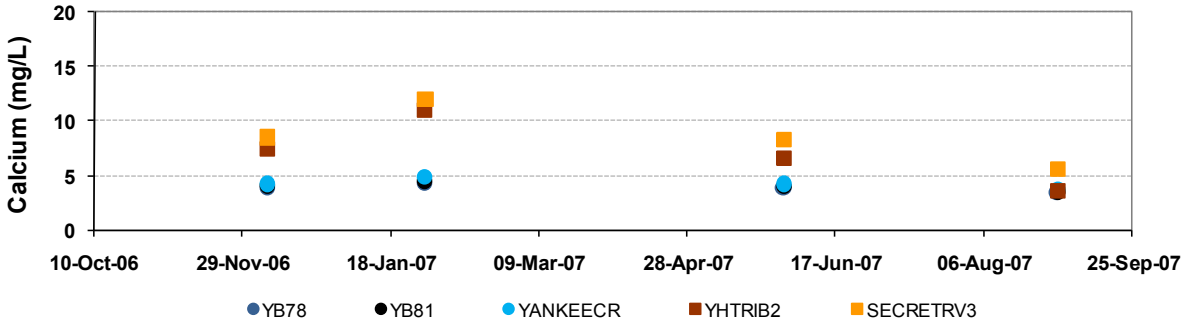

FIGURE 3-69
CALCIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Iron concentrations at the two stream sites monitored within the Secret Ravine watershed, YHTRIB2 and SECRETRV3, display a greater range than those at canal sites. As shown in **Figure 3-70**, iron concentrations at YHTRIB2 and SECRETRV3 ranged from 0.18 mg/L to 0.88 mg/L, whereas iron levels at canal monitoring locations ranged from 0.74 to 0.81 mg/L.

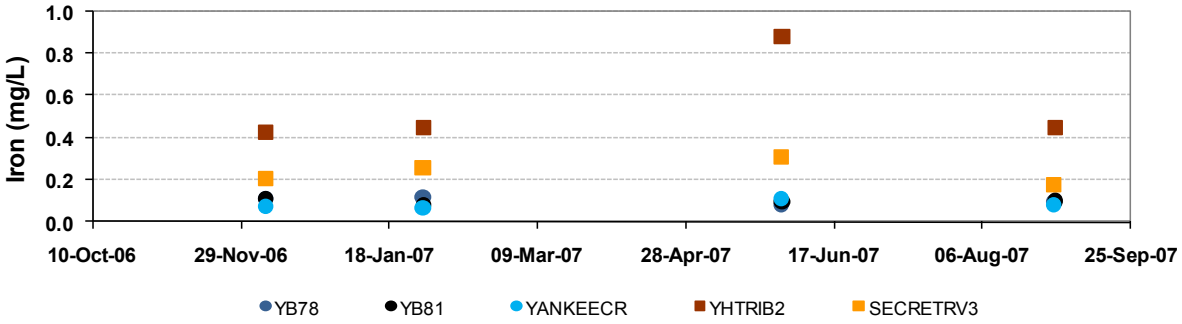

FIGURE 3-70
IRON RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Magnesium concentrations followed the same trend exhibited by SC and calcium results (**Figure 3-71**).

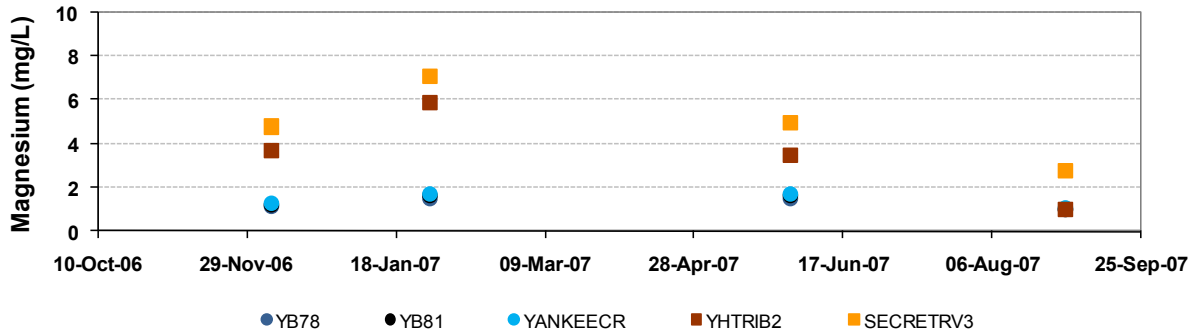

FIGURE 3-71
MAGNESIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Potassium was not detected at canal monitoring locations during baseline sampling events. Potassium results at YHTRIB2 and SECRETRV3 during baseline sampling events were either just above (1.1 mg/L), at, or below the detection limit of 1.0 mg/L.

Sodium results also were consistently higher at YHTRIB2 and SECRETRV3 than at canal monitoring locations. Sodium values at YHTRIB2 and SECRETRV3 ranged from 3.0 mg/L to 7.7 mg/L and ranged from 1.2 to 3.8 mg/L at canal monitoring locations (**Figure 3-72**).

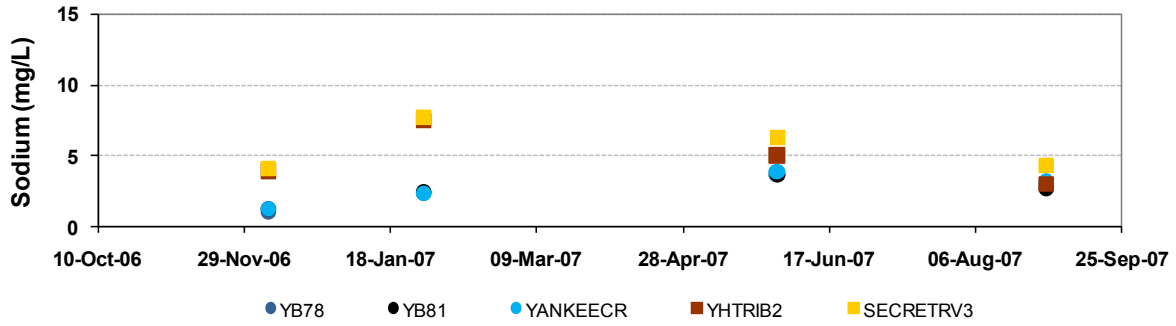

FIGURE 3-72
SODIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Chloride concentrations at YHTRIB2 and SECRETRV3 ranged from 3.4 to 8.2 mg/L, and from 1.0 to 4.0 mg/L at canal monitoring locations (**Figure 3-73**).

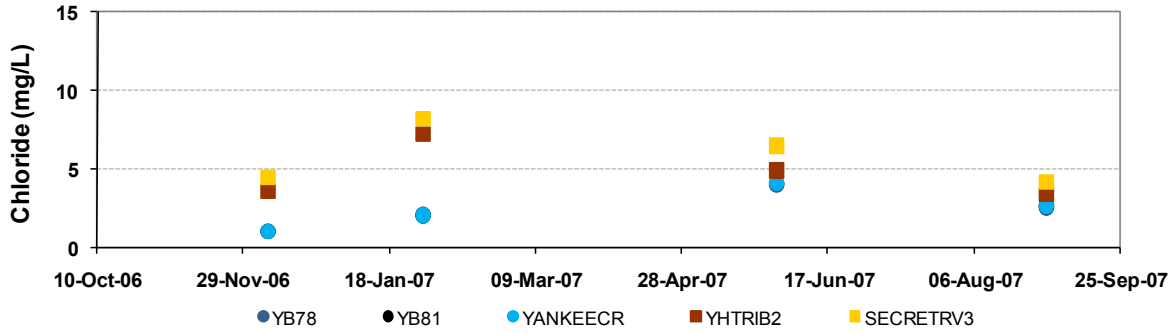

FIGURE 3-73
CHLORIDE RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Nitrate results were at or below the detection limit of 0.1 mg/L at Secret Ravine watershed monitoring sites during baseline sampling events.

Sulfate concentrations at the five monitoring sites exhibited trends similar to SC and several other ions. Across all the sites, sulfate results ranged from 0.5 mg/L to 7.8 mg/L (**Figure 3-74**).

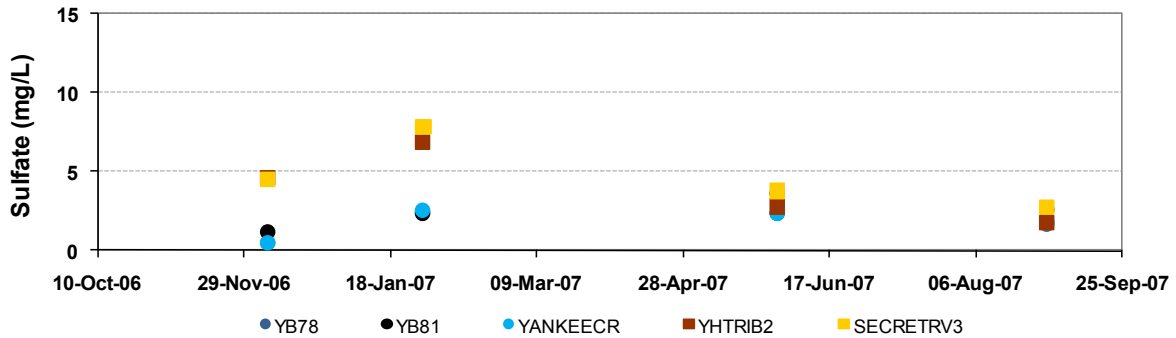

FIGURE 3-74
SULFATE RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

The 2001 to 2005 DCC study collected nitrate data at various locations along Secret Ravine. Nitrate results from this study ranged from 0.09 to 0.20 mg/L during the summer and 0.05 to 0.08 mg/L during winter (Sierra Business Council 2003).

Trace Elements

As shown in **Figure 3-75**, no specific trend was noted with aluminum results at the five monitoring sites. Aluminum concentrations varied at the sites from below the detection limit of 40 µg/L to 137 µg/L.

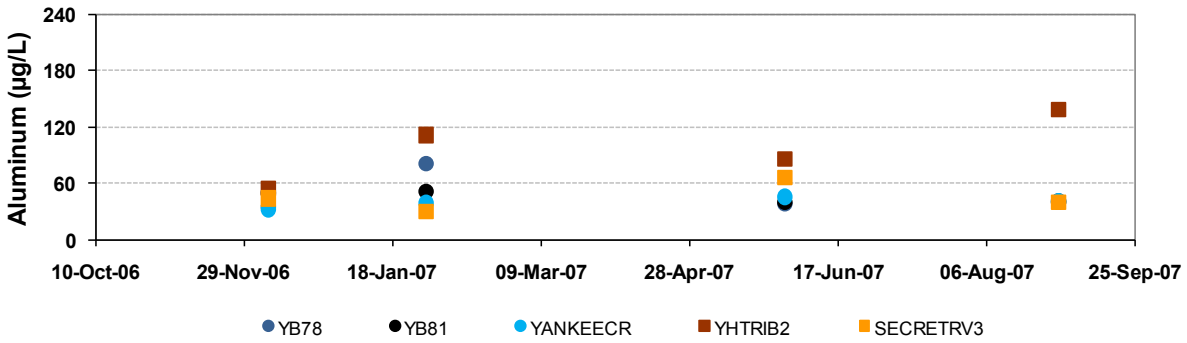

FIGURE 3-75
ALUMINUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Barium results at the YHTRIB2 and SECRETRV3 monitoring sites were consistently higher compared to those at the canal monitoring sites. As shown in **Figure 3-76**, barium levels ranged from 9.7 to 22.0 µg/L at the five monitoring locations.

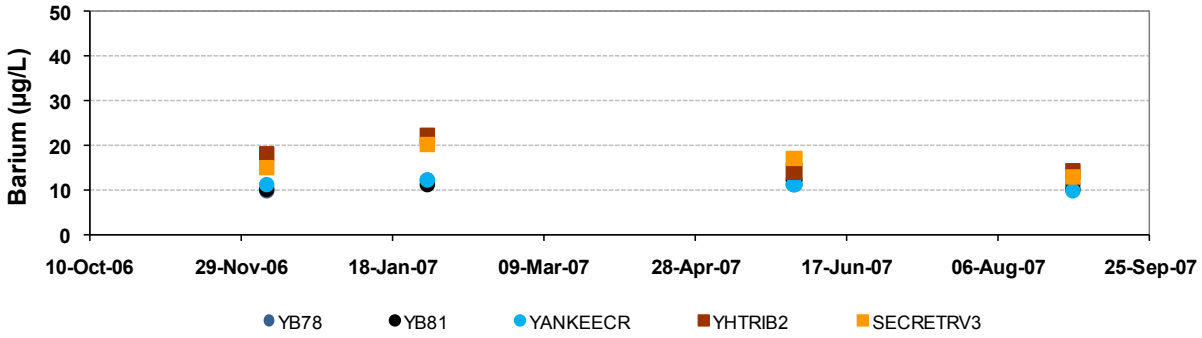

FIGURE 3-76
BARIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Cadmium concentrations at sites monitored in the Secret Ravine watershed were below detection limits for baseline sampling events. Copper concentrations were below the detection limit during the fall monitoring event at the five monitoring locations. During the other seasons, concentrations of copper remained fairly low, with the highest copper concentration measured at 3.5 µg/L at SECRETRV3 during the spring monitoring event and at YB78 during the winter

monitoring event (**Figure 3-77**). Similar to cadmium results, mercury concentrations at sites monitored in the Secret Ravine watershed were below detection limits for baseline sampling events.

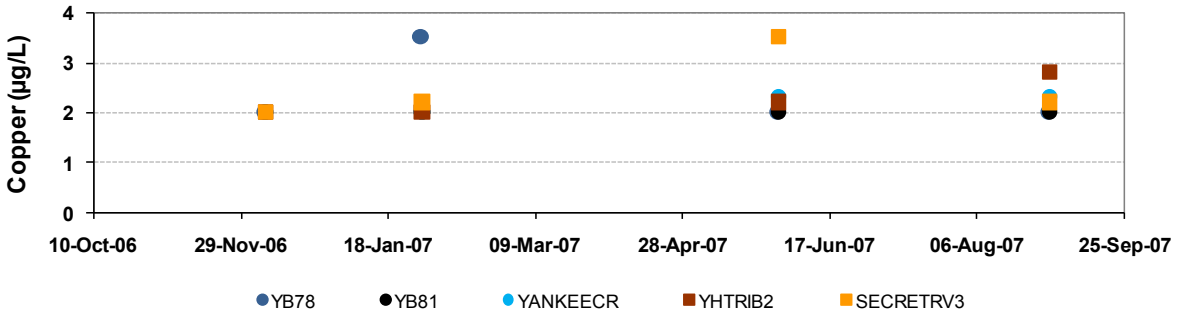

FIGURE 3-77
COPPER RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

Measured zinc concentrations were similar at all sites, with detections only during the fall and winter monitoring events at YHTRIB2 and SECRETRV3 sites (**Figure 3-78**). Concentrations of zinc during the spring and summer monitoring events were below the detection limit (20 µg/L).

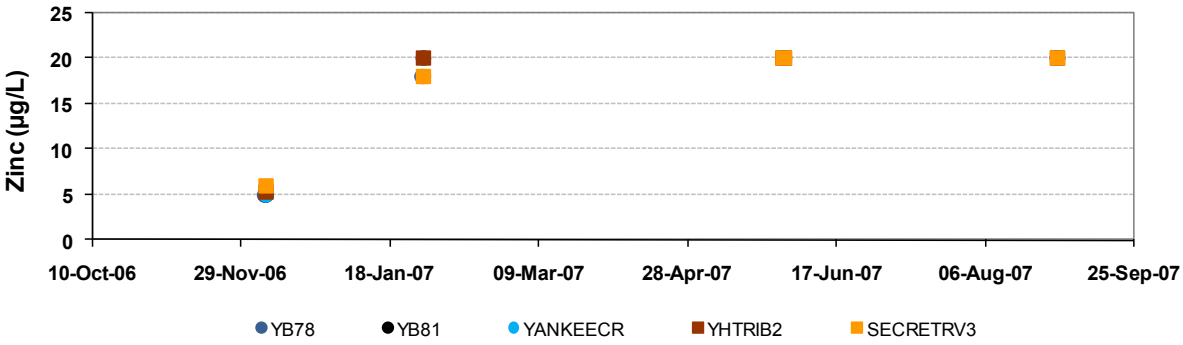

FIGURE 3-78
ZINC RESULTS FROM SEASONAL MONITORING EVENTS IN THE SECRET RAVINE WATERSHED

The Central Valley RWQCB collected data on cadmium, copper, and zinc from Secret Ravine at Loomis Basin Park on a monthly basis from December 2000 through February 2002. Copper, cadmium, and zinc levels exceeded standards of the CTR in November 2002, with reported levels of 12 µg/L, 0.010 mg/L, and 70.0 µg/L, respectively, at the confluence with Miners Ravine (Sierra Business Council 2003).

Miners Ravine

Miners Ravine, similar to Secret Ravine, contributes to flows in Dry Creek. Miners Ravine has topography similar to Secret Ravine; its upper reaches are distinguished by higher elevation steep terrain, and lower reaches consist of flat valleys. Also similar to Secret Ravine, canal system contributions comprise most of the dry weather flows in Miners Ravine. These contributions include customer return flows and unregulated releases from multiple canals. Various tributaries also contribute flows to Miners Ravine. Land uses in the watershed include agricultural, residential, commercial, industrial, and open space (Placer County Planning Department 2007).

Water quality monitoring was conducted at several canal and stream sites within the Miners Ravine watershed:

- **Boardman Canal at Powerhouse Road (YB78)**: Located near the town of Auburn at an elevation of 1,300 feet. This site is the next monitoring location downstream from Boardman Canal below Lake Alta (YB96).

- **Boardman Canal below Mammoth Reservoir (YB81**): PCWA regulates flow releases from Mammoth Reservoir to the Boardman Canal, and lower portions of the PCWA raw water distribution system (East Loomis basin).

- **Baughman Canal Outlet Release (BAUGHMANCR):** A canal south of Mammoth Reservoir that stems from the Boardman Canal to the north. Unregulated releases from this canal flow into an unnamed tributary that contributes flows to Miners Ravine.

- **Miners Ravine at Dick Cook Road (MINERSRV6):** Located in the Town of Loomis upstream from two other monitoring locations for baseline sampling in the Miners Ravine watershed. The site is just south of the Placer County SMD No. 3. Plant.

- **Tributary to Miners Ravine from Baughman Canal (BCTRIB1):** Located along the unnamed tributary receiving unregulated releases from the Baughman Canal Outlet near Cavitt-Stallman Road, immediately upstream from its confluence with Miners Ravine.

- **Miners Ravine at North Sunrise Avenue (MINERSRV3):** Located near a bike path bridge, upstream from the confluence with Secret Ravine.

Water Temperature and Dissolved Oxygen

Water temperature and DO data for the six baseline monitoring sites in the Miners Ravine watershed are shown in **Figure 3-79.** Seasonal water temperature results for all the sites ranged from 41.2 ºF during the winter monitoring event to 81.5ºF during summer. DO levels follow an inverse trend compared to water temperature. DO levels at the six sites ranged from 2.7 mg/L during summer to 14.0 in the winter.

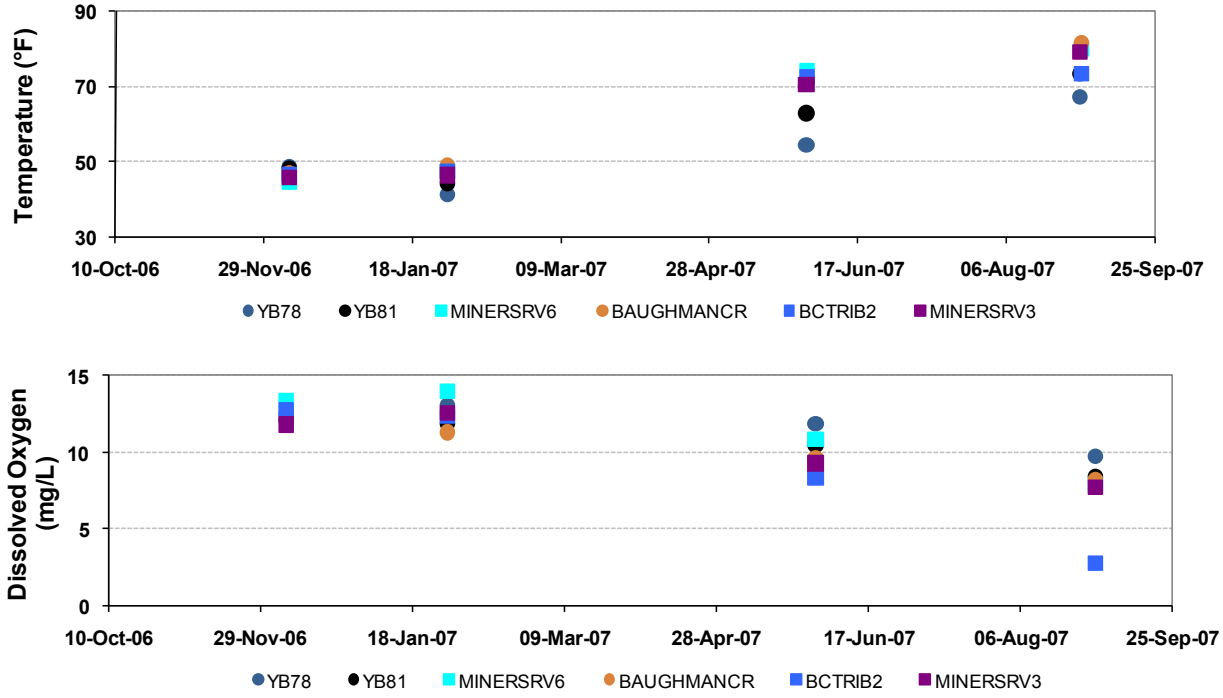

FIGURE 3-79
TEMPERATURE AND DISSOLVED OXYGEN RESULTS FROM SEASONAL MONITORING EVENTS IN MINERS RAVINE WATERSHED

Hourly water temperature data was collected by Bailey Environmental from May to August 2003 at the Miner Ravine Road crossing, Barton Road crossing, Cavitt-Stallman Road crossing, and the Olympus Point development in Roseville behind the United Artists complex (Sierra Business Council 2003). Water temperatures collected at Miner Ravine Road crossing between May 31 and August 5, 2003, ranged from 54 ºF in late June 2003 to 86 ºF in late July 2003. At Barton Road crossing, water temperatures ranged from 64 ºF in mid-June 2003 to 81 ºF in late July 2003, and between 66 ºF in mid-June 2003 to 84 ºF in mid-July 2003 at Cavitt-Stallman Road crossing. Finally, water temperatures at the Olympus Pointe site between June 18 and July 24, 2003, ranged from 68 ºF in late June to 86 ºF in late July 2003. DFG collected water temperature data from 1999 to 2003 at a monitoring site near Dick Cook Road (Sierra Business Council 2003) Water temperatures measured in the fall (September 1 to December 31, 2002) ranged from 80 ºF to 43 ºF, in the winter (January 1 to April 27, 2003) ranged from 42 ºF to 67 ºF, and in the summer (May 1 to August 25, 2003) ranged from 54 ºF to almost 88 ºF (Sierra Business Council 2003).

DO results from a 2000 to 2002 Central Valley RWQCB study at Miners Ravine ranged from 5.4 mg/L to 8.5 mg/L during the summer and 3.4 mg/L to 6.9 mg/L during the winter (Placer and Sacramento Counties 2003).

pH, Alkalinity, and Hardness

Baseline water quality results for pH, alkalinity, and hardness from sites monitored in the Miners Ravine watershed are shown in **Figure 3-80**. Results for pH at MINERSRV3 were consistently

higher compared to the other five monitoring locations. Overall, pH results ranged at the six sites from 7.1 to 8.9. Measured alkalinity and calculated hardness values were consistently higher at the stream sites than the canal sites. Alkalinity levels ranged from 31.0 to 151.0 mg/L $CaCO_3$ at the stream sites and ranged from 15.0 to 20.0 mg/L $CaCO_3$ at the canal sites. Hardness ranged from 25.4 to 70.4 mg/L $CaCO_3$ at the stream sites and 14.0 to 16.1 mg/L $CaCO_3$ at the canal sites.

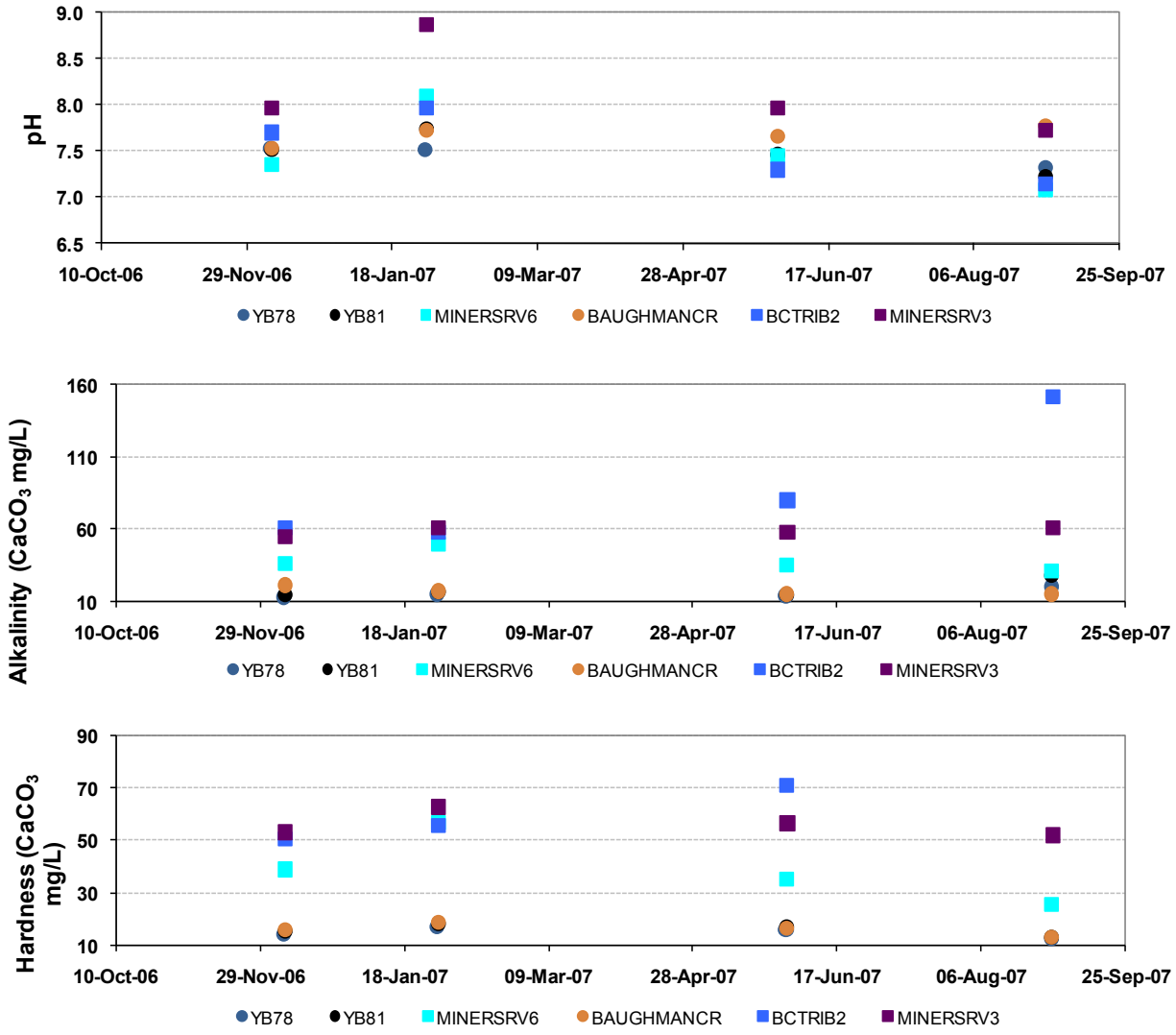

FIGURE 3-80
PH, ALKALINITY, AND HARDNESS RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

A 2000 to 2002 Central Valley RWQCB study found pH values ranging from 6.2 to 7.8 during summer and 6.2 to 8.2 during winter within the Miners Ravine watershed (Sierra Business Council 2003). An Administrative Civil Liability (ACL) complaint and fine were recently issued to Placer County SMD No. 3 by the Central Valley RWQCB for violations in effluent limitations to Miners Ravine for pH from January 2000 to December 2007 (RWQCB 2008).

Total Suspended Solids and Turbidity

TSS values were below detection limits (10 mg/L) at locations monitored in the Miners Ravine watershed during baseline monitoring events, with three exceptions: 13 mg/L at MINERSRV6 during the spring monitoring event, and 17 mg/L at BCTRIB1, and 218 mg/L at YB78 during the summer monitoring event. As shown in **Figure 3-81**, turbidity values at the six sites were similar, ranging between 9.4 and 21.9 NTUs, with the exception of a measurement of 218 NTUs at YB78, which may be an outlier due to sampling procedures or a large object signaling the optical turbidity probe.

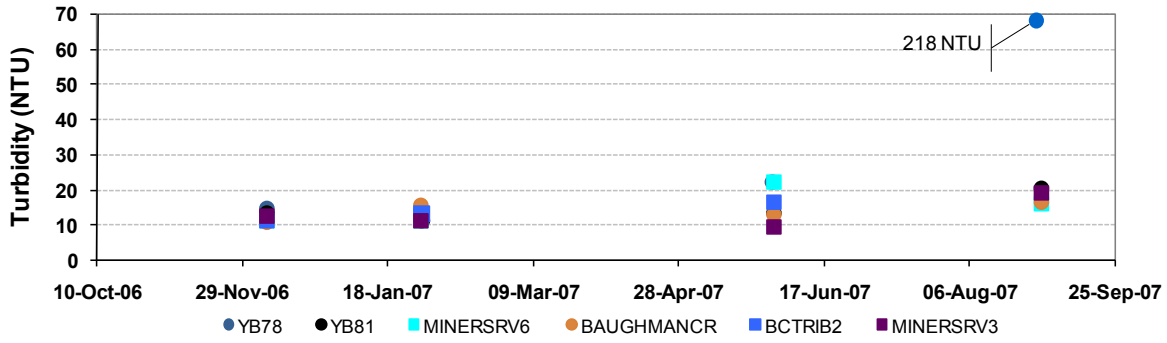

FIGURE 3-81
TURBIDITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

The 2000 to 2002 Central Valley RWQCB study found turbidity values ranging from 3.7 to 5.5 NTUs during summer and 3.4 to 6.9 NTUs during winter within the Miners Ravine watershed (Placer and Sacramento Counties 2003). The Central Valley RWQCB recently issued an ACL complaint and fine to Placer County SMD No. 3 for violations in effluent limitations to Miners Ravine for turbidity from January 2000 to December 2007 (RWQCB 2008).

Specific Conductivity and Ions

SC results at stream monitoring sites in the Miners Ravine watershed (MINERSRV6, BCTRIB1, and MINERSRV3) are higher than those at the canal monitoring sites, and among the highest levels compared to other stream monitoring sites. As shown in **Figure 3-82**, the greatest SC value among the stream sites was measured at 0.31 mg/L at the BCTRIB1 site during the summer monitoring event, and the lowest value (0.1 mg/L) occurred at MINERSRV6. SC values at the canal monitoring locations were similar across sites, and ranged from 0.04 to 0.05 mg/L.

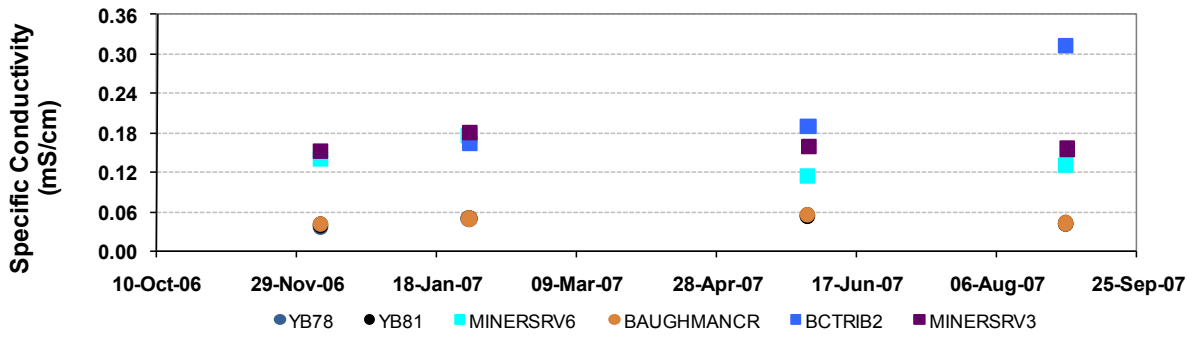

FIGURE 3-82
SPECIFIC CONDUCTIVITY RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

The 2000 to 2002 Central Valley RWQCB study found SC values ranging from 0.075 to 0.145 mS/cm during the summer and 30.2 to 0.200 mS/cm during the winter within the Miners Ravine watershed (Placer and Sacramento Counties 2003).

Trends in calcium baseline water quality monitoring were very similar to those described for specific conductivity (**Figure 3-83)**. The highest concentrations of calcium were observed during the summer monitoring event at BCTRIB1.

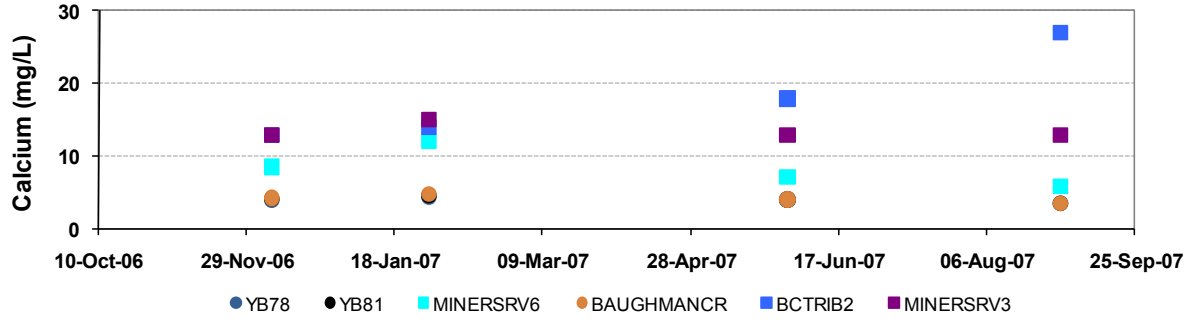

FIGURE 3-83
CALCIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Iron results for baseline water quality monitoring at sites in Miners Ravine watershed are shown in **Figure 3-84**. BCTRIB1 had an iron concentration of 2.3 mg/L during the summer monitoring event, which is particularly high compared to all other monitoring sites during seasonal monitoring events.

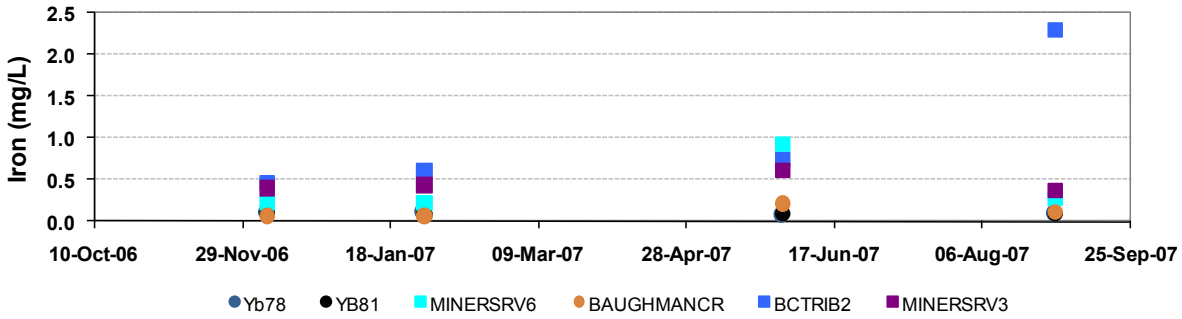

FIGURE 3-84
IRON RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Trends in seasonal magnesium concentrations were similar to those described for SC and calcium (**Figure 3-85**).

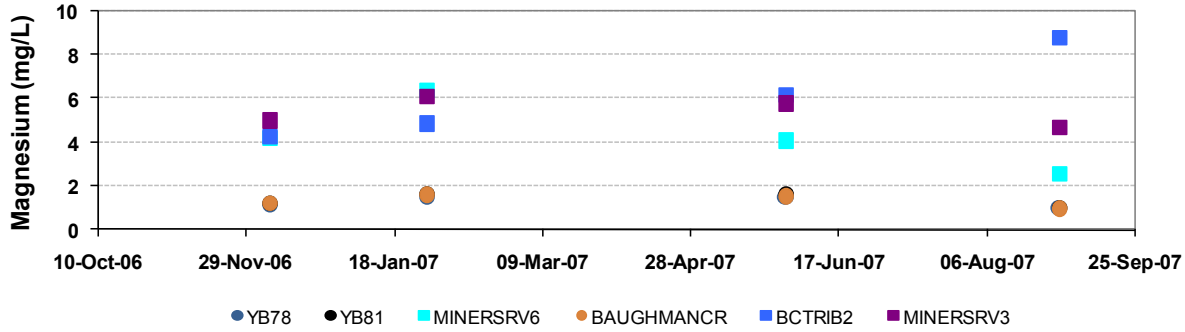

FIGURE 3-85
MAGNESIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Potassium levels were consistently higher at stream sites than at canal monitoring sites. No notable seasonal trends were observed in potassium concentrations at baseline sampling sites in the Miners Ravine watershed (**Figure 3-86**).

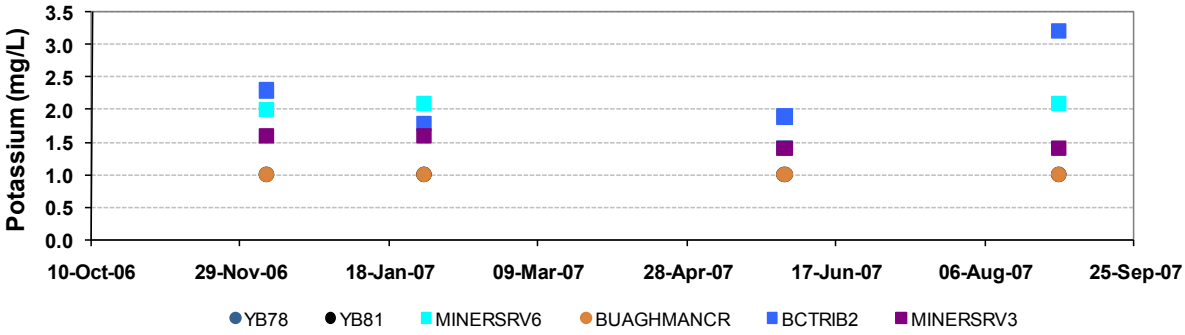

FIGURE 3-86
POTASSIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Sodium concentrations in the Miners Ravine watershed displayed similar seasonal trends as those observed for SC, calcium, and magnesium, in which the BCTRIB1 monitoring location had the highest values during the spring and summer monitoring events (**Figure 3-87**). In addition, most variation across sites occurred during the summer monitoring event.

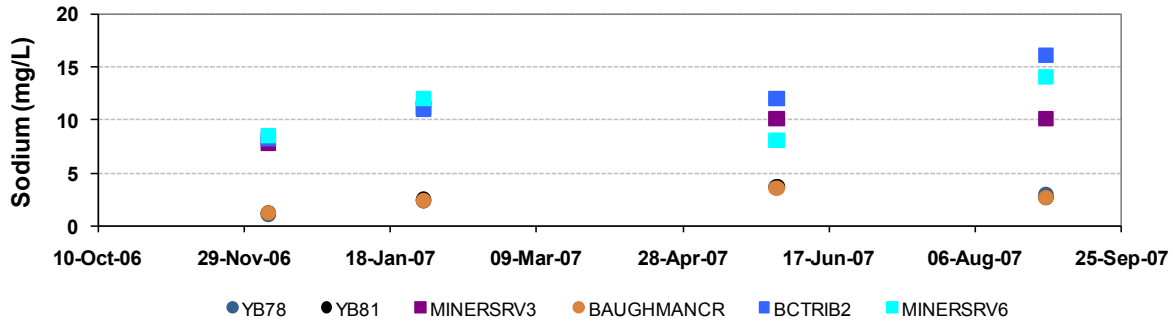

FIGURE 3-87
SODIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Although chloride results at stream monitoring locations are consistently higher than those at canal monitoring sites, as with other ions, chloride was not consistently high at BCTRIB1. As shown in **Figure 3-88**, chloride results varied from 7.7 to 14.0 mg/L at stream monitoring sites and from 1.0 to 4.0 mg/L at canal monitoring locations.

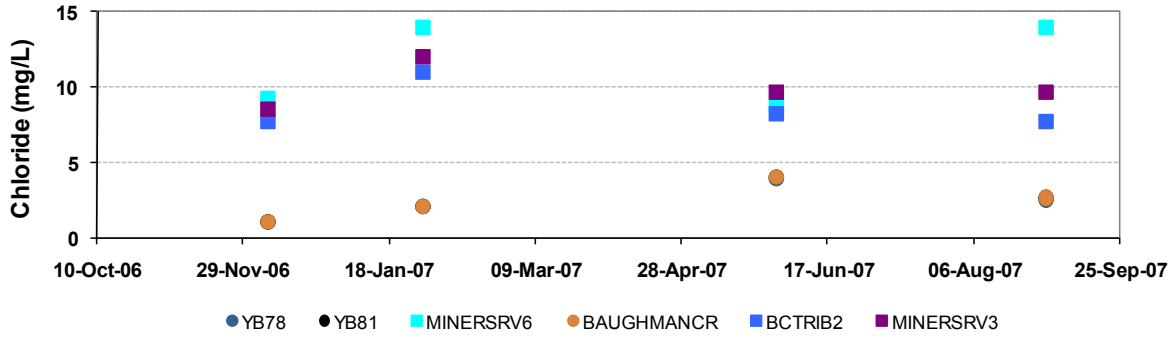

FIGURE 3-88
CHLORIDE RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

An ACL complaint and fine were recently issued to Placer County SMD No. 3 by the Central Valley RWQCB for violations in effluent limitations to Miners Ravine for chlorine residual from January 2000 to December 2007 (RWQCB 2008).

Nitrate concentrations at MINERSRV6 were consistently higher than at other monitoring locations (**Figure 3-89**). MINERSRV6 is downstream from the Placer County SMD No. 3 WWTP. The Central Valley RWQCB recently issued an ACL complaint and fine to Placer County SMD No. 3 for violations in effluent limitations to Miners Ravine for nitrate from January 2000 to December 2007 (RWQCB 2008).

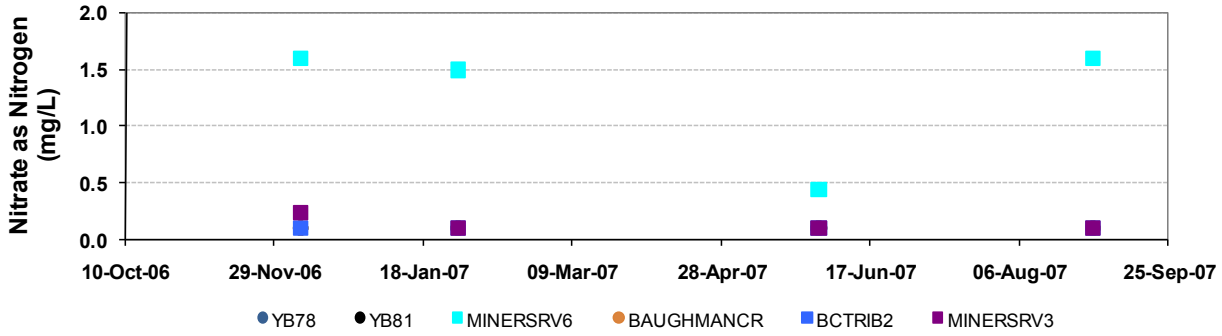

FIGURE 3-89
NITRATE RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Sulfate results for Miners Ravine watershed sites during baseline sampling events were generally higher at the stream sites than at the canal sites, and higher streams in other watersheds monitored. Sulfate was measured at 250 mg/L at MINERSRV6 during the summer monitoring event (**Figure 3-90**). This data point is likely an outlying result that is due to potential changes in analytical methods, or a temporary source of increased sulfate upstream from MINERSRV6, such as wastewater discharges from Placer County SMD No. 3. Data on nitrate and phosphate were also collected during the 2001 to 2005 DCC study. While overall nitrate and phosphorus concentrations were not very high, no nutrients were measured during summer, when nutrient loads are typically highest. The data indicate that the biologically desirable 10:1 ratio of nitrate to phosphate was met only certain times of the year.

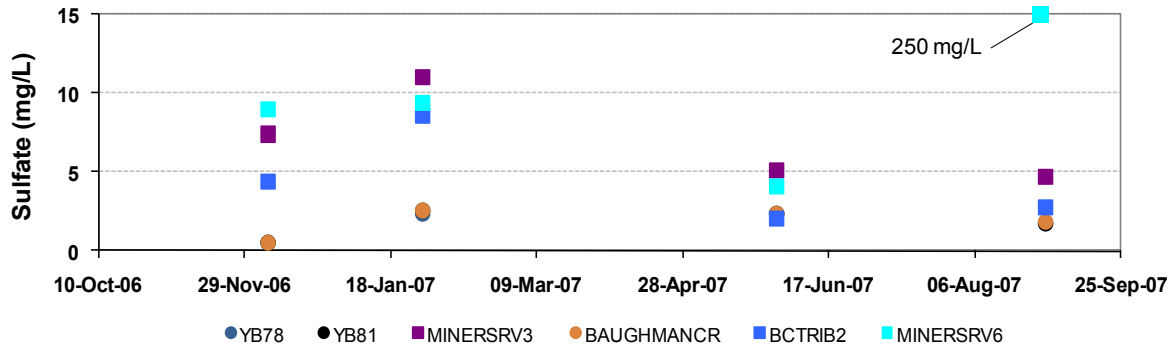

FIGURE 3-90
SULFATE RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Trace Elements

Aluminum concentrations were low at sites evaluated in the Miners Ravine watershed compared to monitoring sites in other watersheds. As shown in **Figure 3-91**, aluminum results at all six monitoring sites ranged from the detection limit (25 µg/L) during the fall monitoring event to 80 µg/L during the summer monitoring event.

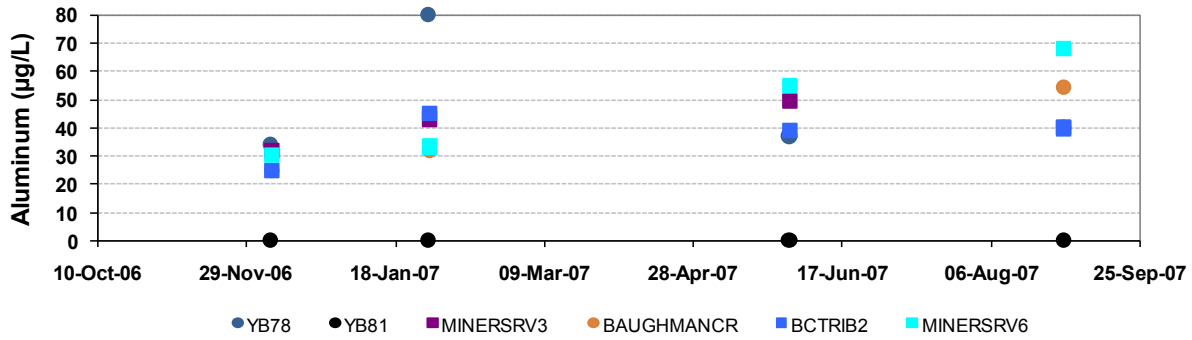

FIGURE 3-91
ALUMINUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Figure 3-92 shows barium concentrations from sites monitored within the Miners Ravine watershed during seasonal baseline sampling events. Barium levels at canal monitoring sites were consistently lower compared to those at stream sites, and ranged from below the detection limit of 2 µg/L to 11 µg/L. Barium results at the stream sites ranged from 11 to 42 µg/L, with the exception of one very high value (190 µg/L) measured at BCTRIB1 during the summer monitoring event.

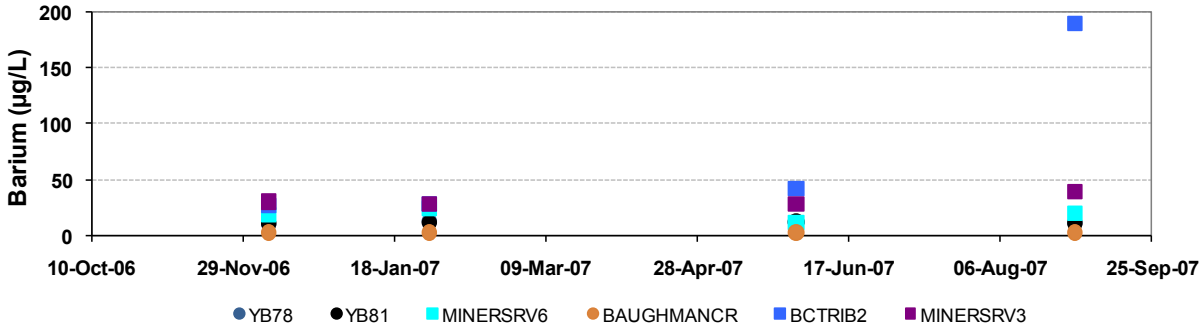

FIGURE 3-92
BARIUM RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Cadmium concentrations at sites monitored in the Miners Ravine watershed were below detection limits for baseline sampling events.

Copper concentrations at the six sites range from below the detection limit of 2 µg/L to 7.5 µg/L (**Figure 3-93**). The 2000 to 2002 Central Valley RWQCB study measured a copper value of 11 µg/L and a zinc value of 1.0 µg/L within the Miners Ravine watershed (Sierra Business Council 2003). Copper exceeded the CTR at 8.0 µg/L at Dick Cook Road during November 2001 (Sierra Business Council 2003).

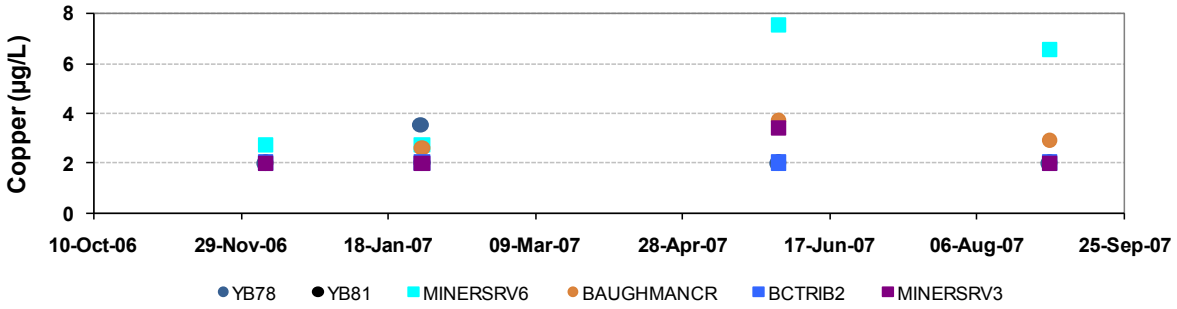

FIGURE 3-93
COPPER RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

Mercury concentrations at sites monitored in the Miners Ravine watershed were below detection limits for baseline sampling events. CVCWA monitored methylmercury from August 2004 through April 2005 at Miners Ravine below the discharge of the Placer County SMD No. 3 WWTP. Methylmercury levels at this site ranged from 0.01 grams per year (grams/year) to 1.29 grams/year, averaging 0.23 grams/year. Mercury pollution in California watersheds originates primarily from historical mining operations and from atmospheric deposition (CVCWA 2005).

Zinc concentrations for seasonal baseline monitoring events at the six monitoring sites are shown in **Figure 3-94**. In general, zinc concentrations were measured close to or below the detection limits during monitoring events, except during the spring monitoring event. Zinc was measured to be 460 µg/L at MINERSRV6 during the spring monitoring event. This is likely an outlier due to methodological errors or a temporary source of increased zinc concentrations during sampling at that location.

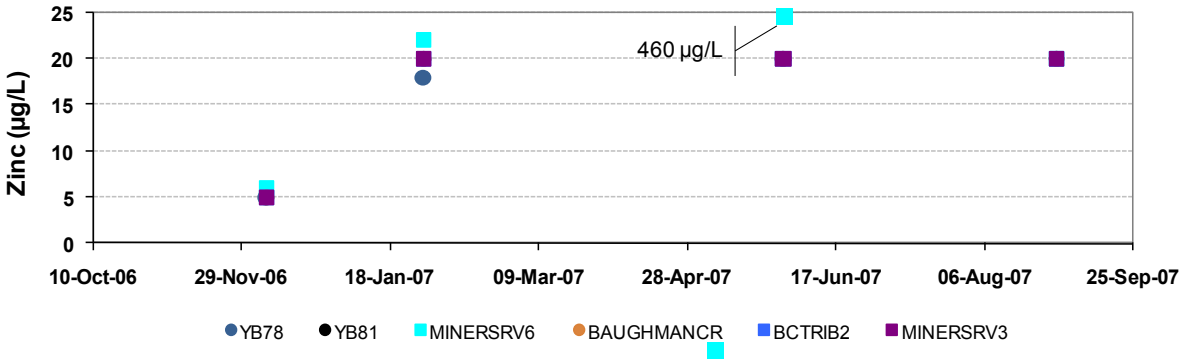

FIGURE 3-94
ZINC RESULTS FROM SEASONAL MONITORING EVENTS IN THE MINERS RAVINE WATERSHED

3.2.2.3 Zone 5

Zone 5 comprises the lower portion of the Auburn Ravine watershed where agricultural water deliveries are made to PCWA customers through the Moore and Pleasant Grove canals.

Although water quality measurements were not taken in the Auburn Ravine watershed during this study, some data were collected by other sources and are summarized below.

Water Temperature and Dissolved Oxygen

Water temperature data collected from other sources include hourly temperature monitoring conducted by Bailey Environmental between April 1999 and August 2003 at Fowler Road, the NID gaging station near Highway 65 in Lincoln, Moore Road, and the Aitken Ranch. Temperature data from this project show summer values (May 28 to August 4, 2003) ranging from approximately 62 °F to 82 °F, fall values (September 9 to December 28, 2002) ranging from 48 °F to 69 °F, winter values (January 1 to April 27, 2003) ranging from 43 °F to 64 °F, and spring values (May 1 to July 31, 2003) ranging from 50 °F to 73 °F (Sierra Business Council 2003).

pH, Alkalinity, and Hardness

Data on pH were collected monthly by the DWR in the lower portion of the Auburn Ravine watershed. The data reveal a wide range of pH values (5.6 to 7.7), but the lower end of this range is considered extremely low for the types of streams found in the Sierra Nevada Foothills (Placer County Planning Department 2003).

Results for pH were also measured by the Lincoln High School Water Quality Monitoring Program (funded by NID, Placer County, and the City of Lincoln) at three sites along the Auburn Ravine: Mackenroth Property (September 21, 2002), the Highway 193 Bridge crossing (October 7, 2002) and the Joiner Parkway Bridge crossing (September 23, 2001). Results for pH were 7.7, 7.7, and 7.16, respectively (Placer County Planning Department 2003).

Turbidity and Total Suspended Solids

Turbidity and TSS in the Auburn Ravine were measured at the Lincoln and Auburn WWTPs under NPDES permit requirements. TSS loads were observed to significantly increase in winter and spring, likely from stormwater runoff. During low flows in Auburn Ravine, turbidity was measured at less than 1 NTU. Turbidity loads of greater than 2 NTUs were measured in the effluent from the Lincoln WWTP during this time (Placer County 2002). Turbidity was also measured in the Auburn Ravine by DWR between January 2001 and January 2002. Turbidity results ranged from 5 to 33 NTUs, with one higher value of 136 NTUs in December 2001.

Specific Conductivity and Ions

Previous water quality studies characterizing SC values within the Auburn Ravine watershed in Zone 5 were not identified for this study. Electrical conductivity, not SC, which is normalized to a temperature of 77 °F (25 °C), was measured by the Lincoln High School Water Quality Monitoring Program at three sites along the Auburn Ravine: Mackenroth Property (September 21, 2002), the Highway 193 Bridge crossing (October 7, 2002) and the Joiner Parkway Bridge

crossing (September 23, 2001). Electrical conductivity was measured at 0.152, 0.056, and 0.072 mS/cm, respectively (Sierra Business Council 2003).

Nitrogen and phosphorus were measured at the Auburn WWTP in 1995 (Placer County 2002). Although nitrogen and phosphorus levels in Auburn WWTP effluent averaged 0.5 mg/L, Auburn Ravine downstream from the Auburn WWTP did not show evidence of eutrophication. However, Auburn Ravine downstream from the Lincoln WWTP was observed to be influenced by both wastewater effluent and stormwater runoff.

Nitrates were also measured by the Lincoln High School Water Quality Monitoring Program at three sites along the Auburn Ravine: Mackenroth Property (September 21, 2002), the Highway 193 Bridge crossing (October 7, 2002) and the Joiner Parkway Bridge crossing (September 23, 2001). Nitrates were measured at 0.7 mg/L, 1.1 mg/L, and 1.9 mg/L, respectively (Placer County Planning Department 2003).

Trace Elements

Data collected by Placer County for the Auburn Ravine/Coon Creek Ecosystem Restoration Plan in 1999 and 2000 show cadmium, copper, and zinc levels in the Auburn Ravine all exceed the CTR standards for aquatic life at various times throughout the year (Placer County 2002). Copper exceeded CTR standards in June, July, and October 1999 and in January, February, and April 2000.

3.2.3 Soil and Sediment Quality

The USDA-NRCS soil data indicate that 39 different soil classes and combinations of soil classes are present in PCWA Zones 1, 3, and 5. To facilitate mapping, these soil classes have been generalized into six different soil textures. Details about the distribution of these soil textures and classes are discussed by zone below. Soil permeability for Zones 1 and 3 is also discussed based on a previously published report by PCWA (2005).

3.2.3.1 Zone 3

Zone 3 is dominated by gravelly, cobbly, and stony loams of the Mariposa, Mariposa-Josephine, Cohasset, and Dubakella soil types. These coarse loams are found particularly at the heads of the steep ravines that characterize the zone. Other types of loams including sandy loam, coarse sandy loam, and silt loam are also common. Xerorthents, which include various soil textures, are found in old placer areas and cut-and-fill sites. Soils are listed by texture and classification in the order of their prevalence in **Table 3-9**. **Figure 3-95** is a map of soils by texture in Zone 3.

TABLE 3-9
ZONE 3 SOILS BY GENERALIZED TEXTURE AND CLASSIFICATION

Soil Texture[1]	Soil Classifications[2]
Gravelly, cobbly, and stony loam	Mariposa, Mariposa-Josephine, Cohasset, Dubakella
Loam	Sites, Josephine, Boomer, Cohasset
Sandy loam and coarse sandy loam	Maymen, Boomer
Variable	Xerorthents
Silt loam	Auburn-Sobrante

Source: Soil Survey Staff, Natural Resources Conservation Service (USDA-NRCS). 2008.
Note:
[1] Soil textures provided in order of prevalence
[2]The soil classifications listed in this table account for 95 percent of the total area of Zone 3. The remaining 5 percent of the area is covered by eight additional classes.

Soil permeability is moderate to high (26 to 480 inches per day) within much of lower Zone 3 (PCWA 2005).

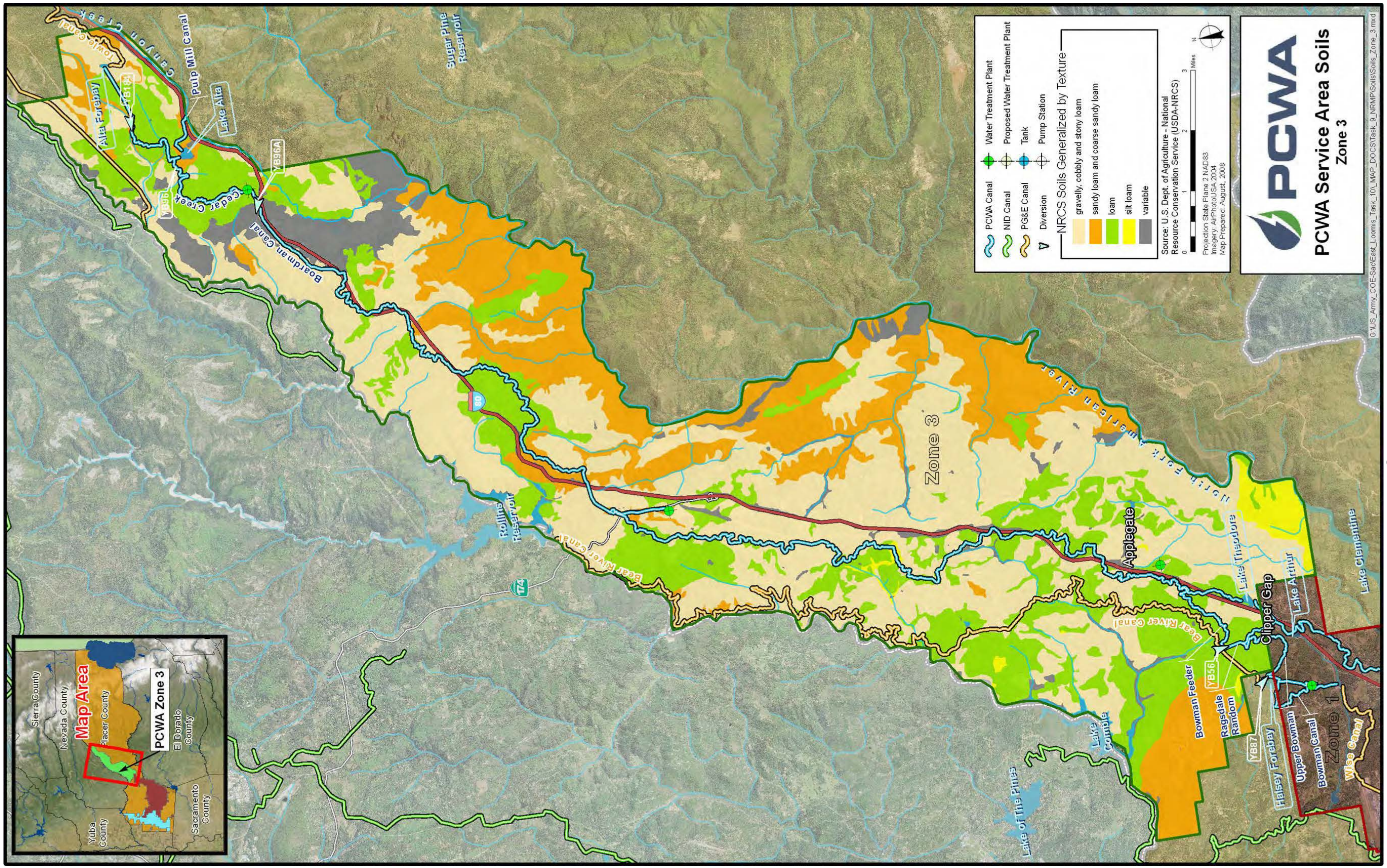

FIGURE 3-95
ZONE 3 SOILS MAP

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3.2.3.2 Zone 1

Much of Zone 1 is underlain by the Rocklin Pluton, an igneous formation intruded during the Lower Cretaceous period[1]. The Rocklin Pluton is composed of quartz-diorite (Olmsted 1961, Swanson 1978, Wagner et al. 1987). In southwestern Zone 1, the sedimentary Mehrten Formation overlies the Rocklin Pluton. The Mehrten is a groundwater-bearing formation composed of moderately to well-indurated andesitic sand to sandstone interbedded with conglomerate, tuffaceous siltstone, and claystone. It was deposited in the mid-Cenozoic era[2] (DWR 2006).

The minerals composing the parent material for soils throughout the Zone 1 service area include quartz, plagioclase feldspar, alkali feldspar, biotite, and hornblende. Common chemical constituents in these minerals include aluminum, oxygen, and silica. Additional chemical constituents, depending on the parent material, may include calcium, iron, magnesium, potassium, and sodium.

Upper Zone 1 is characterized by silt loams, while lower Zone 1 is dominated by the coarser Andregg and other sandy loams. Gravelly, cobbly, and stony loams are found in western Zone 1, along with small areas of Alamo clay soil. Xerofluvents with variable textures are located along unlined canals, drainages, and along Auburn, Secret and Miners ravines. Xerorthents, also with variable textures, are present in cut and fill areas in western Zone 1. Soils in Zone 1 are listed by texture and classification in the order of their prevalence in **Table 3-10**. Zone 1 soils are mapped by texture in **Figures 3-96** and **3-97**.

TABLE 3-10
ZONE 1 SOILS BY GENERALIZED TEXTURE AND CLASSIFICATION

Soil Texture[1]	Soil Classifications[2]
Sandy loam and coarse sandy loam	Andregg, Sierra, Cometa-Ramona, Caperton-Andregg, Boomer
Gravelly, cobbly, and stony loam	Exchequer, Inks, Inks-Exchequer,
Loam	Fiddyment-Kaseberg, Boomer, Cometa-Fiddyment
Silt loam	Auburn, Auburn-Sobrante
Clay	Alamo
Variable	Xerorthents, Xerofluvents

Source: Soil Survey Staff, Natural Resources Conservation Service (USDA-NRCS). 2008.

Notes:

[1] Soil textures provided in order of prevalence

[2] The soil classifications listed in this table account for 85 percent of the total area of Zone 1. The remaining 15 percent of the area is covered by 18 additional classes.

Soil permeability is moderate to high (26 to 480 inches per day) within much of lower Zone 1. Soils of moderately low permeability (9 inches per day) to low permeability (1 to 3 inches per day) lie along the center of lower Zone 1, from the northeast head of the system to the head of Dry Creek in the southwest (PCWA 2005).

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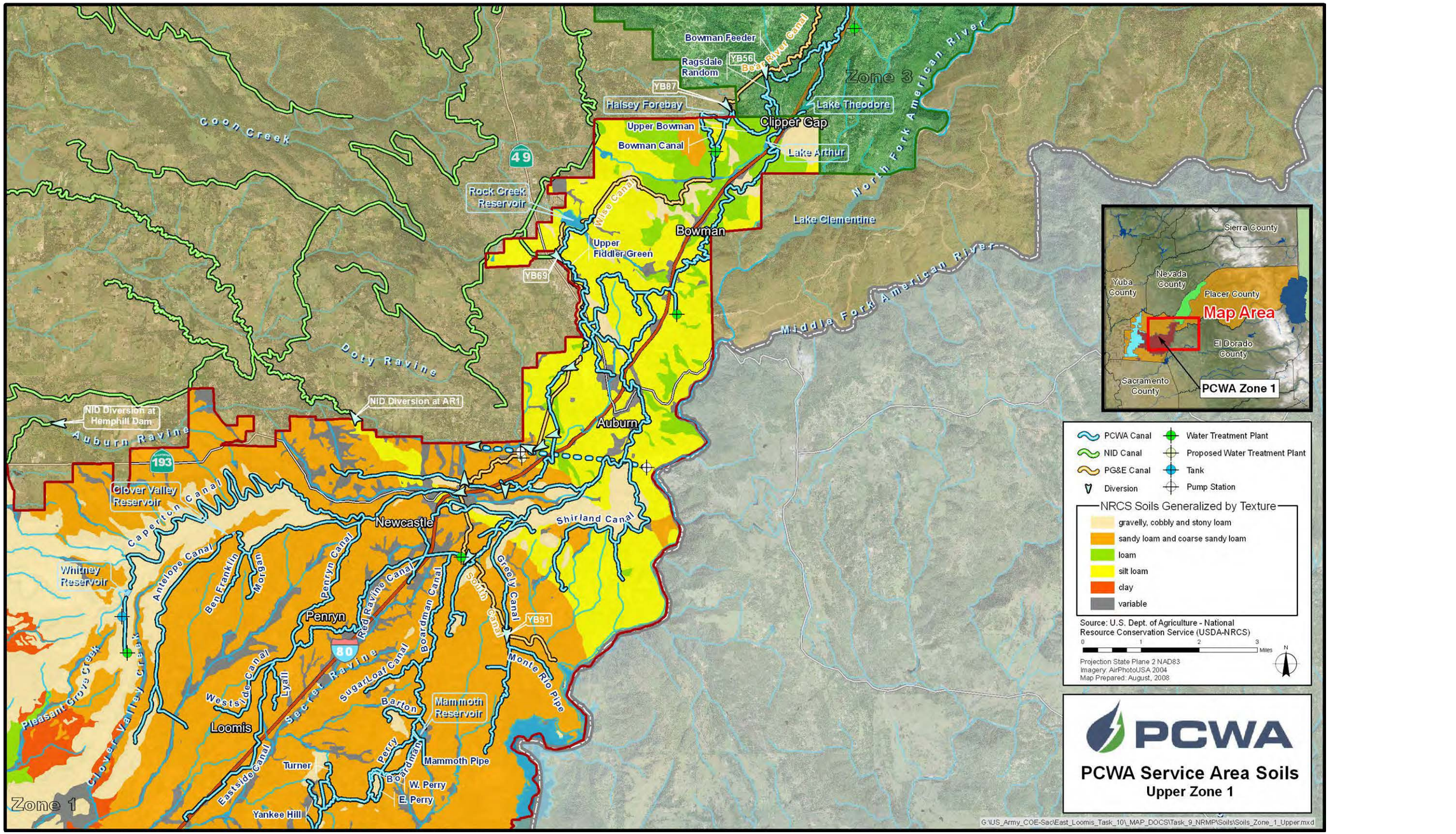

FIGURE 3-96
UPPER ZONE 1 SOILS MAP

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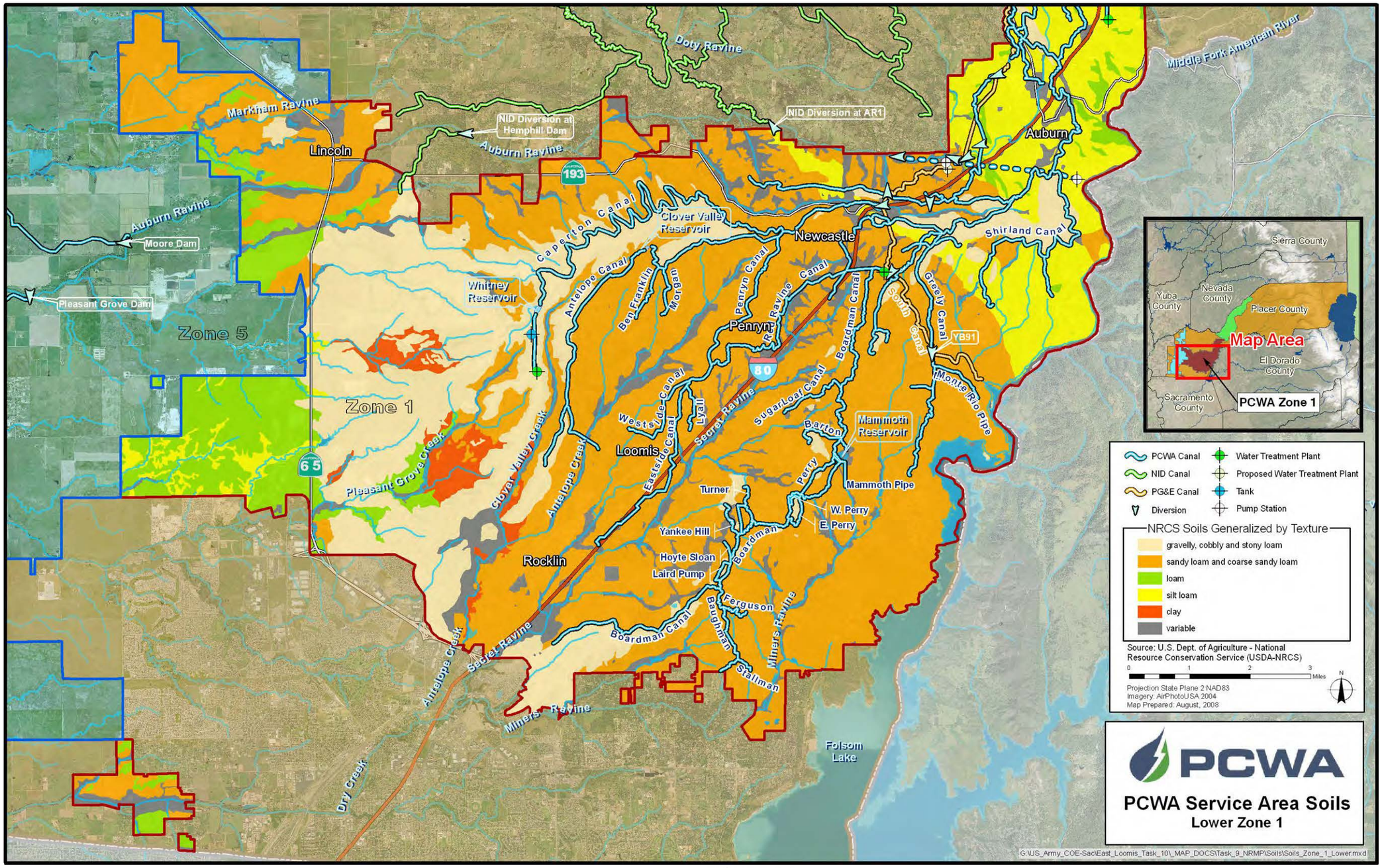

FIGURE 3-97
LOWER ZONE 1 SOILS MAP

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3.2.3.3 Zone 5

Zone 5 is dominated by Cometa-Fiddyment, Kilaga, and Fiddyment loams, which are found in the southern part of the zone. Sandy loam and coarse sandy loams are present in central Zone 5, and gravelly, cobbly, and stony loams make up the majority of soils in the northern part of the zone. Xerofluvents with variable textures are found at the bottoms of the major drainages, including Auburn and Doty ravines and Pleasant Grove Creek. Soils in Zone 5 are listed by texture and classification in the order of their prevalence in **Table 3-11**. Zone 5 soils are mapped by texture in **Figure 3-98**.

TABLE 3-11
ZONE 5 SOILS BY GENERALIZED TEXTURE AND CLASSIFICATION

Soil Texture[1]	Soil Classifications[2]
Loam	Cometa-Fiddyment, Kilaga, Fiddyment
Sandy loam and coarse sandy loam	San Joaquin-Cometa, Cometa-Ramona
Gravelly, cobbly, and stony loam	Redding-Corning
Silt loam	Alamo-Fiddyment
Variable	Xerofluvents

Source: Soil Survey Staff, Natural Resources Conservation Service (USDA-NRCS). 2008.
Note:
[1] Soil textures provided in order of prevalence
[2]The soil classifications listed in this table account for 95 percent of the total area of Zone 5. The remaining 5 percent of the area is covered by eight additional classes.

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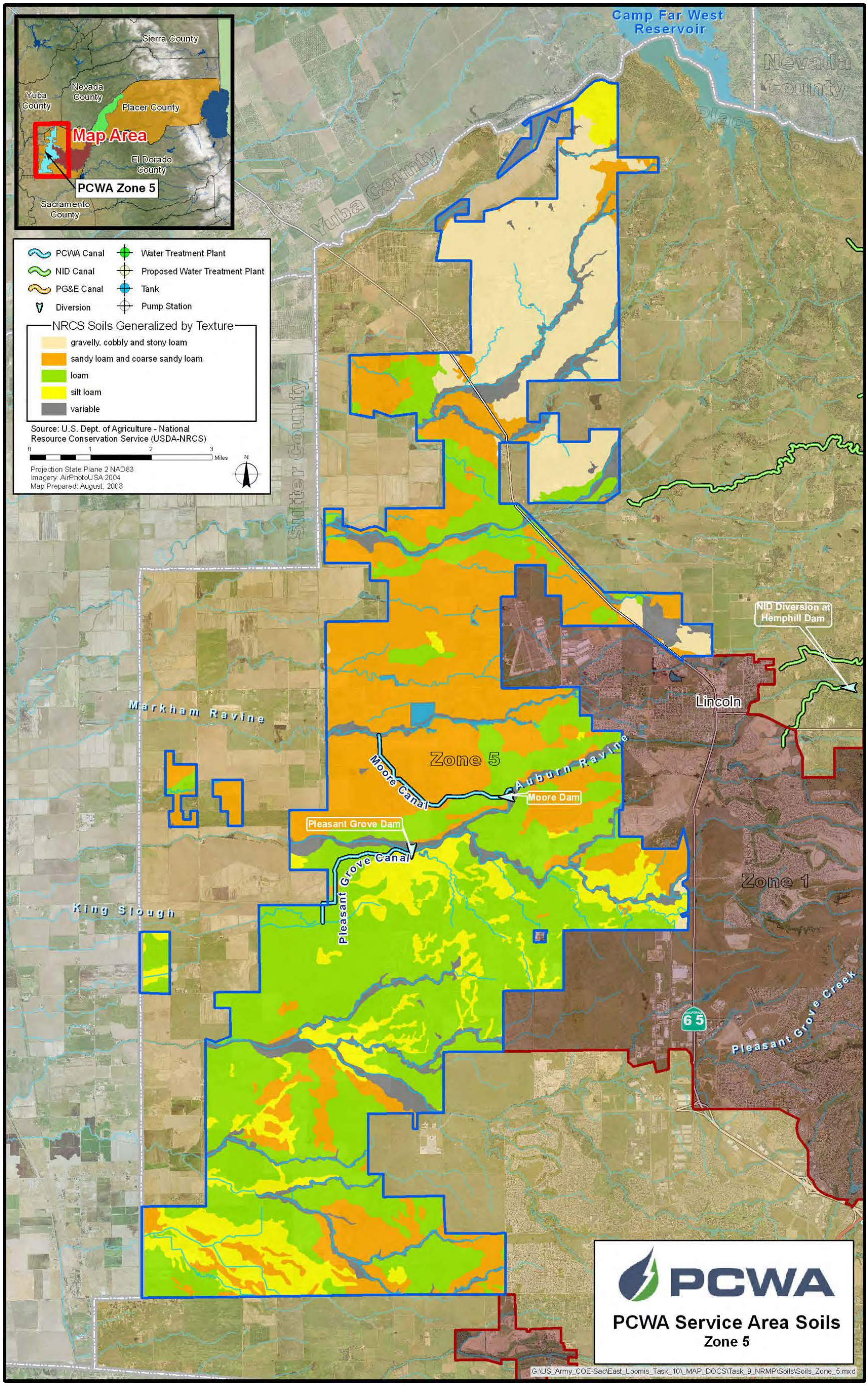

FIGURE 3-98
ZONE 5 SOILS MAP

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3.3 BIOLOGICAL RESOURCES SETTING

The following sections describe terrestrial and aquatic habitat and species within the PCWA raw water distribution system area during routine canal operations.

3.3.1 Terrestrial Habitat and Species

Habitat types in the study area vary in structure and composition throughout the study area. The study area ranges from Lake Alta in the Sierra Nevada foothills at an elevation greater than 3,000 feet msl down to nearly sea level at the western boundary of Zone 3, approximately 50 miles to the southwest. In general, forested habitat types are more common in the higher elevations in the eastern portions of Zone 3. Moving west through Zones 1 and 5, agricultural, urban (including rural residential), and herbaceous habitat types become more common. The following sections describe habitats in the areas that may be directly or indirectly affected by O&M activities. Refer to **Section 3.1** for a description of habitat types, including discussions of associated species.

3.3.1.1 Zone 3

Habitat types along canals in Zone 3 (primarily Boardman Canal) are generally forested, with montane hardwood being the most common (**Figure 3-99**). Douglas-fir and ponderosa pine habitats also frequently occur. Less common habitats include urban (forested and rural residential) and annual grassland.

Reservoirs in Zone 3 that could be directly affected by O&M activities include Lake Alta, Lake Theodore, and Lake Arthur. Lake Alta is located within Sierra Nevada montane forest habitat dominated by Douglas-fir. Oaks and incense cedar also occur in the canopy. Habitat surrounding Lake Theodore is mapped as an urban, oak woodland, and annual grassland. The area around Lake Arthur is mapped as oak woodland, montane hardwood, and montane hardwood conifer.

Canyon Creek traverses a variety of habitats, predominately montane hardwood, montane hardwood conifer, ponderosa pine, urban, and barren.

3.3.1.2 Zone 1

Zone 1 contains the largest number and extent of canals in the study area. Canals traverse a number of different habitat types (**Figures 3-100** and **3-101**). Urban habitats are the most common along canals, specifically rural residential, suburban, and forested urban areas. Forested habitat types are also very common and are largely dominated by oaks. Other less common habitat types include wetlands, agricultural areas, and chaparral.

Five reservoirs have been identified in Zone 1 that may be directly impacted by O&M activities. McCrary Reservoir occurs in a rural residential area. Mammoth Reservoir is surrounded by several habitat types including rural residential, rural residential forested, annual grassland, and agricultural. Clover Valley Reservoir occurs in an oak woodland area, with valley foothill riparian forests bordering the Antelope Canal, which drains into and out of the reservoir. Caperton Reservoir is bordered by rural residential, oak woodland, and annual grassland habitat types. Whitney Reservoir is bordered by oak savannah and oak woodland habitats.

Auburn Ravine in Zone 1 lies within the City of Lincoln. In this area, Auburn Ravine is predominately forested, composed of mature trees with canopy cover generally more than 50 percent. Tree species include Fremont cottonwood, Oregon ash, and willow (Placer County Planning Department 2002).

3.3.1.3 Zone 5

Two canals that could be affected by O&M activities fall within Zone 5: Pleasant Grove Canal and Moore Canal. Habitat types along these canals are primarily disturbed, agricultural lands, generally grasslands and croplands, including rice fields (**Figure 3-102**). Some grassland areas adjacent to these canals have been identified as containing vernal pool complexes.

Auburn Ravine in Zone 5 is predominately forested and supports Fremont cottonwood, Oregon ash, and willow. The eastern portion of Auburn Ravine in Zone 5 is more densely forested, with canopy cover generally greater than 50 percent. Canopy cover decreases to less than 50 percent in the western portion of Zone 5 (Placer County Planning Department 2002).

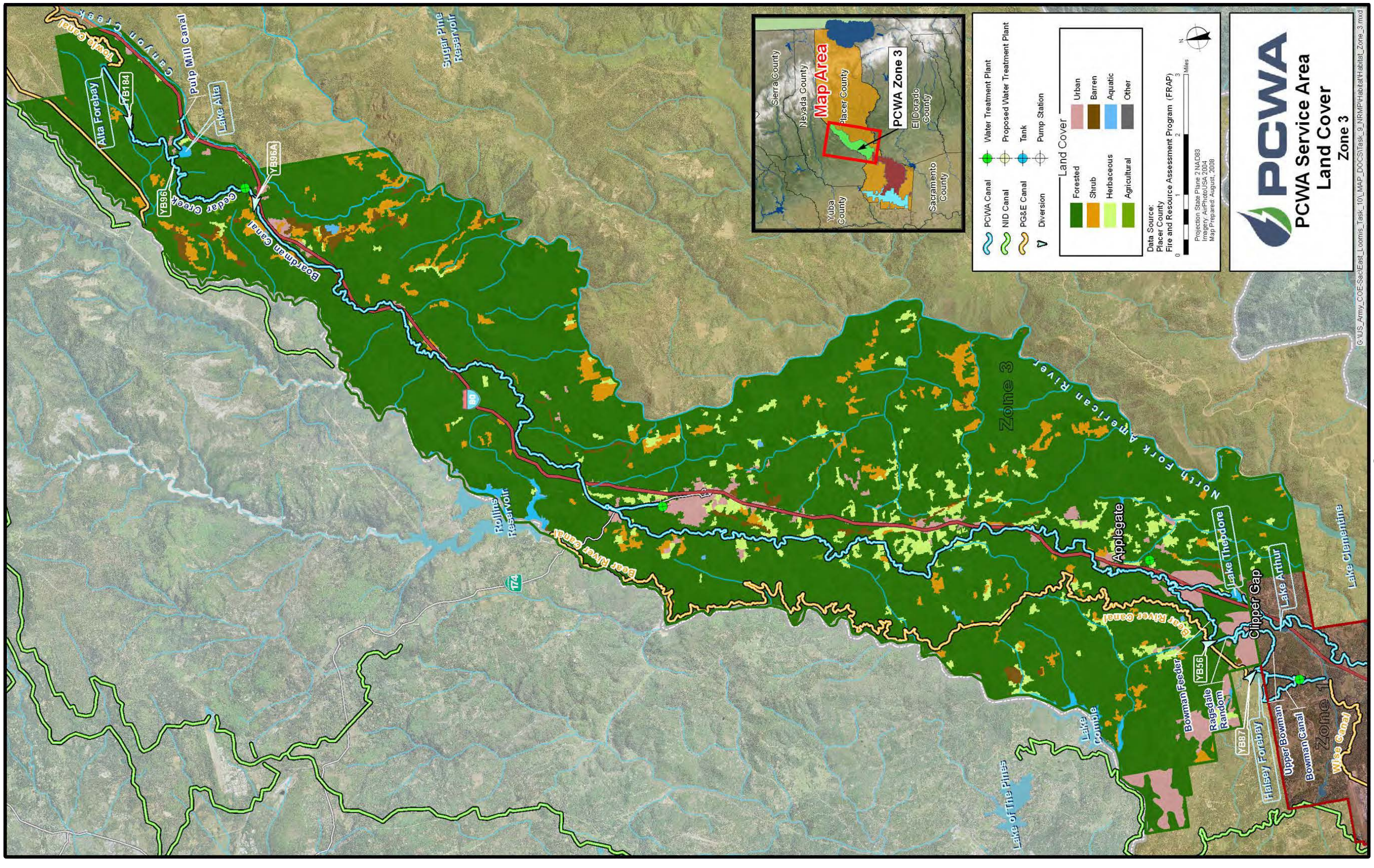

FIGURE 3-99
ZONE 3 LAND COVER TYPES

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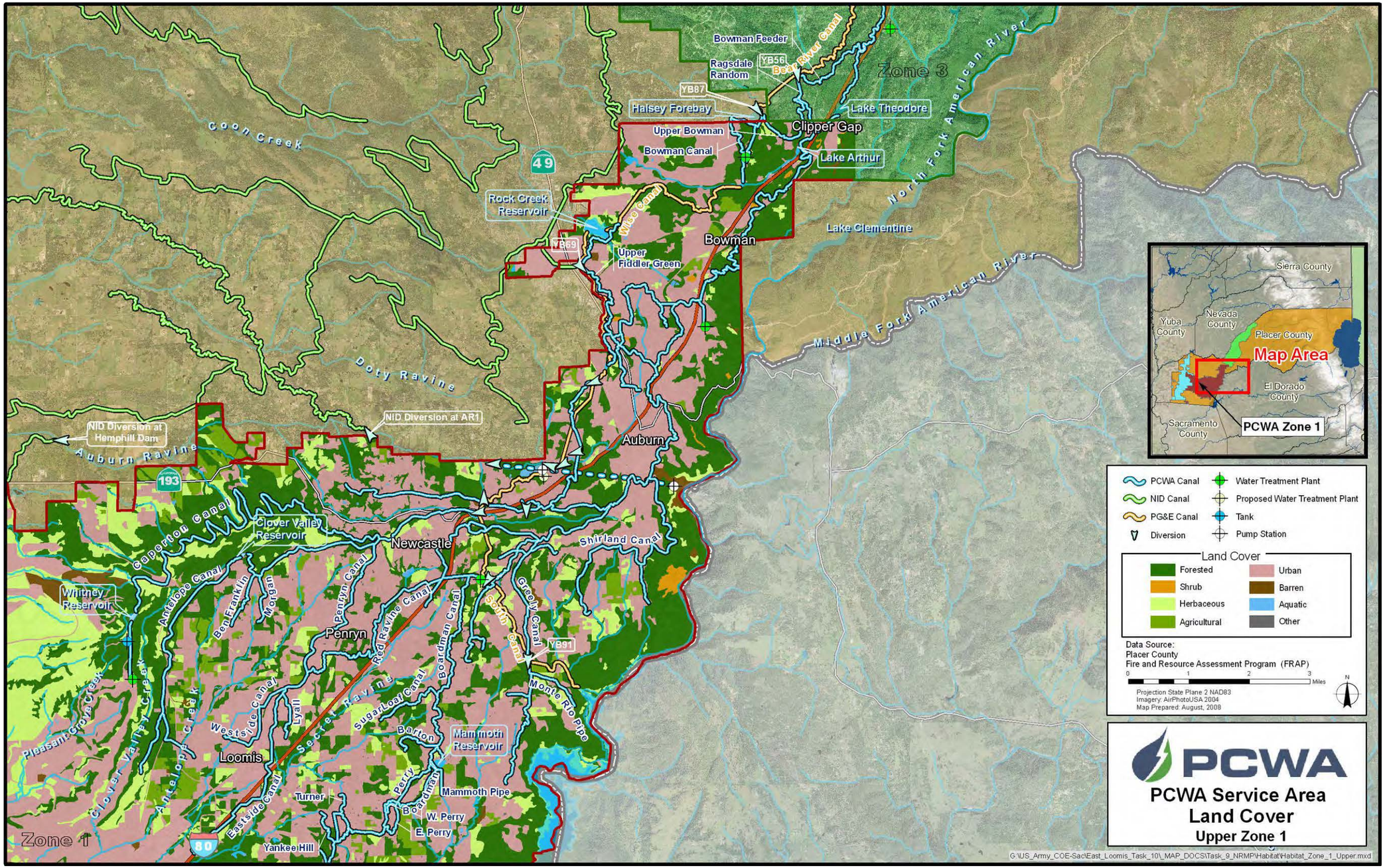

FIGURE 3-100
UPPER ZONE 1 LAND COVER TYPES

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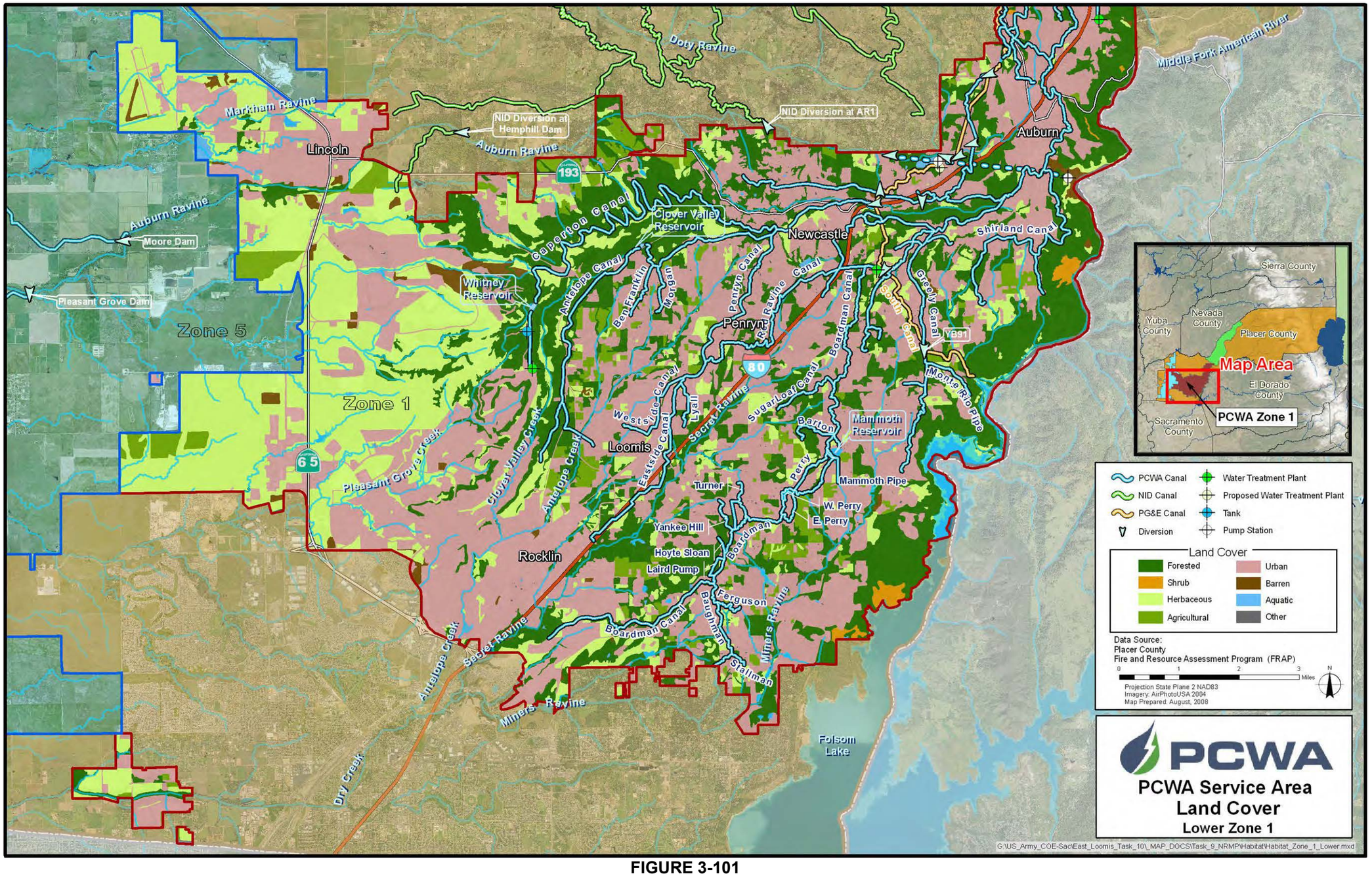

FIGURE 3-101
LOWER ZONE 1 LAND COVER TYPES

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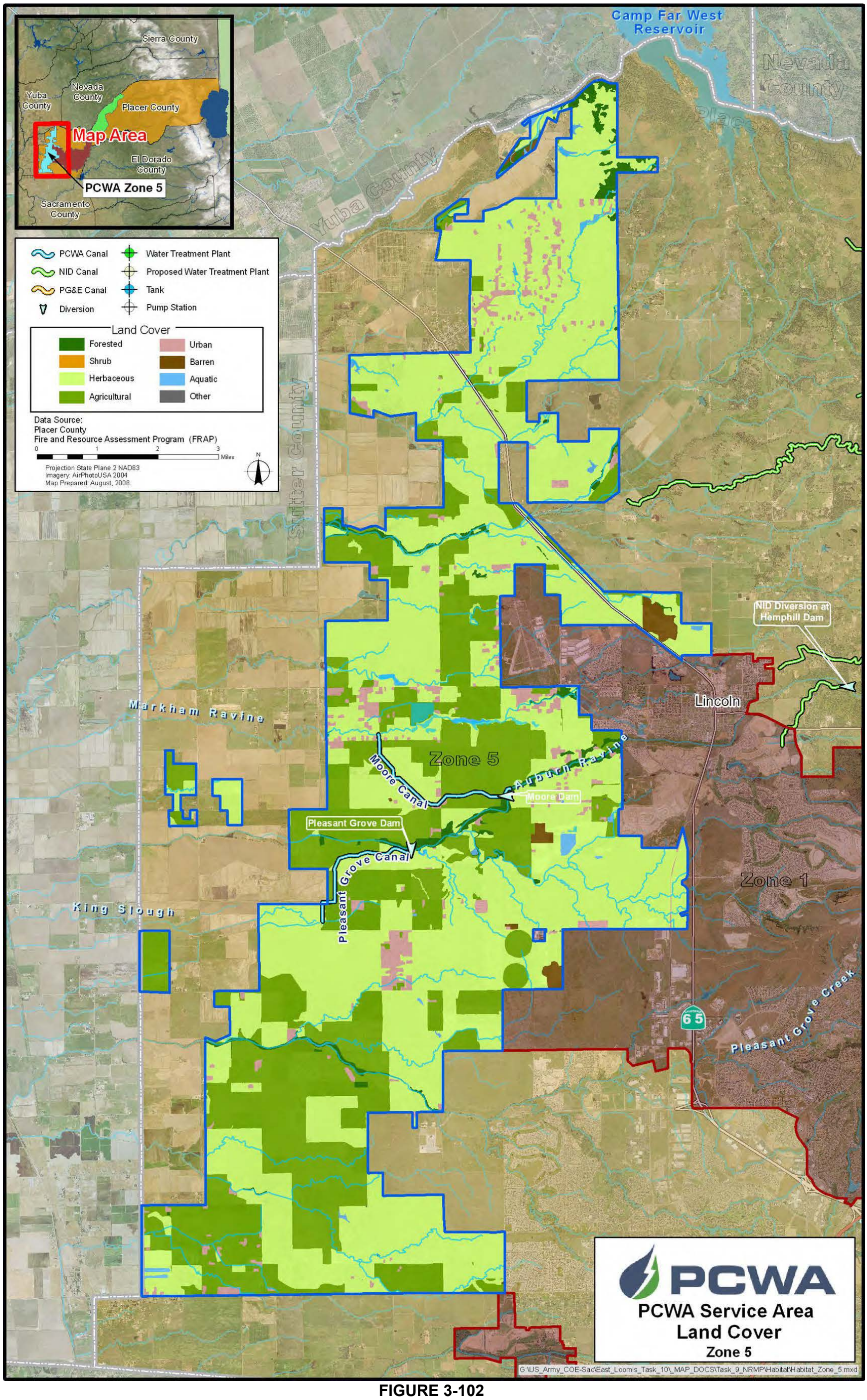

FIGURE 3-102
ZONE 5 LAND COVER TYPES

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3.3.2 Aquatic Habitat and Species

Studies in Zones 1, 3, and 5 of the PCWA regarding aquatic habitat conditions and species evaluations have primarily focused on fish communities, including anadromous fall-run Chinook salmon and Central Valley steelhead. Fish observed in the canal system by PCWA enter the canals from the PG&E reservoirs and canals that supply PCWA, and include brown trout (*Salmo trutta*), rainbow trout (*Oncorhychus mykiss*), catfish (*Ictalurus* or *Ameiurus* sp.), Sacramento sucker (*Catostomus occidantalis*), and Sacramento pikeminnow (*Ptychocheilus grandis*) (PCWA 2004). The canals within PCWA's raw water distribution system, however, are not believed to provide consistent suitable habitat for these species.

3.3.2.1 Zone 3

Although no substantial data was found on aquatic habitat and species conditions specific to Canyon Creek, the creek may include aquatic habit and species common to Sierra Nevada montane hardwood streams. Canyon Creek is at approximately 3,543 feet msl in a relatively rural area composed of hiking trails and campgrounds. Several large dams located downstream (Nimbus and Folsom dams on the Lower American River) prohibit potential access to Canyon Creek by Chinook salmon or steelhead. Fish observed in the North Fork American River would likely be found in Canyon Creek, such as the rainbow trout, riffle sculpin, Sacramento sucker, and speckled dace. Nonnative brown trout may also be found in Canyon Creek. The elevation of the creek is too high for fish such as pikeminnow to be present.

3.3.2.2 Zone 1

Unregulated outlet releases and seepage along the canal system may contribute to flows in natural watercourses in the basin. Secret Ravine and Miners Ravine are recognized by DFG as the primary production areas in the Dry Creek drainage for fall-run Chinook salmon and Central Valley steelhead (DFG 2001). In the Dry Creek watershed, these ravines appear to be especially important for spawning and rearing of these anadromous fishes (DFG 2001).

Auburn Ravine Watershed

The artificially high flows in Auburn Ravine during summer months due to water supply conveyances from PCWA, PG&E, and NID support more aquatic habitat than would be maintained under natural hydrologic conditions (Placer County Planning Department 2002). Portions of Auburn Ravine are designated as Critical Habitat for Central Valley steelhead (70 Code of Federal Regulations (CFR) 52488, September 2, 2005). Efforts are currently underway to improve habitat conditions in Auburn Ravine for salmonids and other native fishes.

Auburn Ravine's characteristics dramatically vary between its headwaters and the East Side Canal. Fall-run Chinook salmon and Central Valley steelhead spawn and rear in upstream reaches (between its headwaters at the City of Auburn to the City of Lincoln), but the quality of migration habitat for salmonids has been substantially reduced by beaver dams, numerous water diversions, and their associated diversion structures (Placer County Planning Department 2002). On behalf of PCWA, South Sutter District installs two seasonal diversion dams in Auburn

Ravine, Moore Dam and Pleasant Grove Dam, where flows are diverted to the Moore and Pleasant Grove canals, respectively. NID Auburn Ravine 1 Dam is a year-round barrier to migration. Also, NID Hemphill Dam (a seasonal diversion dam) and NID gaging station impair migration of salmonids during most flow conditions. Since water deliveries to agricultural water users are curtailed during the fall, generally before fall-run Chinook salmon attempt to migrate upstream to spawn, the depth of water in the stream channel below some flow-control structures is often insufficient to facilitate adult fish passage.

Table 3-12 lists fish species reported to be present in Auburn Ravine. American River and Feather River hatchery-raised juvenile fall- and spring-run Chinook salmon have been released to Auburn Ravine infrequently since the 1980s. Typically, about 100,000 fall-run Chinook salmon from Nimbus Fish Hatchery were released to Auburn Ravine (Placer County Planning Department 2002, Barngrover pers. comm.), with 140,000 fall-run Chinook salmon released in Auburn Ravine during March 1998 (Placer County Planning Department 2002).

TABLE 3-12
FISH SPECIES PRESENT IN AUBURN RAVINE

Native		Introduced	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Chinook salmon	Oncorhynchus tshawytscha	Black bullhead	Ameiurus melas
Sacramento pikeminnow	Ptychocheilus grandis	Common carp	Cyprinus carpio
Steelhead	Oncorhynchus mykiss	Green sunfish	Lepomis cyanellus
Bluegill	Lepomis macrochirus	Largemouth bass	Micropterus spp.
Spreckled dace	Rhinichthys osculus	Pumpkin seed	Lepomis gibbosus
Sacramento sucker	Catostomus occidentalis	Redear sunfish	Lepomis microlophus
California roach	Hesperoleucus symmetricus,	Golden shiner	Notemigonus crysoleucas
Lamprey spp	Lamperta spp.	Mosquitofish	Gambusia affinis
Prickly Sculpin	Cottus asper	Brown trout	Salmo trutta
Hardhead	Mylopharodon conocephalus		

Source: Placer County Planning Department 2003, 2005b

Fish communities and associated aquatic habitat were assessed in the Auburn Ravine by DFG in fall 2004 and spring 2005. Fish community IBI scores for Auburn Ravine were approximately 80 out of 100 (Titus et al. 2005). The gross ecological health of Auburn Ravine was rated "good to very good" based on its IBI score (Titus et al. 2005).

Summary results of BMI population analyses and B-IBI results, along with physical habitat characteristics during BMI analyses, are shown in **Tables 3-13** and **3-14** respectively. Detailed results of BMI population and B-IBI analyses at Auburn Ravine below Auburn Ravine Tunnel Outlet are provided in **Appendix A**. **Figure 3-103** compares B-IBI results for Auburn Ravine to other stream sites evaluated by DCC in the PCWA service area for this NRMP in 2007, and sites previously evaluated by DCC from 2000 through 2006.

Based on BMI and B-IBI analyses described in **Appendix A**, aquatic habitat quality at Auburn Ravine below Auburn Ravine Tunnel Outlet appeared to better than Miners Ravine below Sierra

College Boulevard, as shown in **Table 3-13**. The Auburn Ravine below the Auburn Ravine Tunnel Outlet had a B-IBI score of 41, which is considered to be "fair," as shown in **Figure 3-103**.

TABLE 3-13
BENTHIC INDEX OF BIOTIC INTEGRITY FOR SITES AT AUBURN RAVINE, SECRET RAVINE, AND MINERS RAVINE

	Auburn Ravine below Auburn Ravine Tunnel Outlet	Secret Ravine at Loomis Basin Park	Miners Ravine below Sierra College Blvd
Coleoptera taxa	4	4	0
EPT taxa	5	6	5
Predator Taxa	2	5	4
Collectors (%)	5	5	4
Intolerant (%)	1	2	1
Non-Insect (%)	4	7	2
Tolerant (%)	8	7	5
Total	29	36	21
B-IBI Score	41	51	30
Ranking	Fair	Fair	Poor

TABLE 3-14
PHYSICAL HABITAT SCORES FOR BENTHIC MACROINVERTEBRATE ANALYSES AT AUBURN RAVINE, SECRET RAVINE, AND MINERS RAVINE

	Auburn Ravine below Auburn Ravine Tunnel Outlet	Secret Ravine at Loomis Basin Park	Miners Ravine below Sierra College Blvd
Flow (cfs)	9.6	3.0	1.7
Temperature (°F)	57.4	55.8	55.2
Habitat Types, % Riffle	41	15	11
Slope (average %)	2.5	0.5	1.4
Instream Habitat[1]	14	11	5
Sediment Deposition[1]	19	11	5
Channel Alteration[1]	15	11	18

Note:
[1]Score is out of possible 20.

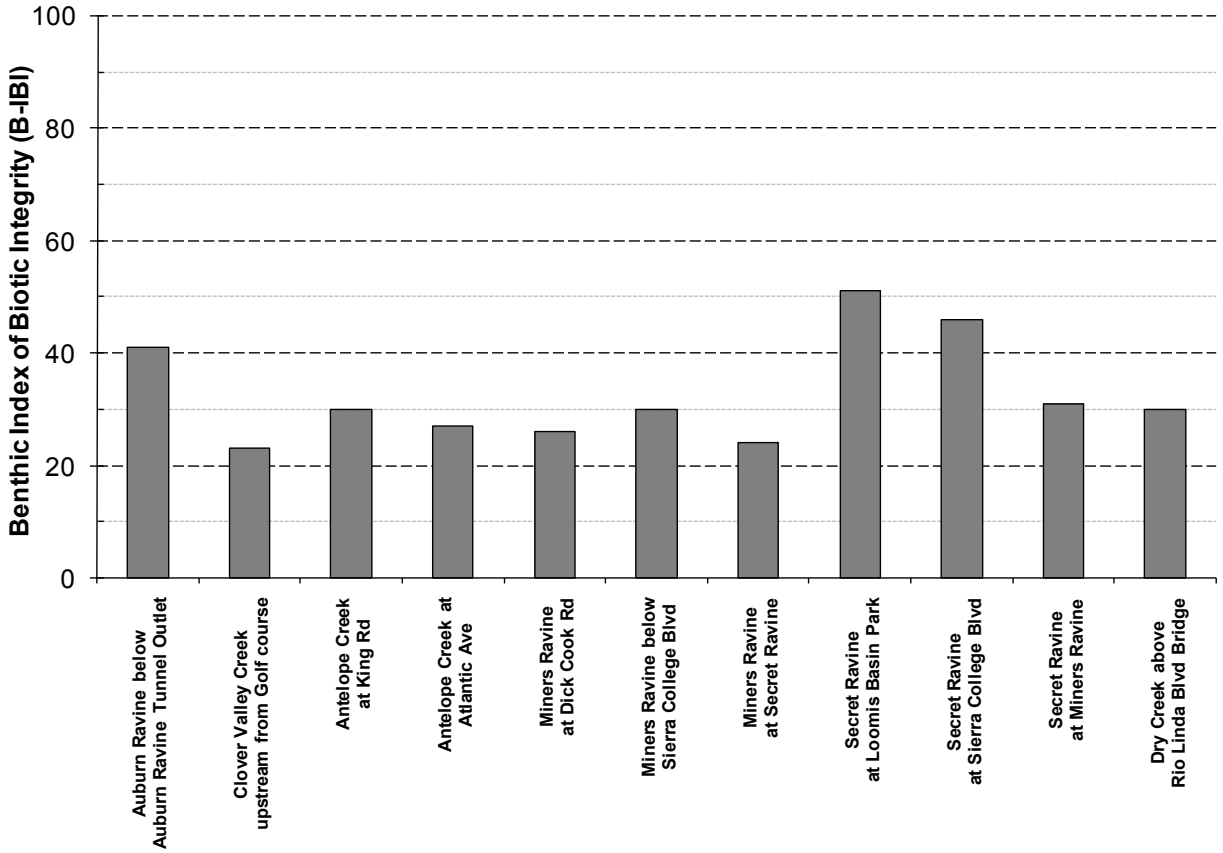

FIGURE 3-103
COMPARISON OF BENTHIC INDEX OF BIOTIC INTEGRITY SCORES AT STREAM SITES IN THE PCWA SERVICE AREA

As for physical habitat, there is a high percentage of riffle habitat, and the cobble and gravel substrate within the segment sampled had very little sediment, as shown in **Table 3-14**. Detailed results of physical habitat analyses at Auburn Ravine below Auburn Ravine Tunnel Outlet are provided in **Appendix A.**

Clover Valley Creek Watershed

Studies of aquatic habitat and species conditions in Clover Valley Creek are very limited. Clover Valley Creek is not included in the designated Critical Habitat for Central Valley steelhead (Placer County 2006). An impassable culvert blocks access of salmonids to Clover Valley Creek (Placer and Sacramento Counties 2003). The lack of deep pools and clean riffle habitat limits the potential for biodiversity, which tends to limit food and preferred habitat for rearing salmonids. The potential for salmonid rearing is considered to exist in lower portions of the creek.

In general, substrate and habitat conditions in Clover Valley Creek are considered unsuitable for rearing salmonids (Placer County 2006). Common substrate in the creek consists of fine sediments (sand and silt) with very little gravel and cobbles, particularly in downstream areas. High sediment loads and sediment deposition, degraded water quality, invasive species, and lack

of riparian vegetation contribute to degraded aquatic habitat conditions in Clover Valley Creek. Lower Clover Valley Creek is highly channelized and sometimes impounded.

Although suitable habitat conditions for some salmonid life stages may exist in Clover Valley Creek, there are many significant barriers to upstream passage of anadromous salmonids (City of Rocklin 2006), including an impassable culvert just upstream of its confluence with Antelope Creek (Placer and Sacramento Counties 2003). The Argonaut Bridge crossing, an impoundment structure at Cimarron Court, and an instream impoundment downstream of Midas Way and Rawhide Drive Bridge are all barriers along Clover Valley Creek (City of Rocklin 2006). The total flow of the creek passes through a 30-foot-long culvert, approximately 2 feet in height, and about 3 feet wide. On the downstream side, the culvert hangs 2 feet over the streambed. Migrating salmonids reportedly cannot swim through the flow from the culvert because of its relatively small opening and high flow velocity (Placer and Sacramento Counties 2003).

Because Clover Valley Creek is a tributary to Antelope Creek, fish species present in Clover Valley Creek are likely comparable to the fish species present in Antelope Creek, described below. An Aquatic Habitat Survey and Fisheries Assessment was conducted by ECORP Consulting, Inc. on Clover Valley Creek on June 16 and 19, 2006 (ECORP 2006). The fish community in Clover Valley Creek was found to be dominated by native minnow and hitch (*Lavinia exilicauda*), particularly in the upper portion of the creek. The nonnative western mosquitofish (*Gambusia affinis*) and green sunfish (*Lepomis cyanellus*) were observed in the lower portions of the creek. No salmonids were observed during the survey. The native Sacramento sucker was also found along Clover Valley Creek. Hitch and Sacramento sucker both prefer low-gradient streams with slow water velocities and sandy to gravel substrates, as do green sunfish and mosquitofish. All four species are tolerant of the warm water temperatures characteristic of Clover Valley Creek, particularly during summer and fall.

Based on BMI analyses conducted by DCC (**Figure 3-103**), the site at Clover Valley Creek upstream from the Sunset Whitney Country Club on Midas Avenue in Rocklin had a B-IBI score of 23, which is considered to be "poor," likely due to presence of organisms tolerant to water quality pollutants and a general lack of benthic macroinvertebrate species diversity.

Antelope Creek Watershed

Antelope Creek is not as well studied as other headwater tributaries of Dry Creek (Secret Ravine and Miners Ravine). Although fall-run Chinook have been periodically documented over the past 40 years to use parts of the watershed for spawning, there is no reliable data on whether steelhead are currently present in the watershed. Similar to Clover Valley Creek, Antelope Creek is not designated as critical habitat for Central Valley steelhead.

Aquatic habitat in Antelope Creek is characterized as low in diversity, generally consisting of flatwater (i.e., shallow run and shallow glide) habitat (Placer and Sacramento Counties 2003). Use of Antelope Creek by anadromous salmonids is generally considered to be limited to occasional stray adults during years of at least moderate streamflow during the migration period. Two potential spawning areas have been identified in Antelope Creek, but the associated habitat is generally not favorable to salmonids (Placer and Sacramento Counties 2003). Juvenile

salmonid habitat is generally limited to shallow pool habitat during years of at least moderate streamflow. Low streamflows in Antelope Creek could impede adult anadromous fish passage during critical periods of the year (Sierra Business Council 2003).

Antelope creek is located in a primarily urban and suburban area. Past and ongoing construction activities adjacent to the creek have resulted in significant upland disturbance and sediment contribution to the stream. Accumulated sediment is common in the lower portion of Antelope Creek. Several portions of the creek are incised (City of Roseville 2005), and vulnerable to erosion. Accumulated sediments, such as sand, small cobbles, and exposed granite, are common in the lower portion of Antelope Creek (Placer and Sacramento Counties 2003). A spawning gravel study conducted by Jones & Stokes in 2004 found that 77 percent of substrate in Antelope Creek was fine sediment, in which fish eggs and larvae would unlikely survive (Placer County Planning Department 2005b).

With the exceptions of wide variations in pH, high nutrient levels, and observed copper concentrations in Antelope Creek, most of the watershed's water quality conditions are capable of supporting anadromous fish year-round (Placer and Sacramento Counties 2003). Water temperatures measured in the creek show that approximately 25 to 50 percent of the channel length is suitable for summer rearing for steelhead (**Table 3-15**). However, some sites along the creek have water temperatures too high for salmonid egg incubations and juvenile rearing (Placer and Sacramento Counties 2003).

TABLE 3-15
WATER TEMPERATURE CRITERIA FOR CHINOOK SALMON AND STEELHEAD

Life Stage	Chinook Salmon	Steelhead
Adult Migration	Less than 57°F	Less than 52°F
Spawning	Less than 57°F	Less than 54°F
Incubation	Less than 55°F	Less than 54°F
Juvenile Rearing	Less than 61°F	Less than 65°F

Sources: A. A. Rich and Associates 2007; Bell 1990; DFG 2007 a and 2007b; Marine 1992; McCullough et al. 2001; NMFS 2002 and 2003; Reiser and Bjornn 1979;

Riparian development has also affected instream habitat, and is generally characterized as poor to fair for aquatic resources (Placer and Sacramento Counties 2003). Large riparian trees are sparse and the floodplain is constrained by the Union Pacific railroad tracks, Interstate 80 to the east, and an old landfill to the west (City of Roseville 2005). The riparian corridor of Antelope Creek consists largely of overhanging vegetation, such as Himalayan blackberry, and remnant oak woodland. Nonnative and native grassland uplands are present, as are wetland swales.

Rock dams, beaver dams, diversion dams, and culverts provide barriers to fish passage (Placer and Sacramento Counties 2003). Asphalt-bottomed culverts underneath Sunset Boulevard and a dam at a large wetlands complex upstream of the railroad bridge in Rocklin are particular fish passage concerns (Placer and Sacramento Counties 2003).

Fish species present in Antelope Creek are provided in **Table 3-16**.

TABLE 3-16
FISH SPECIES PRESENT IN ANTELOPE CREEK

Native		Introduced	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Fall-run Chinook salmon	Oncorhynchus tshawytscha	Black bullhead	Ameiurus melas
Hitch	Oncorhynchus mykiss	Brown bullhead	Ameiurus nebulosus
Sacramento sucker	Lavinia exilicauda	Common carp	Cyprinus carpio
Sacramento pikeminnow	Catostomus occidentalis	Mosquitofish	Gambusia affinis
Speckled dace	Ptychocheilus grandis	Green sunfish	Lepomis cyanellus
	Rhinichthys osculus	Golden shiner	Notemigonus crysoleucas
			Micropterus spp.

Source: Sierra Business Council, 2003

Note: A general siting of both Trout and Bass was reported during the 1959 DFG survey, but specific species were not identified (DFG, 1959)

The BMI community observed at Antelope Creek during previous studies was primarily composed of organisms that are moderately to highly tolerant of impaired water quality conditions. BMI analyses were conducted at two sites (King Road and Atlantic Avenue) along the Antelope Creek by the DCC in 2000. As shown in **Figure 3-103,** the I-IBI score for the upstream site at King Road was 30, and the score for the downstream site at Atlantic Avenue was 27, both of which are considered to be "poor." The limited aquatic insect populations found resulted in the "poor" rating at both sites. The data also indicate a high percentage of pollutant-tolerant organisms, with few BMI taxa associated with cleaner waters (Placer and Sacramento Counties 2003). The combination of high seasonal flow fluctuations, water quality conditions, and high sediment loads in the creek may have contributed to the observed results (Placer and Sacramento Counties 2003).

Secret Ravine Watershed

Secret Ravine is a major tributary of Dry Creek, and is designated as Critical Habitat for Central Valley steelhead (70 CFR 52488, September 2, 2005). Secret Ravine is said to be the most productive stream within the Dry Creek watershed for Central Valley fall-run Chinook salmon and Central Valley steelhead, despite urban encroachment and other human-influenced impacts (Fields 1999). Surveys conducted for steelhead in the Dry Creek watershed have shown that most of the suitable spawning and rearing habitat occurs in Secret Ravine (Placer County Planning Department 2005b).

Both fall-run Chinook salmon and steelhead have been documented spawning in Secret Ravine (Placer County Planning Department 2005b). Based on a 2005 survey, estimated spawning habitat area for spawning in Secret Ravine totaled 1,175 square feet, with the capacity for 21 potential redds (nests) for steelhead and 12 potential redds for Chinook salmon (Placer County Planning Department 2005b). Since the late 1990s, an average of 160 adult fish per year have been observed in Secret Ravine (Placer and Sacramento Counties 2003). Juvenile steelhead have

been observed rearing in Secret Ravine near the headwaters around Gilardi Road and downstream to the Brace Road crossing (Sierra Business Council 2003).

Water temperatures in Secret Ravine have been documented as warmer than ideal and suitable ranges for steelhead rearing (**Table 3-15**), which would have a particular effect on juvenile steelhead (Placer County Planning Department 2005b). Water temperatures measured at Gilardi Road during October 2003 to March 2004 (incubation period) were generally lower than criteria identified in **Table 3-15** for sensitive life stages (Sierra Business Council 2003b). Rearing habitat is limited around Sierra College because of high water temperatures and limited thermal refugia are present in the summer. Chinook salmon, however, typically leave within a few months of hatching.

The 2004 spawning gravel study found the amount of fines measured to range from 51 to 82 percent for Secret Ravine (Placer County Planning Department 2005). Adult Chinook salmon and steelhead clean fine sediments from the gravel with their caudal fins during spawning, and as long as fine sediment does not overwhelm the redd, egg and larvae survival is possible.

Well-established beaver dams, from 0.6 to 1.2 meters (2 to 4 feet), were observed during salmonid spawning gravel surveys in Secret Ravine (Placer County Planning Department 2005b). If these observed dams remain intact during the salmonid migration period, then they could represent significant passage impediments or complete passage barriers. Steelhead, however, tend to migrate in winter months when flows are higher, and obstacles are less of a factor to passage. There is also at least one permanent barrier created by a pipeline, and several utility pipe crossings that may be additional obstacles to fish migration (Placer and Sacramento Counties 2003).

Additional fish species that can be found in Secret Ravine (mostly the lower reaches) are listed in **Table 3-17**. The impact of introduced fishes on fall-run Chinook salmon and steelhead in Secret Ravine is not known. However, bass and sunfish (especially spotted bass) are highly predatory species and could be expected to opportunistically feed on rearing and emigrating juvenile Chinook salmon and steelhead. The degree to which this occurs in Secret Ravine, however, is unknown.

TABLE 3-17
FISH SPECIES PRESENT IN SECRET RAVINE AND MINERS RAVINE

Native		Introduced	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Sacramento sucker	Catostomus occidentalis	White catfish	Ameiurus catus
Roach	Hesperolecus symmetricus	Black bullhead	Ameiurus melas
Pacific lamprey	Lampetra tridentate	Brown bullhead	Ameiurus nebulosus
Hitch	Lavinia exilicauda	Common carp	Cyprinus carpio
Hardhead	Mylopharodon conocephalus	Mosquitofish	Gambusia affinis
Steelhead	Oncorhynchus mykiss	Green sunfish	Lepomis cyanellus
Fall-run Chinook salmon	Oncorhynchus tshawytscha	Warmouth	Lepomis gulosus
Sacramento pikeminnow	Ptychocheilus grandis	Bluegill	Lepomis macrochirus
		Redear sunfish	Lepomis microlophus
		Smallmouth bass	Micropterus dolomieui
		Spotted bass	Micropterus punctulatus
		Largemouth bass	Micropterus salmoides
		Fathead minnow	Pimephales promelas
		White crappie	Pomoxis annulauris

Source: DFG 2003.

Fish communities and associated aquatic habitat were assessed in the Secret Ravine by DFG in fall 2004 and spring 2005. Although not as high as Auburn Ravine, both fish IBI scores for Secret Ravine were fairly high, with scores of approximately 75 out of 100 (Titus et al. 2005). The gross ecological health of Secret Ravine was rated "good to very good" by Titus et al. (2005) based on its IBI score.

BMI surveys have been performed in Secret Ravine, including studies by de Barruel et al. (2003), Fields (1999), and DCC (data collected in 1997, 1998, and 2000 through 2006). Although BMI populations reflecting pollution and high water temperatures within Secret Ravine were found in all three studies, overall results suggest that Secret Ravine provides the highest quality fisheries habitat in the Dry Creek watershed (Placer and Sacramento Counties 2003).

Data studies with upstream and downstream sites found more pollutant-tolerant organisms near the confluence with Miners Ravine than at upstream locations. As shown in **Table 3-13** and **Figure 3-103**, the 2007 DCC BMI study found the site at Secret Ravine at Loomis Basin Park to have a B-IBI score of 51, which is considered "fair" (Titus et al. 2005). This score was higher than any previous score recorded for BMI sites in the Dry Creek watershed. During this BMI assessment, physical habitat at Secret Ravine at Loomis Basin Park exhibited low slopes and low flow velocities, and a fairly low percentage of riffle habitat compared to Auburn Ravine (**Table 3-14)**. However instream habitat was fairly high for these conditions, and was measured at 11 out of 20. Sediment deposition and channel alteration results were lower at this site than at Auburn Ravine. Detailed results of BMI population, B-IBI, and physical habitat analyses for Secret Ravine at Loomis Basin Park are provided in **Appendix A.**

DCC also conducted BMI sampling in 2000 and 2001 at two downstream locations along the creek: Secret Ravine at Sierra College Boulevard and Secret Ravine at its confluence with Miners Ravine. The Sierra College Boulevard site received a B-IBI score of 46, which is considered "fair," and the Secret Ravine at Miners Ravine received a rating of 31, which is considered "poor." Results from these studies indicated a high percentage of pollutant-tolerant organisms with almost no taxa associated with cleaner waters. A BMI survey was conducted at Secret Ravine just downstream from Sierra College (upstream site) and at Secret Ravine just upstream from its confluence with Miners Ravine (downstream site) (de Barruel and West 2003). In this study, the percentage of pollutant-tolerant BMI organisms at the downstream site were found to be significantly higher than at the upstream site, indicating higher perturbation and pollution at the downstream site (de Barruel and West 2003).

Miners Ravine Watershed

Like Secret Ravine, Miners Ravine is a major tributary of Dry Creek, and is also designated as Critical Habitat for Central Valley steelhead (70 CFR 52488, September 2, 2005). Both fall-run Chinook salmon and steelhead have been observed spawning in Miners Ravine (DWR 2002). In the 1950s, up to 100 adult Chinook salmon were estimated to occur in Miners Ravine; however, there is little current information regarding the spawner abundance of Chinook salmon in Miners Ravine, though the Dry Creek Conservancy conducts spawning surveys on up to several days per season (Bates pers. com). During some years in the 1980s and 1990s, DFG planted as many as 100,000 juvenile Chinook salmon from the Feather River hatchery in the lower reaches of Miners Ravine. Although mostly inaccessible to salmonids, aquatic habitat along Miners Ravine was observed to be of highest quality upstream of Cottonwood Dam, near Dick Cook Road, where there is a high canopy cover, deep pools, and higher concentrations of spawning gravel (DWR 2002).

Summer water temperatures in Miners Ravine have been documented as higher than the suitable ranges for steelhead rearing (**Table 3-15**). However, deep pools and cool groundwater accretion could provide thermal refugia for juvenile steelhead. Water temperature data was not recorded during the periods when Chinook salmon would be present in Miners Ravine.

Livestock grazing and riparian vegetation removal have caused increased erosion along banks. Substrate found in Miners Ravine was dominated by fines, such as silt, and clay (DWR 2002), with fine sediment measured between 50 and 75 percent. With the ability of adult Chinook salmon and steelhead to clean fine sediments from the gravel during spawning, egg and larvae survival is still possible if the fines are not reintroduced into the redd.

Many barriers in Miners Ravine reduce the quality of migration habitat. These barriers include six road crossings, one culvert, eight dams, and three natural barriers. Cottonwood Dam, built in the 1950s, is considered to be the uppermost limit to anadromous species in Miners Ravine, but steelhead may be able to pass during flood flows (Placer County Planning Department 2005a, Placer and Sacramento Counties 2003). Additionally, 80 beaver dams were observed in Miners Ravine in one survey (DWR 2002).

Miners Ravine is dominated by spotted bass, a predatory species. As described for Secret Ravine, introduced fishes, such as bass and sunfish, may opportunistically feed upon juvenile salmon and steelhead. Additional fish species that can be found in Miners Ravine (mostly in the lower reaches) are listed in **Table 3-17**.

Fish communities and associated aquatic habitat were assessed in the Miners Ravine by DFG in fall 2004 and spring 2005. Both IBI scores for Miners Ravine were relatively low compared to those of Auburn Ravine and Secret Ravine, with scores of approximately 53 out of 100 (Titus et al. 2005). The gross ecological health of Miners Ravine was rated "fair" based on its IBI score. This low score is due, in part, to the dominant presence of golden shiners (considered an environmentally tolerant species) in the upper reaches of Miners Ravine.

DCC conducted BMI investigations in Miners Ravine from 2000 to 2006 at sites upstream and downstream from the Placer County SMD No. 3 WWTP (DCC 2006). Results of these studies indicate more diversity and more sensitive macroinvertebrates in upstream reaches, and a high proportion of pollution-tolerant organisms farther downstream. Overall, the B-IBI scores at Miners Ravine were considered to be "poor," with a score of about 26 at Miners Ravine at Dick Cook Road, 30 at Miners Ravine downstream from Sierra College Boulevard, and 24 at Miners Ravine at its confluence with Secret Ravine (**Figure 3-103**). The lack of aquatic habitat complexity and high sediment loads in the ravine also contribute to low B-IBI scores. The Miners Ravine site downstream of Sierra College Boulevard was assessed by DCC in 2007, during which physical habitat exhibited fairly low slopes and very low-flow velocities, as well as the lowest percentage of riffle habitat compared to Auburn Ravine and Secret Ravine (**Table 3-14)**. Instream habitat was also the lowest of the three sites, and was measured at 5 out of 20, and channel alteration results exhibited the highest value, at 18 out of 20 (**Table 3-14**). Detailed results of BMI population, B-IBI, and physical habitat analyses for Miners Ravine below Sierra College Boulevard are provided in **Appendix A.**

3.3.2.3 Zone 5

As described earlier, portions of Auburn Ravine are designated as Critical Habitat for Central Valley steelhead (70 CFR 52488, September 2, 2005). Auburn Ravine, downstream from Highway 65, conveys water from the PCWA raw water distribution system to Zone 5 customers. The Zone 5 portion receives treated effluent from the City of Lincoln's WWTP. Rice farms contribute return flows in this area as well.

Spawning gravels in the Auburn Ravine contain high levels of sediment. High erosion within this portion of the ravine is likely due to grazing, other land-use practices, and channel instability. The reaches of Auburn Ravine within Zone 5 have predominantly sandy and fine sediment, which makes egg and larvae survival difficult. As a result, there is minimal spawning habitat available to salmonids in Zone 5.

Riparian habitat varies along the Zone 5 portion of Auburn Ravine. Within Zone 5, Auburn Ravine is characterized as having primarily low levels of shade (Placer County Planning Department 2005b).

Barriers to salmonid migration exist along the Zone 5 portion of Auburn Ravine. Auburn Ravine is seasonally dammed by South Sutter Irrigation District on behalf of PCWA at two locations: Moore Dam and Pleasant Grove Dam. Auburn Ravine flows at Moore Dam are diverted to Moore Canal. Further downstream, flows are diverted from Auburn Ravine at the Pleasant Grove Dam to the Pleasant Grove Canal.

3.3.3 Special Status Species

Threatened and Endangered Species Critical Habitat designations in the study area, as well as CNDDB records of occurrence, are shown in **Figures 3-104** to **3-107** (USFWS 2008, CNDDB 2008). **Table 3-18** summarizes known special status species occurrences within Zones 3, 1, and 5 (CNDDB 2008). PCWA canals, reservoirs, and conveyances in the study area cross a number of habitat types. Although these water bodies may traverse habitats that are used by special status species, O&M activities may not directly affect these habitats and/or species might not be present throughout the study area. Surveys should be conducted before O&M activities to determine which habitat types would be affected and whether special status species are present.

In addition to known species occurrences, a number of special status species have been identified as having the potential to occur. These are summarized in **Table 3-19**, along with their habitat preferences.

Special status species known to occur in the area that could be affected indirectly by impacts to hydrology, water quality, and/or sedimentation in Auburn Ravine, Clover Valley Creek, Antelope Creek, Secret Ravine, Miners Ravine, or connected downstream areas include Central Valley steelhead, fall-run Chinook salmon, western pond turtle, and foothill yellow-legged frog.

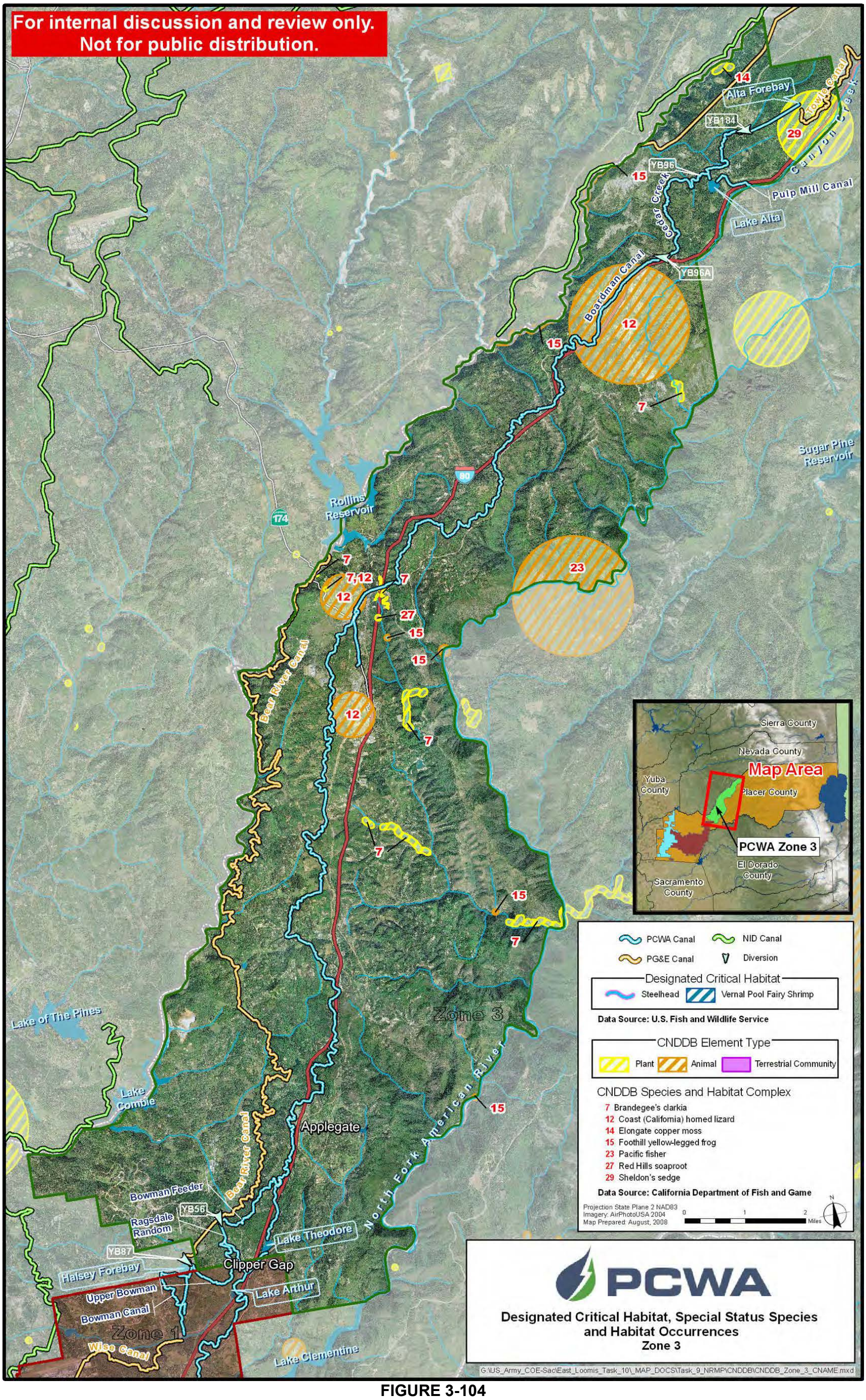

FIGURE 3-104
ZONE 3 DESIGNATED CRITICAL HABITAT, CALIFORNIA NATURAL DIVERSITY DATABASE SPECIAL STATUS SPECIES OCCURRENCES, AND HABITAT COMPLEXES

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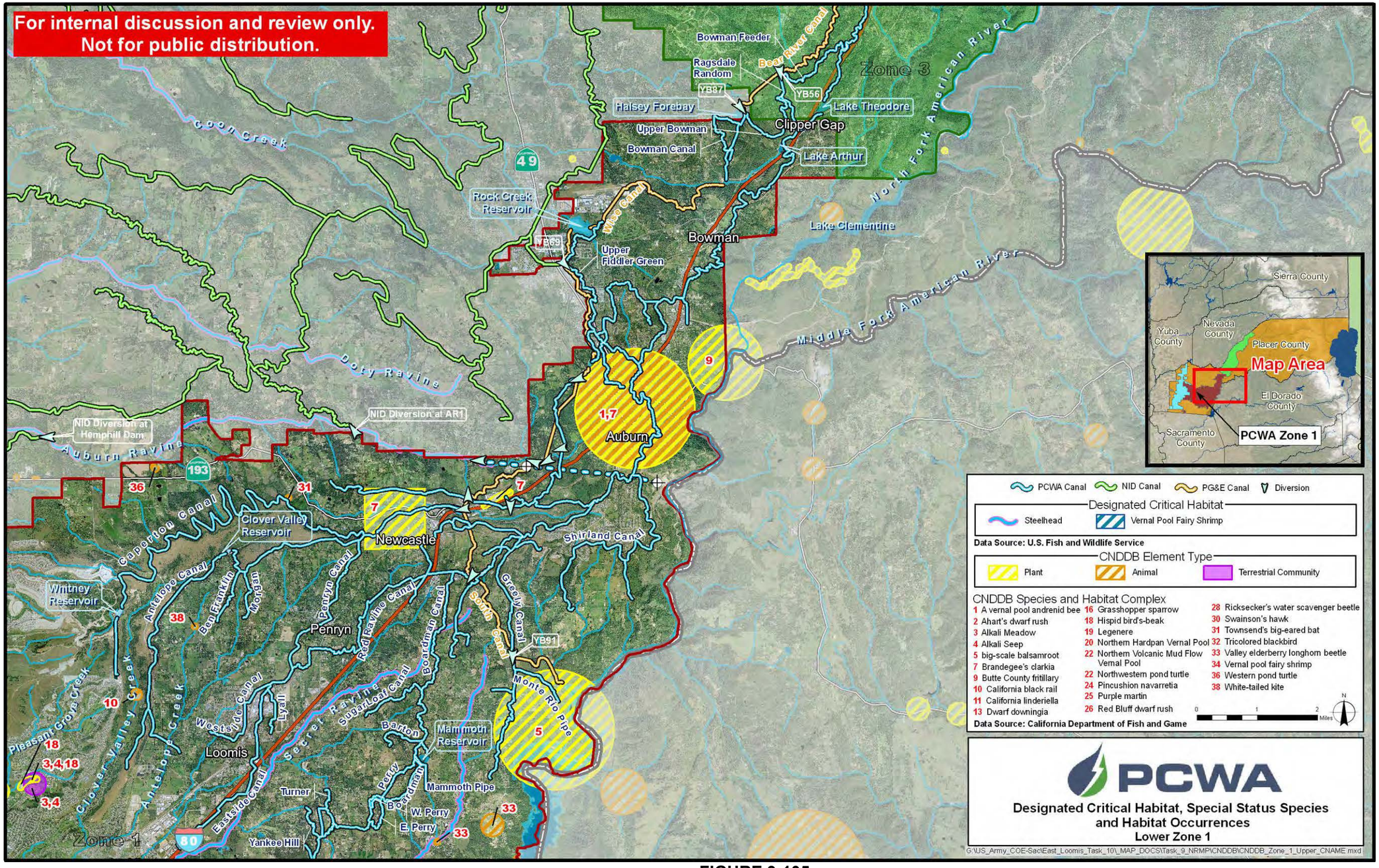

FIGURE 3-105
UPPER ZONE 1 DESIGNATED CRITICAL HABITAT, CALIFORNIA NATURAL DIVERSITY DATABASE SPECIAL STATUS SPECIES OCCURRENCES, AND HABITAT COMPLEXES

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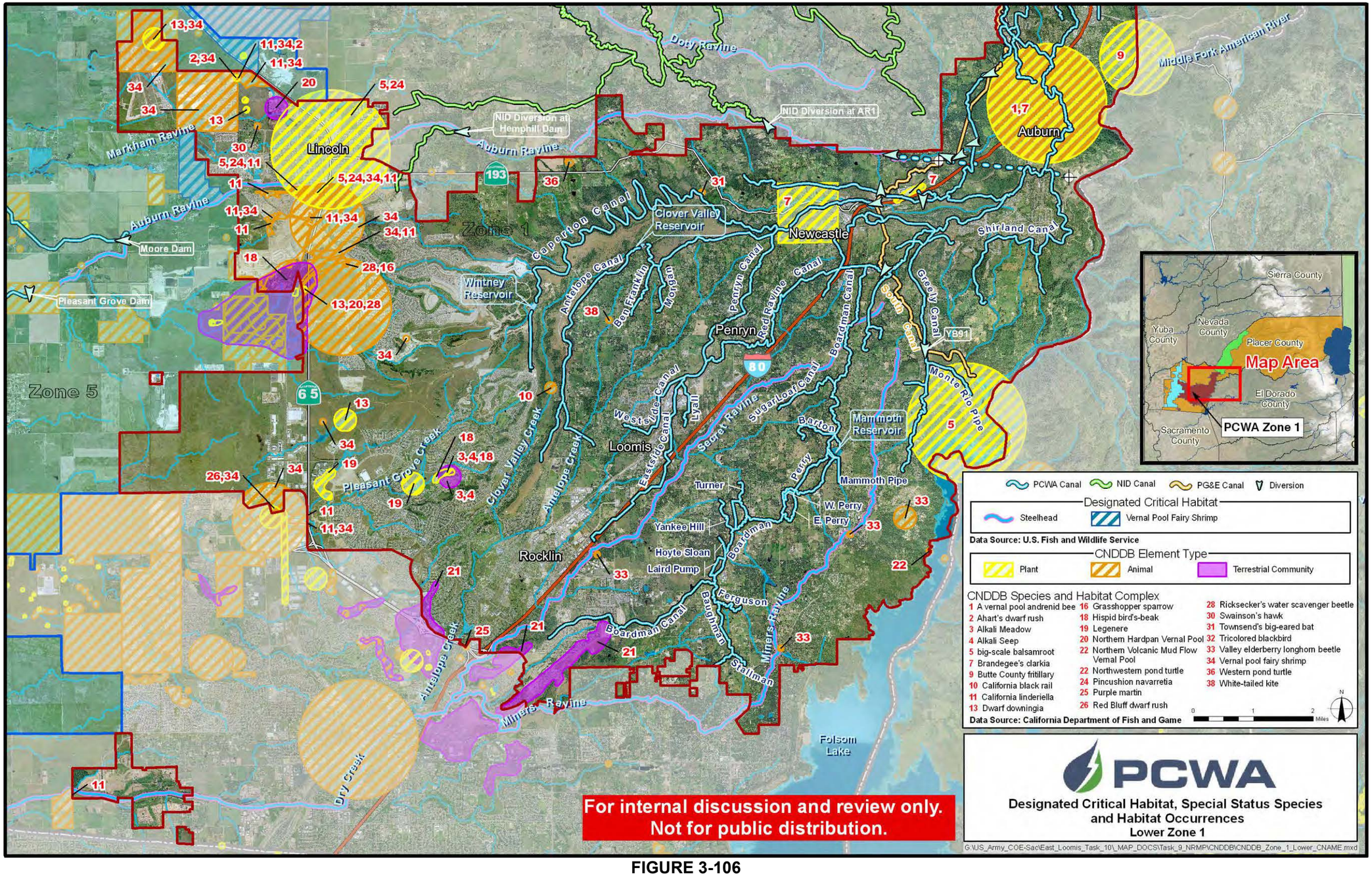

FIGURE 3-106
LOWER ZONE 1 DESIGNATED CRITICAL HABITAT, CALIFORNIA NATURAL DIVERSITY DATABASE SPECIAL STATUS SPECIES OCCURRENCES, AND HABITAT COMPLEXES

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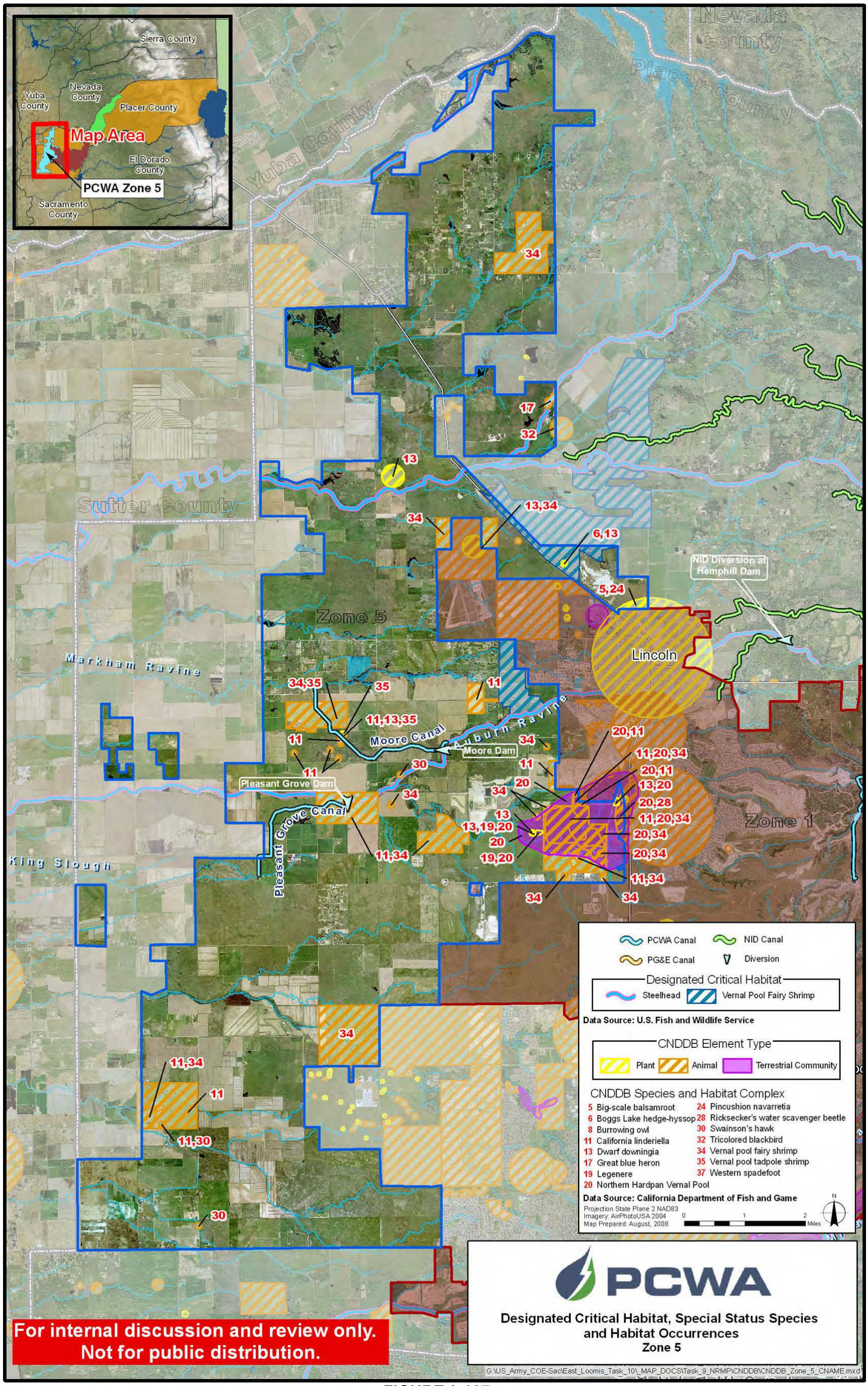

FIGURE 3-107
ZONE 5 DESIGNATED CRITICAL HABITAT, CALIFORNIA NATURAL DIVERSITY DATABASE SPECIAL STATUS SPECIES OCCURRENCES, AND HABITAT COMPLEXES

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TABLE 3-18
KNOWN SPECIAL STATUS SPECIES OCCURRENCES IN ZONES 1, 3, AND 5 (CNDDB 2008)

Common Name	Scientific Name	Federal Status	State Status	CNPS List	Habitat	Occurrence	Notes
Wildlife							
Hardhead	*Mylopharodon conocephalus*	--	WL		Undisturbed areas of larger middle-and low-elevation streams	Zones 1 and 5	
Central Valley steelhead	*Oncorhynchus mykiss*	T	T		Riverine (not known to occur in canals)	Zones 1 and 5	
Fall-run Chinook salmon	*Oncorhynchus tshawytscha*	SC	SSC		Riverine (not known to occur in canals)	Zones 1 and 5	
vernal pool fairy shrimp	*Branchinecta lynchi*	T	--		vernal pools	Zones 1 and 5	
vernal pool tadpole shrimp	*Lepidurus packardi*	E	--		vernal pools	Zone 5	
California linderiella	*Linderiella occidentalis*	--	--		vernal pools	Zones 1 and 5	
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	T	--		valley foothill riparian and oak savanna in elderberry shrubs	Zone 1	
A vernal pool andrenid bee	*Andrena subapasta*	--	--		vernal pools	Zone 1	
Ricksecker's water scavenger beetle	*Hydrochara rickseckeri*	--	--		vernal pools, wetlands	Zones 1 and 5	
coast (California) horned lizard	*Phrynosoma coronatum* (frontale population)	--	SSC		various habitats, including annual grassland, shrubland, forested habitats, and wetlands	Zone 3	lays eggs May-June
western pond turtle	*Actinemys marmorata*	--	SSC		annual grassland, wetland, forested, river, streams, lake and river margins	Zone 1	

TABLE 3-18
KNOWN SPECIAL STATUS SPECIES OCCURRENCES IN ZONES 1, 3, AND 5 (CNDDB 2008) (CONTINUED)

Common Name	Scientific Name	Federal Status	State Status	CNPS List	Habitat	Occurrence	Notes
Wildlife (continued)							
Foothill yellow-legged frog	*Rana boylii*	--	SSC		forest and shrubland with slow-moving stream/river	Zone 3	breeds in water March-May
western spadefoot	*Spea hammondii*	--	SSC		annual grassland, wetland, lake and river margins	Zone 5	
burrowing owl	*Athene cunicularia*	--	SSC		agricultural, annual grassland, oak woodland	Zone 5	
grasshopper sparrow	*Ammodramus savannarum*	--	SSC		Annual grassland, oak woodland	Zone 1	
great blue heron	*Ardea herodias*	--	--		wetlands, agricultural	Zone 5	
purple martin	*Progne subis*	--	SSC		Annual grassland, oak woodland, urban	Zone 1	
white-tailed kite	*Elanus leucurus*	--	FP		annual grassland, agricultural, open woodlands	Zone 1	
California black rail	*Laterallus jamaicensis coturniculus*	--	T, FP		fresh emergent wetland	Zone 1	
tricolored blackbird	*Agelaius tricolor*	--	SSC		agricultural, wetland, annual grassland, urban	Zones 1 and 5	
Swainson's hawk	*Buteo swainsoni*	--	T		agricultural, annual grassland, forested	Zones 1 and 5	Nesting period is generally March 1 to August 15

TABLE 3-18
KNOWN SPECIAL STATUS SPECIES OCCURRENCES IN ZONES 1, 3, AND 5 (CNDDB 2008) (CONTINUED)

Common Name	Scientific Name	Federal Status	State Status	CNPS List	Habitat	Occurrence	Notes
Plants							
Townsend's big-eared bat	*Corynorhinus townsendii*	--	SSC		woodlands, urban areas, requires roosting areas (caves, mines, etc.)	Zone 1	
Pacific fisher	*Martes pennanti (pacifica)*	C	SSC		mature coniferous and riparian forest	Zone 3	
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	--	E	1B	vernal pools, marshes and swamps	Zone 5	blooms April-August
Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	--	--	1B	vernal pools	Zone 1	blooms March-May
Ahart's dwarf rush	*Juncus leiospermus var. ahartii*	--	--	1B	vernal pools, wetlands	Zone 1	blooms March-May
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B	chaparral, woodland, grasslands	Zones 1 and 5	blooms March-June
Brandegee's clarkia	*Clarkia biloba ssp. brandegeeae*	--	--	1B	chaparral, forest, disturbed areas	Zones 1 and 3	blooms May-July
Butte County fritillary	*Fritillaria eastwoodiae*	--	--	3	chaparral, woodland, montane coniferous forest	Zone 1	blooms March-May
dwarf downingia	*Downingia pusilla*	--	--	2	vernal pools, marshes and swamps	Zones 1 and 5	blooms March-May
elongate copper moss	*Mielichhoferia elongate*	--	--	2	woodlands, moist rocky areas	Zone 3	
hispid bird's-beak	*Cordylanthus mollis ssp. hispidus*	--	--	1B	wetlands	Zone 1	blooms June-September
legenere	*Legenere limosa*	--	--	1B	vernal pools, wetlands, drainages	Zones 1 and 5	blooms May-September

TABLE 3-18
KNOWN SPECIAL STATUS SPECIES OCCURRENCES IN ZONES 1, 3, AND 5 (CNDDB 2008) (CONTINUED)

Common Name	Scientific Name	Federal Status	State Status	CNPS List	Habitat	Occurrence	Notes
Plants (continued)							
pincushion navarretia	*Navarretia myersii ssp. myersii*	--	--	1B	wetlands, vernal pools	Zones 1 and 5	blooms in May
Red Hills soaproot	*Chlorogalum grandiflorum*	--	--	1B	chaparral, woodland on serpentine or gabboric soils	Zone 3	blooms May-June
Sheldon's sedge	*Carex sheldonii*	--	--	2	coniferous forest, wetlands, riparian scrub	Zone 3	blooms May-August
Habitats							
Alkali Meadow						Zone 1	
Alkali Seep						Zone 1	
Northern Hardpan Vernal Pool						Zones 1 and 5	
Northern Volcanic Mud Flow Vernal Pool						Zone 1	

Key:
Federal Status:
C = Candidate
E = Endangered
SC = Species of Concern
T = Threatened
State Status:
E = Endangered
FP = Fully Protected
R = Rare
SSC = Species of Special Concern
T = Threatened
WL = Watch List
California Native Plant Society
1B = List 1B species: rare, threatened, or endangered in California and elsewhere
2 = List 2 Species: rare, threatened, or endangered in California but more common elsewhere
3 = plant that need more information to determine their status

TABLE 3-19
SPECIAL STATUS SPECIES POTENTIALLY OCCURRING IN ZONES 1, 3, AND 5*

Common Name	Scientific Name	Federal Status	State Status	CNPS List	Habitat	Potential Occurrence	Notes
California red-legged frog	*Rana aurora draytonii*	T	SSC		valley foothill riparian, wetland, lake and river margins with permanent deep water	Zones 1, 3, 5	breeds in water November-March
giant garter snake	*Thamnophis gigas*	T	T		marshes, wetlands, canals, rice field	Zones 1 and 5	fs
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	C	E		dense riparian forest	Zone 5	
Stebbins' morning glory	*Calystegia stebbinsii*	E	E	1B	chaparral or woodland on gabbroic or serpentinite soils	Zone 1	blooms May-June
Pine Hill ceanothus	*Ceanothus roderickii*	E	R	1B	chaparral or woodland on gabbroic or serpentinite soils	Zone 1	blooms May-June
El Dorado bedstraw	*Galium californicum ssp. Sierrae*	E	R	1B	chaparral or forestland on gabbroic soils	Zone 1	blooms May-June
Layne's ragwort	*Packera layneae*	T	R	1B	chaparral or woodland on gabbroic or serpentinite soils	Zone 1	blooms April-July
Jepson's onion	*Allium jepsonii*	--	--	1B	chaparral or forestland on gabbroic or volcanic soils	Zones 1 and 3	blooms April-August
dubious pea	*Lathyrus sulphureus var. argillaceus*	--	--	3	chaparral or forest	Zones 1 and 3	blooms April-May
oval-leaved viburnum	*Viburnum ellipticum*	--	--	2	chaparral or forest	Zones 1 and 3	blooms May-June

TABLE 3-19
SPECIAL STATUS SPECIES POTENTIALLY OCCURRING IN ZONES 1, 3, AND 5* (CONTINUED)

Common Name	Scientific Name	Federal Status	State Status	CNPS List	Habitat	Potential Occurrence	Notes
red-anthered rush	*Juncus marginatus var. marginatus*	--	--	2	marshes and swamps at elevation over 2,400	Zone 3	blooms in July
brownish beaked-rush	*Rhynchospora capitellata*	--	--	2	coniferous forest, wetlands	Zone 3	blooms July-August
Scadden Flat checkerbloom	*Sidalcea stipularis*	--	E	1B	marshes and swamps	Zone 3	blooms July-August
Bisbee Peak rush-rose	*Helianthemum suffrutescens*	--	--	3	chaparral (often serpentinite, gabbroic, or lone soil)	Zone 1	blooms April-June
El Dorado County mule ears	*Wyethia reticulata*	--	--	1B	chaparral, woodland, montane coniferous forest on clay or gabbroic soils	Zone 1	blooms May-July

Notes:
* Excludes those species known to occur that are listed in Table 3-12

Key:
Federal Status:
C = Candidate
E = Endangered
T = Threatened
State Status:
E = Endangered
FP = Fully Protected
R = Rare
SSC = Species of Special Concern
T = Threatened
California Native Plant Society
1B = List 1B species: rare, threatened, or endangered in California and elsewhere
2 = List 2 Species: rare, threatened, or endangered in California but more common elsewhere
3 = plant that need more information to determine their status

Auburn Ravine, Secret Ravine and Miners Ravine are federally designated Critical Habitat for Central Valley steelhead. Secret Ravine and Miners Ravine and are recognized by DFG and NMFS as the primary production areas in the Dry Creek drainage for Central Valley steelhead and fall-run Chinook salmon (DFG 2001). These ravines appear to be especially important for spawning and rearing of these anadromous fishes (DFG 2001).

Major life stages of fall-run Chinook salmon and Central Valley steelhead in the Auburn Ravine and Dry Creek watershed during a water year (October through September) are shown in **Figure 3-108**.

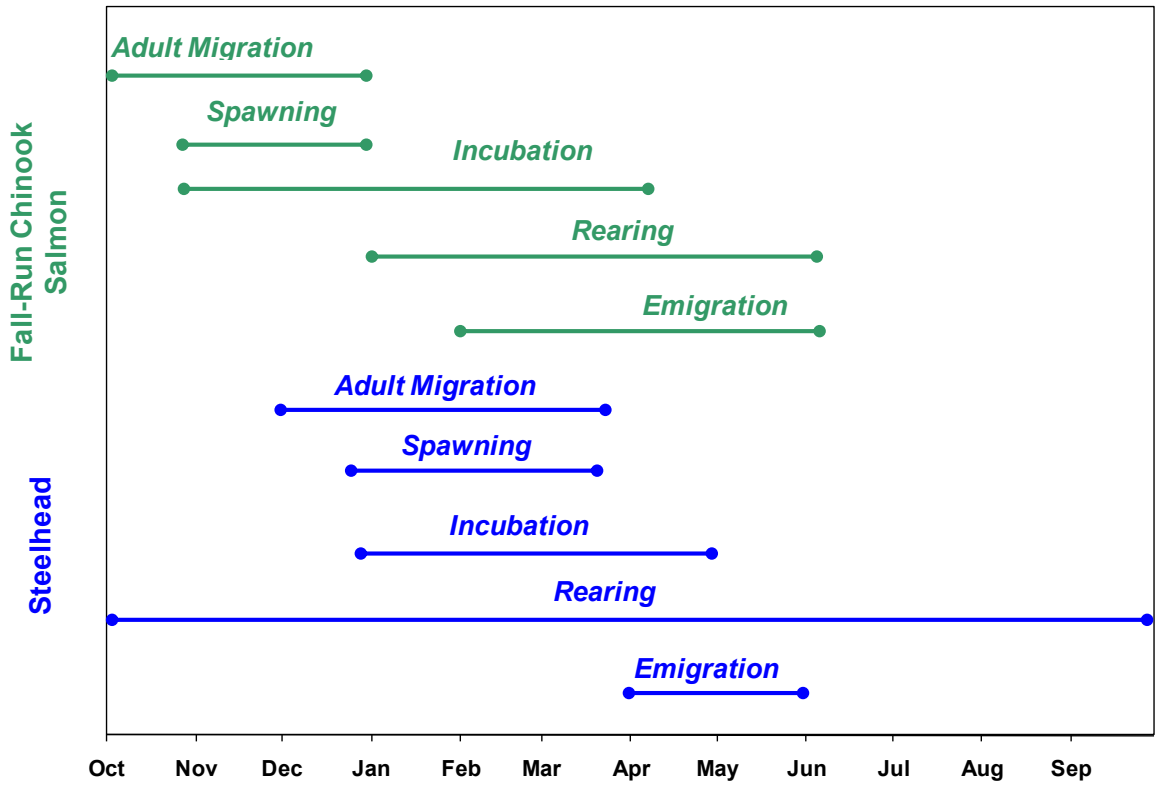

FIGURE 3-108
MAJOR LIFE STAGES OF FALL-RUN CHINOOK AND CENTRAL VALLEY STEELHEAD IN AUBURN RAVINE AND DRY CREEK WATERSHED DURING A WATER YEAR

The timing of migration of adult fall-run Chinook salmon is determined primarily by flows and water temperatures, and migration can occur in the Auburn Ravine and Dry Creek watershed anywhere from October through December. Spawning usually occurs from November through December. From January to mid-April, fry emerge (incubation), and rearing occurs from January to June. Smolts tend to emigrate from the watershed during February through June, peaking in March to May (DFG 2003, Placer and Sacramento Counties 2003).

Central Valley steelhead migration occurs from December through March. Spawning depends on flows and water temperatures, but typically occurs from January through March. Steelhead

incubation typically occurs between January and mid-April. Steelhead rearing can occur year-round. Juvenile emigration takes place from late March through May (DFG 2003, Placer and Sacramento Counties 2003).

Substrate composition refers to the suitability of a particular sized gravel substrate (USDA 1979). Fine substrate, such as silt and suspended solids, can clog fish gills or reduce feeding, and migrating salmon will avoid or cease migration in waters with high silt loads or high turbidity. Excessive sediment loads can also decrease the fish spawning capacity of streams by clogging gravel redds.

Important habitat elements for anadromous salmonids include cover, substrate composition, and water quality and quantity (USDA 1979). Cover for fish can consist of overhanging vegetation, undercut banks, submerged vegetation, large submerged objects (i.e., logs and rocks), and water depth and turbulence. Adequate cover is most important to anadromous salmonids during rearing because they are most susceptible to predation from other fish and terrestrial animals during this time (USDA 1979).

One of the primary water quality parameters that affect fish habitat conditions is water temperature. Salmonids are cold water fish with optimum temperature requirements at different life stages. There is some debate in scientific literature on the definitive temperature range requirements for various life cycle phases of salmon and steelhead. Temperature targets for the life cycle stages of steelhead and Chinook salmon in the study area consistent with values reported in scientific literature are shown in **Table 3-15**.

Adequate water depth and streamflow are necessary for fish passage. Migration can be hampered by too little streamflow and resulting shallow water (USDA 1979). To allow for fish passage, minimum streamflows must be met. In addition, low streamflows can often result in warmer waters.

CHAPTER 4.0
REGULATORY REQUIREMENTS FOR PCWA CANAL SYSTEM OPERATIONS AND MAINTENANCE ACTIVITIES

This chapter summarizes the regulatory requirements for PCWA canal system O&M activities.

4.1 FEDERAL REGULATIONS

The following sections describe Federal regulatory requirements associated with O&M activities carried out by PCWA.

4.1.1 Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act (CWA) (33 U.S.C. §1251 et seq.). The CWA is the primary Federal law that protects the quality of the nation's surface waters. The Act established the basic structure for regulating discharges of pollutants into the "waters of the United States." Waters of the United States and their lateral limits are defined in CFR Title 33, Part 328.3(a), to include the following:

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.
2. All interstate waters including interstate wetlands.
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
    i. Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
    ii. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
    iii. Which are used or could be used for industrial purpose by industries in interstate commerce.
4. All impoundments of waters otherwise defined as waters of the United States under the definition.
5. Tributaries of waters identified in paragraphs (a)(1)-(4) of this section.
6. The territorial seas.

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 123.11(m) which also meet the criteria of this definition) are not waters of the United States.
8. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with the U.S. Environmental Protection Agency (EPA).

Considering this definition of waters of the United States, essentially all natural water bodies are included under the definition of waters of the United States. In addition, several artificial or disturbed water bodies have the potential to fall under this definition, such as:

- Reservoirs
- Farm or stock ponds fed by direct rainfall or impoundment of a stream (not by pumped water)
- Artificial wetlands that receive water without artificial controls (i.e., pumps, valves, or gates)
- Farmed wetlands

Some water bodies that may be excluded from this definition include the following (Cylinder et al., 2004):

- Irrigation ditches that are not considered tributaries of waters of the United States
- Drainage ditches excavated in uplands
- Temporary sediment basins on construction sites
- Reflecting pools
- Wastewater systems, including treatment ponds and lagoons
- Ponds and wetlands created as part of an ongoing mining operation (unless created as mitigation for past impacts)
- Isolated ponds and wetlands that do not have a nexus to interstate commerce

As mentioned above, artificial channels that convey only irrigation water usually are not included under the definition of waters of the United States, unless they connect directly to jurisdictional waters of the United States. However, if the PCWA canal system is deemed

"Waters of the United States" by USACE, Section 404 and all associated regulations under the CWA are applicable.

The CWA authorizes the EPA to set national standards and restrictions on quantities, discharge rates, and concentrations of pollutants discharged into the waters of the United States. Many actions that result in the discharge of pollutants into the waters of the United States require a permit as authorized by sections of the CWA. The permit process is the CWA's primary regulatory tool.

4.1.1.1 Section 303

Under Section 303(c)(2)(B) of the CWA, states must adopt numeric criteria for the priority toxic pollutants listed under Section 307(a) if those pollutants could be reasonably expected to interfere with the designated uses of states' waters. The EPA requires numeric water quality criteria for priority toxic pollutants and other water quality standards provisions to be applied to waters in California. Today's final rule promulgates (1) ambient aquatic life criteria for 23 priority toxics, (2) ambient human health criteria for 57 priority toxics, and (3) a compliance schedule provision that authorizes the state to issue schedules of compliance for new or revised NPDES permit limits based on the Federal criteria when certain conditions are met. The State must use the criteria together with the State's existing water quality standards when controlling pollution in inland waters and enclosed bays and estuaries. The numeric water quality criteria contained in the final rule are identical to EPA's recommended CWA Section 304(a) criteria for these pollutants published in December 1998 (see 63 Federal Register (FR) 68353).

4.1.1.2 Section 404

Section 404 of the CWA establishes a requirement to obtain a permit before any activity that involves any discharge of dredged or fill material into waters of the United States. "Fill" is defined as any material that replaces any portion of a water of the United States with dry land, or that changes the bottom elevation of any portion of a water of the United States. Actions typically subject to Section 404 requirements are those that would take place in wetlands or stream channels that convey natural runoff, including intermittent streams, even if they have been realigned. Per 33 CFR 323.4, maintenance or construction of irrigation ditches, and maintenance (not construction) of drainage ditches are not subject to the Section 404 Regulatory Program.

The Section 404 permit issuance process is conducted in compliance with guidelines developed by EPA that require that there be a demonstration that no alternative is available to meet the project purpose and need that does not result in a discharge of fill in waters. Once this first test has been satisfied, the project that is permitted must be the least environmentally damaging practical alternative before the USACE may issue a permit for the proposed activity.

The USACE issues two broad categories of permits under Section 404: general permits and standard permits. General permits, which include nationwide permits and regional permits, are issued by USACE to streamline the permit process for nationwide, statewide, or regional activities that have minimal environmental impacts (CALFED 2001). Projects that meet specific

criteria, including certain PCWA O&M activities, may proceed under the authorization of a general permit once the conditions specified in the general permit are met (Cylinder et al. 2004). Many general permits may require notification to USACE before the start of an activity in the form of a Preconstruction Notification. Typically the USACE will provide the applicant with a written confirmation that the work can be authorized under the applicable permit. It is important to note that the use of more than one nationwide permit for a single and complete project is prohibited (72 FR 11196) and that all general permits must be reviewed every 5 years by USACE, at which time they may be reissued, modified, or revoked. Nationwide Permits have been issued for a variety of activities that may apply to PCWA, including:

- NW-03: Maintenance
- NW-07: Outfall Structures and Maintenance
- NW-13: Bank Stabilization
- NW-18: Minor Discharges
- NW-23: Approved Categorical Exclusions
- NW-41: Reshaping Existing Drainage Ditch
- NW-46: Discharge into Ditches

Regional conditions for nationwide permits to be applied across the entire Sacramento District include, but are not limited to, the following:

- Nationwide Permits 14, 29, 33, 39, 40, 41, 42, 43, and 44 are withdrawn from use in histosols, including fens (wetlands with organic/peat soils). For the use of all other nationwide permits in fens, project proponents are required to notify the USACE using the notification or preconstruction notification procedures of the nationwide permit program (General Condition 13). This will be a "USACE only" notification.

- For all activities using any existing and proposed nationwide permits, mitigation that is required by special condition must be completed before or concurrent with project construction. Where project mitigation involves the use of a mitigation bank or in-lieu fee, payment must be made to the bank or fee-in-lieu program before starting construction of the permitted activity.

- For all nationwide permits requiring notification, except 27, the applicant must provide a written statement to the district engineer explaining how avoidance and minimization of losses of waters of the United States were achieved on the project site.

Standard permits, which include letters of permission and individual permits, are issued for activities that may have more than a minimal adverse environmental impact and do not qualify for a general permit. A letter of permission is a type of standard permit for an individual action, designed to expedite the permitting process for activities having a minimal impact on the aquatic ecosystem (CALFED 2001). Projects not eligible for a general permit or a letter of permission

must obtain an individual permit. A standard permit for a specific activity may be issued only after an individual application is submitted to USACE and the formal review process is complete.

4.1.1.3 Section 401

Section 401 of the CWA specifies that any applicant for a Federal license or permit to conduct any activity that may result in any discharge into waters of the United States will provide the Federal licensing or permitting agency a certification that any such discharge will not violate State water quality standards. Although this is a federal law, it is state enforced. In California, the authority to grant water quality certification is delegated by the SWRCB to the nine RWQCB. The RWQCB is responsible for issuing water quality certifications indicating that the project will uphold State water quality standards. The RWQCB administers the Section 401 program with the intent of prescribing measures for the applicant's project that are necessary to avoid, minimize, and mitigate adverse impacts on water quality and the ecosystems. Projects that require a Section 404 permit from USACE must also file an application to obtain water quality certification from the RWQCB, and should be filed with the RWQCB at the same time that PCWA files the Section 404 permit application with USACE.

The PCWA service area falls under the jurisdiction of the Central Valley RWQCB. Applications for a 401 certification must be filed with the Central Valley RWQCB and must include: a full, technically accurate description of the entire proposed activity; an alternatives analysis; copies of any draft or final Federal, State, and local licenses, permits, and agreements required for actions associated with the proposed activity; a copy of the CEQA document and notice of determination; and a list of agencies that participated in the CEQA process (CALFED 2001). For projects that require a Section 404 permit from USACE, an application should be filed with the RWQCB at the same time that PCWA files the Section 404 permit application with USACE. The SWRCB has issued Section 401 water quality certifications for select Section 404 nationwide permits.

4.1.1.4 Section 402

Section 402 of the CWA authorized the NPDES program, which states that all discharges into the nation's waters are unlawful, unless specifically authorized by a permit. The primary objective of the NPDES is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The NPDES Permit Program establishes waste discharge requirements, including specific pollution limits and monitoring and reporting requirements, for permitted wastewater and stormwater discharges into waters of the United States. The U.S. EPA or the approved State environmental control agency has responsibility for administering NPDES permits for discharges to surface waters, which must be renewed every 5 years. In California, the SWRCB is responsible for permit administration, and the vast majority of NPDES permits are issued by the nine RWQCBs.

The SWRCB and RWQCBs issue both general and individual NPDES permits. A general permit covers multiple facilities within a specific category, industry facilities with similar operation

types, and facilities with similar wastewater discharge types. General permits may only be issued to dischargers within specific geographical areas, such as a designated planning area, sewer district, city, county, or State boundary. Stormwater, or non-point source, discharges are regulated by the RWQCBs under Stormwater Program General Permits. The following are some stormwater permits that may apply to PCWA raw water distribution system O&M activities:

1. General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ) is required for construction activities, including clearing, grading, and disturbances to the ground such as stockpiling, or excavation that results in soil disturbances of at least 1 acre of total land area. The general permit requires development of a Stormwater Pollution Prevention Plan (SWPPP) and annual monitoring reports for compliance with effluent limitations. The SWPPP will specify the implementation of site-specific BMPs using the best available technology economically achievable and best conventional pollutant control technology.
2. Municipal Separate Storm Sewer System Permits (MS4) require the discharger, or a municipality, to develop and implement a Storm Water Management Plan/Program with the goal of reducing the discharge of pollutants to the maximum extent practicable. Phase I MS4 permits apply to medium (serving between 100,000 and 250,000 people) and large (serving 250,000 people) municipalities. Phase II MS4 permits apply to smaller municipalities, including nontraditional Small MS4s, which are governmental facilities such as military bases, public campuses, and prison and hospital complexes. Placer County has a Phase II MS4 permit with the Central Valley RWQCB.

The SRWCB also issues several point-source general permits. Of them, the following two are most relevant to irrigation canal systems:

1. A General Permit for Dewatering and Other Low Threat Discharges (NPDES No. CAG995001) is required by the Central Valley RWQCB for temporary discharges of clean or relatively pollutant-free wastewater that poses little or no threat to water quality. Temporary discharges include well development water; construction dewatering; pump/well testing; pipeline/tank pressure testing; pipeline/tank flushing or dewatering; condensate discharges; water supply system discharges; and miscellaneous dewatering/low threat discharges.
2. A General Permit for Discharges of Aquatic Pesticides (WQ Order No. 2001-12-DWQ) is typically obtained by irrigation districts, municipal supply districts, and mosquito abatement districts. On November 27, 2007, the EPA issued a Final Rule concluding that pesticides applied in accordance with the FIFRA are exempt from the CWA's permitting requirements (40 CFR §122.3(h)). On January 7, 2009, an appeals court vacated the rule under the CWA, 33 U.S.C. § 1251 et seq., in response to a lawsuit by Baykeeper and supporting environmental groups (U.S. Sixth Circuit Court of Appeals 2009). An NPDES permit is now required even if the application of a pesticide is in compliance with the FIFRA. PCWA is in compliance with FIFRA regulations, has an active General

Permit for discharges of Aquatic Pesticides, and has an extensive Aquatic Weed Management Program.

4.1.2 Endangered Species Act

The Federal ESA was enacted by Congress in 1973 (16 U.S.C. §1531 et seq.). It combined and strengthened the provisions of the 1966 Endangered Species Preservation Act and the 1969 Endangered Species Conservation Act. Currently, the Federal ESA provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the United States or elsewhere. The purposes of the Federal ESA are to provide a means of conserving the ecosystems on which endangered and threatened species depend; provide a program for conserving those species; and take steps necessary to achieve the purposes of international treaties and conventions (Federal ESA, Section 2).

USFWS and National Marine Fisheries Service (NMFS) share responsibility for implementing the Federal ESA, have authority over projects that may result in the take of a federally listed endangered species, and are required to maintain lists of threatened and endangered species. Both agencies ensure that ESA requirements are followed, and evaluate projects that may affect the continued existence of a federally listed (threatened or endangered) species. Generally, USFWS manages land and freshwater species, while NMFS manages marine and "anadromous" species, such as Chinook salmon.

4.1.2.1 Section 9

Section 9 of the ESA prohibits the “take” of federally listed species. Take is defined under the ESA, in part, as killing, harming, or harassment. Under Federal regulations, take is further defined to include habitat modification or degradation when it results in death or injury to wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. The federally listed species that may occur in, or may be affected by PCWA raw water distribution system O&M activities are described in **Chapter 3**. If an activity may affect a federally listed species, either an incidental take permit, under Section 10 of the Federal ESA, or a Federal interagency consultation, under Section 7 of the Federal ESA is required.

4.1.2.2 Section 7

If a PCWA project is funded by a Federal agency or would require a permit or approval from a Federal agency (federal nexus), PCWA would be required to comply with Section 7 of the Federal ESA rather than obtain an incidental take permit under Section 10. Under Section 7, all Federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated Critical Habitat. These requirements apply only to Federal agency actions, and the latter only to habitat that has been designated as Critical.

Critical Habitat is defined as “the specific areas within the geographical area occupied by the species, at the time it is listed . . . that are essential to the conservation of the species and which may require special management considerations or protection” (Federal ESA, Section 3).

Critical Habitat is determined using the best available scientific information about the physical and biological needs of the species. These needs include: space for individual and population growth and for normal behavior; food, water, light, air, minerals, or other nutritional or physiological needs; cover or shelter; sites for breeding, reproduction, and rearing of offspring; habitat that is protected from disturbance or is representative of the historical geographic and ecological distribution of a species. A Critical Habitat designation does not set up a preserve or refuge, and applies only when federal funding, permits, or projects are involved. Critical Habitat requirements do not apply to citizens engaged in activities on private land that do not involve a federal agency. The required steps in the Section 7 consultation process are as follows:

1. Agencies must request information from USFWS and/or NMFS on the existence in a project area of listed species or species proposed for listing.
2. Following receipt of the USFWS/NMFS response to this request, agencies generally prepare a Biological Assessment to determine whether any listed species or species proposed for listing are likely to be affected by a proposed action.
3. Agencies must initiate formal consultation with USFWS and/or NMFS if the proposed action might adversely affect listed species.
4. USFWS and/or NMFS must prepare a Biological Opinion (BO) to determine whether the action would jeopardize the continued existence of listed species or adversely modify their Critical Habitat.
5. If a finding of jeopardy or adverse modifications is made in the BO, USFWS and/or NMFS must recommend reasonable and prudent alternatives that would avoid jeopardy, and the federal agency must modify the project to ensure that listed species are not jeopardized and that their Critical Habitat is not adversely modified (unless an exemption from this requirement is granted) (USFWS and NMFS 1998).

4.1.2.3 Section 10

If a PCWA project is not funded by, or does not need a permit from, a Federal agency, actions that would result in the take of a listed species require a permit issued under Section 10 of the Federal ESA. The most common permit is an "incidental take permit." Section 10 allows USFWS or NMFS, under certain conditions, to issue incidental take permits for actions in which a take of the species is incidental to, and not the purpose of, the action. To obtain an incidental take permit, PCWA would have to meet certain requirements, including preparation of a Habitat Conservation Plan (HCP). A complete application package consists of a permit application form, fee (if required), a completed HCP, a draft National Environmental Policy Act (NEPA) document (if required), and in some cases, an Implementing Agreement (USFWS and NMFS 1996, USFWS 2005). The HCP also must analyze and explain an action's impacts on listed species and discuss measures to minimize and mitigate impacts, identify funding, and include a Mitigation Monitoring Plan (USFWS and NMFS 1996, USFWS 2005).

In 1994, the "No Surprises" Policy was issued to provide sufficient incentives for the private sector to participate in the development of long-term conservation plans. The No Surprises

Policy provides regulatory assurances to the permittee, that if "unforeseen circumstances" arise, USFWS and NMFS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed to in the HCP without the consent of the permittee (63 FR 8859). The government will honor these assurances as long as a permittee is implementing the terms and conditions of the HCP, permit, and other associated documents in good faith.

4.1.3 Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act

Essential Fish Habitat (EFH) was established under the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act. Under this act, suitable habitat is considered essential for the sustenance of commercial fisheries. Although the concept of EFH is similar to that of "critical habitat" under the Federal ESA, measures recommended to protect EFH by NMFS are advisory, not prescriptive. EFH includes all habitats necessary to allow commercially valuable aquatic species production needed to support a long-term sustainable fishery and contributions to a healthy ecosystem, and is defined in the Magnuson-Stevens Act as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is further clarified by defining "waters" to include aquatic areas and their associated physical, chemical, and biological properties used by fish, and may include aquatic areas historically used by fish where appropriate; defining "substrate" to include sediment, hard bottom, structures underlying the waters, and associated biological communities; defining "necessary" to mean the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and defining "spawning, breeding, feeding, or growth to maturity" to cover a species' full life cycle.

In response to growing concern about the status of fisheries in the U.S., the Sustainable Fisheries Act of 1996 (Public Law 104-297) was passed by Congress to amend the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265), the primary law governing marine fisheries management in the waters of the United States. Under the Sustainable Fisheries Act, consultation is required by NMFS on any activity that might adversely affect EFH. EFH includes those habitats that fish rely on throughout their life cycles. EFH encompasses habitats necessary to allow sufficient production of commercially valuable aquatic species to support a long-term sustainable fishery and contribute to a healthy ecosystem. The EFH mandate applies to all species managed under a Federal Fishery Management Plan. In California, estuarine species covered under the Sustainable Fisheries Act that occur in the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta), and could be affected by PCWA raw water distribution system O&M activities, include Pacific salmon (includes winter-run, spring-run, and fall-run/late fall-run Chinook salmon), Central Valley steelhead, northern anchovy, Pacific sardine, and starry flounder.

4.1.4 The Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA), first enacted in 1918, domestically implements a series of treaties among the United States and Great Britain (on behalf of Canada), Mexico, Japan, and the former Soviet Union that provide for international migratory bird protection. The MBTA authorizes the Secretary of Interior to regulate the taking of migratory birds; the act provides that it will be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird…" (United States Code (USC) Title 16, Section 703). This prohibition includes both direct and indirect acts, although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. The current list of birds protected by the MBTA contains several hundred species and essentially includes all native birds. The act offers no statutory or regulatory mechanism for obtaining an incidental take permit for the loss of nongame migratory birds.

4.2 STATE REGULATIONS

The following sections describe state regulatory requirements for O&M activities carried out by PCWA.

4.2.1 California Environmental Quality Act

The CEQA was enacted in 1970 as California's counterpart to the NEPA. CEQA requires State and local agencies to identify significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. The objectives of CEQA are to:

- Disclose to decision makers and the public the significant environmental effects of proposed activities; identify ways to avoid or reduce environmental damage
- Prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures
- Disclose to the public reasons for agency approval of projects with significant environmental effects; foster interagency coordination in the review of projects
- Enhance public participation in the planning process (CALFED 2001)

CEQA requires State and local agencies to prepare multidisciplinary environmental impact analysis. By requiring agencies to make decisions based on multidisciplinary studies, CEQA encourages the protection of all aspects of the environment. Depending on the potential impacts of a proposed project, the environmental information is presented in one of three CEQA documents: a notice of exemption (optional), an initial study supporting either a negative declaration or mitigated negative declaration, or an environmental impact report (EIR). A project is defined by CEQA as an activity undertaken by a public agency, or an activity undertaken by a private entity that must receive some discretionary approval from a government

agency, and may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment (CEQA Guidelines, Section 15378).

CEQA documents should be prepared during the agency planning process and must be completed and certified before project approval, which is the decision committing an agency to a definite course of action on the project (Bass et al.,1999). The two State agencies responsible for CEQA administration are the Governor's Office of Planning and Research and the Resources Agency.

The first phase of the CEQA process is a preliminary review of a project to determine whether it is subject to CEQA. A project may not be segmented into small parts for the purpose of avoiding full disclosure of environmental impacts; therefore, a project is the whole of an action which has the potential for resulting in physical change in the environment. The preliminary review is initiated when the project is ready for CEQA consideration. If there is no possibility of a significant impact, or if the activity is outside of the definition of a project, then the activity is outside the jurisdiction of CEQA. Additionally, if the project is described in either a Statutory Exemption or a Categorical Exemption, an optional notice of exemption may be written, and there is no need to continue with the CEQA process.

If the project is under the jurisdiction of CEQA, and not exempt, then an initial study will be conducted to determine whether the project may have significant environmental effects. A significant effect is generally defined as a substantial, or potentially substantial, adverse change in the physical environment, and may be direct, indirect, or cumulative (Bass et al. 1999). When there is evidence that a project may have a significant effect, an EIR is required. The agency must provide public notice of intent to prepare an EIR in the form of a notice of preparation (NOP). If there is no substantial evidence that a project may have a significant environmental impact, or if the project as mitigated or revised will have no significant impact on the environment, then a Negative Declaration (ND) or a Mitigated Negative Declaration (MND) may be prepared. As with an NOP during the EIR process, the agency must provide public notice of intent to adopt an ND or MND.

4.2.2 Porter-Cologne Water Quality Control Act (Title 23, California Water Code)

The Porter-Cologne Water Quality Control Act is the primary state law protecting the quality of California's waters. Enacted by the State Legislature in 1969, the act established the SWRCB and nine RWQCBs. The act gives the RWQCBs the authority to regulate discharges of waste into "waters of the State." "Waters of the State" are defined as "any surface or groundwater, including saline water, within the boundaries of the state" (California Water Code, Section 13050). Under this definition, surface watercourses and water bodies include lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, marshes, inlets, canals, and all other bodies of surface waters. This definition includes, but is broader than, "waters of the United States."

Section 13240 of the act requires each RWQCB to adopt water quality control plans (basin plans), for all areas within the region. Each basin plan establishes narrative and numerical water

quality objectives to ensure the protection of beneficial uses, and a program of implementation for achieving water quality objectives within the basin. In California, the beneficial uses and water quality objectives are the State's water quality standards. The NPDES permitting system is the primary process by which waste discharges are regulated and water quality objectives are met.

Although it is not explicitly part of the basin plans, the EPA rule established CFR Part 131, Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, which is regulated by the RWQCBs to protect aquatic life from exposure to toxic pollutants. These criteria are designed to protect human health and welfare and aquatic life from pollutants in freshwater and marine surface waters. The Central Valley RWQCB's staff report, A Compilation of Water Quality Goals, was last updated in July 2008. The report contains several tables of updated numerical water quality limits compiled from various sources, including EPA's National Recommended (Ambient) Water Quality Criteria, the NTR (**Table 3-5**), and the CTR (**Table 3-6**).

The PCWA raw water distribution system area is situated within the jurisdiction of the Central Valley RWQCB. Of the two water quality control plans, or basin plans, adopted by the Central Valley RWQCB, the PCWA raw water distribution system area is covered within the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins. As stated in the Basin Plan for the Sacramento River and San Joaquin River Basins, it is impractical to list beneficial uses for every surface water body in the region. Therefore, beneficial uses of the unidentified water bodies are evaluated on a case-by-case basis. Often the beneficial uses of a smaller tributary of a river are considered to be the same as those for the larger river. In this case, beneficial uses for study area streams are considered to be the same as those for the Sacramento River described in **Chapter 3**. Although water quality objectives are achieved primarily through the adoption of waste discharge requirements (including permits) and enforcement actions, they are intended to generally govern levels of constituents and characteristics in the water body.

4.2.3 California Endangered Species Act

The California ESA was enacted in 1970 to conserve, protect, restore, and enhance any endangered or threatened species and its habitat (California Fish and Game Code, Section 2052). California ESA Section 2080 prohibits the take of any threatened or endangered species within the state. Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." This definition does not include harm or harass, as the Federal act does. As a result, habitat modification is not necessarily considered take under California ESA. The DFG administers the California ESA for all native species of fish, plants, and wildlife. California ESA requires that DFG maintain lists of threatened and endangered species and provides for protection of species on these lists. The official California listing of endangered and threatened animals is contained in the California Code of Regulations, Title 14. The State-listed species that may be affected by PCWA raw water distribution system O&M activities are listed **Chapter 3**.

Section 2801 of California ESA requires that an incidental take permit be obtained for any project that would result in the take of a listed species. California ESA does not specifically require the preparation of an HCP, but requires an applicant to analyze and explain the project's impacts on listed species, identify measures to mitigate the impacts of taking the listed species, identify funding for implementation, and include a monitoring plan (CALFED 2001). The specific criteria for issuing an incidental take permit are as follows:

- The authorized take is incidental to an otherwise lawful activity.
- The impacts of the authorized take are minimized and fully mitigated.
- The measures required to minimize and fully mitigate the impacts of the authorized take are roughly proportional in extent to the impact of the taking on the species, maintain the applicant's objectives to the greatest extent possible, and are capable of successful implementation.
- Adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with the effectiveness of the measures.
- Issuance of the permit will not jeopardize the continued existence of a State-listed species.

In addition, DFG cannot issue a permit for the take of a fully protected species. Ordinarily, Federal agencies are not subject to California ESA and are not required to obtain California ESA incidental take permits for Federal agency actions. The incidental take permit process is normally initiated in the region where the permitted activity will take place by contacting the appropriate regional office.

Under Section 2800.1, if PCWA obtains a Section 10 incidental take permit under the Federal ESA, they are not required to obtain a separate California ESA incidental take permit, so long as PCWA notifies the Director of DFG in writing that PCWA has received an incidental take permit, and includes in the notice to the Director, a copy of the incidental take permit. The Director must determine that the Federal document is "consistent" with the California ESA. If DFG determines that the Federal permit is not consistent with the California ESA, then the applicant must apply for a State incidental take permit under Section 2801.

4.2.4 California Fish and Game Code – Fully Protected Species

Protection of fully protected species, such as birds, mammals, reptiles, amphibians, and fish, is described in Sections 3511, 4700, 5050, and 5515 of the DFG. These statutes prohibit take or possession of fully protected species. DFG is unable to authorize incidental take of fully protected species when activities are proposed in areas inhabited by those species. DFG has informed non-Federal agencies and private parties that they must avoid take of any fully protected species in carrying out projects.

4.2.5 California Fish and Game Code Section 1602 – Lake and Streambed Alteration Program

California Fish and Game Code (Section 1602) requires an entity to notify DFG of any proposed activity that may substantially modify a river, stream, or lake that flows at least intermittently through a bed or channel. The types of activities that require notification include an activity that will substantially divert or obstruct the natural flow of any river, stream or lake; substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake; or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake. If DFG determines that an activity may substantially adversely affect fish and wildlife resources, a Lake or Streambed Alteration Agreement is prepared by DFG in compliance with CEQA, The agreement include measures to protect fish and wildlife resources while conducting the activity.

4.2.6 California Native Plant Protection Act

In addition to the California ESA, the California Native Plant Protection Act (NPPA) provides protection to endangered and "rare" plant species, subspecies, and varieties of wild native plants in California. The NPPA's definition of "endangered" and "rare" closely parallels the California ESA definitions of "endangered" and "threatened" plant species.

4.3 LOCAL REQUIREMENTS AND CONSIDERATIONS

The following sections describe local requirements and considerations for O&M activities carried out by PCWA.

4.3.1 Placer County Conservation Plan

Placer County has shown an active interest in the county's resources. Placer Legacy is a Placer County program designed to implement the goals of the 1994 Placer County General Plan. Placer Legacy will result in a comprehensive open space and habitat protection plan for Placer County that preserves the diversity of plant and animal communities in the county and addresses a variety of other open space needs, from agriculture and recreation to urban edges and public safety. Placer Legacy is intended to help maintain the county's high quality of life and promote economic vitality.

In June 2000, the Placer County Board of Supervisors directed staff to initiate implementation of the Placer Legacy Program. As part of that direction, staff began preparing an ambitious, large-scale habitat and wetland conservation plan to achieve a number of environmental, economic, and administrative objectives (Placer County Planning Department 2008). This effort, now referred to as the Placer County Conservation Plan (PCCP), is developing the first phase of Placer Legacy Program implementation, which will balance the needs of endangered species and wetlands with a wide variety of stakeholder issues. The PCCP will address the impacts associated primarily with unincorporated growth in western Placer County and growth associated

with the build-out of Lincoln's updated General Plan (Placer County Planning Department 2005c).

The PCCP includes two integrated programs intended to combine State and Federal regulatory requirements into a comprehensive and locally controlled program that will streamline permitting under State and Federal ESAs and other State and Federal environmental laws (Placer County Planning Department 2008). These programs include: (1) a joint Natural Community Conservation Plan (NCCP) and HCP that will protect fish and wildlife and their habitat, and (2) a County Aquatic Resources Program (CARP) that will protect streams, wetlands and other water resources (Placer County Planning Department 2008).

According to the Placer County Planning Department, the NCCP/HCP is intended to:

- Conserve threatened and endangered species in western Placer County
- Avoid or resolve potential conflicts between species conservation and the construction of new urban, suburban, and rural infrastructure and development
- Fulfill the requirements of State and Federal ESAs

The CARP is intended to:

- Protect streams, wetlands, and other water resources
- Avoid or resolve potential conflicts between water resources protection and the construction of new urban and rural infrastructure and development
- Fulfill the requirements of the Federal CWA and analogous State laws

PCWA is a participating entity in the PCCP, along with Placer County, City of Lincoln, and Placer County Transportation Authority on behalf of the South Placer Regional Transportation Authority for the Placer Parkway project. Participating entities will ensure that the PCCP's conservation program is implemented successfully and ensure that projects covered by the PCCP fulfill PCCP mitigation and conservation requirements (Placer County Planning Department 2008).

The PCCP is also intended to provide coverage under the following environmental permits and authorizations to be issued to Participating Entities and extended to projects encompassed by the PCCP (Placer County Planning Department 2008):

- A renewable, 50-year, incidental take permit for 31 species issued by the USFWS under the Federal ESA
- A renewable, 50-year, incidental take permit for three species issued by the NMFS under the Federal ESA

- A renewable, 50-year, incidental take authorization for 34 species issued by the DFG under the NCCP (which also fulfills the requirements of the California ESA)
- A renewable, 5-year, Programmatic Section 404 permit issued by the USACE under the CWA
- A renewable, 5-year, Section 401 certification for the Section 404 permit issued by the Central Valley RWQCB under the CWA
- "Joint Procedures" approved by the USACE that may be used by the Participating Entities for aquatic resource permit processing under the CWA
- A 50-year, programmatic master streambed alteration agreement issued by the DFG.

4.3.2 Placer County Stormwater Management Plan

As part of the NPDES MS4 program, municipalities are required to obtain a permit to develop and implement a Stormwater Management Plan (SWMP) with the goal of reducing the discharge of pollutants to the maximum extent practicable. The Placer County SWMP (2004) provides a comprehensive plan to reduce pollution in stormwater runoff in portions of western Placer County, and is designed to comply with the CWA and meet Federal and State NPDES stormwater regulations for small MS4s. In 2004, the Central Valley RWQCB issued an NPDES permit to Placer County for stormwater management program activities upon receipt of the Placer County SWMP for 2003 to 2008. The permit must be renewed every 5 years. Portions of the PCWA raw water distribution area fall within the NPDES stormwater permit area for western Placer County, and include the Dry Creek, Pleasant Grove Creek, and Auburn Ravine watersheds (Placer County 2004). Placer County's SWMP includes activities to improve and protect the quality of stormwater runoff, including the following control measures:

- Public education and outreach on stormwater impacts
- Public involvement/participation
- Illicit discharge detection and elimination
- Construction site stormwater runoff control
- Postconstruction stormwater management in new development and redevelopment
- Pollution prevention/good housekeeping for municipal operations

The SWMP provides guidance in establishing BMPs before, during, and after construction activities, as well as long-term maintenance BMPs. Placer County reviews and evaluates each program activity at least once a year to assure their BMPs are effective to the maximum extent practicable. Annual reports on Placer County's SWMP are provided to the Central Valley RWQCB.

4.3.3 Placer County Code, Tree Preservation Ordinance

The Tree Ordinance adopted by Placer County is contained within the Placer County Code, under Article 12.16. The ordinance sets a policy for the county to preserve trees through the review of all proposed development activities where trees are present on either public or private property, wherever feasible, while at the same time recognizing individual rights to develop private property in a reasonable manner (Placer County, No Date (ND)). The ordinance article does not categorically prohibit tree removal, and contains numerous exemptions for specific types of activities.

Placer County's tree ordinance sets county-wide requirements for projects within riparian zones, permit requirements for removal of landmark trees, removal of more than 50 percent of trees, and commercial firewood cutting, and establishes tree preservation zones (Placer County, ND).

In addition to the tree ordinance established by Placer County, localities within the county have established their own ordinances, including the City of Rocklin.

4.3.4 Placer County Oak Woodland Management Plan

The Placer County Oak Woodland Management Plan was developed through the Oak Woodlands Conservation Act of 2001, which recognizes the importance of California's oak woodlands, how they enhance the natural and scenic beauty of California, the critical role of the private landowner and the importance of private land stewardship (McCreary, 2004). Placer County's plan provides a consistent policy for oak woodland habitats throughout the county and compliments existing programs and policies including: (1) projects subject to an environmental assessment under the CEQA, (2) projects subject to the Placer County Tree Ordinance, and (3) projects evolving out of the Placer Legacy (Placer County Planning Department, ND).

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CHAPTER 5.0
POTENTIAL EFFECTS, REGULATORY FRAMEWORK, AND BEST MANAGEMENT PRACTICES FOR SYSTEMWIDE OPERATIONS

This chapter provides an overview of the potential effects of PCWA raw water distribution systemwide operations on natural resource conditions in the study area, the regulatory framework for effects, and potential BMPs to reduce effects of operations' activities on natural resources.

5.1 POTENTIAL EFFECTS OF SYSTEMWIDE OPERATIONS ON NATURAL RESOURCES

The potential effects of the PCWA canal system operations on physical and biological resources in the study area are described below.

5.1.1 Yearly Outages

The yearly outages that occur within the PCWA canal system, typically from mid-October to mid-November, result in reductions in the amount of water available to PCWA's Zone 1 customers. The following sections describe potential effects of the yearly canal outages on natural resources.

5.1.1.1 Physical Resources

Potential effects of PCWA canal system operations during yearly PG&E outages on hydrology, water quality, and soils and sediment quality conditions in the study area are described in the following sections.

Hydrology

PCWA operations during yearly outages do not affect hydrologic conditions in Canyon Creek or Auburn Ravine. During the yearly outages, PCWA canal system contributions to streamflow in Canyon Creek and Auburn Ravine, and/or diversions from Canyon Creek and Auburn Ravine do not change as a result of PCWA operations.

Continuous flow data collected from canal and stream sites within PCWA's lower Zone 1 service area during 2006 were evaluated to determine the effects of yearly outages on hydrologic conditions in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine. Continuous flow monitoring locations used for operations' evaluations, and their respective watersheds, are listed in **Table 5-1**.

TABLE 5-1
CONTINUOUS FLOW MONITORING STATIONS IN ZONE 1 FOR OPERATIONS

Secret Ravine Watershed	Miners Ravine Watershed
Secret Ravine at Horseshoe Bar Road	Miners Ravine at Lomida Lane
Tributary to Secret Ravine from Yankee Hill Canal Outlet	Tributary to Miners Ravine from Ferguson Canal Outlet
Tributary to Secret Ravine from Turner Canal Outlet	Tributary to Miners Ravine Stallman Canal Outlet
Boardman Canal Outlet	Tributary to Miners Ravine Baughman Canal Outlet
Secret Ravine at Rocklin Road	Miners Ravine near North Sunrise Avenue

Average daily flows for canal and stream sites evaluated during 2006 outages are shown in **Figure 5-1** for sites within the Secret Ravine watershed, and in **Figure 5-2** for sites within the Miners Ravine watershed.

Based on the average daily flows for sites shown in **Figures 5-1** and **5-2**, streamflow within Secret and Miners ravines is substantially decreased during the yearly outages. Effects on flow conditions in Antelope and Clover Valley creeks are likely similar to conditions shown for Secret and Miners ravines. These data further demonstrate that canal system contributions (including unregulated releases and customer return flows) dominate dry season flows in Secret and Miners ravines. These historic reductions in canal system contributions, and resultant historic decreases in streamflow, are dictated by the PG&E annual water delivery outages.

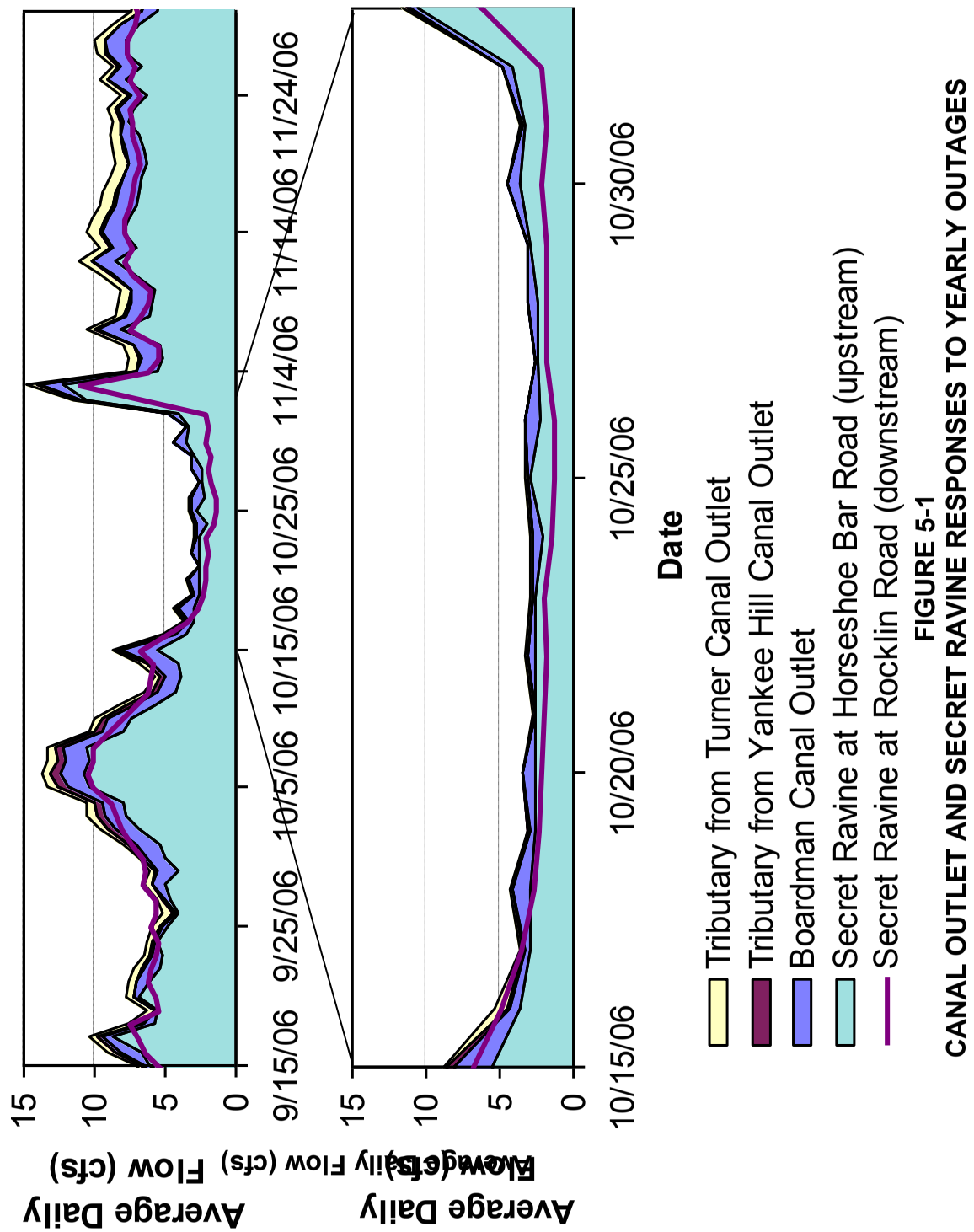

FIGURE 5-1
CANAL OUTLET AND SECRET RAVINE RESPONSES TO YEARLY OUTAGES

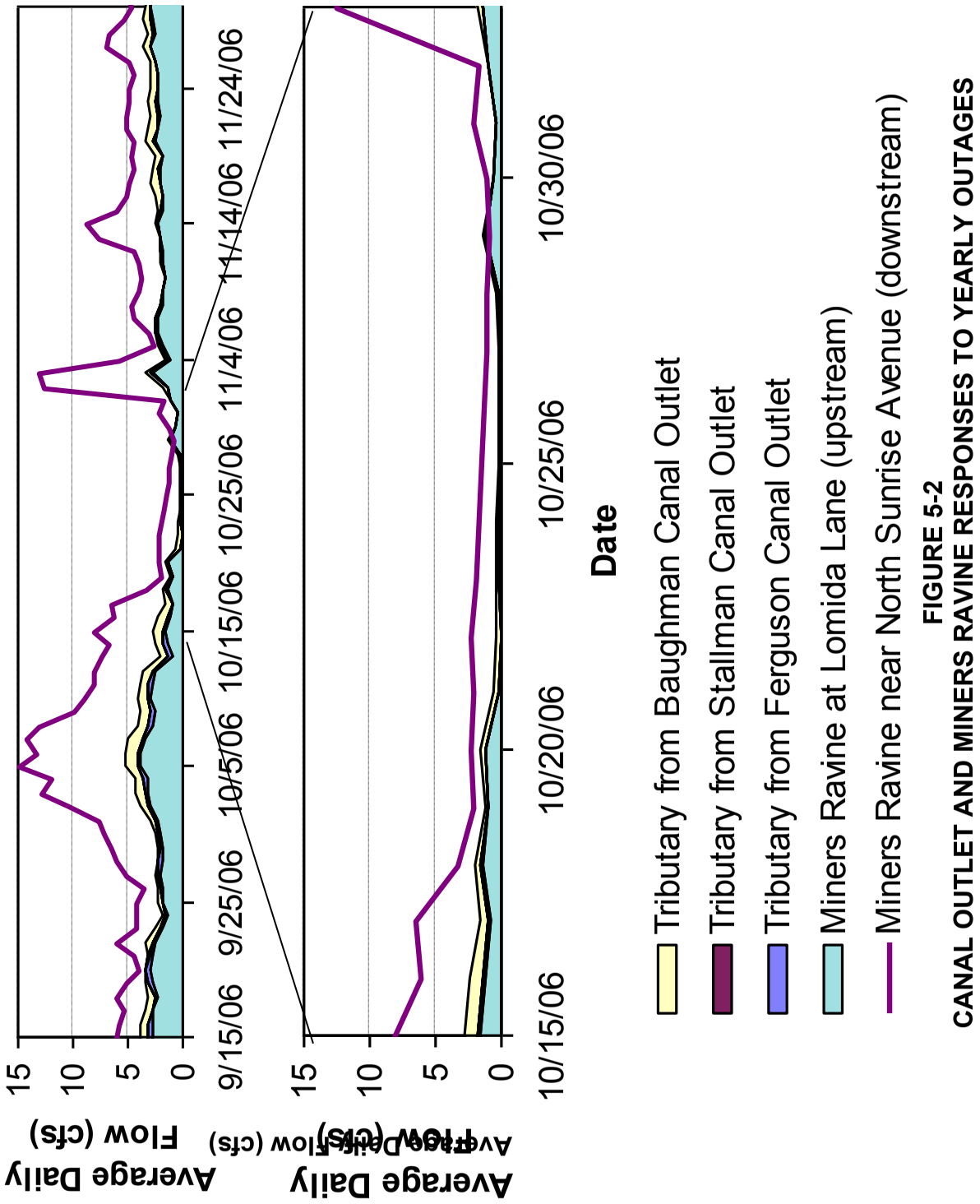

FIGURE 5-2
CANAL OUTLET AND MINERS RAVINE RESPONSES TO YEARLY OUTAGES

Water Quality

The locations listed in **Table 5-2** and shown in **Figures 5-3** and **5-4** were selected to identify potential effects of canal system contributions on water quality conditions in study area streams during yearly outages. The monitoring events targeted outages that occurred at Clover Valley and Mammoth reservoirs, and associated monitoring sites were located in PCWA's Zone 1 service area, within the Antelope Creek, Clover Valley Creek, Secret Ravine, and Miners Ravine watersheds. Outages below the reservoirs occurred on alternate days between the two reservoirs, with outages typically starting at 9:00 a.m., and ending at 9:00 a.m. the following day. Samples were obtained at upstream and downstream locations within the canal system, as well as within the receiving water tributaries and streams downstream of the canal outlets. Monitoring events spanned 2 days for each event. Samples were often collected at each location before, during, and after outage events. Measured water quality parameters are the same as those presented in **Table 3-3** for baseline sampling events, with the exception of mercury. Canal and stream monitoring sites are discussed within their associated watersheds.

Clover Valley Creek Watershed

Water quality monitoring was conducted within the Clover Valley Creek watershed on November 1 and 2, 2006, following the October 31, 2006, outage event. Flows were restored to the PCWA canal system below Clover Valley Reservoir at around 9:00 a.m. on November 1, 2006. The sites monitored within the Clover Valley Creek watershed during the outage event are described below, from the most upstream to the most downstream locations:

- **Clover Valley Reservoir release to Clover Valley Creek (CLVRESR)**
- **Clover Valley Creek at Midas Avenue (CLVRC3)**: located at the Sunset Whitney Country Club on Midas Avenue in Rocklin.

The following section describes water quality conditions at sites in the Clover Valley Creek watershed monitored on November 1 and 2, 2006, during the yearly canal outage. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and Clover Valley Creek are included in **Appendix B**.

TABLE 5-2
WATER QUALITY MONITORING LOCATIONS IN THE PCWA SERVICE AREA FOR YEARLY OUTAGE EVENTS

Site Name	Site ID	Type	Watershed(s)	Outage Start / End Time	Weather
Mammoth Reservoir Outage				Start: 10/30/2006, 9:00 a.m. End: 10/31/2006, 9:00 a.m. Start: 11/01/2006, 9:00 a.m. End: 11/02/006, 9:00 a.m.	11/01/2006: Clear and dry 11/02/2006: Light rain at 11:22 a.m. Heavy rain at 3:38 p.m.
Boardman Canal at Lubeck Road	YB69A	Canal	NA		
Boardman Canal at Powerhouse Road	YB78	Canal	NA		
Boardman Canal below Mammoth Reservoir	YB81	Canal	Miners Ravine / Secret Ravine		
Yankee Hill Canal Tributary	YHTRIB2	Stream	Secret Ravine		
Boardman Canal Outlet Release	BOARDMANCR	Canal	Secret Ravine		
Secret Ravine at Rocklin Road	SECRETRV3	Stream	Secret Ravine		
Secret Ravine at Roseville Parkway	SECRETRV2	Stream	Secret Ravine		
Baughman Canal Outlet Release	BAUGHMANCR	Canal	Miners Ravine		
Tributary to Miners Ravine from Baughman Canal	BCTRIB1	Drainage	Miners Ravine		
Miners Ravine near N. Sunrise Avenue	MINERSRV3	Stream	Miners Ravine		
Clover Valley Reservoir Outage				Start: 10/31/2006, 9:00 a.m. End: 11/01/2006 9:00 a.m.	11/01/2006: Clear and dry 11/02/2006: Light rain at 10:15 a.m.
Clover Valley Reservoir release to Clover Valley Creek and Antelope Canal	CLVRESR	Canal	Clover Valley Creek		
Clover Valley Creek at Midas Avenue	CLVRC3	Stream	Clover Valley Creek		
Antelope Stub Canal near Antelope Canal	ANTSTUBCR	Canal	Antelope Creek		
Antelope Creek at Midas Avenue	ANTC3B	Stream	Antelope Creek		
Antelope Creek near Sierra College Blvd	ANTC3	Stream	Antelope Creek		
Mammoth Reservoir Outage				Start: 10/27/2007, 9:00 a.m. End: 10/28/2007, 9:00 a.m.	10/27/2007: Clear and dry 10/28/2007: Clear and dry
Boardman Canal below Mammoth Reservoir	YB81	Canal	Miners Ravine / Secret Ravine		
Yankee Hill Canal Outlet Release	YANKEECR	Canal	Secret Ravine		
Boardman Canal Outlet Release	BOARDMANCR	Canal	Secret Ravine		
Yankee Hill Canal Tributary	YHTRIB2	Stream	Secret Ravine		
Secret Ravine at Rocklin Road	SECRETRV3	Stream	Secret Ravine		
Secret Ravine at Roseville Parkway	SECRETRV2	Stream	Secret Ravine		

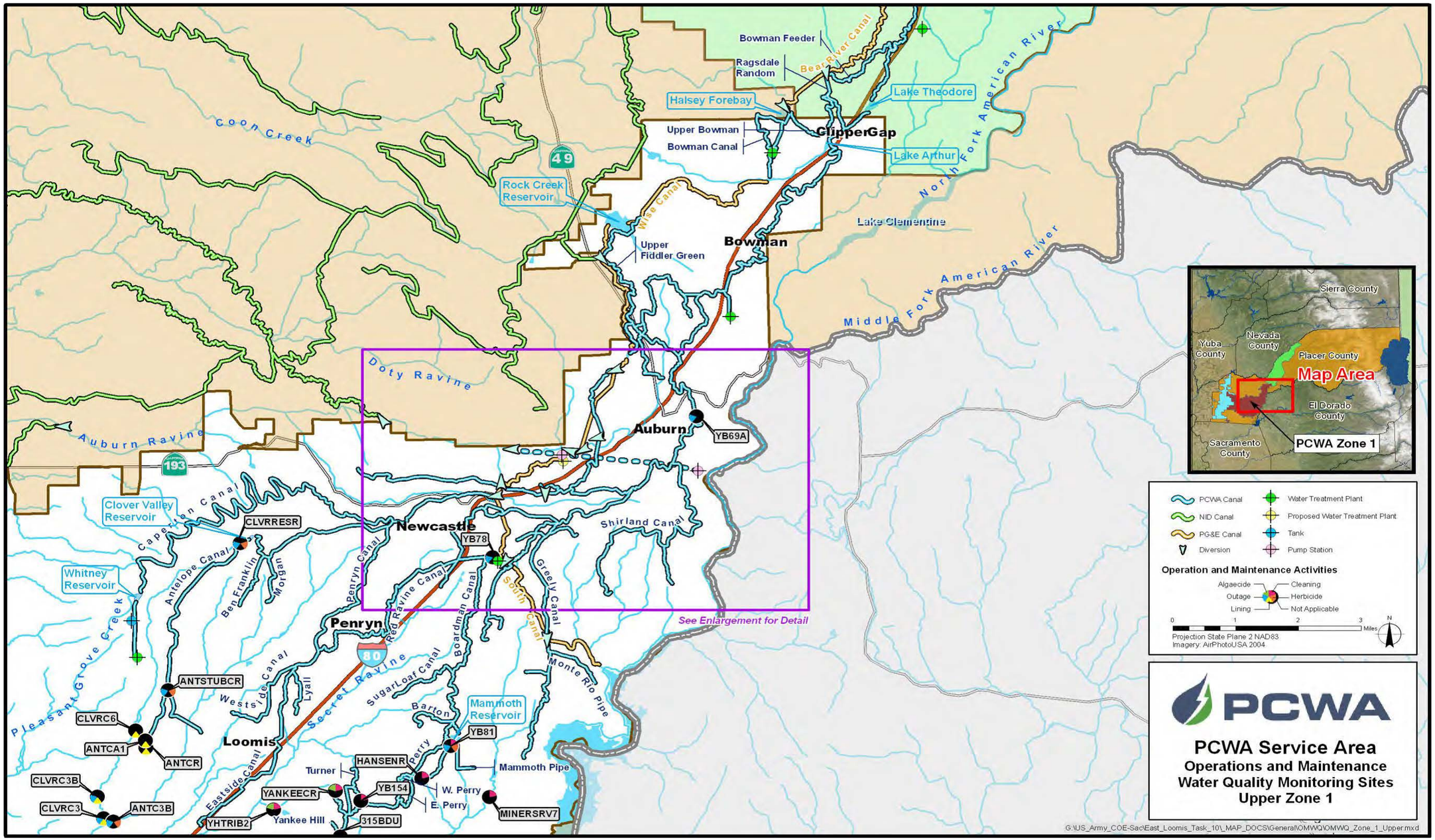

FIGURE 5-3
OPERATIONS AND MAINTENANCE ACTIVITY WATER QUALITY SAMPLING LOCATIONS WITHIN THE UPPER ZONE 1 SERVICE AREA

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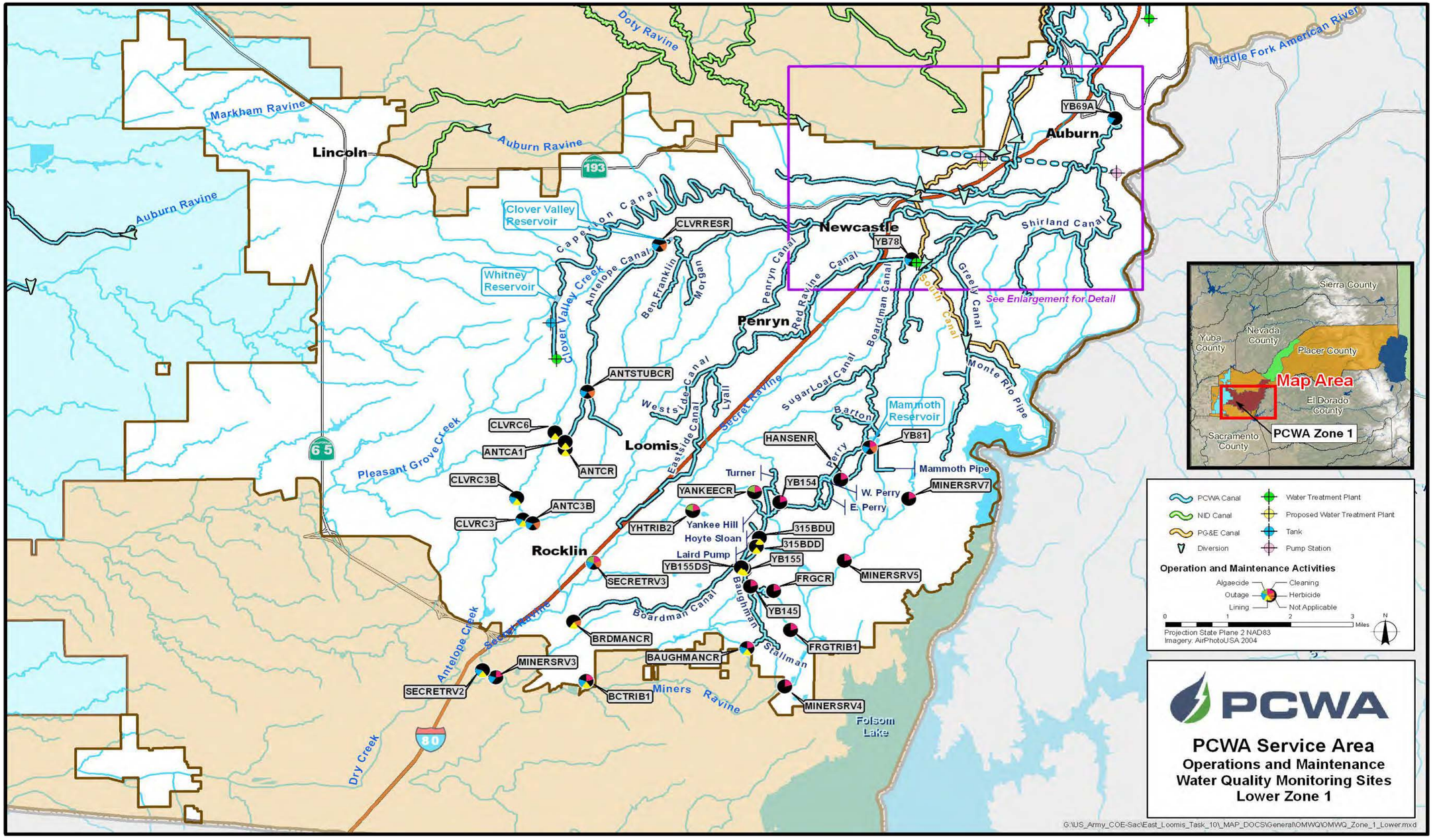

FIGURE 5-4
OPERATIONS AND MAINTENANCE ACTIVITY WATER QUALITY SAMPLING LOCATIONS WITHIN THE LOWER ZONE 1 SERVICE AREA

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Water Temperature and Dissolved Oxygen

PCWA operations during the yearly outages did not result in notable effects on water temperature in Clover Valley Creek. Water temperatures in the Clover Valley watershed were higher during the November 1 to 2, 2006, outage event compared to the fall baseline, collected on December 12, 2006. These temperature differences, however, are likely due to the gradual decreases in air temperature observed between the sampling dates.

DO levels across canal and stream sites monitored during the event were relatively high. Based on the water quality data collected before, during, and after the outage, DO levels in Clover Valley Creek did not appear to be affected by the yearly outage.

pH, Alkalinity, and Hardness

Values for pH across sites monitored in the Clover Valley Creek watershed were not affected by the outage. Alkalinity and calculated total hardness levels were generally higher at CLVRC3 than at CLVRESR, suggesting that canal system contributions may decrease alkalinity and hardness conditions in Clover Valley Creek.

Total Suspended Solids and Turbidity

Based on sampling results, TSS concentrations and turbidity in Clover Valley Creek did not appear to be affected by the canal system outage. TSS concentrations and turbidity did increase at Clover Valley Creek on November 2, 2006 (after canal flows were restored below Clover Valley Reservoir), most likely in response to runoff contributions to streamflow during the November 2, 2006, precipitation event.

Specific Conductivity and Ions

Based on water quality data collected across the Clover Valley Creek watershed, SC, calcium, iron, magnesium, sodium, chloride, and sulfate concentrations in Clover Valley Creek did not appear to be affected by the yearly canal outages. Some constituents, including SC, calcium, magnesium, and iron did have higher concentrations in samples collected from Clover Valley Creek on November 2, 2006, most likely in response to runoff contributions to streamflow during the November 2, 2006, precipitation event.

Nitrate and potassium concentrations are not affected by yearly outages. Nitrate levels were at or slightly above the nondetect level (0.1 mg/L) throughout the monitoring period, while potassium concentrations were either below the detection limit (1 mg/L) or very low across all sites. Potassium reached a maximum level of 2.5 mg/L at CLVRC3.

Trace Elements

Barium and zinc concentrations across sites in the Clover Valley Creek watershed showed similar trends as TSS and turbidity in samples obtained during the outage event, and did not appear to be affected by yearly outages. Barium levels at CLVC3 ranged from 73 to 110 µg/L, compared to the maximum observed during routine canal operations, 42 µg/L. Concentrations of barium and zinc were higher at CLVRC3 on November 2, 2006, most likely in response to runoff contributions to streamflow during the to the November 2, 2006, precipitation event. Aluminum concentrations at canal and stream sites monitored during the yearly outage event were comparable for most samples. One sample obtained at Clover Valley Creek on November 2, 2006, had a substantially higher concentration of aluminum compared to previous samples and

samples obtained during baseline sampling events. Copper concentrations were consistently low across canal sites and slightly higher in Clover Valley Creek. The highest measured concentration of copper in Clover Valley Creek during yearly outage sampling event was 8.5 µg/L. All cadmium levels were below the detection limit (0.5 µg/L) at Clover Valley Creek watershed sites during the yearly outage monitoring event.

Antelope Creek Watershed

Water quality monitoring was conducted within the Antelope Creek watershed on November 1 and 2, 2006, following the October 31, 2006, outage event. Flows were restored to the PCWA canal system below Clover Valley Reservoir at around 9:00 a.m. on November 1, 2006. The sites monitored in the Antelope Creek watershed during the outage event are described below, from the most upstream to the most downstream locations:

- **Antelope Stub Canal near Antelope Canal (ANTSTUBCR)**: located at the head of Antelope Stub Canal and Antelope Canal.

- **Antelope Creek at Midas Avenue (ANTC3B)**

The following section describes water quality conditions at sites in the Antelope Creek watershed monitored on November 1 and 2, 2006, during the yearly canal outage. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and Antelope Creek are included in **Appendix B**.

Water Temperature and Dissolved Oxygen

Based on measurements taken at sites, yearly outages did not appear to affect water temperature conditions in Antelope Creek. Little to no water temperature changes were observed at ANTSTUBCR and ANTC3/ANTC3B during monitoring for the November 1, 2006, outage event at Clover Valley Reservoir. Water temperatures measured within the Antelope Creek watershed ranged from 50.8 to 59.0 °F.

DO concentrations in Antelope Creek during and after the outage at Clover Valley Reservoir were comparable to conditions during baseline sampling events, and are not likely affected by PCWA operations during yearly outages. Overall, DO concentrations were higher at ANTSTUBCR than at ANTC3/ANTC3B.

pH, Alkalinity, and Hardness

Based on water quality data collected, yearly outages did not affect pH, alkalinity, and hardness in Antelope Creek. Results for pH, alkalinity, and hardness across sites in the Antelope Creek watershed were fairly invariable during and after the outage at Clover Valley Reservoir. Alkalinity and hardness values were consistently lower, and pH was consistently higher, within the canal system compared to Antelope Creek.

Total Suspended Solids and Turbidity

TSS concentrations and turbidity levels in samples collected from Antelope Creek were not affected by PCWA canal system operations during the yearly outage sampling event. TSS and turbidity values were consistently low across all sites monitored during the event.

Specific Conductivity and Ions

Based on water quality monitoring during the yearly outage event, SC and ion concentrations did not appear to be affected by PCWA operations during yearly outages. Little SC variation was observed across sites monitored in the Antelope Creek watershed during the yearly outage event. Overall, SC was higher in Antelope Creek compared to the canal system.

Calcium, iron, magnesium, sodium, chloride, and sulfate concentrations were also consistently higher in Antelope Creek, and demonstrated little variation during and after the outage event. Nitrate and potassium concentrations were low across all sites sampled during and after the outage at Clover Valley Reservoir.

Trace Elements

Barium and copper concentrations in samples collected from Antelope Creek increased after flows were restored to Antelope Canal following the Clover Valley Reservoir outage. These increases may be attributed to precipitation in the watershed and runoff contributions to streamflow, or to PCWA operations during the yearly outage. Aluminum concentrations in Antelope Creek also increased, but were comparable to concentrations measured during baseline sampling events. Zinc concentrations in samples were fairly constant during and after the outage, and were comparable across sites sampled in the Antelope Creek watershed. All samples collected had cadmium concentrations below the detection limit (0.5 µg/L).

Secret Ravine Watershed

As shown in **Table 5-2**, water quality monitoring in the Secret Ravine watershed was conducted during two different outage events at Mammoth Reservoir; November 1 and 2, 2006, following the November 1, 2006, outage, and October 28, 2007, following the October 27, 2007, outage. For the 2006 outage monitoring event, flows were restored to the PCWA canal system below Mammoth Reservoir at around 9:00 a.m. on October 31, 2006, and November 2, 2006. Flows were restored to the PCWA canal system below Mammoth Reservoir at around 9:00 a.m. on October 28, 2007, for the 2007 outage monitoring event. Water quality was monitored at three canal sites (Boardman Canal at Lubeck Road (YB69A), YB78, and YB81) and one stream site in Secret Ravine (SECRETRV3), for the November 1 to 2, 2006, monitoring event. On October 28, 2007, monitoring occurred at three canal sites (YB81, YANKEECR, Boardman Canal Outlet Release (BOARDMANCR)) and three stream sites (YHTRIB2, SECRETRV3, Secret Ravine at Roseville Parkway (SECRETRV2)). Only water temperature, DO, pH, SC, turbidity, alkalinity, sulfate, and copper were measured during the October 28, 2007, event. The sites monitored during the yearly outage events are described below, from the most upstream to the most downstream locations:

- **Boardman Canal at Lubeck Road (YB69A)**: located east of the railroad tracks on Lubeck Road in Auburn. This is the most upstream monitoring site for yearly outage events.

- **Boardman Canal at Powerhouse Road (YB78)**

- **Boardman Canal below Mammoth Reservoir (YB81)**

- **Yankee Hill Canal Outlet Release (YANKEECR)**
- **Tributary to Secret Ravine from Yankee Hill Canal (YHTRIB2)**
- **Secret Ravine at Rocklin Road (SECRETRV3)**
- **Boardman Canal Outlet Release (BOARDMANCR)**: located at the end of the Boardman Canal. Unregulated releases from the Boardman Canal currently flow through a planned residential development, and outflow directly to Secret Ravine. This is the most downstream terminal point within the PCWA raw water distribution system.
- **Secret Ravine at Roseville Parkway (SECRETRV2)**: located just upstream from its confluence with Miners Ravine.

The following section describes water quality conditions during the yearly canal outage at sites in the Secret Ravine watershed monitored on November 1 and 2, 2006, and October 28, 2007. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and Secret Ravine are included in **Appendix B**.

Water Temperature and Dissolved Oxygen

Based on water quality data obtained during sampling events, water temperature and DO conditions in Secret Ravine do not appear to be affected by PCWA operations during yearly outages. Water temperature and DO values at sites monitored in Secret Ravine were comparable to conditions sampled during baseline sampling events. Water temperature and DO fluctuations at sites are likely attributed to natural variability due to diurnal effects, such as photosynthesis and respiration.

pH, Alkalinity, and Hardness

The yearly outages did not appear to affect pH within the PCWA canal system, but measured values for pH in Secret Ravine on November 1 and 2, 2006, fluctuated from 6.67 to 7.51. No effects on pH were observed at sites monitored in the Secret Ravine watershed during the October 28, 2007, sampling event. Alkalinity and hardness are not likely affected by yearly outages. Measured values for all sites in the Secret Ravine watershed were comparable to values measured during baseline sampling events.

Total Suspended Solids and Turbidity

Based on data collected on November 1 and 2, 2006, for the yearly outages, TSS levels in Secret Ravine are not affected by the yearly outages. One sample obtained at SECRETRV2 did have a high concentration of TSS, but the value is most likely associated with heavy rain and runoff contributions to streamflow at the time of sampling. TSS was not evaluated during the October 2007 sampling event.

The yearly outages may affect turbidity conditions in Secret Ravine. Measured values of turbidity at canal sites during the November 2006 sampling event fluctuated during sampling, but did not result in variation in turbidity at Secret Ravine sampling sites. During the October 2007 sampling event, turbidity values at canal and stream sites in the Secret Ravine watershed

increased after flows were restored to the canal system (**Figure 5-5**). These higher values were likely attributed to mobilization of fine sediment and organic material that had settled when canals were dewatered during the outage.

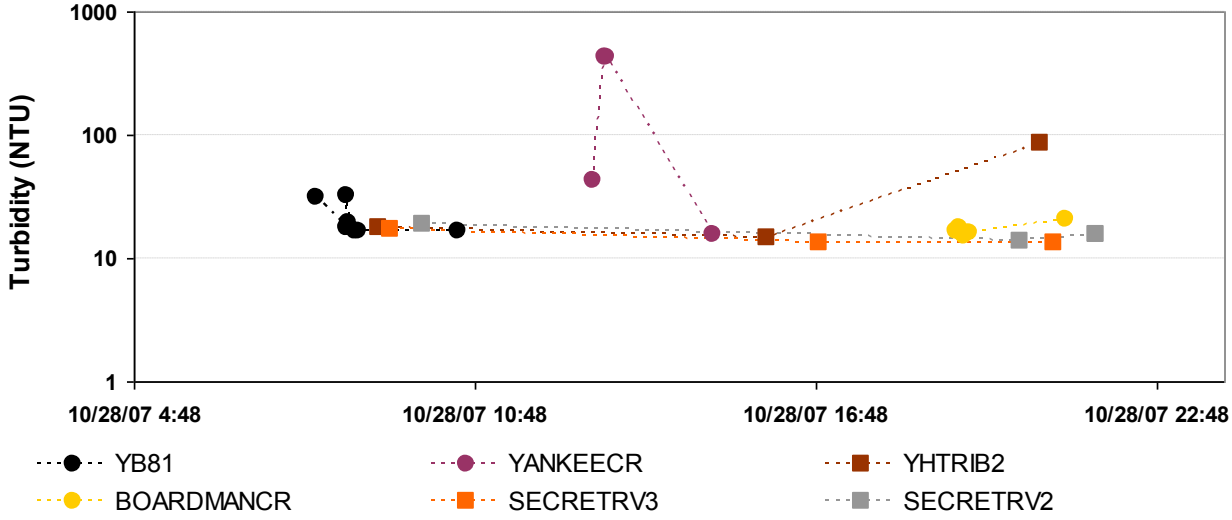

FIGURE 5-5
MEASURED TURBIDITY VALUES AT SECRET RAVINE WATERSHED SITES DURING OCTOBER 2007 YEARLY OUTAGE SAMPLING EVENT

Specific Conductivity and Ions

Based on water quality monitoring during the yearly outage events, SC and ion concentrations at sites sampled in Secret Ravine did not appear to be affected by PCWA operations during yearly outages. Measured SC values remained relatively low at all sites sampled during the November 2006 and October 2007 outages, with Secret Ravine sites exhibiting higher values than canal sites. Calcium, magnesium, sodium, chloride, and sulfate concentrations were also consistently higher in Secret Ravine, and demonstrated little variation during and after the November 2006 outage event. Iron concentrations across canal and stream sites increased after heavy rainfall in the watershed, and are most likely associated with runoff contributions to streamflow at the time of sampling. Nitrate and potassium concentrations were low across all sites sampled in the Secret Ravine watershed during and after the November 2006 outages at Mammoth Reservoir.

Trace Elements

Based on water quality data collected, PCWA operations during the November 2007 yearly outage event did not affect barium, cadmium, copper, or zinc concentrations in Secret Ravine. Barium, copper, and zinc concentrations did increase at canal and stream sites on November 2, 2006, likely due to heavy rain and runoff contributions to streamflow. During the precipitation event, barium and copper concentrations reached 58 µg/L and 21 mg/L, respectively, at SECRETRV3, while zinc concentrations at YB69A and SECRETRV3 measured 71 and 60 µg/L, respectively. All samples had cadmium concentrations below the detection limit (0.5 µg/L) during the 2006 yearly outage monitoring event. Aluminum concentrations at canal sites monitored during the November 2006 yearly outage event were consistently higher than samples

obtained in Secret Ravine, and higher at all sites after heavy rain in the watershed, most likely due to heavy rain and runoff contributions to canal and streamflows at the time of sampling.

During the October 2007 sampling event, measured copper values at canal and stream sites in the Secret Ravine watershed increased after flows were restored to the canal system (**Figure 5-6**). These higher values were likely attributed to mobilization of copper associated with fine sediment and organic material that had settled when canals were dewatered during the outage.

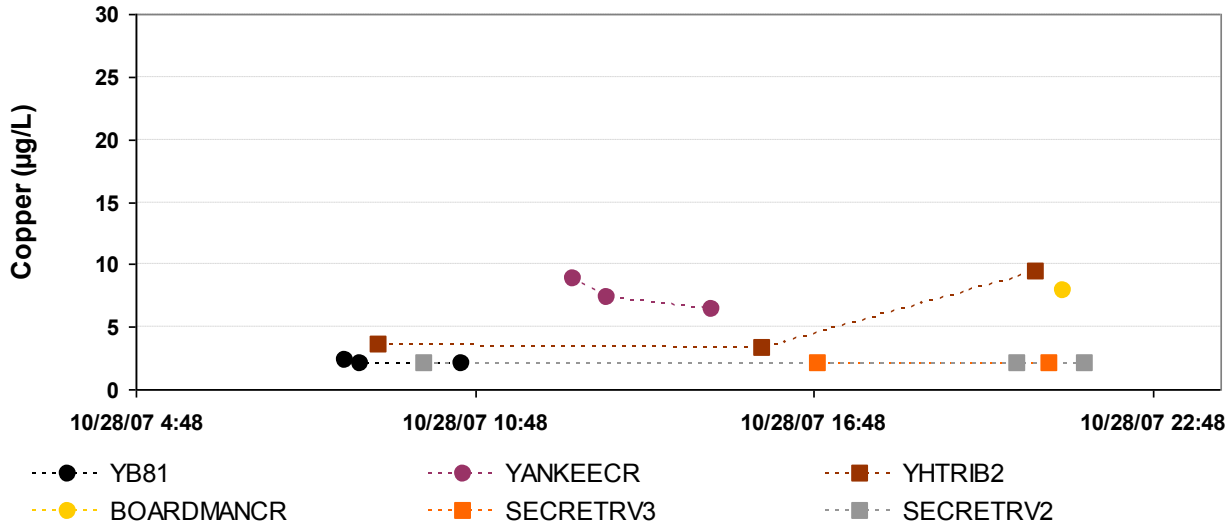

FIGURE 5-6
MEASURED COPPER CONCENTRATIONS AT SECRET RAVINE WATERSHED SITES DURING THE OCTOBER 2007 YEARLY OUTAGE SAMPLING EVENT

Miners Ravine Watershed

As with the Secret Ravine watershed, water quality monitoring in the Miners Ravine watershed was conducted during two different outage events at Mammoth Reservoir; November 1 and 2, 2006, following the November 1, 2006 outage, and October 28, 2007, following the October 27, 2007, outage. For the 2006 outage monitoring event, flows were restored to the PCWA canal system below Mammoth Reservoir at around 9:00 a.m. on October 31, 2006, and November 2, 2006. Flows were restored to the PCWA canal system below Mammoth Reservoir at around 9:00 a.m. on October 28, 2007, for the 2007 outage monitoring event. BAUGHMANCR was monitored along with some canal monitoring sites also used for analysis within the Secret Ravine watershed (YB69A, YB78, and YB81). Water quality was monitored at two stream sites during this event (BCTRIB1 and MINERSRV3). During the October 28, 2007, monitoring sites were located at YB81 and MINERSRV3. Only water temperature, DO, pH, SC, turbidity, alkalinity, sulfate, and copper were measured during the October 28, 2007, event. The sites monitored in the Miners Ravine watershed during the yearly outage events are described below, from the most upstream to the most downstream locations:

- **Boardman Canal at Lubeck Road (YB69A)**
- **Boardman Canal at Powerhouse Road (YB78)**
- **Boardman Canal below Mammoth Reservoir (YB81)**
- **Baughman Canal Outlet Release (BAUGHMANCR)**
- **Tributary to Miners Ravine from Baughman Canal (BCTRIB1)**
- **Miners Ravine near N. Sunrise Avenue (MINERSRV3)**

The following section describes water quality conditions during the yearly canal outage at sites in the Miners Ravine watershed monitored on November 1 and 2, 2006, and October 28, 2007. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and Miners Ravine are included in **Appendix B**.

Water Temperature and Dissolved Oxygen

Based on results of water quality monitoring, water temperature and DO conditions in Miners Ravine were not affected by PCWA operations during the yearly outages. Water temperature and DO values at BCTRIB1 and MINERSRV3 were comparable to values measured during baseline sampling events. Water temperature and DO fluctuations at sites were likely attributed to natural variability due to diurnal effects, such as photosynthesis and respiration.

pH, Alkalinity, and Hardness

Monitoring results suggest that Miners Ravine pH, alkalinity, and hardness values were not likely affected by PCWA operations during yearly outages. Measured values for pH and alkalinity decreased at BCTRIB1 and MINERSRV3 following the outage at Mammoth Reservoir. These fluctuations were not likely associated with the decreased canal flows because pH and alkalinity values at canal sites remained consistent. Values for pH, alkalinity, and hardness across canal and stream sites in the Miners Ravine watershed were comparable to values measured during baseline sampling events.

Total Suspended Solids and Turbidity

Measured TSS concentrations at stream sites monitored in the Miners Ravine watershed during the November 2006 event were not affected by PCWA operations during the yearly outages. TSS concentrations were close to or below detection limits at all sites monitored on November 1, 2006, and increased at sites sampled during and after heavy rain on November 2, 2006. Higher TSS concentrations at sites sampled on November 2, 2006, are likely associated with heavy rain and runoff contributions to flow at sites during sampling. TSS was not evaluated during the October 2007 sampling event.

Turbidity values measured at sites during the November 2006 outage event followed the same trends described for TSS, demonstrating no effects associated with PCWA operations during the yearly outages. Measured turbidity values during the October 2007 also suggest that the yearly outages are not likely to affect turbidity in Miners Ravine.

Specific Conductivity and Ions

Based on results of water quality monitoring, PCWA operations during yearly outages did not affect SC and ion concentrations in Miners Ravine. Measured SC and ion values at sites were comparable to values measured during baseline sampling events at sites in the Miners Ravine watershed. SC was consistently low (less than 0.2 mS/cm) across all sites during monitoring, with the exception of one sample obtained at the Baughman Canal Outlet Release on November 1, 2006 (0.5 mS/cm). Calcium, magnesium, sodium, chloride, and sulfate concentrations were also consistently higher in Miners Ravine during the November 2006 outage event, and demonstrated little variation during and after the outage event. Iron, nitrate, and potassium concentrations were low across all sites sampled in the Miners Ravine watershed, and had slightly higher concentrations in Miners Ravine during heavy rain. Measured sulfate concentrations during the October 2007 outage event were also consistently higher in Miners Ravine, and demonstrated little variation at canal and stream sites during and after the outage event.

Trace Elements

Barium, zinc, and copper concentrations were consistently low across canal and stream sites during the November 2006 yearly outage, but increased following heavy rain in the watershed. Aluminum concentrations were comparable to values measured during baseline sampling events, but also increased across sites after heavy rain. The higher concentrations of barium, zinc, copper, and aluminum follow the same trend as TSS, and are most likely due to high flows at sites during sampling, which may have may have mobilized sediments and metals bound in sediments. Copper concentrations across canal and stream sites were consistently low during the November 2006 and October 2007 yearly outage monitoring events. All cadmium concentrations were below the detection limit (0.5 µg/L) during the 2006 yearly outage monitoring event.

Soils and Sediment Quality

Soils and sediment quality in the study area are not likely to be affected by PCWA activities during the annual PG&E delivery outages. PCWA operations during the yearly outages do not disturb soils in the study area, or introduce constituents that may affect sediment quality.

5.1.1.2 Biological Resources

The following sections describe effects of PCWA operations during yearly outages to terrestrial and aquatic habitat and species.

Terrestrial Habitat and Species

Yearly outages are not expected to have substantial effects on terrestrial habitats and species. Historic decreases in water delivery during the PG&E outages could result in temporary minimal decreases in the extent of wetland habitats that may be indirectly supported by canal deliveries. This could have minimal effects on species that use wetland habitats such as foraging birds and amphibians by decreasing the amount of available habitat, but these effects are representative of historic conditions within the study area.

Other changes in water quality, such as increased water temperature, decreased DO, and increased pH and alkalinity could have some negative effects on plants and wildlife on the margins of canals and tributaries; however, any effects are expected to be very minimal because these changes are anticipated to be very small.

Aquatic Habitat and Species

PCWA's operations during yearly outages likely affect fish found in the canal system, potentially including brown trout (*Salmo trutta*), rainbow trout (*Oncorhychus mykiss*), catfish (*Ictalurus* or *Ameiurus* sp.), Sacramento sucker (*Catastomus occidentalis*), Sacramento pikeminnow (*Ptychocheilus grandis*), black bass (*Micropterus* sp.), and mosquitofish (*Gambusia affinis*) (PCWA 2004; field observations, MWH). Potential effects to fish in the canal system are associated with canal system dewatering.

Aquatic habitat and species in Canyon Creek and Auburn Ravine are not affected by PCWA operations during the PG&E annual outages since the operations do not alter hydrologic and water quality conditions in Canyon Creek and Auburn Ravine.

As described above and shown in **Figure 5-2**, decreased and intermittent canal system flows during the PG&E yearly outages result in reduced flow contributions from the PCWA canal system and flow reductions in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine. These flow reductions likely affect aquatic habitat and species in these streams. The reduced canal system contributions, and resultant decreased flow in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine are dictated by the PG&E annual water delivery outages. PCWA's reliance on stored water in surface reservoirs and water delivered through the ARPS to supplement flow to WTPs and canal customers during the yearly outages limits PCWA's ability to maintain canal system flows. Antecedent hydrologic conditions may reduce or accentuate the effects of PCWA's operations during yearly outages on aquatic habitat and species in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine.

Special Status Species

PCWA operations during PG&E's yearly outages are not expected to have substantial effects on terrestrial special status species. Historic decreases in water delivery during the PG&E outages could result in temporary minimal decreases in the extent of wetland habitats that may be indirectly supported by the canal system. This could have minimal effects on species that use these habitats wetland habitats, such as foraging special status bird and amphibian species by decreasing the amount of available habitat, but these effects are representative of historic conditions within the study area. The typical timing of the outage period from mid-October to mid-November is outside of the breeding period for special status amphibians. California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds mid-March through early June, and the western spadefoot toad breeds late January through July (Stebbins 2003).

Other changes in water quality, such as increased water temperature, decreased DO, and increased pH and alkalinity could have some negative effects on plants and wildlife on the

margins of canals and tributaries; however, any effects are expected to be minimal because these changes are anticipated to be small.

Fall-run Chinook salmon and Central Valley steelhead spawn in both Secret and Miners ravines. Because streamflows are typically lower, and water temperatures higher in the Dry Creek watershed, spawning often occurs later than in other Central Valley streams. Historic reductions in streamflow contributions from the canal system during PG&E's yearly outages may also delay the spawning migration.

Fall-run Chinook salmon may begin spawning activities from early November to December, which may, in some years, coincide with the tail end of PG&E's yearly outages and the resulting streamflow reductions. If the reduction of canal system contributions to streamflow occurs after spawning has begun, there is a potential for redd dewatering, providing the flow and stage decrease occurs where spawning has occurred.

Central Valley steelhead typically do not start their upstream migration until after a large storm event, typically after the PG&E yearly outages are completed. Spawning also occurs after the outages, so spawning and egg incubation would not be affected by the outages. Juvenile outmigration typically occurs before the PG&E outages. Steelhead do, however, rear year-round, especially in Secret Ravine, and may be affected by the PG&E yearly outages through the reduction or loss of rearing habitat, and the potential increase in predation rates. The level of effect to the rearing steelhead is dependent upon how low the flows drop during the annual outages, and if the water temperatures increase. If flows decrease too much, or if water temperatures rise too high, steelhead will move to locations more suitable, most likely downstream into Dry Creek.

5.1.2 Seasonal Customer Delivery Schedule Changes

The following sections describe potential effects of PCWA's seasonal customer delivery schedule changes on physical and biological resources in the study area. PCWA's customer delivery schedule changes typically take 1 week to complete, with minimal interruptions to service. Post-irrigation season customer delivery schedule changes coincide with yearly outages.

5.1.2.1 Physical Resources

Potential effects of PCWA seasonal delivery schedule changes on hydrology, water quality, and soils and sediment quality conditions in the study area are described in the below sections.

Hydrology

PCWA customer delivery schedule changes do not affect hydrologic conditions in Canyon Creek. Diversions from Canyon Creek to PCWA's Pulp Mill Canal, and resulting streamflow in Canyon Creek, are maintained during delivery schedule changes.

Hydrologic conditions in Auburn Ravine are not affected by customer delivery schedule changes. PCWA customer delivery schedule changes along Auburn Ravine and in the Zone 5 service area do not require any exchanges of orifices at customer delivery points. PCWA's water diversions to Auburn Ravine are limited to the irrigation season, when natural flows in Auburn

Ravine are low. Also, PCWA contributions to streamflow in Auburn Ravine during the irrigation season are a fairly small fraction of the flow augmentation that occurs through other irrigation conveyance and return flow, hydroelectric generation releases, and treated effluent discharges.

Delivery schedule changes after the irrigation season do not affect the hydrologic conditions in Clover Valley Creek, Antelope Creek, Secret Ravine, or Miners Ravine. As described above, post-irrigation season delivery schedule changes coincide with yearly outages.

Delivery schedule changes during the irrigation season also are not likely to affect hydrologic conditions in Clover Valley Creek, Antelope Creek, Secret Ravine, or Miners Ravine. The orifice changes at customer delivery points do not require canal dewatering and have minimal interruptions to service.

Water Quality

As described above, PCWA's activities associated with delivery schedule changes typically coincide with other O&M activities that require canal dewatering, such as yearly outages, canal lining/guniting, and canal cleaning and flushing. However, because delivery schedule changes do not require dewatering, water quality conditions in study area streams are not likely to be affected by PCWA operations during irrigation season delivery schedules changes. It is possible that sediment and/or debris could enter the canals from canal banks if PCWA personnel need to enter the canals to switch out orifice plates, but would not likely result in water quality effects at canal outlets. Effects of outages during the fall season delivery schedule changes are described above in the yearly outages section.

Soils and Sediment Quality

Soils and sediment quality in the study area are not likely to be affected by PCWA's seasonal customer delivery schedule changes. PCWA operations during seasonal customer delivery schedule changes do not disturb soils in the study area, or introduce constituents that may affect sediment quality.

5.1.2.2 Biological Resources

The following sections describe effects of PCWA operations during seasonal customer delivery schedule changes on terrestrial and aquatic habitat and species.

Terrestrial Habitat and Species

Very minimal effects are likely to occur to terrestrial habitats and species, mostly associated with trampling vegetation while orifices are being changed.

Aquatic Habitat and Species

Aquatic habitat and species are not affected by seasonal customer delivery schedule changes. As described above, hydrology and water quality conditions in study area streams are not likely affected by seasonal customer delivery schedule changes.

Special Status Species

Effects on special status plant species (see **Tables 3-12** and **3-13**) are unlikely to occur because they are not expected to be present along canal banks. Some potential negative effects could occur to special status raptors if they are nesting near work areas that may be disturbed by noise. Special status raptors potentially occurring in the study area include Swainson's hawk, Cooper's hawk (*Accipiter cooperi*), Northern Goshawk (*Accipiter gentiles*), White-tailed Kite, and Northern Harrier. As mentioned above, the nesting period for raptors is generally March 1 to August 15.

Because hydrology and water quality conditions in study area streams supporting salmonids are not altered, Central Valley steelhead and fall-run Chinook salmon are not affected by seasonal customer delivery schedule changes.

5.1.3 Seasonal Flood Management Practices

PCWA's use of selected outlet locations along canals to release stormwater during precipitation events with high canal flows for flood management has the potential to affect natural resource conditions in the study area. The following sections describe potential effects of PCWA's flood management practices on natural resources in the study area.

5.1.3.1 Physical Resources

Potential effects on hydrology, water quality, and soils and sediment quality conditions in the study area are described in the below sections.

Hydrology

PCWA's use of select canal outlets for stormwater releases during precipitation events likely results in temporary increases in streamflow in many unnamed drainages within the study area. Flow conditions in study area streams, however, are not expected to be affected by stormwater releases from PCWA's canal system due to the effects of other runoff contributions to streamflow within the watersheds of study area streams. Hydrologic conditions in study area streams during PCWA flood management activities are likely similar to conditions generally exhibited across study area streams during periods of high precipitation runoff.

Water Quality

As described previously, the tributaries and streams in the PCWA raw water distribution area are naturally prone to flooding. High flows during storm events can cause excessive erosion and may carry debris, such as tree branches and trash, into canals and streams. PCWA's flood management practices during these events likely have minimal effects on water quality conditions in study area streams. Additional flow releases from canal outlets may result in a short-term increase in erosion downstream from canal outlets in areas with soils of high erodibility and little riparian vegetation. The increased flows in many unnamed drainages within the study area may result in bank erosion near the canal outlet releases, and potential sediment loading to receiving waters. The potential for bank erosion near the canal outlets may result in increased sediment transport downstream, increased TSS and turbidity, and increased loading of

constituents associated with soils at eroded banks. Water quality conditions in study area streams during PCWA's flood management activities are likely similar to conditions generally observed during periods of high precipitation runoff.

Soils and Sediment Quality

PCWA flood management practices likely have minimal effects on soils and sediment quality in the study area. Unregulated releases from canal outlets during periods of high canal flows would reduce the effects of bank erosion along unlined canals, and the increased flows in unnamed drainages downstream from canal outlets may result in bank erosion near the canal outlet releases, and potential sediment loading to receiving waters.

5.1.3.2 Biological Resources

The following sections describe potential effects of PCWA's flood management practices on terrestrial and aquatic habitat and species, and special-status species.

Terrestrial Habitat and Species

Direct effects to terrestrial habitats and species are not expected. Stormwater releases would reduce the effects of bank erosion along canals and would therefore lessen potential negative impacts resulting from flood flows. The increased flows in many unnamed drainages within the study area may result in bank erosion near the canal outlet releases, and potential sediment loading to receiving waters. This would have the potential to wash away amphibian eggs, if present in the outlet areas, or bury wetland or riparian vegetation. These effects are expected to be minimal due to the limited area affected and similar to conditions generally exhibited across study area streams during periods of high precipitation runoff.

Aquatic Habitat and Species

PCWA's seasonal flood management practices are not likely to affect aquatic habitat and species in the study area. High flows within the PCWA canal system that occur as a result of precipitation runoff are indicative of high flows in study area streams.

Special Status Species

Direct effects to special status species are not expected to result from PCWA flood management practices. Stormwater releases from the canal system would reduce the effects of bank erosion along canals and would therefore lessen potential negative impacts resulting from flood flows. The increased flows in many unnamed drainages within the study area may result in bank erosion near the canal outlet releases, and potential sediment loading to receiving waters. This would have the potential to wash away special status amphibian eggs, if present in the drainages downstream from canal outlets, or bury any special status plant species that may be present. California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds mid-March through early June, and the western spadefoot toad breeds in late January through July (Stebbins 2003). Special status species are not known to occur in the area of the canal

outlets, and these potential effects are expected to similar to conditions generally exhibited across study area streams during periods of high precipitation runoff.

Steelhead and fall-run Chinook salmon are not likely affected by PCWA flood management practices. As described above, high flows in study area streams are more likely to affect aquatic habitat and species compared to PCWA operations during precipitation events.

5.1.4 Routine Operations

The following sections describe potential effects of PCWA's routine canal system operations on physical and biological resources in the study area.

5.1.4.1 Physical Resources

Potential effects on hydrology, water quality, and soils and sediment quality conditions in the study area are described in the below sections.

Hydrology

PCWA's routine raw water distribution system operations affect hydrologic conditions in Canyon Creek during summer and fall through direct diversions from the stream; however, these effects are negligible in comparison to effects of PG&E hydroelectric operations. During winter and spring, PCWA's routine operations are not likely to affect Canyon Creek hydrology due to potentially high streamflows associated with snowmelt and runoff in the watershed.

PCWA's water diversions to Auburn Ravine during the irrigation season have a positive effect on hydrologic conditions within portions of Auburn Ravine upstream from diversions to Zone 5 customers during late summer and early fall when natural flows in Auburn Ravine are low (Reclamation and PCWA 2002). As described in **Chapter 3**, natural flows in Auburn Ravine decline to very low levels during spring months, with no natural flow during summer months (Reclamation and PCWA 2002, City of Lincoln 1999). PCWA contributions to streamflow in Auburn Ravine during the irrigation season, however, are a fairly small fraction of the flow augmentation in Auburn Ravine during the dry season that occurs through other irrigation conveyance and return flow, hydroelectric generation releases, and treated effluent discharges. Routine PCWA operations do not affect hydrologic conditions in Auburn Ravine outside of the irrigation season.

Based on water balance results for the PCWA canal system and streams from the East Loomis Basin Canal Efficiency Study, routine canal system operations contribute to flows in Secret and Miners ravines year-round (USACE and PCWA 2008). The PCWA canal system provides direct contributions to flows within study area streams through regulated releases to streams used for conveyance and unregulated releases from canal outlets, and indirect contributions through customer return flows. These flow contributions have a positive effect on hydrologic conditions in study area streams.

Water Quality

PCWA's routine raw water distribution system operations likely have minimal effects on water quality conditions in Canyon Creek during summer and fall, such as water temperature, as a result of direct diversions from the stream. However, these effects are negligible in comparison to effects of PG&E hydroelectric operations on water quality. During winter and spring, PCWA's routine operations are not likely to affect water quality in Canyon Creek due to potentially dominating effect of high streamflows associated with snowmelt and runoff in the watershed.

Water quality conditions in Auburn Ravine are likely improved through PCWA's water diversions to Auburn Ravine during the irrigation season. As described in **Chapter 3**, water quality conditions measured at Auburn Ravine below the Auburn Ravine Tunnel outlet were generally better during spring and summer compared to fall and winter sampling events, exhibiting lower concentrations for many constituents in samples collected.

Based on water quality results obtained from canal and stream sites within the Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine watersheds during baseline sampling events, water temperatures at canal sites were lower than stream sites during late spring and late summer. Water temperatures observed at canal and stream sites during winter and late fall were variable, but remained below 50 °F. DO concentrations measured at canal and stream sites inversely followed water temperature trends described above, exhibiting higher DO concentrations at canal sites during late spring and late summer.

TSS was very low, often below detection limits, and turbidity values were variable across all canal and stream sites monitored in the Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine watersheds during baseline sampling events. These data suggest that PCWA routine operations do not affect TSS or turbidity in Clover Valley Creek, Antelope Creek, Secret Ravine, or Miners Ravine. Measured pH values were variable across canal and streams sites, while alkalinity and hardness were lower in canal sites compared to stream sites.

SC, ion, and trace element concentrations in samples obtained during baseline sampling events were also consistently lower at canal sites compared to stream sites. These lower constituent concentrations for ions and trace elements suggest that PCWA routine operations potentially provide a water quality benefit to Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine through flow contributions to streamflow.

Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine are included in **Appendix B**.

Soils and Sediment Quality

Soils and sediment quality in the study area are not likely to be affected by PCWA's routine operations. PCWA's routine operations do not disturb soils in the study area, or introduce constituents that may affect sediment quality.

5.1.4.2 Biological Resources

Studies conducted through the East Loomis Basin Canal Efficiency Study (USACE and PCWA 2008) suggest that the condition of existing aquatic and terrestrial resources in the study area are dependent on the canal system. While canal operations (including unregulated releases and customer return flows) contribute to flows in Secret Ravine and Miners Ravine, and their tributaries year-round, the canal system contributions dominate dry season flows.

Terrestrial Habitat and Species

Habitat would not be expected to be adversely affected by changes in flow. Some benefits may be experienced by amphibians and wetland/riparian vegetation from improvements in water quality. Some minor damage could be caused to habitats by placement of debris and soil near canals.

Aquatic Habitat and Species

Routine PCWA operations are not likely to affect aquatic habitat and species in Canyon Creek. Flow augmentation in Auburn Ravine by PCWA during spring and summer increases streamflows and supports greater habitat diversity, increased quantity and quality of habitats, and lower summer water temperatures that would be found under natural conditions (Reclamation and PCWA 2002, City of Lincoln 1999). Therefore, current water management practices in Auburn Ravine, including routine PCWA operations, enhance aquatic habitat conditions and potential anadromous salmonid production in Auburn Ravine (Reclamation and PCWA 2002, City of Lincoln 1999).

As described above, routine PCWA canal system operations contribute to flows in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine year-round. The PCWA canal system provides direct contributions to flows within these streams through unregulated releases from canal outlets, and indirect contributions through customer return flows, especially during the dry season. These flow contributions have a positive effect on aquatic habitat and species conditions in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine.

Special Status Species

Habitat would not be expected to be adversely affected by changes in flow. Some benefits may be experienced by special status amphibians and vegetation from improvements in water quality. Some minor damage could be caused to special status species plants, if present, by placement of debris and soil near canals.

Routine PCWA operations within the Auburn Ravine watershed are beneficial for Chinook salmon and steelhead (Reclamation and PCWA 2002). Increased flows in Auburn Ravine as a result of PCWA's streamflow augmentation (up to 50 cfs), especially during late summer and early fall, support more consistent habitat conditions to rearing steelhead.

As described above, hydrologic and water quality conditions in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine are generally improved through routine PCWA operations. Populations of fall-run Chinook salmon and Central Valley steelhead in Secret and

Miners ravines likely benefit from consistent contributions to streamflow from the PCWA canal system during routine operations.

The infrequent presence of special status fish in Clover Valley Creek and Antelope Creek, is likely affected by PCWA routine operations.

5.2 REGULATORY FRAMEWORK FOR POTENTIAL EFFECTS OF SYSTEMWIDE OPERATIONS

The following sections provide the regulatory framework for the potential effects of PCWA operations activities described above. The regulatory framework discussion is organized by Federal, State, and local regulations, and is summarized in **Table 5-3**.

5.2.1 Federal Regulations

Federal laws and regulations associated with the potential effects of PCWA operations activities are described below.

5.2.1.1 Clean Water Act

PCWA activities during yearly PG&E outages were found to have minimal effects on water quality conditions in study area streams. In particular, turbidity and copper levels temporarily increased at canal and stream sites after flows were restored to the canal system following reservoir outages. These increases may indicate the transport of fine sediments and potential mobilization of constituents bound to sediments, such as copper, into receiving waters of the U.S. In general, PCWA activities during yearly PG&E outages are subject to the provisions under the CWA, but they are not required to be permitted. Sections 101(a)(2) and 303(c) of the CWA state the national goal of working with states to establish water quality goals that provide for the protection of beneficial uses, such as the propagation of fish, shellfish, and wildlife and for recreation in and on the water, and agricultural, industrial, and other purposes including navigation. These water quality goals are explained further in **Chapter 4** under the Porter-Cologne Water Quality Control Act.

Seasonal PCWA delivery schedule changes potentially have minimal to no water quality effects, and would not likely result in water quality effects at canal outlets. Minimal effects are associated with the potential for sediment and/or debris to enter the canals from canal banks if PCWA personnel disturb soil along canal banks when entering them to switch out orifice plates. If this occurs, TSS and turbidity levels could temporarily increase. However, it is unlikely that these levels could exceed water quality standards promulgated in the CWA and identified in the Porter-Cologne Water Quality Control Act.

PCWA flood management practices may cause minimal effects on the water quality of receiving water tributaries and streams. Stormwater releases from intermediate canal outlets reduce the effects of bank erosion along canals and lessen potential negative effects along unlined canals resulting from flood flows. However, the canal releases and increased flows to unnamed drainages within the study area may result in bank erosion below the canal outlets, and potential sediment loading to receiving waters, and increased TSS and turbidity in study area streams.

Despite these minimal effects, these flood management practices are in compliance with State and Federal flood management requirements and it is unlikely that the effects would be considered an infringement of CWA regulations.

Routine/Daily PCWA operations may have minimal water quality effects. Water quality conditions in canals during routine/daily operations were observed to be generally better than stream water quality conditions. For example, water temperatures measured were lower and DO levels were higher at canal sites compared to stream sites during late spring and late summer. TSS, turbidity, SC, ion, and trace element levels measured were also generally lower year-round at canal sites compared to stream sites. Because these are overall positive potential effects, CWA is not likely to apply to PCWA's routine/daily operations.

TABLE 5-3
SUMMARY OF REGULATORY FRAMEWORK AND POTENTIAL BEST MANAGEMENT PRACTICES THAT MAY APPLY TO PCWA OPERATIONS ACTIVITIES

PCWA Operations Activity				Effect	Natural Resource Areas Potentially Affected											Relevant Regulations									Best Management Practices (BMP)	Type of BMP		
					Physical			Biological								Federal				State				Local				
								Terrestrial Habitat and Species			Aquatic Habitat and Species	Special Status																
Yearly Outages	Delivery Schedule Change	Flood Management	Routine Operations		Hydrology	Water Quality	Soils and Sediment Quality	Wetlands	Nesting birds	Other		Salmonids	Amphibians	Raptors	Plants	Clean Water Act	Endangered Species Act	Magnuson-Stevens and Sustainable Fisheries Act	Migratory Bird Treaty Act	Porter Cologne	California Endangered Species Act	Fully Protected Species	Native Plant Protection Act	Placer County Conservation Plan		Pre-Implementation	Implementation	Ongoing/Post-Implementation
✓		✓		Bank erosion along unlined canals and at canal outlets and sediment loading to receiving waters		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		✓	**Improve Canal Bank Stability and Install Sediment Traps in Areas of Soil Disturbance**	✓		
																									Install Erosion-Control Blankets			
																									Install Temporary Fiber Rolls			
																									Apply Spray-On Soil Binders			
																									Install Velocity Dissipaters at Canal Outlets			
																									Line Banks below Canal Outlets			
		✓			✓	✓	✓	✓			✓	✓	✓			✓	✓				✓	✓	✓			**Avoid Potential Wet Weather Effects**	✓		
																									Patrol Canals and Remove Potential Obstructions to Prevent Erosion and Property Damage			
																									Minimize Water Purchases from PG&E Before and During High Precipitation Events			
																									Distribute Flood Releases from Canal System by Releasing Flows at Numerous Intermediate Outlets			
	✓		✓	Disturbance or damage to sensitive species and habitat potentially present in the area.				✓	✓	✓	✓		✓	✓	✓		✓				✓	✓	✓	✓	✓	**Protect Sensitive Species and Sensitive Species Habitat**	✓		
																									Provide Staff with Species Identification Training			
																									Evaluate Sites with Sensitive Species and Mark/Protect Sensitive Species Habitat			
		✓					✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				✓	✓	✓	✓	✓	**Avoid Species-Sensitive Areas**		✓	
																									Avoid Disturbance to Sensitive Species			
✓				Constituent loading to receiving waters from O&M activities		✓		✓			✓	✓	✓			✓	✓	✓		✓	✓	✓		✓	**Prevent Degraded Water from Entering Streams**		✓	
																									Modify Reservoir Operations to Gradually Restore Reservoir Releases to Canals at Slower Rate			
✓	✓	✓	✓	All potential effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	**Implement PCWA BMP Program**			✓

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5.2.1.2 Endangered Species Act

PCWA operations during annual PG&E outages potentially have minimal effects on special status species. PCWA's rotating outages at Clover Valley and Mammoth reservoirs, and resultant canal dewatering below the reservoirs, may result in minimal effects on special status terrestrial species, including slight decreases in the extent of wetland habitats for special status species. For special status aquatic species, canal dewatering during outages and resultant decreased canal system contributions to streamflow in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine may affect Central Valley steelhead and/or critical habitat for Central Valley steelhead. The Federal ESA, regulated by USFWS and NMFS, habitat modification or degradation could be considered a "take" of federally listed species. In which case, an incidental take permit, under Section 10 of the Federal ESA, or a Federal interagency consultation, under Section 7 of the Federal ESA, is required.

Seasonal PCWA customer delivery schedule changes are not likely to affect special status species. Special status plants, if present, may be trampled while PCWA personnel access delivery points, and special status raptors, if present, may be affected by PCWA access to canals. Because these effects are likely minimal and easily avoidable if special status species are present, it is unlikely that Federal ESA permits would be required.

PCWA flood management practices potentially have minimal effects on terrestrial special status species. High-flow releases from canal outlets could wash away amphibian eggs downstream from the outlets, if present, and sediment loading to receiving waters may bury wetland or riparian vegetation. Central Valley steelhead are not likely affected by PCWA flood management practices. High streamflows during precipitation events are more likely to affect aquatic habitat and species than PCWA operations. Because these effects are minimal, and easily avoidable, it is unlikely that Federal ESA permits would be required.

Routine/Daily PCWA operations likely have positive effects on special status species within the PCWA raw water distribution area. Contributions from the PCWA raw water distribution system typically augment streamflows in Auburn Ravine, Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine, which benefits Central Valley steelhead. These streamflow contributions are particularly evident during summer months, and provide more consistent habitat conditions to rearing Central Valley steelhead. Some benefits to amphibians and wetland/riparian vegetation may also be realized through improvements to water quality as a result of canal system contributions to streamflow. Because the potential negative effects of daily routine operations are negligible and easily avoidable, it is unlikely that Federal ESA permits would be required.

5.2.1.3 Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act

PCWA operations during yearly PG&E outages have minimal effects on suitable habitat considered essential for the sustenance of commercial fisheries. Historic decreases in streamflow associated with canal dewatering during outages likely contribute to the delayed spawning

migration of fall-run Chinook salmon observed in the Dry Creek watershed, or may cause redd dewatering. Although the concept of EFH is similar to that of "Critical Habitat" under the Federal ESA, measures recommended to protect EFH by NMFS are advisory, not prescriptive.

5.2.1.4 Migratory Bird Treaty Act

PCWA operations during annual PG&E outages potentially have minimal effects on migratory bird species. Canal dewatering may cause slight decreases in the extent of wetland habitats and affect the species that use wetland habitats, such as foraging birds. However, it is unlikely that these effects would constitute a "take" of a migratory bird species or habitat (as defined by the MBTA) and therefore would not be subject to the MBTA.

5.2.2 State Regulations

Laws and regulations governed by the State of California and associated with the potential effects of PCWA operations activities are described below.

5.2.2.1 Porter-Cologne Water Quality Control Act

The regulatory framework for water quality effects resulting from PCWA operations during yearly PG&E outages, seasonal delivery schedule changes, flood management practices, and routine/daily operations, are similar to those described previously under the CWA.

Of the Criteria for Priority Toxic Pollutants in California, cadmium, copper, and zinc were three criteria parameters monitored for during PCWA outage activities. Neither cadmium nor zinc criteria were exceeded. The freshwater CCC for copper (9 µg/L) was exceeded at sites monitored during the PG&E yearly outages (November 2, 2006) within the Antelope Creek, Secret Ravine, and Miners Ravine watersheds, but the exceedances are likely associated with heavy rain and runoff contributions to flow at sites during sampling.

Of the water quality objectives associated with beneficial uses of the Sacramento River in the Sacramento-San Joaquin Basin Plan, barium, copper, iron, zinc, DO, pH, and turbidity were monitored during PCWA outage activities. The water quality objective for copper (based on specific levels of hardness calculated from measured calcium and magnesium levels) was exceeded at the Antelope Creek monitoring site on November 2, 2006 (10 µg/L for an objective of 9.3 µg/L based on the associated hardness of 70 mg/L), but the exceedance is likely associated with heavy rain and runoff contributions to flow at the site during sampling.

5.2.2.2 California Endangered Species Act

Under the California ESA, the effects on special status species from PCWA operations during PG&E yearly outages, seasonal delivery schedule changes, flood management practices, and routine/daily operations, are similar to those described previously under the Federal ESA. However, the California ESA addresses the incidental take of State-listed species as threatened or endangered. DFG is the enforcement agency of the California ESA.

5.2.2.3 California Fish and Game Code-Fully Protected Species

Under the Fish and Game Code-Fully Protected Species, the effects on special status species from PCWA operations of annual PG&E outages, seasonal delivery schedule changes, flood management practices, and routine/daily operations, are similar to those described previously under the Federal ESA. However, this code addresses the incidental take of fully protected species. DFG is unable to authorize incidental take of fully protected species, such as White-tailed Kite and the California Black Rail, when activities are proposed in areas inhabited by those species. Therefore, the take of any fully protected species for project implementation is prohibited.

5.2.2.4 California Native Plant Protection Act

This act applies to endangered and "rare" plant species, subspecies, and varieties of wild native plants in California. Annual PG&E outages, seasonal delivery schedule changes, and routine/daily operations may have minimal effects on endangered and "rare" plant species in the PCWA raw water distribution area if vegetation is damaged during fieldwork. However, these effects are easily avoidable through effective BMP implementation. Routine/daily operations are likely to benefit wetland/riparian vegetation from improvements in water quality and increased flows.

5.2.3 Local Requirements and Considerations

The following sections describe the framework for local requirements during PCWA maintenance activities.

5.2.3.1 Placer County Conservation Plan

As described in **Chapter 4**, the PCCP includes plans with goals to protect fish and wildlife and their habitat and protect streams, wetlands, and other water resources, as well as coverage under several environmental permits to be issued to Participating Entities. With PCCP long-term environmental permits, such as ESA and NCCP incidental take, Section 404, a renewable Section 401 certification, "Joint Procedures" approved by the USACE may be used by the Participating Entities for aquatic resource permit processing under the CWA, and a programmatic master streambed alteration agreement, PCWA will be covered for activity projects that require it.

The regulatory framework for PCWA operations activities related to the PCCP are the same as those described for CWA, ESA, Porter-Cologne Water Quality Control Act, California ESA, and California Fish and Game codes.

5.3 BEST MANAGEMENT PRACTICE OPTIONS TO ADDRESS POTENTIAL EFFECTS OF SYSTEMWIDE OPERATIONS ACTIVITIES

BMPs are measures designed to reduce or prevent potential effects of a particular activity on the surrounding environment. The term originated from rules and regulations in Section 208 of the CWA. The "best" practice is cost effective and site specific. BMPs can be both structural and nonstructural. Structural BMPs include facilities constructed to prevent or minimize effects, and nonstructural BMPs include changes in activities or operation management, such as scheduling around periods when potential effects are greatest, and often focus more on controlling pollutants at the source.

BMPs to address potential effects of PCWA operations can be applied during three different stages: (1) pre-implementation, (2) during implementation, and (3) ongoing or post-implementation. Some BMPs can be implemented during more than one stage. The list of BMP options is not comprehensive; instead, it provides examples of BMPs that may be implemented to minimize particular potential effects of PCWA canal operations activities. As part of these BMP recommendations, BMP monitoring and evaluation are recommended for determining BMP effectiveness. Potential BMPs to reduce potential effects of PCWA operations activities on natural resources are summarized in **Table 5-3**, and described below.

5.3.1 Pre-Implementation Best Management Practices

Pre-implementation BMPs are those that are applied in preparation for the activity because they may take more time to develop before they become effective or because they involve complex setup procedures. Below are potential pre-implementation BMPs for reducing potential effects of PCWA operations activities on natural resources in the study area.

5.3.1.1 Improve Canal Bank Stability and Install Sediment Control Measures at Canal Outlets

Canal bank erosion along unlined canals, which may occur after canal flows are restored following dewatering activities (such as PCWA operations during yearly PG&E outages) and by PCWA flood management practices, may be minimized through implementation of BMPs to improve canal bank stability. PCWA is already implementing BMPs to provide canal bank stability by lining canals with gunite. Stabilizing vulnerable or disturbed areas along unlined canal banks can decrease erosion and associated sediment transport and deposition. Areas vulnerable to erosion may be those with steep slopes, little to no vegetation, and loose soil. Areas along canal banks that have been disturbed by previous canal activities, recreation along canals, or storm events, are particularly vulnerable to erosion. Additionally, sediment-control measures may be installed at canal outlets, where possible, to reduce sediment and associated constituents, and loading to receiving waters during PCWA operations activities. Maintaining site stabilization should be implemented year-round by keeping wet season sediment-trapping devices available and operational. The following sections describe potential BMPs to improve canal bank stability and reduce sediment loading to receiving waters.

Install Velocity Dissipaters at Canal Outlets

Velocity dissipaters are strategically placed rock along the flow line in a stream or at a canal outlet to dissipate energy and slow the flow of water released at canal outlets, thereby reducing the potential for erosion and sediment loading downstream. Rocks are often set in mortar in a way that is designed to interrupt water passage and spread concentrated flows over and through protruding rock. For example, rocks could be set in a step pool formation based on natural channel design concepts. Dissipators can be underlain with geotextile fabric to reduce the potential for eroding the underlying soil. Other types of dissipaters include solid concrete structures, riprap, baffles, pipe junctions, and drop boxes.

Line Banks below Canal Outlets

Through lining banks below canal outlets with gunite, where possible, bank stability is improved and the potential for erosion is decreased. Although lining is also addressed in this manual as an O&M activity, it is also considered a BMP as it is applied to areas along the canal system that have been disturbed by previous canal activities, recreation along canals, or storm events, are particularly vulnerable to erosion. PCWA is already implementing this type of BMP, where possible.

5.3.1.2 Avoid Potential Wet Weather Effects

Avoidance of potential adverse effects of PCWA operations activities during wet weather, when and where feasible, can be very effective. Avoided adverse effects may include canal bank erosion and sediment loading into receiving streams during wet weather events. Examples of BMP options are as follows:

Patrol Canals and Remove Potential Obstructions to Prevent Erosion and Property Damage

Large debris that gets into the canals, such as fallen tree limbs, may obstruct water flow within the canal system and may lead to canal bank erosion and/or property damage if not removed. Through implementing this BMP, PCWA staff would periodically patrol the canal system before the wet season and after heavy storm events and remove potential obstructions in a timely manner. PCWA is already implementing this type of BMP.

Minimize Amount of Water Purchased from PG&E During Periods of High Precipitation

Before and during precipitation events likely to cause in substantial precipitation runoff, PCWA may reduce water purchases from PG&E to increase canal capacity for conveyance of precipitation runoff. Through reducing the flow conveyed by PCWA's canal system during precipitation events, PCWA may decrease the potential for canal bank erosion. PCWA is already implementing this type of BMP.

Distribute Flood Releases from Canal System by Releasing Flows at Numerous Intermediate Outlets

During precipitation events when flows and water levels in the canals are high, water can be released from several intermediate canal outlets to dissipate flows throughout the system at lower

flow rates and reduce the potential for downstream erosion and sedimentation. PCWA is already implementing this type of BMP, where possible.

5.3.1.3 Protect Sensitive Species and Sensitive Species Habitat

Taking steps to ensure the protection of sensitive species and sensitive species habitat before an activity occurs involves both structural and nonstructural solutions.

Provide Staff with Species Identification Training

As a nonstructural solution to protecting sensitive species habitat in the PCWA raw water distribution system, PCWA personnel can be trained to recognize special status habitat and species before O&M activities. With this information, potential effects to species, such as trampling special status vegetation and habitat, and effects on raptor nests from noise disturbance, may be prevented. As part of this training program, PCWA field staff will be provided with an identification table with photos and descriptions to assist in identifying special status species known or expected to occur near work areas. PCWA is already implementing this type of BMP.

Evaluate Sites with Sensitive Species and Mark/Protect Sensitive Species Habitat

If special status species and/or associated habitats are identified, temporary fencing, signs, or colored ribbon may be used to mark the known location of the species or habitat, such as rare plants or trees with active raptor nests, to help prevent disturbance to the habitat or species during operations activities. PCWA is already implementing this type of BMP.

5.3.2 Implementation Best Management Practices

Implementation BMPs are management measures applied while the activity is being implemented. The following sections provide potential implementation BMPS to reduce potential effects of PCWA operations activities on natural resources.

5.3.2.1 Avoid Sensitive Species Areas

During operations activities, PCWA personnel can do several things to prevent potential effects on terrestrial species and disturbance to terrestrial species habitat. Examples of BMP options follow.

Avoid Disturbance to Sensitive Species

To avoid potentially disturbing sensitive species in the vicinity of operations activities, PCWA staff may stay on roads, paths, or other previously disturbed areas whenever possible. This BMP option also involves helping equipment and vehicles confined to roads, paths, or other previously disturbed areas to avoid disturbing sensitive species in the vicinity. PCWA is already implementing this type of BMP, where possible.

5.3.2.2 Prevent Degraded Water from Entering Streams

BMPs may be implemented to prevent or reduce the amount of degraded water from PCWA's canal system from entering streams. Based on results from water quality monitoring, water

quality conditions downstream from O&M activities that involve canal dewatering can exhibit high turbidity, TSS, and concentrations of constituents associated with sediment or other material.

Modify Canal Operations to Gradually Restore Reservoir Releases to Canals at Slower Rate

Modifying PCWA reservoir management practices during PG&E yearly outages can be effective for reducing sediment loading into receiving waters. When possible, water releases from Mammoth and Clover Valley reservoirs to canals following outages during the PG&E yearly outages may be restored at a slow and graduated rate. These graduated reservoir releases may decrease the potential mobilization and transport of settled materials and constituent loading to receiving waters after canal flows are restored.

5.3.3 Ongoing or Post-Implementation Best Management Practices

Ongoing or post-implementation BMPs are typically management and preventative measures. One potential ongoing or post-implementation BMP was identified to minimize potential effects of PCWA operations activities, and is described below.

5.3.3.1 Implement PCWA Best Management Practice Program

An ongoing PCWA BMP program would serve to update and maintain BMPs, as well as track BMP effectiveness. The program would also provide staff training for BMP implementation during PCWA O&M activity implementation.

BMP alternatives are continually being developed and information on BMP effectiveness is continually changing. It is important to stay updated on BMP news so as to provide for the most effective BMP implementation.

BMP maintenance increases the durability and effectiveness of structural BMPs. In fact, unmaintained BMPs can increase potential effects. For example, if an erosion-control blanket is not well-maintained it could become dislodged and be swept down a canal as debris.

Staff BMP implementation training would consist of a BMP training manual and periodic training sessions on effective BMP implementation in the field. Several of the pre-implementation BMPs, such as species identification training, would be part of this program.

5.4 SUGGESTIONS FOR FURTHER STUDIES

Based on results of NRMP studies, PCWA operations may affect natural resources conditions within the study area. Higher concentrations of trace metals, particularly aluminum and copper, were observed at sites monitored within the PCWA canal system compared to stream sites for sampling events associated with PCWA's operations during the PG&E yearly outages. These data may inconclusively suggest that the PCWA canal system is a source for loading of some constituents to study area streams.

Additional routine and event-based water quality monitoring should be conducted at sites within the PCWA canal system, and stream sites upstream and downstream from canal system contributions, to characterize potential effects of PCWA operations activities on water quality conditions. One of the focal points for additional studies should be to evaluate aluminum and copper inputs to study area streams from the PCWA canal system. Potential sites for routine and operations event-based water quality monitoring include:

- Boardman Canal below Mammoth Reservoir
- End of Boardman Canal outlet
- End of Yankee Hill Canal outlet
- Secret Ravine at Loomis Basin Park
- Secret Ravine at Rocklin Road
- Clover Valley Reservoir release to Clover Valley Creek and Antelope Canal

Additionally, sediment quality monitoring at numerous sites exhibiting variable soil conditions along the canal system and study area streams may be help to determine potential sources of trace metals in PCWA canals and study area streams. Soil sampling for representative soil types should be coordinated with routine and operations event-based water quality monitoring. Soil samples should be collected from undisturbed sites of representative soil types, as characterized by PCWA (2005), near and upstream from canal and stream water quality monitoring sites, and within watersheds of Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine.

CHAPTER 6.0
POTENTIAL EFFECTS, REGULATORY FRAMEWORK, AND BEST MANAGEMENT PRACTICES FOR MAINTENANCE ACTIVITIES

This chapter provides an overview of the potential effects of PCWA raw water distribution system maintenance activities on natural resource conditions in the study area, the regulatory framework for effects, and potential BMPs to reduce effects of the maintenance activities on natural resources.

6.1 POTENTIAL EFFECTS OF MAINTENANCE ACTIVITIES ON NATURAL RESOURCES

Potential effects of scheduled and as-needed, site-specific PCWA raw water distribution system maintenance activities are described below.

6.1.1 Scheduled Maintenance Activities

The following sections address scheduled maintenance activities conducted by PCWA within their raw water distribution system.

6.1.1.1 Canal Cleaning and Flushing

PCWA's canal cleaning and flushing activities have the potential to affect natural resource conditions in the study area. The following sections describe potential effects of canal cleaning and flushing activities on natural resources.

Physical Resources

Potential effects of PCWA canal cleaning and flushing activities on hydrology, water quality, and soils and sediment quality conditions in the study area are described in the following sections.

Hydrology

PCWA operations during canal cleaning and flushing activities do not affect hydrologic conditions in Canyon Creek or Auburn Ravine. During the canal cleaning and flushing, PCWA canal system contributions to streamflow in Canyon Creek and Auburn Ravine, and/or diversions from Canyon Creek and Auburn Ravine, do not change as a result of PCWA operations.

Continuous-flow data collected from canal and stream sites within PCWA's lower Zone 1 service area during WDY 2006 (October 16, 2005, to October 15, 2006) were evaluated to determine effects of canal cleaning and flushing activities on hydrologic conditions in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine. Continuous-flow monitoring locations used for maintenance evaluations, and their respective watersheds, are listed in **Table 6-1**.

TABLE 6-1
CONTINUOUS-FLOW MONITORING STATIONS IN ZONE 1 FOR MAINTENANCE

Secret Ravine Watershed	Miners Ravine Watershed
Secret Ravine at Horseshoe Bar Road	Miners Ravine at Lomida Lane
Yankee Hill Canal Outlet	Ferguson Canal Outlet
Turner Canal Outlet	Stallman Canal Outlet
Boardman Canal Outlet	Baughman Canal Outlet
Secret Ravine at Rocklin Road	Miners Ravine near North Sunrise Avenue

Table 6-2 provides PCWA's schedule of canal outages for cleaning and flushing during March 2006. During these outages for canal cleaning and flushing, canal flows were typically interrupted during business hours to dewater canal segments and allow removal of sediment and debris from canals by PCWA staff.

TABLE 6-2
CANALS OUTAGES FOR CLEANING AND FLUSHING DURING 2006

Canal	Time	Dates
Mammoth Reservoir to Boardman Canal Outlet	7:00 a.m. to 11:00 p.m.	March 13, 14, 15, 16, 17, 20, 21, 22, 23, 24
Baughman Canal		
Ferguson Canal		
Stallman Canal		
Yankee Hill Canal		
Turner Canal		
Turner Pump Canal		
Laird Pump Canal		

Average daily flows for canal and stream sites evaluated during WDY 2006 canal cleaning and flushing activities are shown in **Figure 6-1** for sites within the Secret Ravine watershed, and in **Figure 6-2** for sites within the Miners Ravine watershed. As illustrated in **Figures 6-1** and **6-2,** canal system contributions to flow within study area streams through unregulated releases from canal outlets is variable during periods associated with canal cleaning activities.

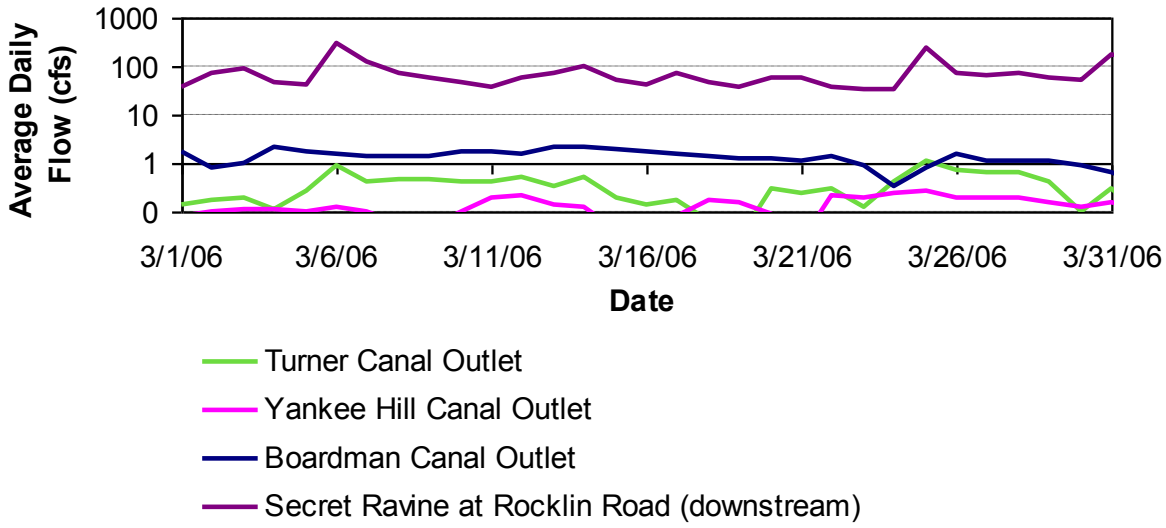

FIGURE 6-1
CANAL OUTLET AND SECRET RAVINE RESPONSES TO CANAL CLEANING AND FLUSHING ACTIVITIES

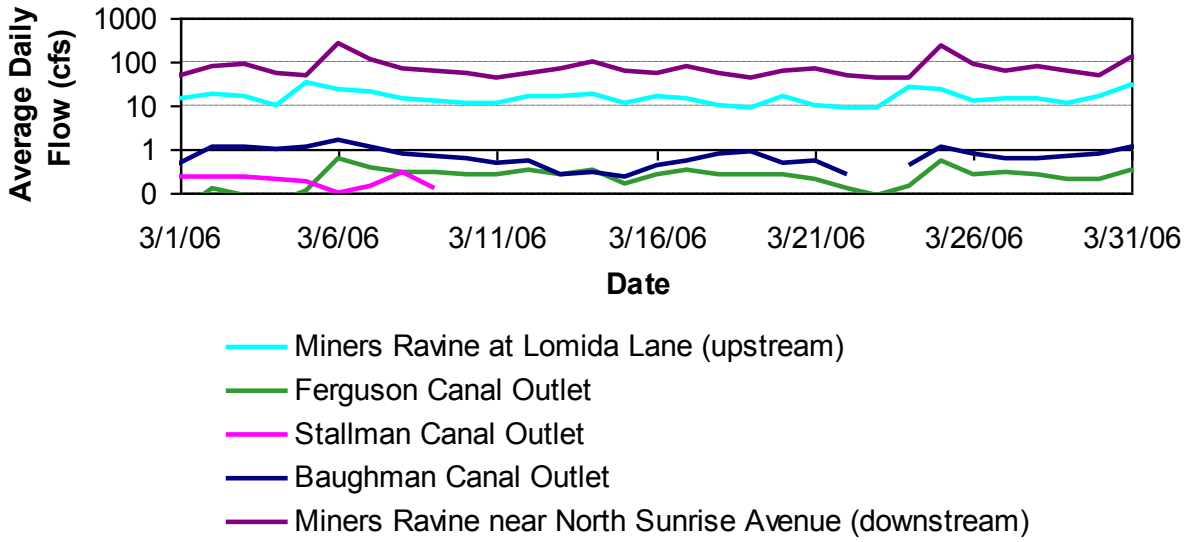

FIGURE 6-2
CANAL OUTLET AND MINERS RAVINE RESPONSES TO CANAL CLEANING AND FLUSHING ACTIVITIES

Based on the average daily flows for sites provided in **Figures 6-1** and **6-2,** the short-duration reduction in flows within the PCWA canal system during canal cleaning and flushing activities is not expected to affect flow conditions in Secret and Miners ravines. Effects on flow conditions in Antelope Creek and Clover Valley Creek are likely similar to conditions shown for Secret and Miners ravines. Precipitation runoff within the watersheds of study area streams is likely to have a much greater influence on stream flow conditions during the time periods that PCWA conducts canal cleaning and flushing activities. Precipitation during March 2006 is shown in **Figure 6-3**.

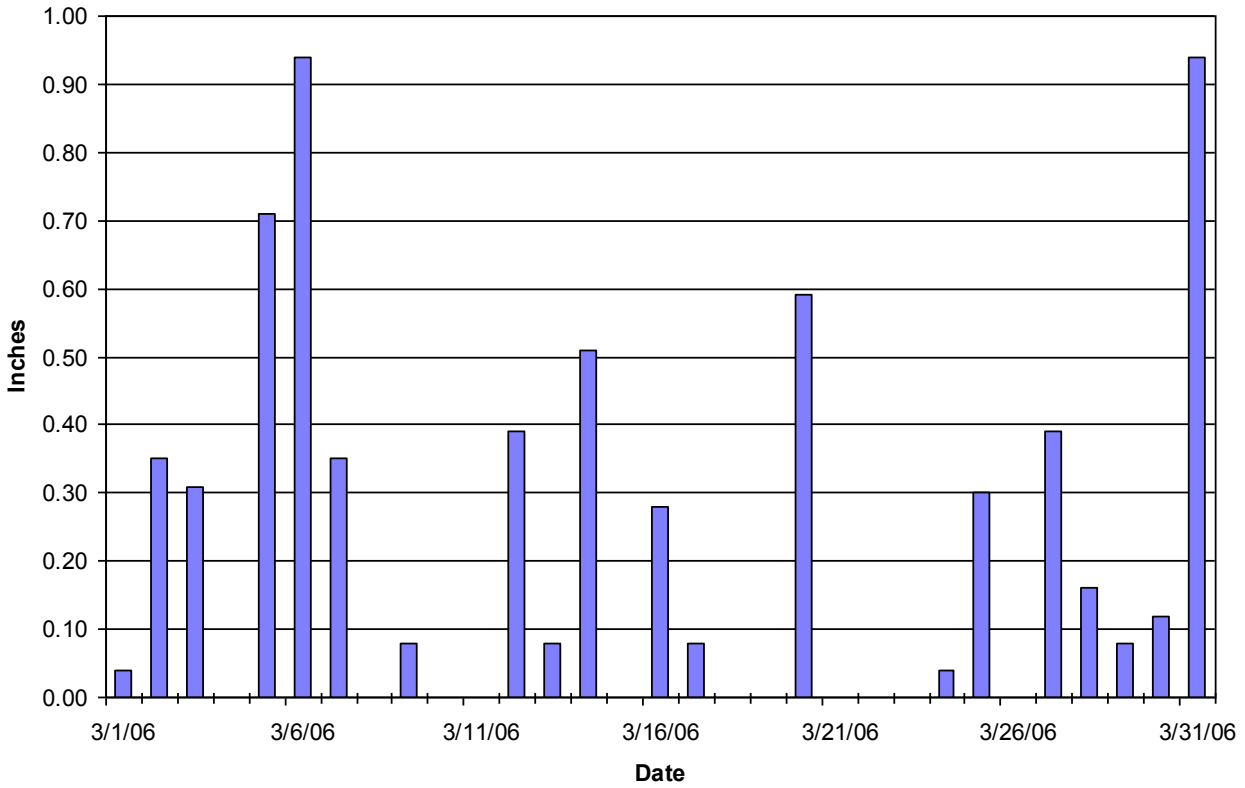

FIGURE 6-3
PRECIPITATION AT CHINA GARDEN ROAD GAGE DURING MARCH 2006

Water Quality

Water quality conditions were monitored at 15 locations within the PCWA canal system and study area streams during PCWA canal cleaning activities. All water quality monitoring locations are located within Zone 1 of the PCWA service area. These locations, shown in **Figures 5-1 and 5-2**, were selected according to canal cleaning locations. **Table 6-3** lists the monitoring site names, site type, associated watershed(s), and information for the canal cleaning activities for which sampling occurred at those locations.

Monitoring for canal cleaning and flushing events along the Boardman, Yankee Hill, Baughman, and Ferguson canals was conducted on March 15, 2007, March 22, 2007, March 26, 2007, and March 27, 2007, respectively. Monitoring sites were located along the canals and stream sites in the Secret Ravine and Miners Ravine watersheds. Results from water quality monitoring and potential effects of canal cleaning activities are discussed below. Water quality conditions were not evaluated in the Auburn Ravine, Clover Valley Creek, and Antelope Creek watersheds, but are likely to be similar to conditions described for Secret Ravine and Miners Ravine. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and study area streams monitored during canal cleaning activities are included in **Appendix C**.

TABLE 6-3
WATER QUALITY MONITORING LOCATIONS IN THE PCWA SERVICE AREA FOR CANAL CLEANING ACTIVITIES

Site Name	Site Identification	Type	Watershed(s)	Canal Cleaning Start/End Time	Weather
Boardman Canal Cleaning, Graveyard Outlet to Hansen Outlet					
Boardman Canal below Mammoth Reservoir	YB81	Canal	Miners Ravine /Secret Ravine	Start: 3/15/2007, 7:15am End: 3/15/2007, 3:50pm	Warm and dry
Boardman Canal at Hansen Outlet Release	HANSENR	Canal	Miners Ravine		
Miners Ravine at Lomida Lane	MINERSRV7	Stream	Miners Ravine		
Miners Ravine at Moss Lane	MINERSRV5	Stream	Miners Ravine		
Yankee Hill Canal Cleaning					
Boardman Canal at Head of Turner Canal	YB154	Canal	Miners Ravine/ Secret Ravine	Start: 3/22/2007, 6:15pm End: 3/22/2007, 3:25pm	Cool and dry
Yankee Hill Canal Outlet Release	YANKEECR	Canal	Secret Ravine		
Tributary to Secret Ravine from Yankee Hill Canal	YHTRIB2	Stream	Secret Ravine		
Secret Ravine at Rocklin Road	SECRETRV3	Stream	Secret Ravine		
Baughman Canal Cleaning, Head of Ferguson Canal to Baughman Canal Outlet					
Baughman Canal at Head of Ferguson Canal	YB145	Canal	Miners Ravine	Start: 3/26/2007, 6:10am End: 3/26/2007, 1:00pm	Cool with rain at around 2:00 p.m.
Baughman Canal Outlet Release	BAUGHMANCR	Canal	Miners Ravine		
Tributary to Miners Ravine from Baughman Canal	BCTRIB1	Drainage	Miners Ravine		
Miners Ravine near N. Sunrise Avenue	MINERSRV3	Stream	Miners Ravine		
Ferguson Canal Cleaning					
Baughman Canal at Head of Ferguson Canal	YB145	Canal	Miners Ravine	Start: 3/27/2007, 6:10am End: 3/27/2007, 11:55am	Cool and dry
Ferguson Canal Outlet Release	FRGCR	Canal	Miners Ravine		
Tributary to Miners Ravine from Ferguson Canal	FRGTRIB1	Drainage	Miners Ravine		
Miners Ravine at Auburn-Folsom Road	MINERSRV4	Stream	Miners Ravine		

Secret Ravine Watershed

As shown in **Table 6-3**, water quality monitoring in the Secret Ravine watershed was conducted during one canal cleaning event on March 22, 2007, that occurred along a section of the Yankee Hill Canal. Water quality was monitored at two canal sites, upstream and downstream from the canal section that was cleaned (YB154 and YANKEECR, respectively), and two stream sites downstream from the Yankee Hill Canal Outlet release (YHTRIB2 and SECRETRV3). These monitoring sites are listed below from the most upstream to the most downstream locations:

- **Boardman Canal at the Head of Turner Canal (YB154):** Located along the Boardman Canal at the head of the Turner Canal.
- **Yankee Hill Canal Outlet Release (YANKEECR)**
- **Yankee Hill Canal Tributary (YHBTRIB2)**
- **Secret Ravine at Rocklin Road (SECRETRV3)**

As shown in **Figure 6-1**, potential flow contributions from the Yankee Hill Canal comprise a small proportion of streamflow at SECRETRV3. Precipitation runoff within the Secret Ravine watershed is likely to have a much greater influence on water quality conditions in Secret Ravine during the time periods that PCWA conducts canal cleaning and flushing activities.

Water Temperature and Dissolved Oxygen

Minimal to no effects on water temperatures and DO levels were observed at the two stream sites (YHTRIB2 and SECRETRV3) downstream from the canal cleaning activity during this event. Water temperatures at the canal outlet release downstream from the canal cleaning activity, YANKEECR, increased from about 62ºF to up to 67ºF for about 15 minutes, then stabilized to reflect water temperature conditions similar to values measured upstream from canal cleaning. The temporary increase in water temperature is likely attributed to the displacement and flushing of water that collected in shallow pools and exposed to direct sunlight in the canal after the canal was dewatered. Measured DO levels across canal and stream sites exhibited similar, but inverse trends.

pH, Alkalinity, and Hardness

Based on measurements at sites during monitoring, canal cleaning activities do not appear to affect pH conditions in Secret Ravine. Measured pH levels at YANKEECR increased for a short duration after canal cleaning, and then stabilized to reflect pH levels similar to values measured upstream from canal cleaning. Measured pH levels at YANKEECR increased by more than 1 unit up to 9.2 during canal flushing after cleaning activities, subsequently decreased by more than 2 units to 6.9, then stabilized at 7.7. The pH measured at YHTRIB2 also increased slightly after canal cleaning, but did not fluctuate at SECRETRV3. Alkalinity and total hardness measured at sites during the canal cleaning monitoring event fluctuated slightly at YANKEECR, but remained consistent at both stream sites downstream from the canal cleaning activity. Stream sites monitored demonstrated higher buffering capacity (alkalinity) and lower total hardness compared to canal sites.

Total Suspended Solids and Turbidity

Despite a temporary increase in TSS and turbidity levels observed at YANKEECR after canal cleaning activities, no effects were observed at stream monitoring sites during this canal cleaning monitoring event.

Specific Conductivity and Ions

No effects on SC, calcium, iron, magnesium, potassium, or sodium levels were observed at stream sites in the Secret Ravine watershed during monitoring for canal cleaning activities. Minimal increases in iron concentrations were observed at YANKEECR after flows were restored to Yankee Hill Canal, but were not reflected in samples collected at stream sites downstream. SC, calcium, magnesium, potassium, and sodium values measured at stream sites were higher than canal sites. Water quality results also suggest that chloride, nitrate, and sulfate concentrations at stream sites are not affected by canal cleaning activities.

Trace Elements

Aluminum, barium, copper, and zinc concentrations at YANKEECR increased after flows were restored to Yankee Hill Canal, but do not appear to affect concentrations in samples collected at stream sites downstream. Cadmium concentrations measured at all sites during the canal cleaning monitoring event were below the detection limit (0.5 μg/L).

Miners Ravine Watershed

Water quality conditions in the Miners Ravine watershed were evaluated during canal cleaning and flushing activities along sections of the Boardman, Baughman, and Ferguson canals, on March 15, 2007, March 26, 2007, and March 27, 2007, respectively. On March 15, 2007, water quality was monitored at two canal sites upstream and downstream from canal cleaning activities, and two stream sites in Miners Ravine also upstream and downstream from canal cleaning activities:

- **Boardman Canal below Mammoth Reservoir (YB81)**
- **Hansen Outlet Release (HANSENR)**: located at the Hansen outlet from the Boardman Canal. Regulated releases from this canal flow into an unnamed tributary that contributes flows into Miners Ravine.
- **Miners Ravine at Lomida Lane (MINERSRV7)**: located at Lomida Lane upstream from the confluence with the unnamed tributary to Miners Ravine receiving regulated releases from HANSENR.
- **Miners Ravine at Moss Lane (MINERSRV5)**: located at Moss Lane, downstream from the confluence with the unnamed tributary to Miners Ravine receiving regulated releases from HANSENR.

On March 26, 2007, water quality parameters were monitored at two canal sites upstream and downstream from canal cleaning activities, and two stream sites downstream from canal cleaning activities:

- **Baughman Canal at the Head of Ferguson Canal (YB145):** located upstream from the cleaning event at the head of the Ferguson Canal.
- **Baughman Canal Outlet Release (BAUGHMANCR)**
- **Tributary to Miners Ravine from Baughman Canal (BCTRIB1)**
- **Miners Ravine near N. Sunrise Avenue (MINERSRV3)**

Due to the extensive length of the unnamed tributary to Miners Ravine from Baughman Canal and long travel time from BAUGHMANCR to BCTRIB1, samples obtained during canal cleaning activities at BCTRIB1 and MINERSRV3 were intended to provide a relative comparison of water quality conditions in receiving waters downstream from BAUGHMANCR.

On March 27, 2007, water quality was monitored at two canal sites upstream and downstream from canal cleaning activities, and two stream sites downstream from canal cleaning activities:

- **Baughman Canal at the Head of Ferguson Canal (YB145)**
- **Ferguson Canal Outlet Release (FRGCR)**: located at the Ferguson Canal Outlet. Unregulated releases from this canal flow into an unnamed tributary that contributes flows into Miners Ravine.
- **Tributary to Miners Ravine from Ferguson Canal (FRGTRIB1)**: located at Rock Crest Place along the unnamed tributary receiving unregulated releases from the FRGCR.
- **Miners Ravine at Auburn-Folsom Road (MINERSRV4)**: located on the west side of Auburn-Folsom Road downstream from the confluence with the unnamed tributary to Miners Ravine receiving regulated releases from FRGCR.

As shown in **Figure 6-2**, potential direct flow contributions from the Ferguson and Baughman canals comprise a small proportion of streamflow at MINERSRV3. Precipitation runoff within the Miners Ravine watershed is likely to have a much greater influence on water quality conditions in Miners Ravine during the time periods that PCWA conducts canal cleaning and flushing activities.

Water Temperature and Dissolved Oxygen

Based on water quality monitoring results, water temperature conditions in Miners Ravine were not affected by the March 15, 2007, and March 26, 2007, canal cleaning activities. Water temperatures observed at HANSENR on March 15, 2007, increased for a short duration, then stabilized to reflect water temperature conditions similar to values measured upstream from canal cleaning. During the March 27, 2007, canal cleaning monitoring event, water temperatures increased for a short duration at FRGCR, and water temperatures observed at FRGTRIB1 and MINERSRV4 also slightly increased, potentially as an effect of canal cleaning activities. DO

levels measured across stream sites in the Miners Ravine watershed were not affected by canal cleaning activities.

pH, Alkalinity, and Hardness

Although measured pH levels temporarily increased at the canal outlets after flows were restored to the canals following canal cleaning, minimal effects were observed at stream sites during the canal cleaning monitoring events. Sharp decreases and subsequent increases in pH observed at canal release outlets were likely responses to the displacement and flushing of water that collected in shallow pools and exposed to direct sunlight in the canal after the canal was dewatered. Alkalinity of water samples collected was higher across stream sites in the Miners Ravine watershed compared to the canal sites. The higher buffering capacity (alkalinity) at stream sites likely attributed to the minimal effects observed on pH at Miners Ravine sites. The canal cleaning activities also did not appear to affect total hardness values observed at stream sites within the Miners Ravine watershed. Although minimal effects were observed in tributaries receiving unregulated releases from canal outlets on March 26 and 27, 2007, no effects were observed in Miners Ravine. **Figure 6-4** shows pH values measured in the Miners Ravine watershed during the March 27, 2007, canal cleaning event.

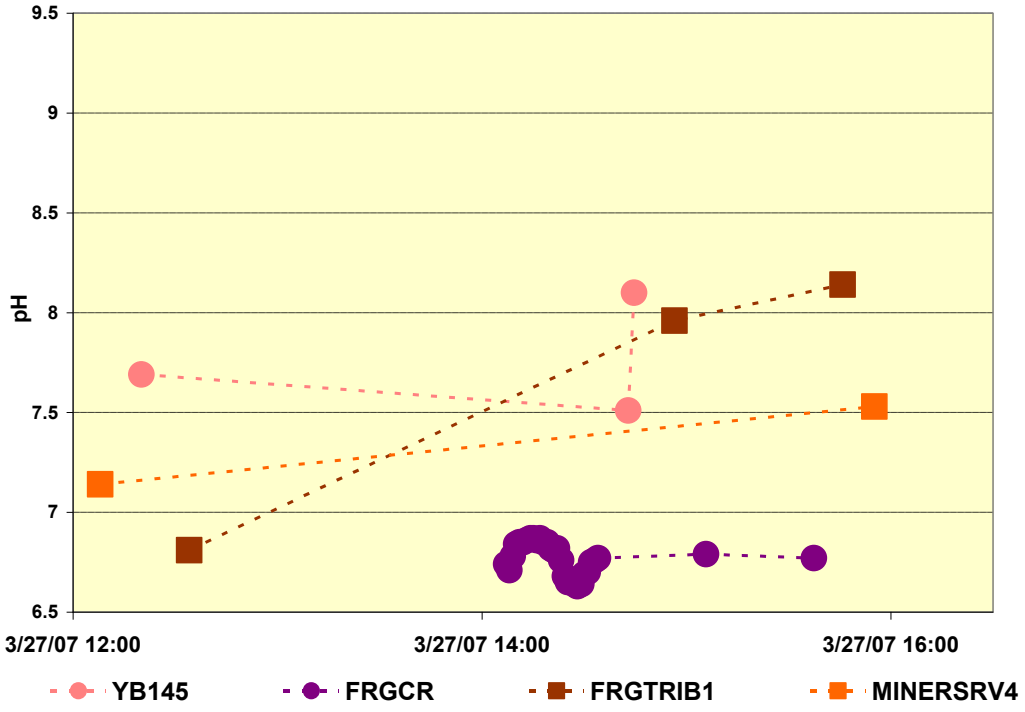

FIGURE 6-4
MEASURED PH LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 27, 2007, CANAL CLEANING EVENT

Total Suspended Solids and Turbidity

Despite a temporary increase in TSS and turbidity levels observed at canal outlet releases after flows were restored to canals following canal cleaning activities, no related effects were observed at stream monitoring sites in the Miners Ravine watershed during sampling events.

Specific Conductivity and Ions

Based on water quality results, canal cleaning activities did not affect SC and ion concentrations in Miners Ravine. Although calcium, iron, magnesium, potassium, sodium, chloride, and sulfate concentrations increased at canal outlet releases after flows were restored to canals following canal cleaning activities, no changes in SC and ion concentrations were observed at stream monitoring sites. In general, SC and ion concentrations were higher at Miners Ravine watershed stream sites compared to canal sites.

Trace Elements

Following canal cleaning activities, concentrations of aluminum, barium, copper, and zinc increased to very high levels at canal outlet releases for a short duration. During the March 15, 2007, canal cleaning event, aluminum concentrations measured in samples collected in Miners Ravine increased from 120 to 710 µg/L, potentially as a result of canal cleaning activities and aluminum loading to the unnamed tributary to Miners Ravine below the Hansen Outlet (**Figure 6-5**). Aluminum levels also increased at BCTRIB1 and FRGCR on March 26, 2007, and March 27, 2007, respectively, but did not increase at Miners Ravine sites monitored downstream. **Figures 6-5, 6-6** and **6-7** show aluminum concentrations for canal and stream sites monitored during canal cleaning activities.

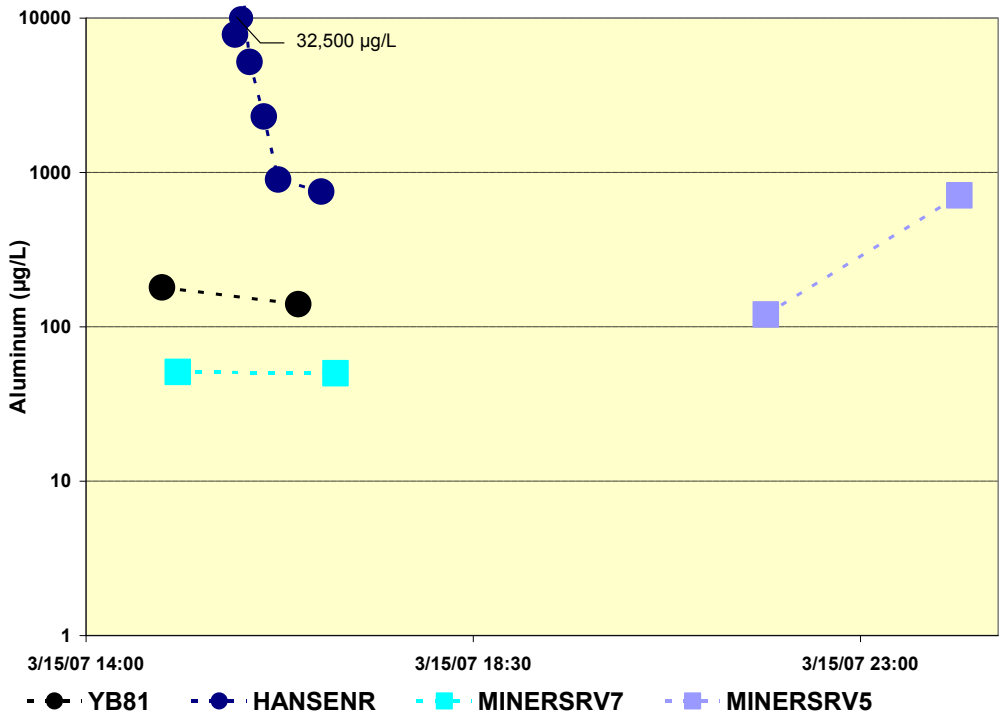

FIGURE 6-5
MEASURED ALUMINUM LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL CLEANING EVENT

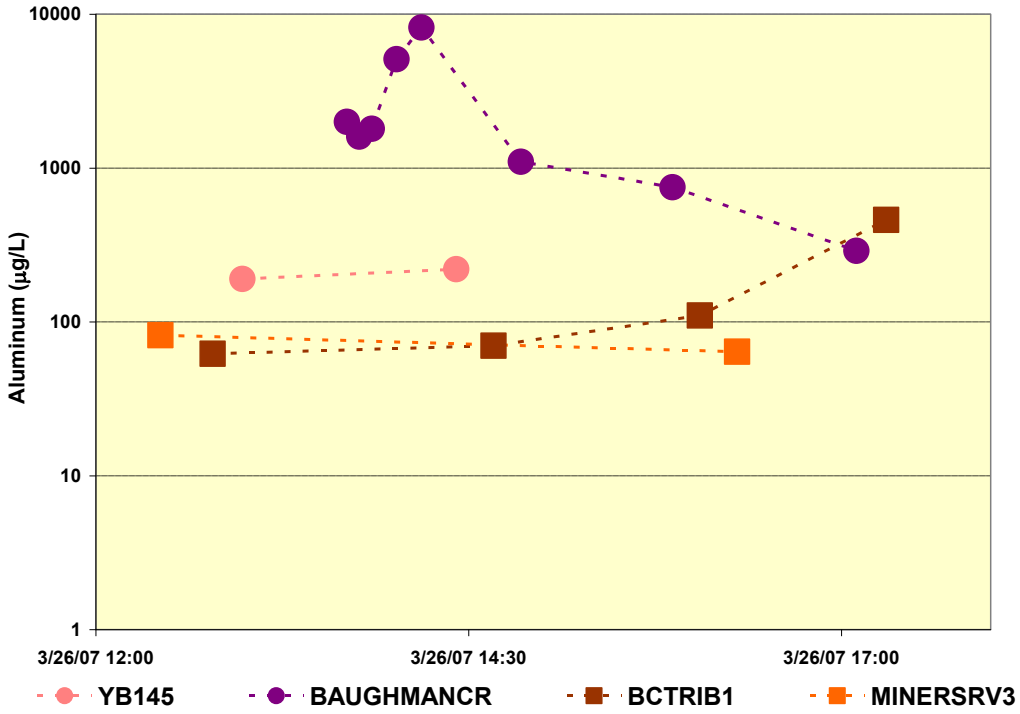

FIGURE 6-6
MEASURED ALUMINUM LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 26, 2007, CANAL CLEANING EVENT

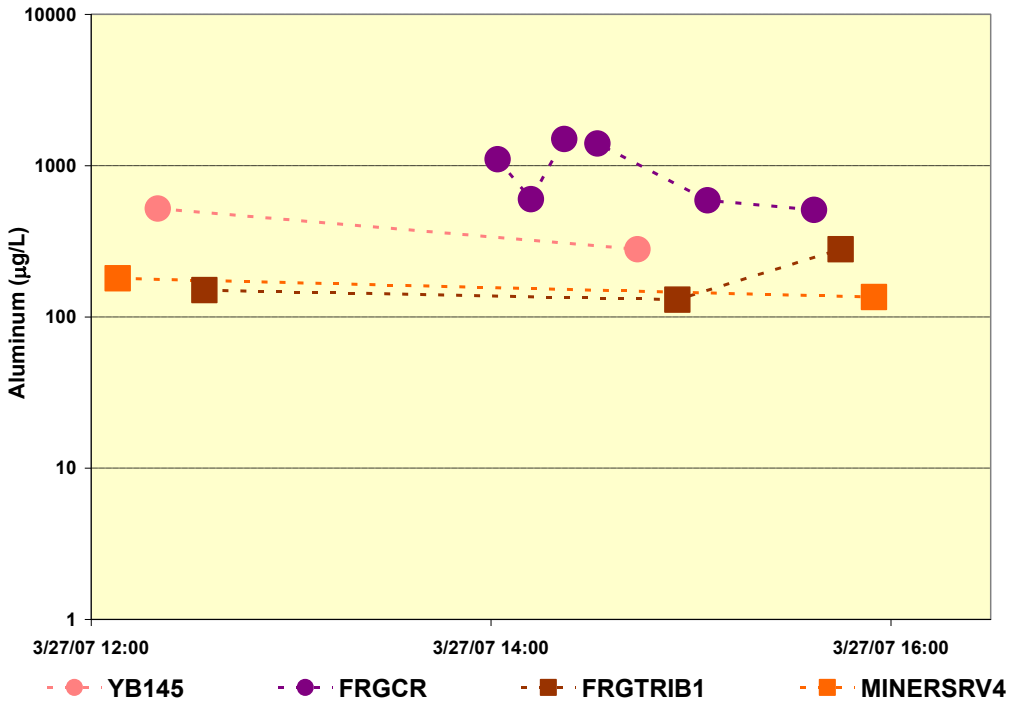

FIGURE 6-7
MEASURED ALUMINUM LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 27, 2007, CANAL CLEANING EVENT

Barium, copper, and zinc concentrations increased at canal outlet releases for a short duration (about 1 hour) following canal cleaning activities. Water quality data collected during monitoring suggest that these increased concentrations at canal outlets generally did not result in increased concentrations at stream sites downstream from the canal outlet releases. However, the concentration of copper and zinc at MINERSRV5 did increase from 3.2 to 8.8 µg/L, and from 5.1 to 7.6 µg/L, respectively, during the March 15, 2007, monitoring event. These increases may be attributed to canal cleaning activities. **Figures 6-8 and 6-9** show barium results for sites monitored during the March 26, 2007, and March 27, 2007, canal cleaning events. Copper and zinc results for Miner Ravine watershed sites monitored during the March 15, 2007, canal cleaning event are shown in **Figures 6-10** and **6-11**. Cadmium concentrations measured at all sites during the canal cleaning monitoring event were below the detection limit (0.5 µg/L).

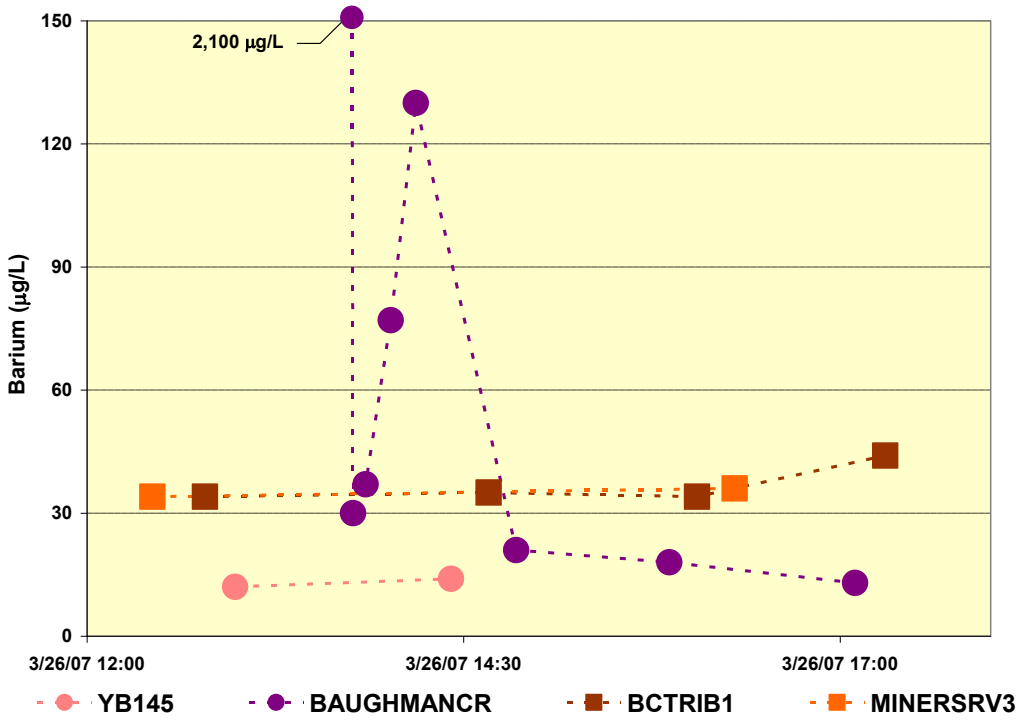

FIGURE 6-8
MEASURED BARIUM LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 26, 2007, CANAL CLEANING EVENT

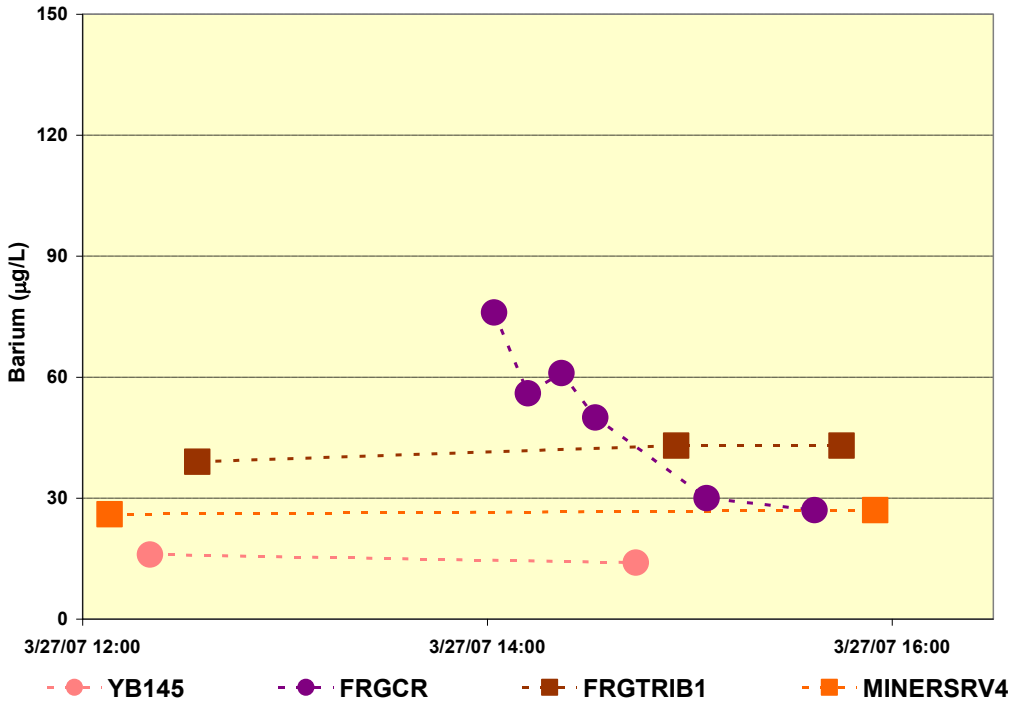

FIGURE 6-9
MEASURED BARIUM LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 27, 2007, CANAL CLEANING EVENT

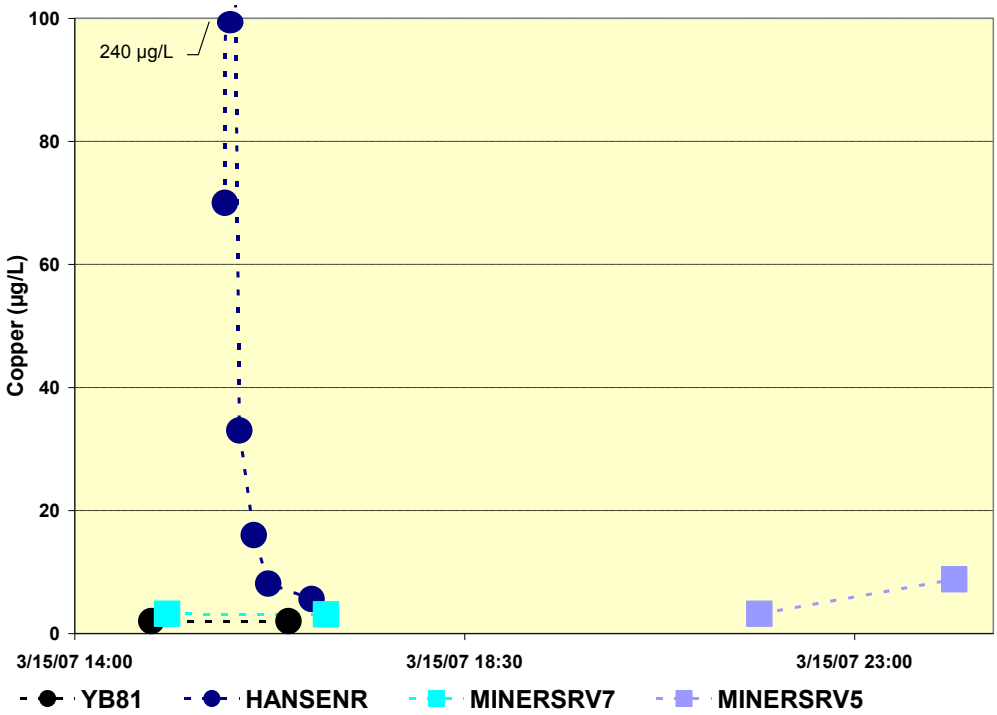

FIGURE 6-10
MEASURED COPPER LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL CLEANING EVENT

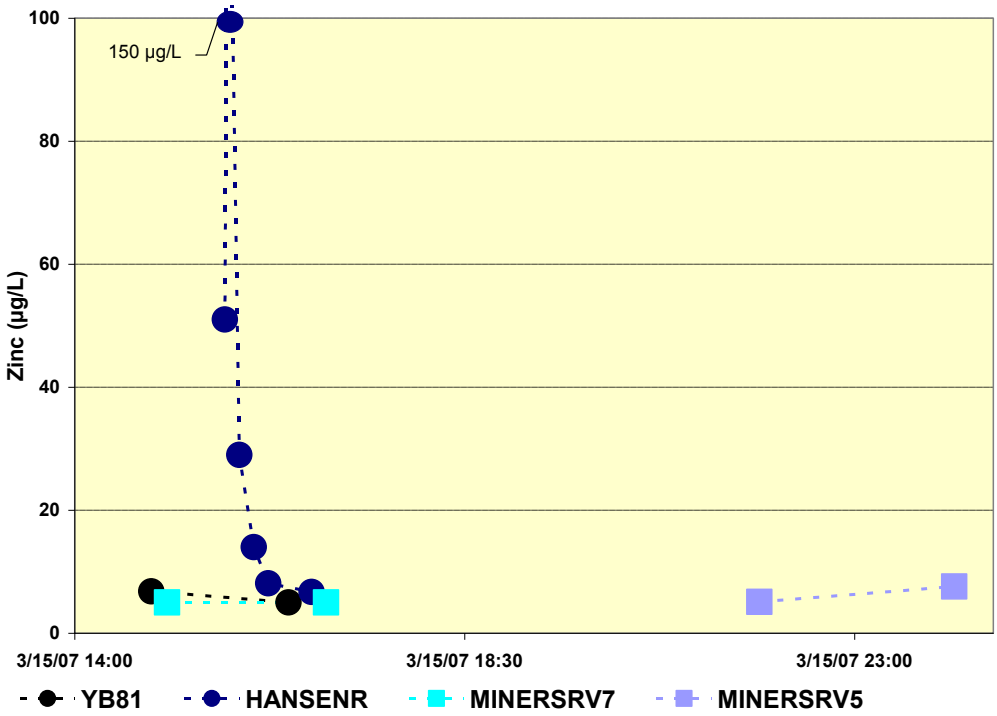

FIGURE 6-11
MEASURED ZINC LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL CLEANING EVENT

Soils and Sediment Quality

As described in **Chapter 2**, debris and sediment removed from the canals are typically deposited along canal banks. To quantify the effects of canal cleaning on soil and sediment quality, soils were collected along canal banks where debris had been deposited. Soils were collected in two high-density polyethylene 500-ml canisters from the banks of five canals, the Antelope, Boardman, Yankee Hill, Baughman, and Ferguson canals. These canals were cleaned on February 14, 2007, and March 15, 22, 26, and 27, 2007, respectively. All soil samples were collected on March 30, 2007. These canals were selected and their soils sampled on March 30, 2007, to provide an understanding of the effects of cleaning on soil quality over time. As shown in **Table 6-4**, the selected canals locations for sampling provide data for evaluating soil quality effects after 44, 15, 8, 4, and 3 days, respectively. High air temperatures during the period when the first canal cleaning activity evaluated for soil quality effects to the date of sample collection ranged from 40°F to 80°F, with lows ranging from 27°F to 56°F (**Figure 6-12**). As shown in **Figure 6-3**, rain fell intermittently during the days before the first canal cleaning event and to the sampling date. Air temperature and precipitation may affect the persistence of constituents in soils directly, through chemical and physical interactions, and indirectly, by influencing microbiological communities in soils. At the time of sampling, the weather was sunny, dry, with a high air temperature of 74°F.

TABLE 6-4
QUALITY OF SEDIMENTS REMOVED FROM CANALS DURING CLEANING AND FLUSHING ACTIVITIES

Constituent (mg/kg)	Ferguson Canal		Baughman Canal		Yankee Hill Canal		Boardman Canal		Antelope Canal	
	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
Aluminum	9,750	+/-1,768	10,000	+/-0	10,800	+/-1,697	4,200	+/-141	12,500	+/-2,121
Barium	89	+/-9.2	62	+/-0.7	62	+/-9.9	41	+/-4.2	125	+/-7.1
Calcium	1,850	+/-354	915	+/-92	4,950	+/-71	1,400	+/-141	2,300	+/-566
Cadmium	Below Detection		Below Detection		0.45	NA	Below Detection		Below Detection	
Copper	90	+/-28.3	52	+/-7.8	75	+/-36	22	+/-0.7	55	+/-43
Iron	12,500	+/-2,121	9,500	+/-141	8,450	+/-9,264	6,000	+/-141	20,500	+/-707
Potassium	1,750	+/-354	1,450	+/-71	545	+/-573	860	+/-198	3,000	+/-1,131
Magnesium	3,400	+/-566	2,600	+/-0	2,070	+/-1,739	2,350	+/-212	4,500	+/-283
Sodium	69	+/-11	58	+/-2.8	375	+/-446	54	+/-0	130	+/-14
Zinc	71	+/-1.4	61	+/-3.5	99	+/-73	16	+/-4.2	54	+/-2.8
Days after Cleaning	3		4		8		15		44	

Ten chemical parameters were measured in soil samples collected: aluminum, barium, cadmium, calcium, copper, iron, magnesium, potassium, sodium, and zinc. Results of chemical analyses are shown in **Table 6-4**.

Samples collected had very high concentrations of aluminum, calcium, iron, magnesium, and potassium across all sites. High concentrations of these constituents are not likely attributed to PCWA raw water distribution system O&M activities, because PCWA O&M activities do not introduce these constituents to the study area. High background concentrations of these constituents in study area soils are most likely due to the chemical composition of minerals in parent material comprising soils.

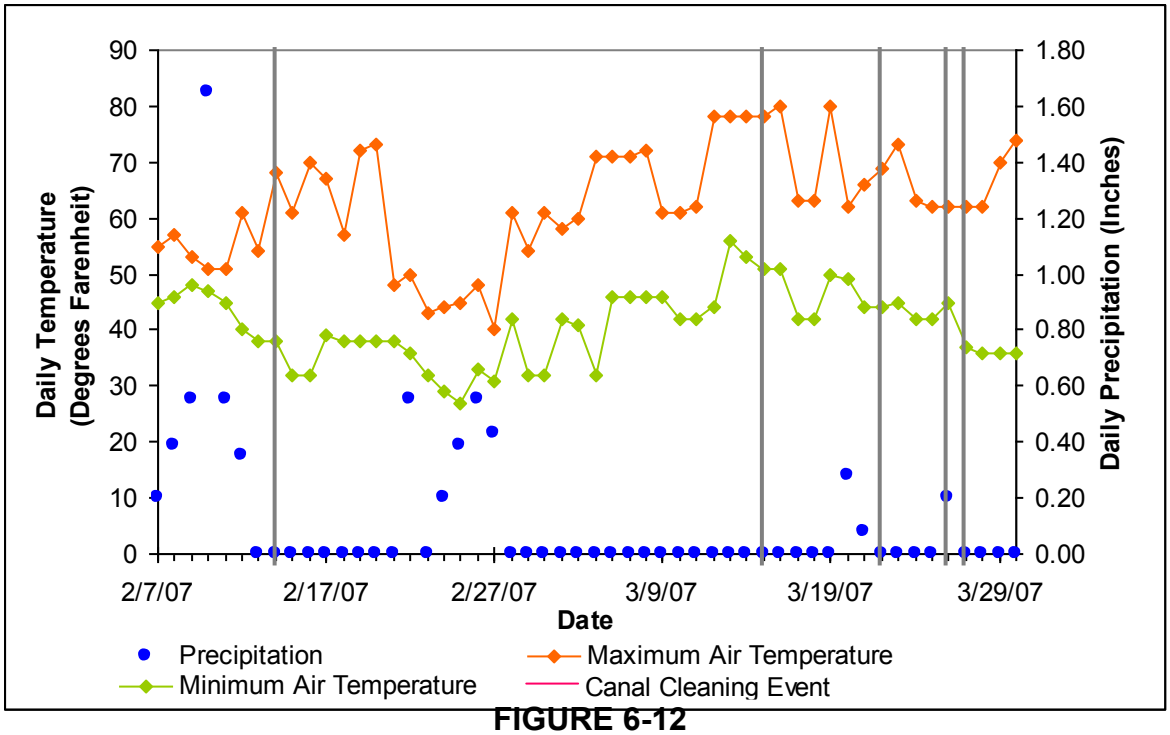

FIGURE 6-12
DAILY AIR TEMPERATURES AND PRECIPITATION BEFORE SOIL SAMPLING FOR CANAL CLEANING EVENTS

Copper concentrations in soil samples collected across some sites were higher than the mean concentration of copper in soils in the region, while cadmium and zinc concentrations across all sites were consistent with regional mean concentrations for soils shown in **Table 6-5** (Holmgren et al. 1993). These higher copper concentrations may be associated with the removal of sediments from the canal with higher copper concentrations attributed to PCWA's algaecide applications, and deposition of the soils along the canal banks. Barium and sodium concentrations in soil samples collected after PCWA canal cleaning activities varied across sites, but are not expected to be affected by PCWA canal cleaning activities.

Soil compaction and erosion may occur as a result of equipment access and use along canal banks during canal cleaning activities. Mechanical equipment may also introduce chemical contaminants (i.e., petroleum products) to soils at access sites.

TABLE 6-5
GEOMETRIC MEAN CONCENTRATIONS OF CADMIUM, COPPER, AND ZINC IN SOILS

Constituent (mg/kg)	State of California Geometric Mean	California Subtropical Land Resource Region Geometric Mean
Cadmium	0.253	0.254
Copper	37.3	43.4
Zinc	82.7	90.4

Source: Holmgren et al. 1993.
Key:
mg/kg = milligrams per kilogram

Biological Resources

The following sections describe potential effects of PCWA canal cleaning and flushing activities on terrestrial and aquatic habitat and species in the study area.

Terrestrial Habitat and Species

Minimal decreases in study area streams due to a short duration reduction of flows in the PCWA canal system could result in temporary, very minimal decreases in the extent of wetland habitats that may be indirectly supported by canal deliveries. This could have minimal effects on species that use these wetland habitats, such as foraging birds and breeding amphibians, by decreasing the amount of available habitat. Reductions in water levels could expose amphibian eggs in the shallow, vegetated margins of drainages or adjacent wetlands. Potential effects from temporary water reductions on species that use these habitats are expected to be minimal. Flushing after canal cleaning could erode banks and wash away amphibian eggs that may be present on stream margins. The typical timing of the cleaning period in the early part of the year occurs within the breeding period for several amphibian species.

Changes in water quality could indirectly affect terrestrial habitats and species. Increased sedimentation from flushing activities could bury amphibian eggs. Increases in trace elements (such as aluminum and copper) could have some negative effects on plants and wildlife on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to such water quality changes, although effects vary dramatically by type and concentration of contaminant, species, and life stage.

Habitats and species could potentially be affected directly or indirectly by impacts to soils and sediments from equipment, including compaction, erosion, and introduction of petroleum products. Effects on habitats and species could include plant mortality or decreased plant growth. These types of impacts are expected to be relatively minimal and small in aerial extent.

If equipment is used for removal of debris, damage could be caused to habitats by movement of equipment or by placement of debris and soil near canals. Some potential negative effects could occur if raptors are nesting near work areas that may be disturbed by noise. Raptors potentially occurring in the study area include Red-shouldered Hawk, American Kestrel, Red-tailed Hawk, and Great Horned Owl. The nesting period for raptors is generally March 1 to August 15.

Aquatic Habitat and Species

Changes in water quality conditions, particularly aluminum and copper concentratons, observed in study area streams following canal cleaning activities may affect aquatic habitat and species. Most aquatic organisms are relatively unaffected by suspended zinc (Eisler 1993). However, high levels of zinc could result in destruction of the gill epithelium and tissue hypoxia. The temporary increases in zinc in Miners Ravine were still below the acute toxicity levels, and would not substantially affect the fish in Miners Ravine.

Aluminum can affect gill function and growth rates. Aluminum bioavailability is closely tied to pH levels. At elevated aluminum concentrations and pH between 5.5 and 7.0, fish and invertebrates may suffer asphyxiation caused by aluminum adsoption on gill surfaces (NMFS 2006). At lower pH levels, aluminum toxicity can result in erosion of gill epithelium and mortality (NMFS 2006). The EPA standard for the 1-hour maximum concentration exposure of fish to aluminum is 750 µg/L, while the 4-day maximum continuous concentration is 87 µg/L (NMFS 2006). The level of effect is dependent upon other environmental conditions, such as pH and water temperature. Higher pH levels in the water increase the buffering capacity for the effects of aluminum on fishes.

The increase in the aluminum concentration observed at MINERSRV5 following canal cleaning during the March 15, 2007, canal cleaning event may result in negative effects to fish. Because the increase in the aluminum concentration (maximum measured at 710 µg/L) were likely short-lived, and because the pH levels were above 6.5, the long-term effects on the fish present was probably minimal. An increase in aluminum concentrations in study area streams as a result of canal cleaning activities that to levels above 750 µg/L for a prolonged period of time may affect fish, but the degree of effects would be dependent on the length of time and pH levels.

Potential effects of copper on fish include reduced olfactory sensors, and possibly temporary decreased feeding activity. The toxicity of copper on fish is dependent on the chemical form, water hardness, and the lifestage and species exposed. Elevated copper concentrations can result in reduced olfactory sensitivity, affecting the ability to detect predators and prey. Elevated copper concentrations could also reduce survival of benthic macroinvertebrates – prey for many fish species. Copper levels in Miners Ravine resulting from canal cleaning operations on March 15 increased from about 5 µg/L to about 10 µg/L. The increase was likely for a short duration (few hours), but could result in impacts that affect fish gills and benthic invertebrates that are prey for many fish species.

Although not observed during water quality monitoring activities, temporary increases in TSS and/or turbidity levels in streams may affect aquatic species and habitat. Increased sedimentation and turbidity resulting from erosion and/or flushing of sediment associated with canal cleaning activities may result in short-term effects on fish. Prolonged exposure to high levels of suspended sediment can create a loss of visual capability, leading to a reduction in feeding and growth rates; a thickening of the gill epithelium, potentially causing the loss of respiratory function; a clogging and abrasion of gill filaments; and increases in stress levels, reducing the tolerance of fish to disease and toxicants (Waters 1995). In addition, high suspended sediment levels will cause the movement and redistribution of fish populations and

can affect physical habitat. Once the suspended sediment is deposited, it can reduce water depths in pools, decreasing the amount of physical habitat for juvenile and adult fish (Waters 1995). Increased sediment loading can also degrade food-producing habitat downstream of the project area. Sediment loading can interfere with photosynthesis of aquatic flora and result in the displacement of aquatic fauna.

Many fish, including juvenile salmonids, are sight feeders. Turbid waters reduce the fish's efficiency in locating and feeding on prey. Some fish, particularly juveniles, can get disoriented and leave areas where their main food sources are located, which can result in reduced growth rates.

Avoidance is the most common result of increases in turbidity and sedimentation. Fish will not occupy areas that are not suitable for survival, unless they have no other option. Therefore, habitat can become limiting in systems where high turbidity precludes a species from occupying habitat required for specific life stages.

Special Status Species

Minimal streamflow decreases in study area streams due to a short duration reduction of flows in the PCWA canal system could result in temporary, very minimal decreases in the extent of wetland habitats that may be indirectly supported by canal deliveries. This could have minimal effects on special status species that use these wetland habitats, such as special status foraging birds and breeding amphibians, by decreasing the amount of available habitat. Reductions in water levels could expose eggs of special status amphibian species that may occur in the shallow, vegetated margins of drainages or adjacent wetlands. Potential effects from temporary water reductions on species that use these habitats are expected to be minimal. As described above, flushing after canal cleaning could erode banks and wash away amphibian eggs, including those of special status species, which may be present on stream margins. The typical timing of the cleaning period in the early part of the year occurs within the breeding period for several special status amphibian species. The California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds between mid-March through early June, and the western spadefoot toad breeds late January through July (Stebbins 2003).

Special status plant species (see **Tables 3-12** and **3-13**), if present along the PCWA canal system, could potentially be affected directly or indirectly by impacts to soils and sediments from equipment, including compaction, erosion, and introduction of petroleum products. Effects on species could include plant mortality or decreased plant growth. These types of effects are expected to be unlikely to occur.

If equipment is used to remove debris, damage could be caused to special status plant species, if present, by movement of equipment or by placement of debris and soil near canals. Some potential negative effects could occur if raptors are nesting near work areas that may be disturbed by noise. Special status raptors potentially occurring in the study area include Swainson's hawk, Cooper's hawk, Northern Goshawk, White-tailed Kite, and Northern Harrier. As mentioned above, the nesting period for raptors is generally March 1 to August 15.

Potential water quality effects discussed above could indirectly affect terrestrial habitats and species. Increased sedimentation from flushing activities could bury special status amphibian eggs, if present. Increases in trace elements (such as aluminum and copper) could have some negative effects on special status plants and wildlife, if present, on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to such water quality changes, although effects vary dramatically by species, life stage, and parameters.

Increased levels of aluminum and copper in study area streams during and after canal cleaning activities could potentially affect steelhead and Chinook salmon. As described above, aluminum can affect gill function and growth rates. Pacific salmonids are considered susceptible to copper toxicity, with a mean acute toxicity level at 29.11 µg/L (NMFS 2006). Avoidance by Chinook salmon can occur at levels as low as 0.7 µg/L, and at 1.6 µg/L for rainbow trout. Increased copper levels can result in diminished olfactory sensitivity, which affects the fishes' ability to detect predators, prey, and also to affect imprinting of smolts on their natal stream (NMFS 2006). Exposure to levels at 25 µg/L for 1 and 4 hours indicate a substantial decrease in the number of receptors in the olfactory bulb due to cellular necrosis (cell death) in Chinook salmon. Rainbow trout can tolerate higher concentrations at the 1-hour increment, but have similar effects at the 4-hour interval. Social interactions can also be impaired with copper exposure. Increased stress levels of subordinate fish may also lead to increased copper uptake across the gills. Elevated copper concentrations could also reduce survival of benthic macroinvertebrates – prey for juvenile salmonids. Select examples from research studies of adverse effects with copper to Chinook salmon and steelhead are provided in **Table 6-6**.

TABLE 6-6
EXAMPLES OF ADVERSE EFFECTS WITH COPPER TO SALMONIDS

Species (lifestage)	Effect	Effect Concentration (µg/L)[a]	Effect statistic	Hardness[b]	Exposure duration	Source
Chinook salmon (*Oncorhynchus tshawytscha*)						
Juvenile	Avoidance in laboratory exposures	0.75	LOEC	25	20 minutes	Hansen et al. 1999
Juvenile	Loss of avoidance ability	2	LOEC	25	21 days	Hansen et al. 1999
Adult	Spawning migrations in wild apparently interrupted	10-25	LOEC	40	Indefinite	Mebane 2000
NA	Reduced growth (as weight)	1.9	EC_{10}	25	120 days	Chapman 1982
Fry	Death	19	LC_{50}	24	96 hours	Chapman 1978
Steelhead (*Oncorhynchus mykiss*)						
Juvenile – Rainbow trout	Avoidance in laboratory exposures	1.6	LOEC	25	20 minutes	Hansen et al. 1999
NA – Rainbow trout	Loss of homing ability	22	LOEC	63	40 weeks	Saucier et al. 1991
NA	Reduced growth (as weight)	45 to >51	NOEC	24-32	60 days	Mudge et al. 1993
Fry	Death	9-17	LC_{50}	24-25	96 hours	Chapman 1978, Marr et al. 1996
Adult	Death	57	LC_{50}	42	96 hours	Chapman and Stevens 1978
Juvenile	Death	24-28	NOEC	24-32	60 days	Mudge et al. 1993
Egg-to-fry	Death	11.9	EC_{10}	25	120 days	Chapman 1982

Source: NMFS 2007. An Overview of Sensory Effects on Juvenile Salmonids Exposed to Dissolved Copper.

Notes:

[a] Effects of exposure durations stem from laboratory and field experiments; therefore, in some experiments, multiple routes of exposure may be present (i.e., aqueous and dietary) and water chemistry conditions will likely differ.

[b] Toxicity of copper may be influenced by hardness.

Key

EC_{10} = Effective concentration adversely affecting 10 percent of the test population or percent of the measured response

LC_{50} = The concentration that kills 50 percent of the test population

LOEC = Lowest observed adverse effect concentration (may not be a threshold, but simply the lowest concentration tested

NA = Not available

NOEC = No observed adverse effect concentration

6.1.1.2 Weed and Brush Control

The following sections describe potential effects of weed and brush control activities conducted by PCWA on natural resource conditions in the study area. Additionally, the regulatory framework for the weed and brush control activities is provided, along with descriptions of potential BMPs that may reduce potential effects.

Physical Removal of Vegetation

Effects of PCWA's physical removal of vegetation during scheduled canal maintenance activities are described below.

Physical Resources

Potential effects of PCWA's physical removal of vegetation along canal banks on hydrology and water quality conditions in study area streams, and soils and sediment quality in the study area are described below.

Hydrology

Flows within canals are generally not disrupted while PCWA undertakes physical removal of vegetation within or along the canal system. Therefore, physical removal of vegetation is not likely to affect hydrologic conditions within study area streams.

Water Quality

Potential water quality effects of physical removal of vegetation are expected to be minimal to none. Minimal effects on TSS and turbidity may occur if the removal of vegetation results in the dislodging or loosening of soil along canal banks causes loose sediment to be deposited into the canals. During this activity, the removed vegetation is either deposited away from canals or hauled away in trucks, which prevents from potential deposition of debris in the canals. No dewatering or flushing activities are associated with the physical removal of vegetation.

Soils and Sediment Quality

Potential effects of PCWA activities during physical removal of vegetation likely depend on the equipment used for removal, and type and location of vegetation. Equipment used along canal banks may increase erosion, and motorized equipment may introduce petrochemicals to soils and affect sediment quality. These potential effects are likely to be minor.

Biological Resources

The following sections describe potential effects of physical removal of vegetation within the PCWA raw water distribution system on terrestrial and aquatic habitat and species in the study area.

Terrestrial Habitat and Species

Physical removal of vegetation would result in direct loss of vegetation and habitat. Native trees may be trimmed or removed. Bird nests or eggs in vegetation to be trimmed or removed may be disturbed or destroyed. Habitats and species could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used for vegetation removal, including compaction, erosion, and introduction of petroleum products. Potential effects on habitats and

species may include plant mortality or decreased plant growth. These types of impacts are expected to be relatively minimal and small in aerial extent.

If equipment is used to remove vegetation, some potential negative effects could occur if raptors nesting near work areas are disturbed by noise. Raptors potentially occurring in the study area include Red-shouldered Hawk, American Kestrel, Red-tailed Hawk, and Great Horned Owl. The nesting period for raptors is generally March 1 to August 15.

Aquatic Habitat and Species

As described above, flows within canals are generally not disrupted while PCWA undertakes physical removal of vegetation within or along the canal system, and potential water quality effects of physical removal of vegetation are expected to be minimal to none. Therefore, physical removal of vegetation is not likely to affect aquatic habitat and species within study area streams.

Special Status Species

Physical removal of vegetation could result in direct loss of or damage to special status plant species or elderberry shrubs that may host the valley elderberry longhorn beetle, if present. Special status bird nests or eggs in vegetation to be trimmed or removed, if present, may be disturbed or destroyed.

Special status plant species (see **Tables 3-12** and **3-13**), if present, could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used for vegetation removal, including compaction, erosion, and introduction of petroleum products. Effects on species could include plant mortality or decreased plant growth. These types of impacts are expected to be unlikely to occur.

If equipment is used for removal of vegetation, some potential negative effects could occur if raptors are nesting near work areas that may be disturbed by noise. Special status raptors potentially occurring in the study area include Swainson's hawk, Cooper's hawk, Northern Goshawk, White-tailed Kite, and Northern Harrier. As mentioned above, the nesting period for raptors is generally March 1 to August 15.

Algaecide Application

PCWA's raw water distribution system algaecide applications have the potential to affect natural resource conditions in the study area. The following sections describe potential effects of algaecide applications on natural resources.

Physical Resources

The following sections describe potential effects of PCWA's algaecide applications on the hydrology and water quality of study area streams, and soils and sediment quality.

Hydrology

Flows within canals are generally not disrupted while PCWA carries out algaecide applications within the canal system. Therefore, algaecide applications conducted by PCWA in the raw water distribution system are not likely to affect hydrologic conditions in study area streams.

Water Quality

As shown in **Figures 2-8** to **2-11** and discussed in **Table 2-1**, PCWA has 21 established points of algaecide application within the system, with "spot" treatments at other locations as conditions warrant. Water quality conditions at canal and stream sites within the Secret Ravine watershed were monitored during two application events at Boardman Canal below Mammoth Reservoir on May 16, 2007, and August 15, 2007. The locations and times of sampling were selected to determine potential effects of algaecide applications on water quality conditions in receiving waters. These locations are shown in **Figures 5-3 and 5-4**. **Table 6-7** provides details of the algaecide application monitoring events. Potential water quality effects described for sites monitored within the Secret Ravine watershed are assumed to be representative of the potential effects in watersheds of other study area streams affected by PCWA maintenance activities. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and study area streams monitored during algaecide applications are included in **Appendix C**.

TABLE 6-7
WATER QUALITY MONITORING LOCATIONS FOR ALGAECIDE APPLICATIONS AT BOARDMAN CANAL BELOW MAMMOTH RESERVOIR

Site Description	Site Identification	Site Type	Application Start /End Time	Weather
Boardman Canal below Mammoth Reservoir[1]	YB81	Canal	Start: 5/16/2007, 8:30 a.m. End: 5/16/2007, 12:00 p.m.	Warm and dry
Yankee Hill Canal Outlet Release	YANKEECR	Canal		
Tributary to Secret Ravine from Yankee Hill Canal	YHTRIB2	Stream		
Secret Ravine at Rocklin Road	SECRETRV3	Stream		
Boardman Canal below Mammoth Reservoir[2]	YB81	Canal	Start: 8/15/2007, 8:25 a.m. End: 8/15/2008, 12:00 p.m.	Warm and dry
Yankee Hill Canal Outlet Release	YANKEECR	Canal		
Tributary to Secret Ravine from Yankee Hill Canal	YHTRIB2	Stream		
Secret Ravine at Rocklin Road	SECRETRV3	Stream		

Notes
[1] Cutrine application conducted by PCWA with a target dosage of 800 μg/L
[2] Cutrine-Plus® application conducted by PCWA with a target dosage of 800 μg/L

Water Temperature and Dissolved Oxygen

No effects on water temperatures were observed during the algaecide application events. Measured changes in water temperatures during the algaecide events are consistent with diurnal fluctuations with the highest temperatures occurring during the afternoon, and lowest temperatures occurring at night and during the early morning. No effects on DO levels were observed during algaecide application activities.

pH, Alkalinity, and Hardness

Minimal effects on pH were observed during the algaecide application monitoring events. Measured pH levels increased slightly at YANKEECR and subsequently increased at YHTRIB2 and SECRETRV3. These results are shown in **Figure 6-13** below. According to the Material Safety and Data Sheet for Cutrine-Plus®, the pH of the algaecide ranges from 10.3 to 10.5 (Applied Biochemists 2006). The high pH allows the copper to stay in solution even under conditions of high hardness and alkalinity.

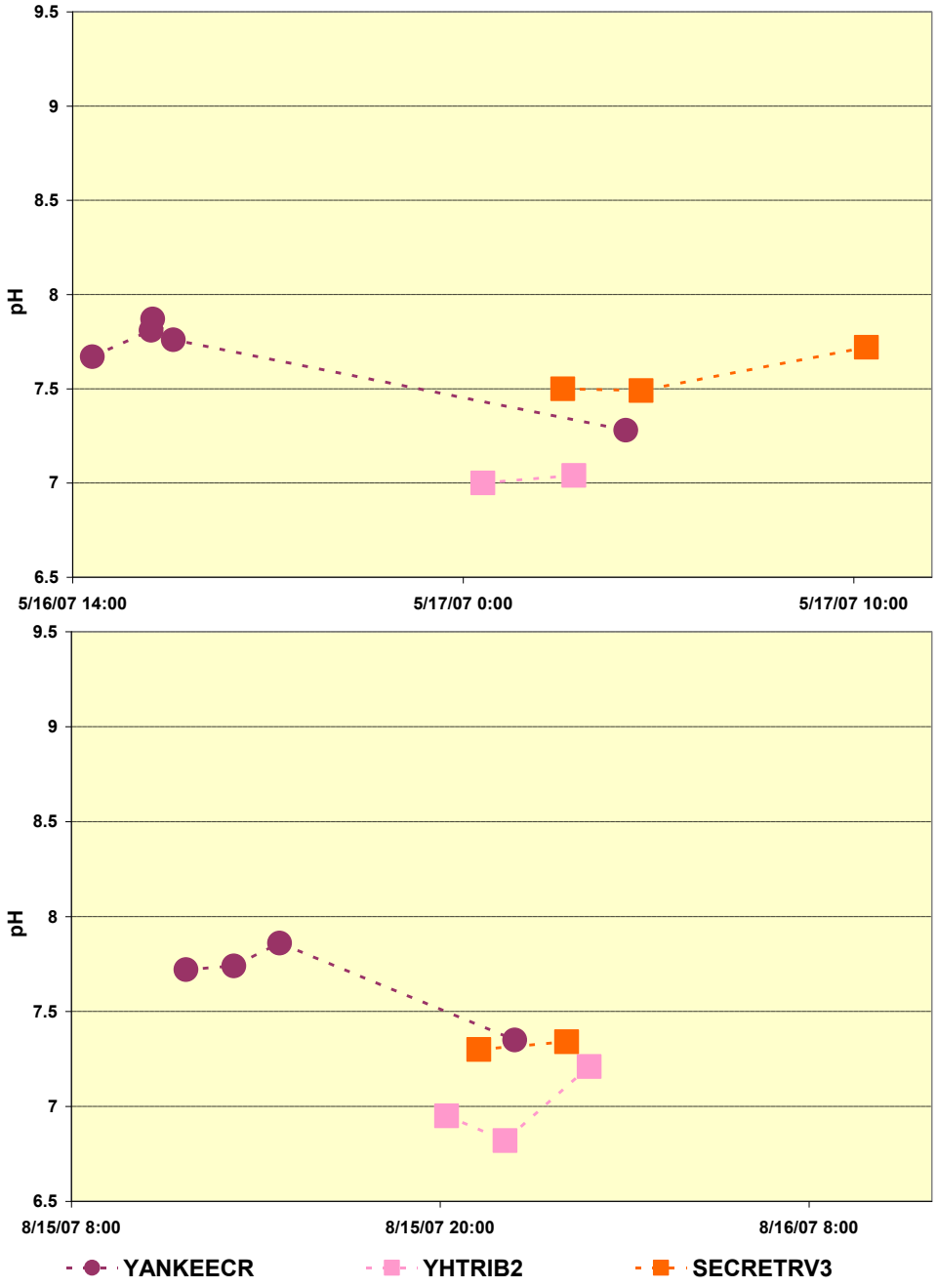

FIGURE 6-13
MEASURED PH LEVELS AT SECRET RAVINE WATERSHED SITES DURING MAY 16, 2007, AND AUGUST 15, 2007, ALGAECIDE APPLICATION EVENTS

No effects on alkalinity and calculated total hardness were observed during algaecide application events. In general, alkalinity and total hardness levels were higher at stream sites compared to canal sites.

Total Suspended Solids and Turbidity

TSS was not sampled during the algaecide application events. No effects on turbidity were observed during the events.

Specific Conductivity and Ions

Measured values in samples collected during monitoring suggest that SC and major ion (calcium, iron, magnesium, potassium, sodium, chloride, nitrate, and sulfate) concentrations at Secret Ravine watershed sites were not affected by algaecide applications.

Trace Elements

Algaecide applications do not appear to affect aluminum, barium, cadmium, and zinc concentrations in study area streams. Copper concentrations at YANKEECR did increase in response to algaecide applications upstream at Boardman Canal below Mammoth Reservoir. Based on measured values of copper in samples collected during monitoring, minimal to no effects on copper concentrations were observed at YHTRIB2 and SECRETRV3. Copper concentrations at sites monitored during the algaecide application events are shown in **Figures 6-14 and 6-15**. Cadmium and zinc concentrations measured at all sites during algaecide application monitoring events were below the detection limit (0.5, and 20 µg/L, respectively).

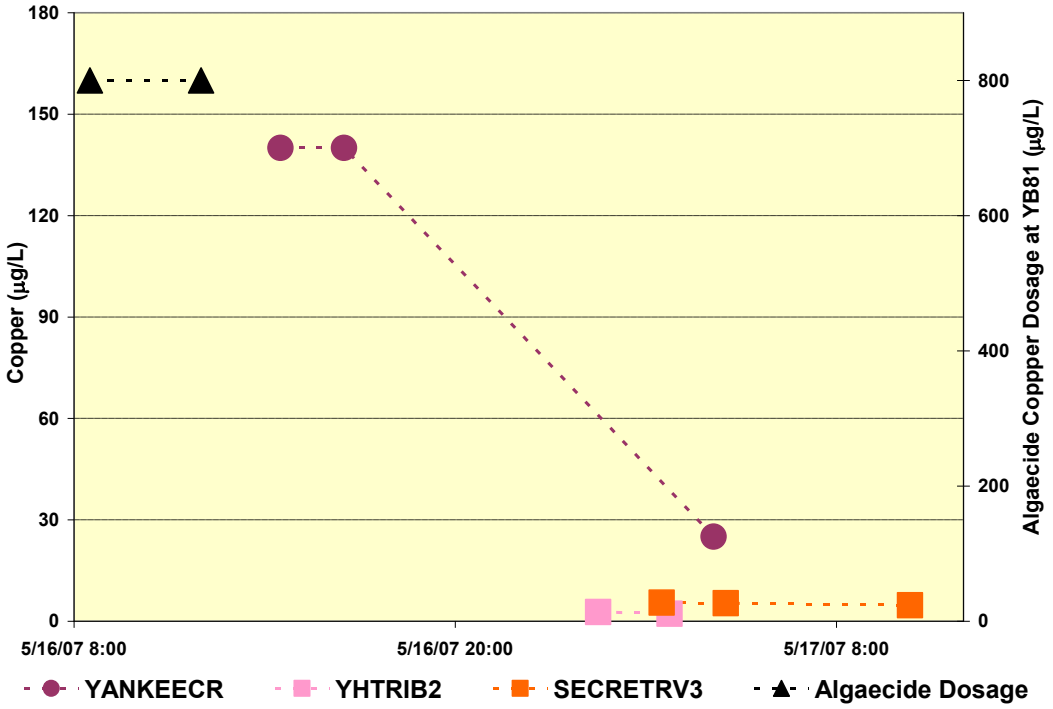

FIGURE 6-14
MEASURED COPPER LEVELS AT SECRET RAVINE WATERSHED SITES DURING MAY 16, 2007, ALGAECIDE APPLICATION EVENT

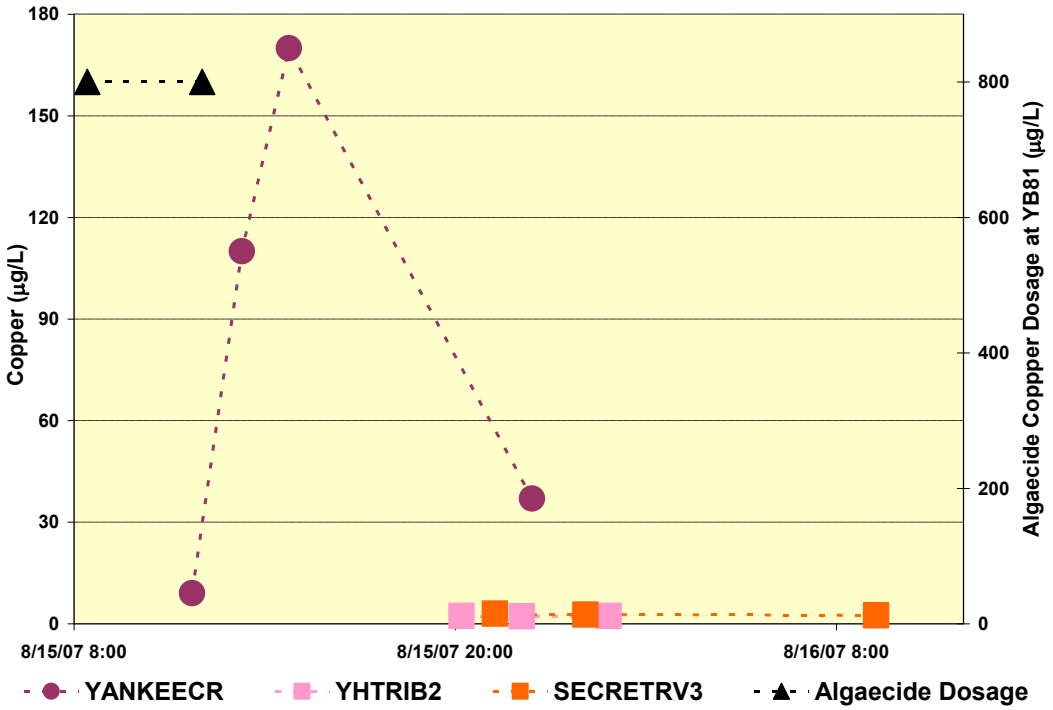

FIGURE 6-15
MEASURED COPPER LEVELS AT SECRET RAVINE WATERSHED SITES DURING AUGUST 15, 2007, ALGAECIDE APPLICATION EVENT

Soils and Sediment Quality

Algaecides are released directly to water supplies at PCWA canal system locations by staff; therefore, effects of applications on soils and sediment quality in the study area are minimal. Potential effects are likely associated with unintentional discharges to the environment during transport of algaecides to application sites and/or leaks from algaecide storage vessels at application sites. These potential effects are not likely due to training and qualifications requirements for staff involved in algaecide applications.

Biological Resources

The following sections describe potential effects of PCWA's algaecide applications on biological resources in the study area.

Terrestrial Habitat and Species

Copper in applied algaecides could have some negative effects on plants and wildlife on the margins of canals and tributaries. Exposure routes for copper through dietary consumption of contaminated prey items or direct contact with contaminated sediments are important and may affect a broad range of terrestrial species (NMFS 2007). Heavy metals, especially copper, have been found to be very toxic to amphibians, particularly at the egg and tadpole life stages (U.S. EPA 2008, B.C. Ministry of Water, Land and Air Protection 2004). Algaecides are typically applied starting in April through summer, which coincides with the breeding season and tadpole stages for several amphibian species. Birds and mammals appear to be less sensitive to copper than aquatic organisms; however, toxic effects have been documented, including reduced growth

rates, lowered egg production, and developmental abnormalities in birds, and various physiological effects on mammals, such as liver cirrhosis, damage to kidneys and the brain, and fetal mortality (U.S. EPA 2008, EXTOXNET 1994a).

Very minimal effects could occur to terrestrial habitats and species associated with trampling of vegetation at application points while algaecides are being applied.

Aquatic Habitat and Species

Based on water quality monitoring results, aquatic habitat and species in study area streams are not likely affected by PCWA activities during algaecide application events. Potential indirect effects are associated with mobilization of constituents associated with fine sediment and organic material that had settled when canals were dewatered during the outage, as described for canal cleaning activities and discussed in **Chapter 7**.

Special Status Species

Copper in applied algaecides could have some negative effects on special status species, if present, on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to such water quality changes, although effects vary dramatically by species, life stage, and contaminant. Algaecides applications typically start during April through summer, which coincides with the breeding season and tadpole stages for several special status amphibians. California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds between mid-March through early June, and the western spadefoot toad breeds late January through July (Stebbins 2003).

If present, special status plant species could also be affected by trampling while algaecide is being applied.

Based on water quality monitoring results, special status fish species in study area streams are not likely affected by PCWA activities during algaecide application events. Potential indirect effects on special status fish species are associated with mobilization of constituents associated with fine sediment and organic material that had settled when canals were dewatered during the outage, as described for canal cleaning activities and discussed in **Chapter 7**.

Herbicide Application

PCWA's herbicide application activities have the potential to affect natural resource conditions in the study area. The following sections describe potential effects of PCWA's herbicide applications on natural resources.

Physical Resources

The following sections describe potential effects of herbicide applications within the PCWA raw water distribution system on hydrologic and water quality conditions in study area streams, and soils and sediment quality.

Hydrology

Flows within canals are generally not disrupted while PCWA carries out herbicide applications within or near the canal system. Therefore, herbicide applications conducted by PCWA are not likely to affect hydrologic conditions in study area streams.

Water Quality

Potential effects of PCWA herbicide applications for managing pre-emergent vegetation, woody plants, and annual and perennial broadleaf weeds along canal berms were not evaluated through water quality monitoring. Herbicide applications along canal berms are not likely to affect water quality conditions in study area streams due to the rapid degradation of these herbicides, as described in **Chapter 2**.

Water quality was monitored at six locations to evaluate potential effects associated with AquaMaster™ glyphosate aquatic herbicide application events that occurred at Clover Valley and Mammoth reservoirs on August 2, 2007. Two canal monitoring sites and one stream site were sampled downstream from Clover Valley Reservoir in the Antelope Creek watershed, and two canal monitoring sites and one stream site were sampled below Mammoth Reservoir in the Secret Ravine watershed (**Figure 5-4**). Water quality conditions were not monitored at Auburn Ravine, Clover Valley Creek, or Miners Ravine sites, but are likely to be similar to conditions described below for Antelope Creek and Secret Ravine. **Table 6-8** below lists the aquatic herbicide application information and sites monitored for each sampling event. Water quality parameters evaluated through monitoring during the aquatic herbicide application events include water temperature, DO, pH, SC, turbidity, alkalinity, and glyphosate. The results from water quality monitoring during herbicide application events are discussed in this section by watershed. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and study area streams monitored during herbicide application monitoring events are included in **Appendix C**.

TABLE 6-8
WATER QUALITY MONITORING LOCATIONS IN THE PCWA SERVICE AREA FOR HERBICIDE APPLICATION

Site Description	Site Identification	Site Type	Watershed(s)	Application Start /End Time	Weather
Herbicide Application at Mammoth Reservoir (Glyphosate)					
Boardman Canal below Mammoth Reservoir	YB81	Canal	Miners Ravine/Secret Ravine	Start: 8/2/2007, 8:00 a.m. End: 8/2/2007, 11:30am	Warm and dry, light rain at night
Boardman Canal Outlet Release	BOARDMANCR	Canal	Secret Ravine		
Secret Ravine at Rocklin Road	SECRETRV3	Stream	Secret Ravine		
Herbicide Application at Clover Valley Reservoir (Glyphosate and Reward)					
Clover Valley Reservoir release to Clover Valley Creek and Antelope Canal	CLVRESR	Canal	Antelope Creek/Clover Valley Creek	Start: 8/15/2007, 8:25 a.m. End: 8/15/2008, 12:00 p.m.	Warm and dry
Antelope Stub Canal near Antelope Canal	ANTSTUBCR	Canal	Antelope Creek		
Antelope Creek at Midas Avenue	ANTC3B	Stream	Antelope Creek		

Antelope Creek Watershed

AquaMaster™ was applied to emergent aquatic vegetation along the perimeter of Clover Valley Reservoir on August 2, 2007. Water quality was monitored at:

- **Clover Valley Reservoir release to Clover Valley Creek and Antelope Canal (CLVRESR)**
- **Antelope Stub Canal near Antelope Canal (ANTSTUBCR)**
- **Antelope Creek near Midas Avenue (ANTC3B)**

Based on water quality results, Antelope Creek water temperatures, DO, pH, alkalinity, SC, and turbidity conditions were not affected by the aquatic herbicide application event at Clover Valley Reservoir. Minimal changes in water temperature and DO observed during monitoring are likely due to diurnal fluctuations. The aquatic herbicide application event also did not appear to affect glyphosate concentrations in Antelope Creek; all water quality samples collected at Antelope Creek watershed sites during the monitoring event had glyphosate concentrations below the measurable detection limit (6 μg/L).

Secret Ravine Watershed

AquaMaster™ was applied to emergent aquatic vegetation along the perimeter of Mammoth Reservoir on August 2, 2007. Water quality was monitored at:

- **Boardman Canal below Mammoth Reservoir (YB81)**
- **Boardman Canal Outlet Release (BOARDMANCR)**
- **Secret Ravine at Rocklin Road (SECRETRV3)**

Similar to the conditions described above within the Antelope Creek watershed, the aquatic herbicide application event did not appear to affect water temperature, DO, pH, alkalinity, SC, turbidity, or glyphosate conditions at Secret Ravine watershed sites. All water quality samples collected during the monitoring event had glyphosate concentrations below the measurable detection limit (6 μg/L).

Soils and Sediment Quality

PCWA's application of herbicides along canal berms likely result in temporary effects on soil chemistry. Chemical constituents of herbicides applied by PCWA may include triclopyr, glyphosate, dithiopyr, diquat dibromide, and non-ionic alkylphenol ethoxylate surfactants. As described in **Chapter 2**, these constituents, with the exception of diquat dibromide, degrade rapidly to inert compounds or products with low toxicity. Diquat dibromide is tightly adsorbed to soil particles, persistent, toxic to fish and wildlife, and is unavailable to soil microbes' microbial degradation and for plant uptake.

Biological Resources

The following sections describe potential effects of PCWA's herbicide applications on biological resources in the study area.

Terrestrial Habitat and Species

Application of herbicide may result in indirect mortality or damage to non-target vegetation. Herbicides may also affect wildlife species, particularly amphibians. Glyphosate herbicides, which are used near water, are generally less toxic to wildlife than other types of herbicide; however, effects vary dramatically by concentration of contaminant, species, and life stage. Some studies of glyphosates on amphibians have found negative effects at various life stages, including mortality, developmental defects, and behavioral abnormalities (B.C. Ministry of Water, Land and Air Protection 2004).Other components, such as surfactants, commonly contained in glyphosate formulations, including Roundup®, have also been found to cause severe negative effects to amphibians (USFWS 2002). Herbicides are typically applied in early spring through summer, which coincides with the breeding season for several amphibian species. Glyphosates have been found to be only slightly toxic to birds and mammals (EXTOXNET 1994b, Tu et al. 2001). Triclopyr was also found to be only slightly toxic to birds and mammals (EXTOXNET 1994b, Tu et al. 2001). According to these sources, triclopyr is not expected to bioaccumulate in wildlife. A study in Canada, however, found triclopyr to be harmful to amphibians under normal field use (Thompson et al. 2007).

Aquatic Habitat and Species

Based on results from water quality monitoring during herbicide applications, aquatic habitat and species in study area streams are not likely affected by the application of AquaMaster™ glyphosate aquatic herbicide at PCWA reservoirs. Glyphosate herbicides designed for aquatic use, such as AquaMaster™, have minimal surfactants, and thus have a low toxicity level to fish. Glyphosate dissipates in water by binding to soil particles and organic material or through microbial degradation. Any fish present in Mammoth and Clover Valley reservoirs are likely to suffer minimal effects resulting from the use of AquaMaster™ as an herbicide.

Special Status Species

Application of herbicide may result in indirect mortality or damage to untargeted special status plants or elderberry shrubs hosting the valley elderberry longhorn beetle, if present near the application area. Herbicides may also affect special status wildlife species, particularly amphibians, if present. Herbicides are typically applied in early spring through summer, which coincides with the breeding season for several special status amphibians. California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds between mid-March through early June, and the western spadefoot toad breeds late January through July (Stebbins 2003).

Special status fishes are not likely affected by the application of the herbicides within the canal system. Herbicides applied by PCWA have a relatively short half life, and AquaMaster™ is relatively nontoxic to fishes.

Other special status species, particularly amphibians, may be negatively affected by applications of herbicides if in close proximity to the application. Water quality monitoring results during the herbicide application event do not show effects to stream habitat.

6.1.2 As-Needed Site-Specific Maintenance Activities

The following sections address potential effects of PCWA's as-needed site-specific maintenance activities on natural resource conditions in the study area. These activities include canal lining/guniting, canal repair, and pipe repair.

6.1.2.1 Canal Lining/Guniting

This section provides an overview of the potential effects of PCWA's canal lining/guniting activities.

Physical Resources

The following sections describe potential effects of PCWA canal repair activities on hydrologic and water quality conditions in study area streams, and soils and sediment quality.

Hydrology

PCWA operations during canal lining/guniting activities do not affect hydrologic conditions in Canyon Creek or Auburn Ravine. During the canal cleaning and flushing, PCWA canal system contributions to streamflow in Canyon Creek and Auburn Ravine, and/or diversions from

Canyon Creek and Auburn Ravine, do not change as a result of PCWA operations. As described above for canal cleaning and flushing activities, continuous-flow data collected from canal and stream sites within PCWA's lower Zone 1 service area during WDY 2006 were evaluated to determine effects of canal lining/guniting activities on hydrologic conditions in Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine. Continuous-flow monitoring locations, and their respective watersheds, are listed in **Table 6-1**.

Table 6-9 provides PCWA's schedule of canal lining/guniting within a portion of PCWA's raw water distribution system during 2006. During these outages for canal lining/guniting, canal flows were typically interrupted during business hours to dewater canal segments, apply gunite to dewatered segments, and allow sufficient time for the new canal lining to dry.

TABLE 6-9
CANAL OUTAGES FOR CANAL LINING/GUNITE DURING 2006

Canal	Date
East Perry near Horseshoe Bar Road	March 6, 7, 8
Boardman near Valley Quail Drive	March 13, 14, 15
Baughman near headgate	March 15, 16
Baughman downstream from Mutoza spill	March 17, 20
Ferguson at Morgan Place/Wells Lane	March 17, 20
End of Stallman Canal	July 18
Boardman at Rocklin road	September 14, 21

Average daily flows for canal and stream sites evaluated during March 2006 canal lining/guniting are shown in **Figure 6-1** for sites within the Secret Ravine watershed, and in **Figure 6-2** for sites within the Miners Ravine watershed. Based on the average daily flows for sites provided in **Figures 6-1** and **6-2,** the short duration reduction in flows within the PCWA canal system during March 2006 canal lining/guniting activities are not likely to affect flow conditions in study area streams. Precipitation runoff within the watersheds of study area streams is likely to have a much greater influence on stream flow conditions during spring season canal lining/guniting activities. Precipitation during March 2006 is shown in **Figure 6-3**. Effects on flow conditions in Antelope Creek and Clover Valley Creek are likely similar to conditions shown for Secret and Miners ravines.

Canal lining/guniting activities during September 2006 are likely to have some effect on flow conditions in study area streams, although canal system contributions to flow within study area streams through unregulated releases from canal outlets are variable. Average hourly flows for the end of Boardman Canal outlet, downstream from canal lining/guniting activities, are shown in **Figure 6-16**. Average daily flows for Secret Ravine at Rocklin Road, which is located just upstream from the Boardman Canal outlet, are also shown in **Figure 6-16**. Based on flow data observed during September 2006, canal lining/guniting during the dry season does have the potential to affect hydrologic conditions in study area streams. **Figure 6-16** shows releases from the end of Boardman Canal potentially comprise approximately one-third of flow in Secret Ravine during September 2006.

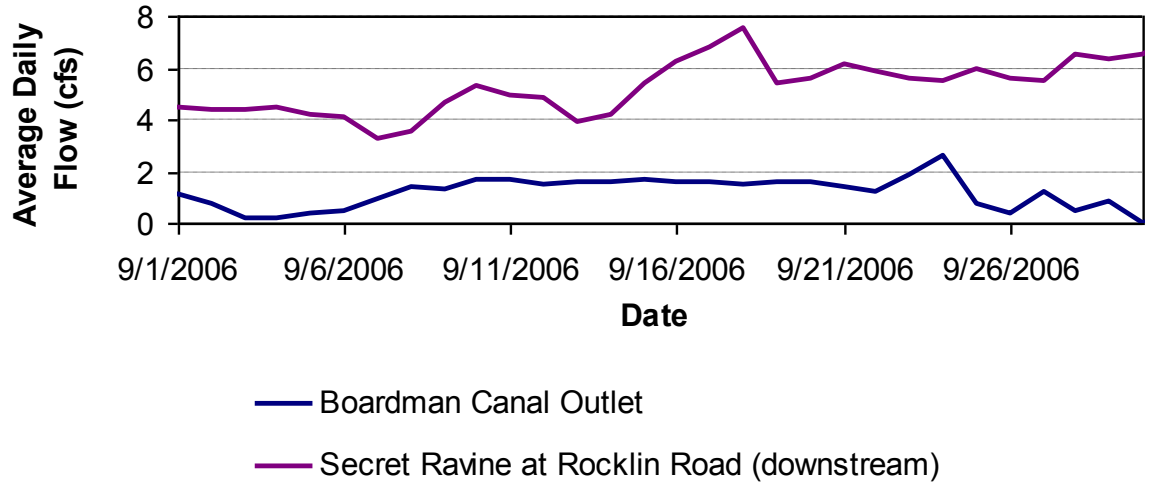

FIGURE 6-16
CANAL OUTLET AND SECRET RAVINE FLOW RESPONSES TO CANAL LINING/GUNITING ACTIVITIES

Water Quality

Water quality conditions were monitored for PCWA canal lining/guniting activities on February 16, 2007, March 16, 2007, and March 20, 2007, at sites within the Clover Valley Creek, Secret Ravine, and Miners Ravine watersheds, respectively. These locations, shown in **Figures 5-3 and 5-4**, were selected according to canal lining activity locations. **Table 6-10** lists the monitoring site names, site type, associated watershed, and information related to the canal lining/guniting activity. Water quality conditions were not evaluated in the Auburn Ravine, Antelope Creek, or Miners Ravine watersheds, but are likely to be similar to conditions described below for Clover Valley Creek, Secret Ravine, and Miners Ravine. Figures providing a comparison of water quality conditions within the PCWA raw water distribution system and study area streams monitored during monitoring events for canal lining/guniting are included in **Appendix C**.

Clover Valley Creek Watershed

Water quality conditions in the Clover Valley Creek watershed were evaluated at the following sites during canal lining/guniting activities along sections of the Antelope Canal on February 16, 2007:

- **Antelope Canal (ANTCA):** located on the Antelope Canal upstream from the Antelope Canal Outlet. This site was upstream from the canal lining activity, but was located within a dewatered section of the canal.

- **Antelope Canal Outlet Release (ANTCR):** Unregulated releases from this canal flow into an unnamed tributary that contributes flows to Clover Valley Creek.

- **Clover Valley Creek at Rawhide Road (CLVRC6)**: located on Clover Valley Creek at Rawhide Road upstream from Antelope Canal Outlet.

- **Clover Valley Creek near Argonaut Avenue (CLVRC3B)**

TABLE 6-10
WATER QUALITY MONITORING LOCATIONS IN THE PCWA SERVICE AREA FOR CANAL LINING/GUNITING ACTIVITIES

Site Description[1]	Site Identification	Type	Watershed(s)	Canal Lining Start/End Time	Weather
Antelope Canal near Antelope Canal Outlet					
Antelope Canal above Outlet Release	ANTCA	Canal	Clover Valley Creek	Start: 2/16/2007, 5:00am End: 2/16/2007, 8:00pm	Warm and dry
Antelope Canal Outlet Release	ANTCR	Canal	Clover Valley Creek		
Clover Valley Creek near Rawhide Road	CLVRC6	Stream	Clover Valley Creek		
Clover Valley Creek near Argonaut Avenue (near Golf Course)	CLVRC3B	Stream	Clover Valley Creek		
Boardman Canal downstream from Baughman Canal					
Boardman Canal below Head of Baughman Canal	YB155	Canal	Secret Ravine	Start: 3/15/2007, 5:00am End: 3/15/2007, 8:10pm	Warm and dry
Boardman Canal below Head of Baughman Canal – downstream	YB155DS	Canal	Secret Ravine		
Boardman Canal Outlet Release	BOARDMANCR	Canal	Secret Ravine		
Secret Ravine at Rocklin Road	SECRETRV3	Stream	Secret Ravine		
Secret Ravine at Roseville Parkway	SECRETRV2	Stream	Secret Ravine		
Boardman Canal near Laird Pump					
Boardman Canal near Laird Pump	315BDU	Canal	Miners Ravine/ Secret Ravine	Start: 3/20/07, 5:00am End: 3/20/07 at 6:30pm	Light Rain
Boardman Canal near Laird Pump	315BDD	Canal	Miners Ravine/ Secret Ravine		
Baughman Canal Outlet Release	BAUGHMANCR	Canal	Miners Ravine		
Tributary to Miners Ravine from Baughman Canal	BCTRIB1	Drainage	Miners Ravine		
Miners Ravine at Moss Lane	MINERSRV5	Stream	Miners Ravine		

Water Temperature and Dissolved Oxygen

Water temperature or DO levels observed at Clover Valley Creek downstream from canal lining activities were not affected by of canal lining along the Antelope Canal.

pH, Alkalinity, and Hardness

Measured pH values at ANTCR increased to up to 11.66 after flows were restored to Antelope Canal following canal lining. Alkalinity and hardness at the Antelope Canal Outlet release also increased for a short duration. Based on water quality measurements upstream (CLVRC6) and downstream (CLVRC3B) from the canal lining, pH, alkalinity, and hardness conditions in Clover Valley Creek did not appear to be affected by canal lining activities. These results are shown below in **Figures 6-17** to **6-19**.

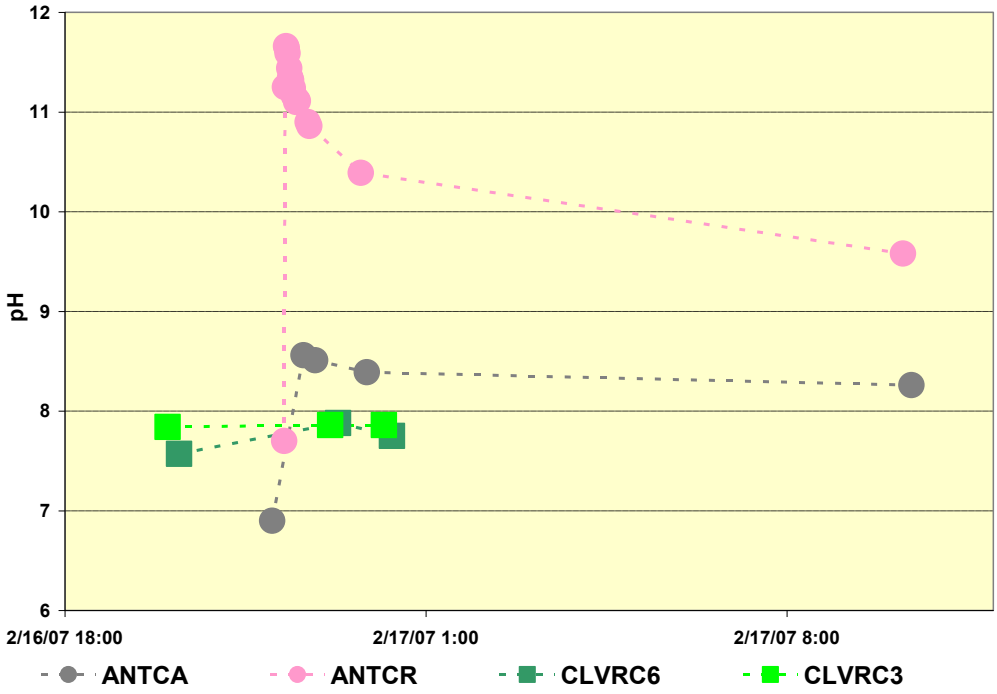

FIGURE 6-17
MEASURED PH LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

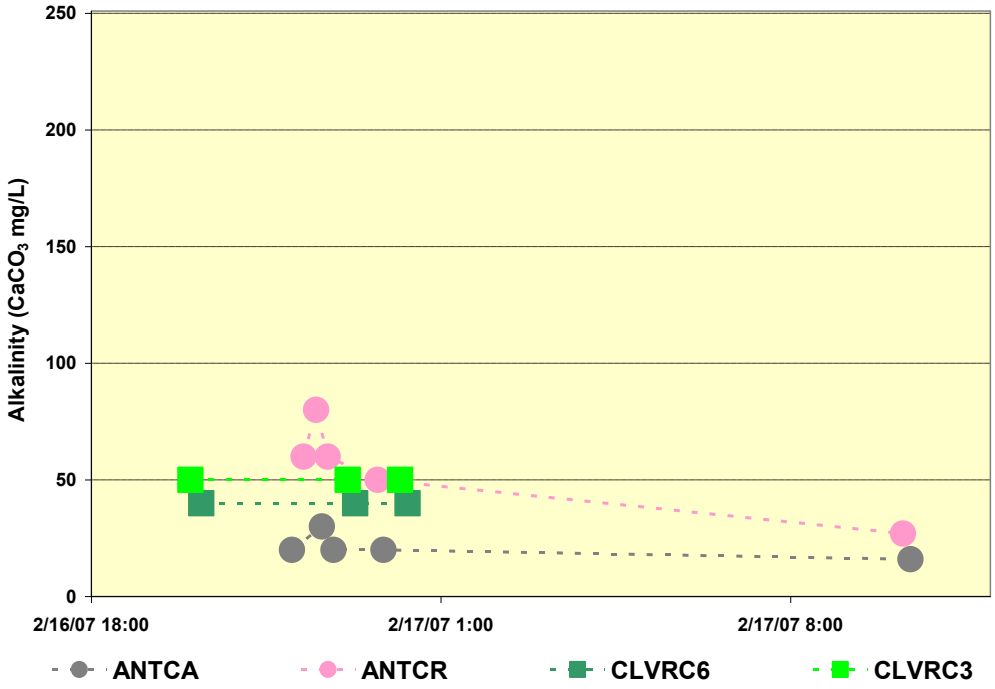

FIGURE 6-18
MEASURED ALKALINITY LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

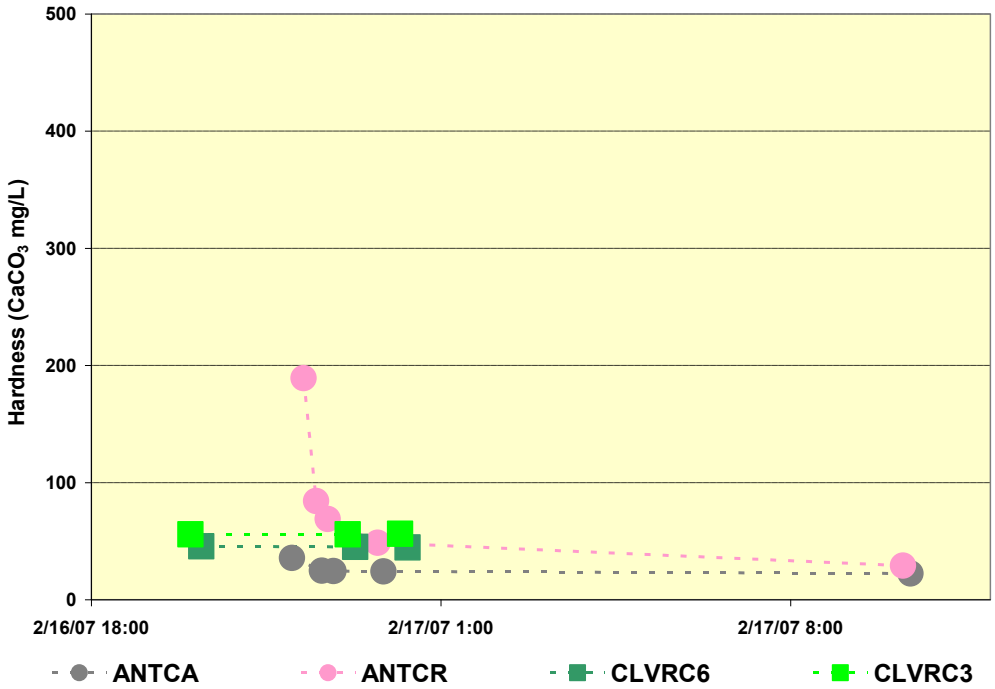

FIGURE 6-19
MEASURED HARDNESS LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

Total Suspended Solids and Turbidity

TSS and turbidity levels measured at ANTCR were very high for a short duration (about 1 hour) after flows were restored to Antelope Canal following canal lining, but were also comparably high upstream from the canal lining, at ANTCA. Samples collected at Clover Valley Creek sites suggest that Clover Valley Creek TSS and turbidity conditions, however, were not affected by canal lining. TSS and turbidity levels at Clover Valley Creek watershed sites from the canal lining monitoring event are shown in **Figures 6-20** and **6-21**.

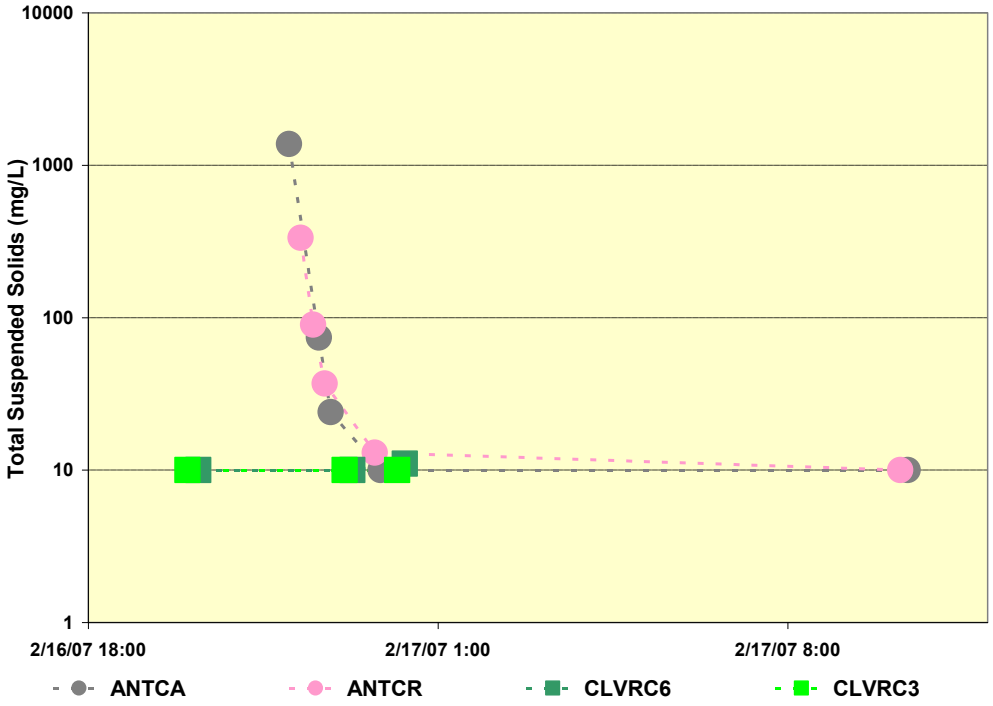

FIGURE 6-20
MEASURED TOTAL SUSPENDED SOLIDS LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

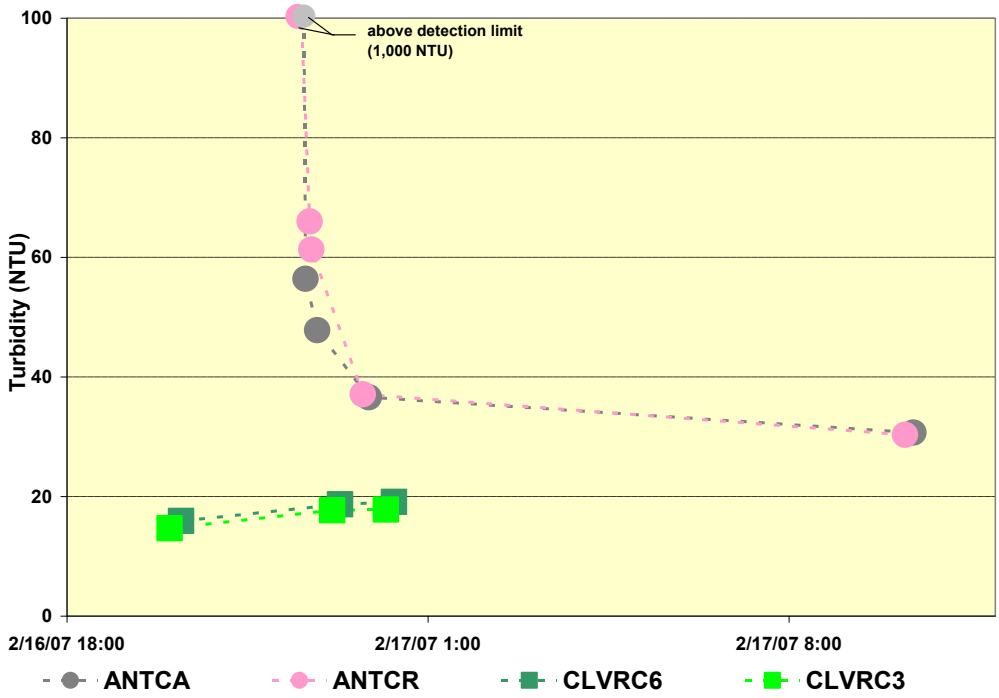

FIGURE 6-21
MEASURED TURBIDITY LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

Specific Conductivity and Ions

SC and ion concentrations (calcium, iron, magnesium, potassium, sodium, chloride, nitrate, sulfate) measured at ANTCR were high for a short duration after flows were restored to Antelope Canal following canal lining, then decreased rapidly. Based on water quality data collected during the sampling event, these elevated levels at ANTCR did not appear to affect SC or major ion concentrations downstream from canal lining at Clover Valley Creek.

Trace Elements

Measured concentrations of aluminum, barium, copper, and zinc at ANTCR were high immediately following the canal lining activity upstream. These high concentrations were likely associated with flushing of sediment and other material that settled after the canal was dewatered for canal cleaning. Aluminum levels measured at CLVRC3 increased following the canal lining activity, but also increased at Clover Valley Creek upstream from the canal lining activity (CLVRC6), suggesting that the increase is not likely associated with the canal lining event. Water quality data collected during the sampling event did not show any effects associated with the canal lining activity on barium, copper, and zinc concentrations at Clover Valley Creek. Aluminum, barium, copper, and zinc results from the canal lining monitoring event are shown in **Figures 6-22** to **6-25**. Cadmium concentrations measured at all sites during the canal cleaning monitoring event were below the detection limit (0.5 µg/L).

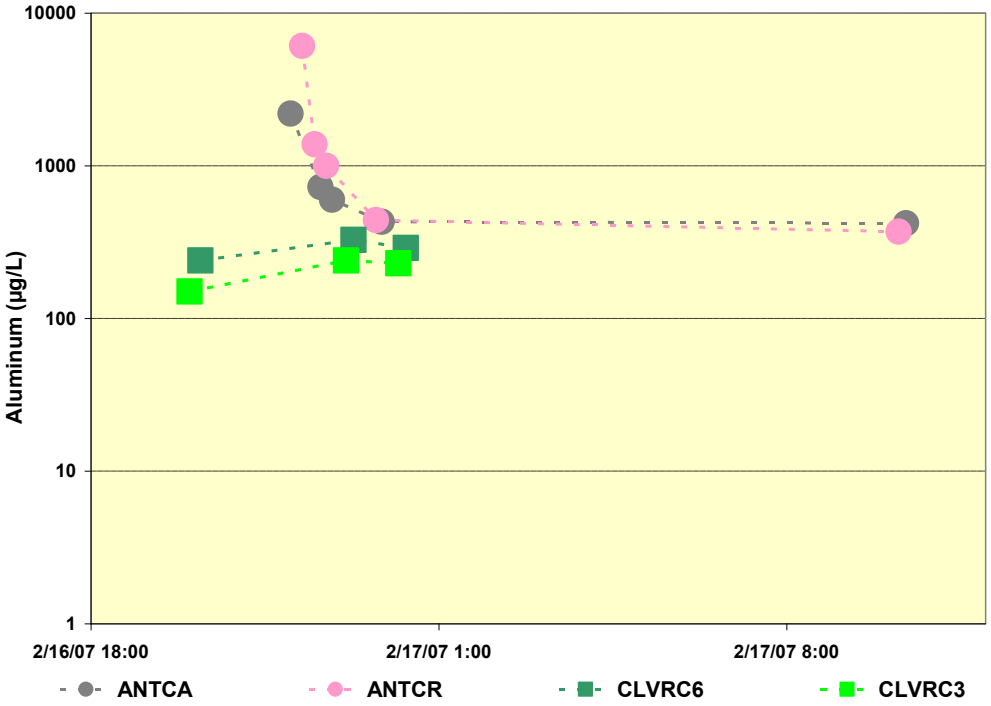

FIGURE 6-22
MEASURED ALUMINUM LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

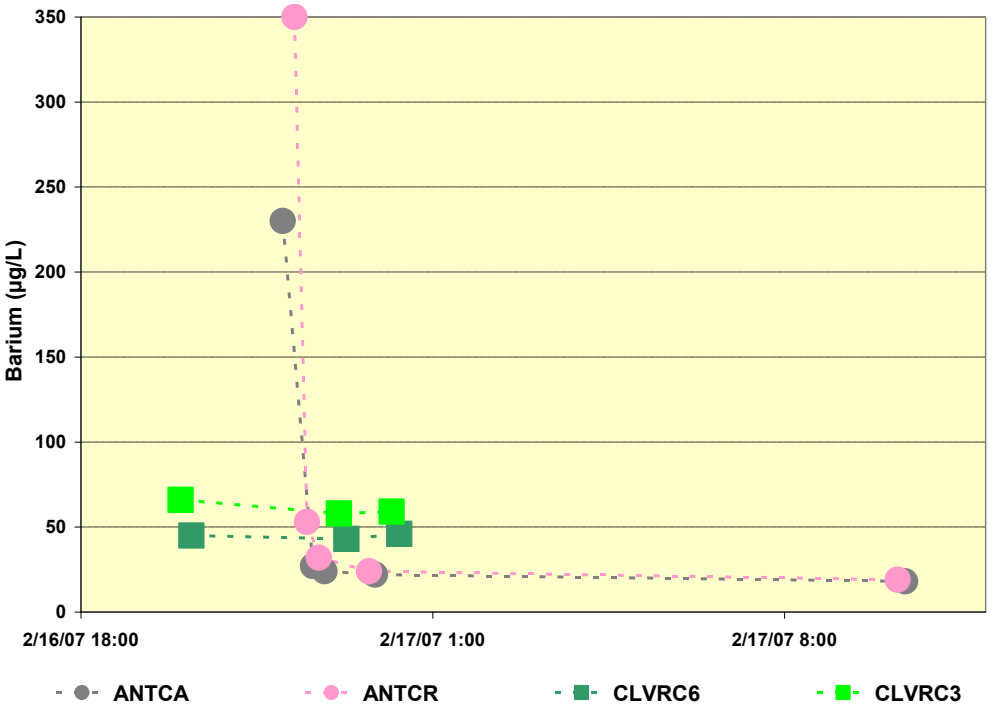

FIGURE 6-23
MEASURED BARIUM LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

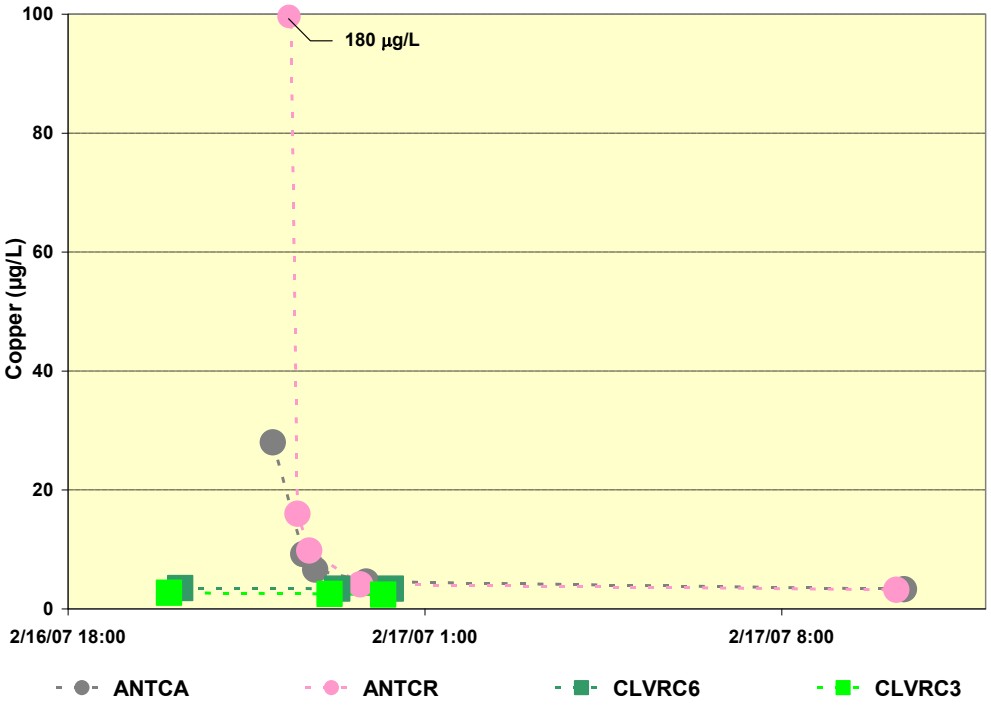

FIGURE 6-24
MEASURED COPPER LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

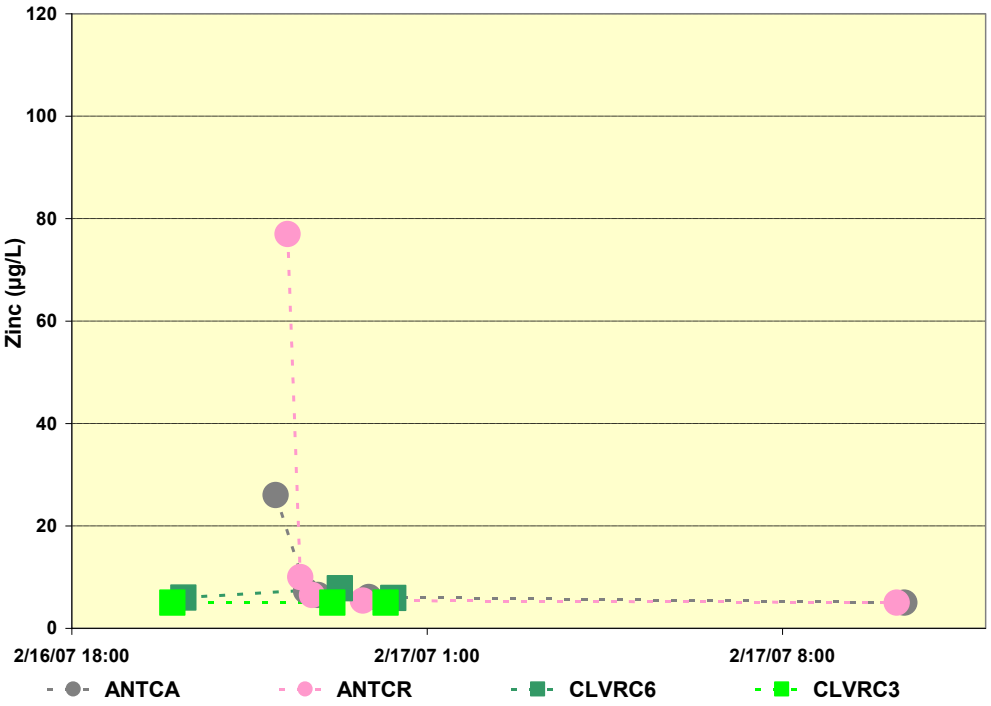

FIGURE 6-25
MEASURED ZINC LEVELS AT CLOVER VALLEY CREEK WATERSHED SITES DURING FEBRUARY 16, 2007, CANAL LINING EVENT

Secret Ravine Watershed

Water quality conditions in the Secret Ravine watershed were evaluated at the following sites after canal lining/guniting activities along a section of the Boardman Canal downstream from the head of the Baughman Canal on March 20, 2007:

- **Boardman below the head of Baughman Canal (YB155)**: located along the Boardman Canal just below the head of the Baughman Canal.
- **Boardman downstream from YB155 (YB155DS):** located downstream from the lined section along the Boardman Canal.
- **Boardman Canal Outlet Release (BOARDMANCR)**
- **Secret Ravine at Rocklin Road (SECRETRV3)**
- **Secret Ravine at Roseville Parkway (SECRETRV2)**

Water Temperature and Dissolved Oxygen

Water quality results suggest that the canal lining/guniting activity monitored did not affect water temperature or DO conditions in Secret Ravine. Minimal to no effects on water temperature and DO were observed in Secret Ravine following canal lining/guniting along the Boardman Canal. DO levels increased slightly at YB155DS and BOARDMANCR for a short duration after flows were restored to the canal following the canal lining.

pH, Alkalinity, and Hardness

Measured values for pH, alkalinity, and hardness at Secret Ravine did not appear to be affected by canal lining activities. The pH levels observed at YB155DS increased to very high levels (up to 11.62) following the canal lining activity, and also increased slightly at BOARDMANCR, but did not affect pH at SECRETRV2. These results of pH measurements are shown in **Figure 6-26**. Alkalinity and hardness values at YB155DS increased after canal lining, but these increases did not result in an increase to alkalinity or hardness for samples collected at BOARDMANCR or SECRETRV2.

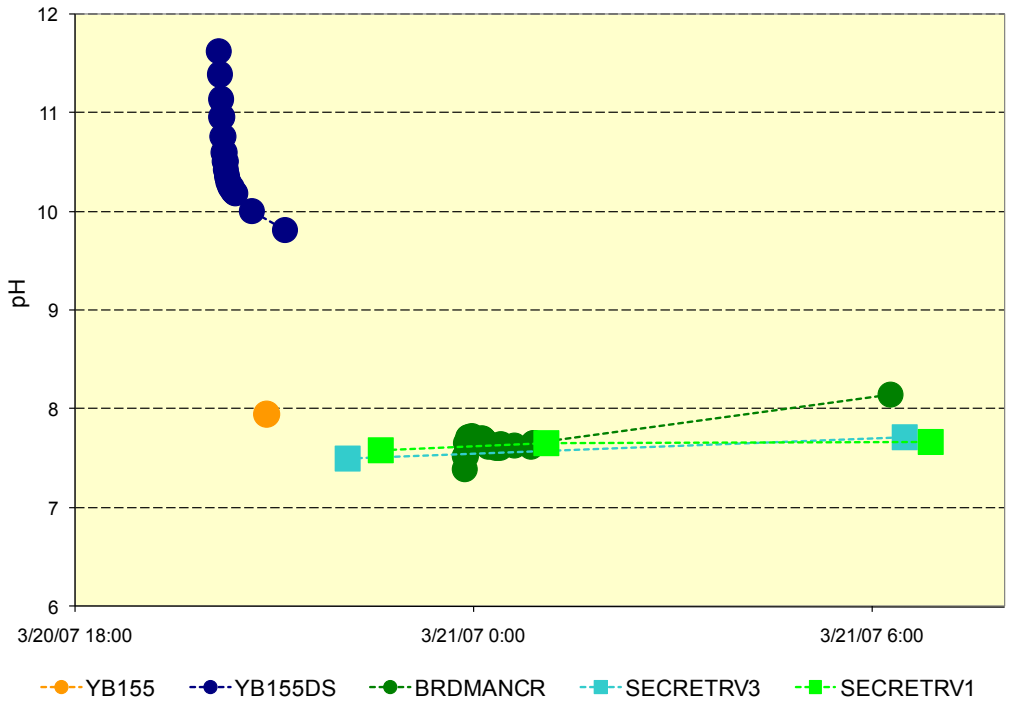

FIGURE 6-26
MEASURED PH LEVELS AT SECRET RAVINE WATERSHED SITES DURING MARCH 20, 2007, CANAL LINING EVENT

Total Suspended Solids and Turbidity

Despite increases in TSS and turbidity values at YB155DS and BOARDMANCR, TSS and turbidity values measured at SECRETRV2 do not appear to be affected by canal cleaning activities. The high TSS and turbidity values measured at canal sites downstream from the canal lining activity are likely associated with flushing of sediment and other material that settled after the canal was dewatered for canal cleaning.

Specific Conductivity and Ions

SC, calcium, iron, magnesium, potassium, sodium, chloride, nitrate, and sulfate concentrations all increased at YB155DS following canal cleaning, similar to TSS and turbidity. These increases upstream, however, did not appear to affect SC and ion concentrations at the Boardman Canal Outlet release to Secret Ravine or at SECRETRV2.

Trace Elements

Measured concentrations of aluminum were high across all sites evaluated during the canal lining monitoring event, with highest values at YB155DS immediately after flows were restored to the canal below the canal lining activity. Because aluminum concentrations were high in all samples collected during the event, aluminum levels in Secret Ravine are not likely affected by canal lining activities. Barium, copper, and zinc concentrations also increased at YB155DS after flows were restored to Boardman Canal below the canal lining activity. Based on water quality

results, concentrations of these constituents in Secret Ravine do not appear to be affected by canal lining activities upstream.

Miners Ravine Watershed

Water quality conditions in the Miners Ravine watershed were evaluated after a section of the Boardman Canal near Laird Pump was lined on March 15, 2007. The sites monitored during the event include:

- **Boardman Canal near Laird Pump, upstream (315BDU)**: located along the Boardman Canal near Laird Pump, upstream from the lining/guniting event.
- **Boardman Canal near Laird Pump, downstream (315BDD)**: located along the Boardman Canal near Laird Pump, downstream from the lining/guniting event.
- **Baughman Canal Outlet Release (BAUGHMANCR)**
- **Tributary to Miners Ravine from Baughman Canal (BCTRIB1)**
- **Miners Ravine at Moss Lane (MINERSRV5)**

Due to the extensive length of the unnamed tributary to Miners Ravine from Baughman Canal and long travel time from BAUGHMANCR to BCTRIB1, samples obtained during canal lining activities at BCTRIB1 and MINERSRV5 were intended to provide a relative comparison of water quality conditions in receiving waters downstream from BAUGHMANCR.

Water Temperature and Dissolved Oxygen

Water temperature and DO conditions at stream sites in the Miners Ravine watershed did not appear to be affected by canal lining/guniting activities along the Boardman Canal. DO levels temporarily decreased then increased at 315DD and BAUGHMANCR, but these fluctuations are not likely to affect conditions at stream sites in the Miners Ravine watershed.

pH, Alkalinity, and Hardness

Measured values of pH, alkalinity, and hardness increased to very high levels at 315DD following canal lining activities, but are not likely to affect conditions at Miners Ravine. Values for pH measured at BAUGHMANCR also increased for a short duration, then gradually decreased and stabilized to baseline levels. Results from pH measurements at Miners Ravine watershed sites during the canal lining monitoring event are shown in **Figure 6-27**.

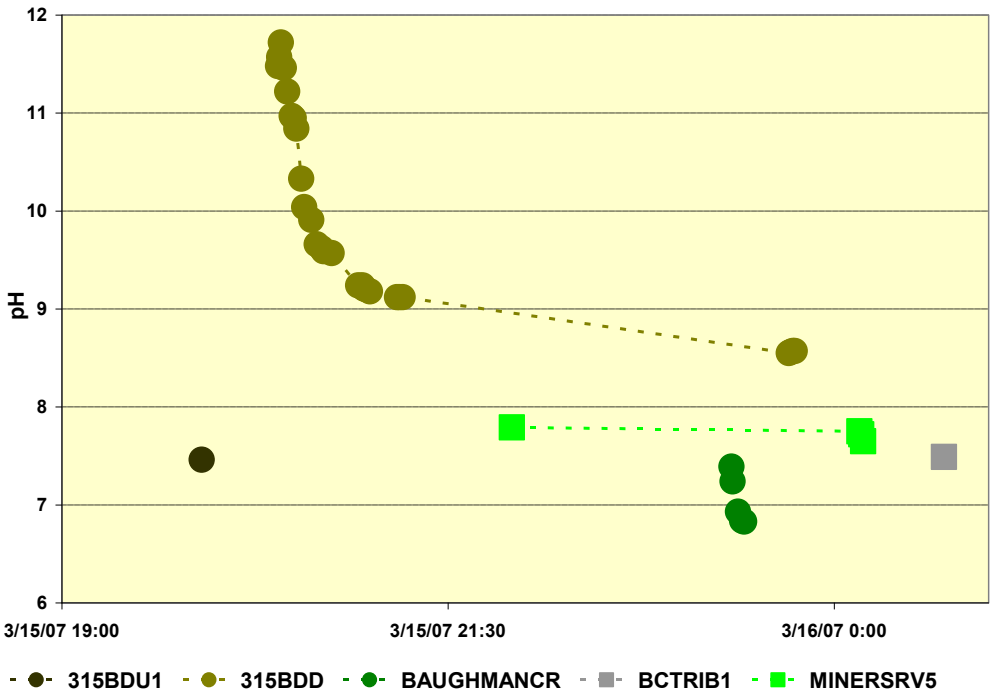

FIGURE 6-27
MEASURED PH LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL LINING EVENT

Total Suspended Solids and Turbidity

TSS and turbidity values measured at 315BDD and BAUGHMANCR increased after flows were restored to the canals following canal lining. Turbidity measured at BAUGHMANCR the exceeded detection limit (1,000 NTUs) for some samples. These increases were not likely to affect TSS and turbidity conditions in Miners Ravine. Similar to other canal dewatering activities, these high TSS and turbidity values are likely associated with flushing of sediment and other material that settled after the canal was dewatered for canal lining.

Specific Conductivity and Ions

SC and ion concentrations at Miners Ravine watershed sites exhibited a similar response to canal lining activities as those described for Clover Valley Creek and Secret Ravine watershed sites. SC increased for a short duration at 315BDD, but these increases were not likely to affect conditions downstream in Miners Ravine. Similar trends were observed with calcium, iron, magnesium, potassium, sodium, chloride, nitrate, and sulfate concentrations.

Trace Elements

Aluminum concentrations measured at all Miners Ravine watershed sites during the canal lining event were high, with the highest values at 315BDD immediately after flows were restored to the canal below the canal cleaning activity. Measured barium, copper, and zinc values at 315BDD were also high immediately following the canal lining activity. Sample concentrations of aluminum, copper, and zinc also increased at MINERSRV5 during the event. These increases at MINERSRV5 are not likely to be specifically associated with the canal lining activity, because

MINERSRV5 is upstream from direct canal system inputs to Miners Ravine streamflow, but may be related to canal cleaning activities that occurred within the canal system on March 15, 2007.

Measured concentrations of aluminum were high across all sites in the Miners Ravine watershed evaluated during the canal cleaning monitoring event, with highest values at BAUGHMANCR immediately after flows were restored to the canal below the canal lining activity. Because aluminum concentrations were high in all samples collected during the event, aluminum levels in Miners Ravine are not likely affected by canal lining activities. Barium, copper, and zinc concentrations also increased at YB155DS after flows were restored to Boardman Canal below the canal cleaning activity. Based on water quality results, concentrations of these constituents in Miners Ravine do not appear to be affected by canal lining activities upstream. **Figures 6-28 to 6-31** show aluminum, barium, copper, and zinc results for Miners Ravine watershed sites during the monitoring event for canal lining.

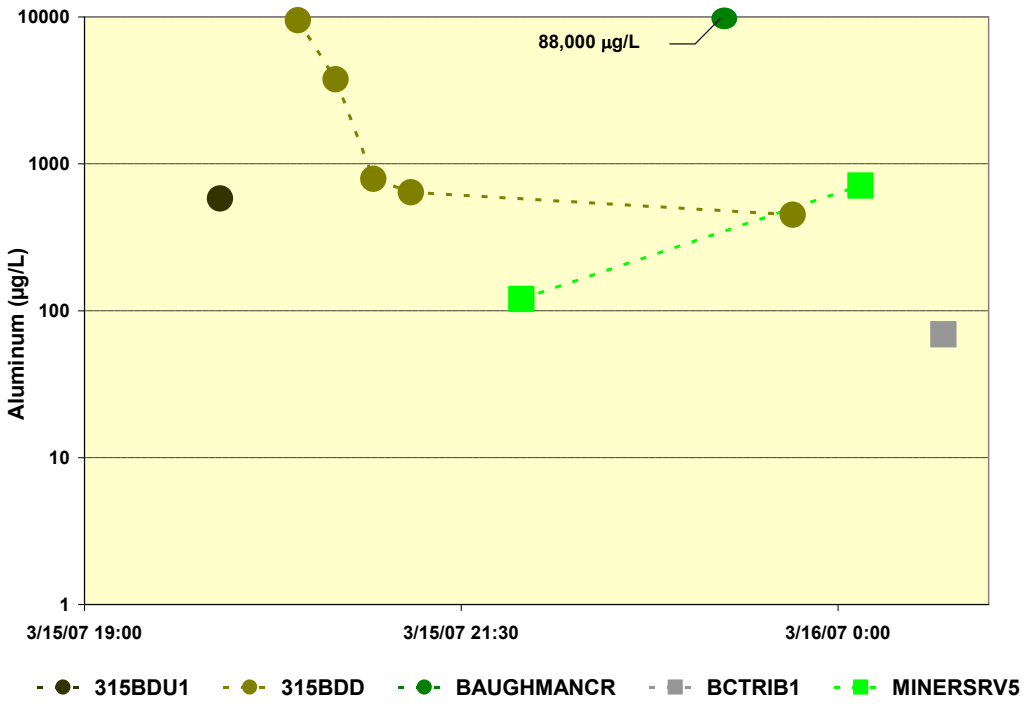

FIGURE 6-28
MEASURED ALUMINUM LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL LINING EVENT

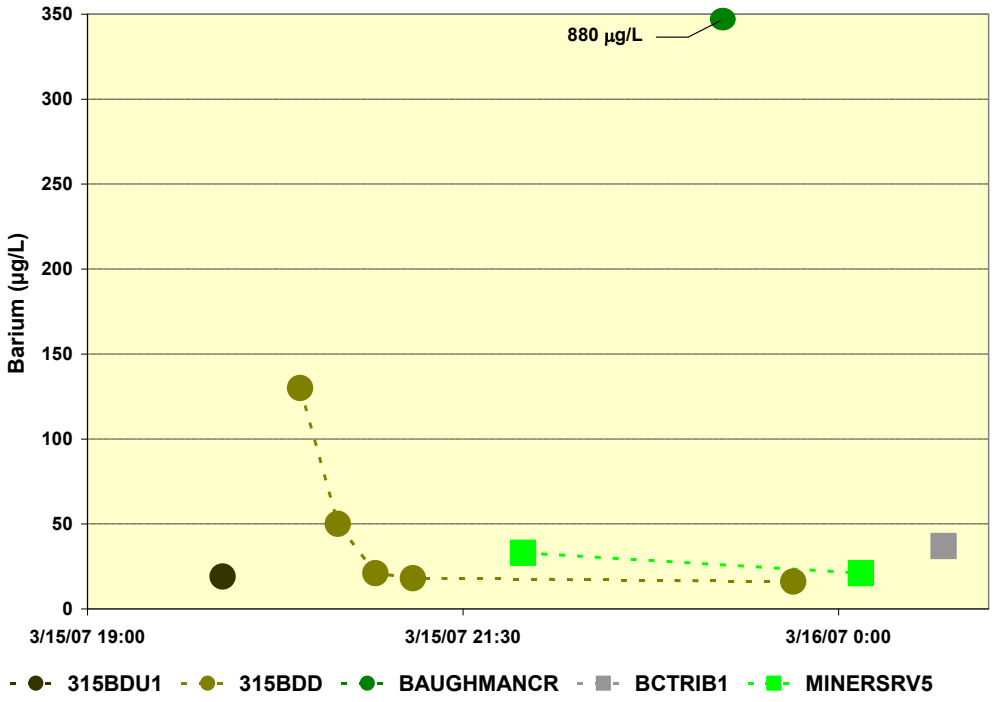

FIGURE 6-29
MEASURED BARIUM LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL LINING EVENT

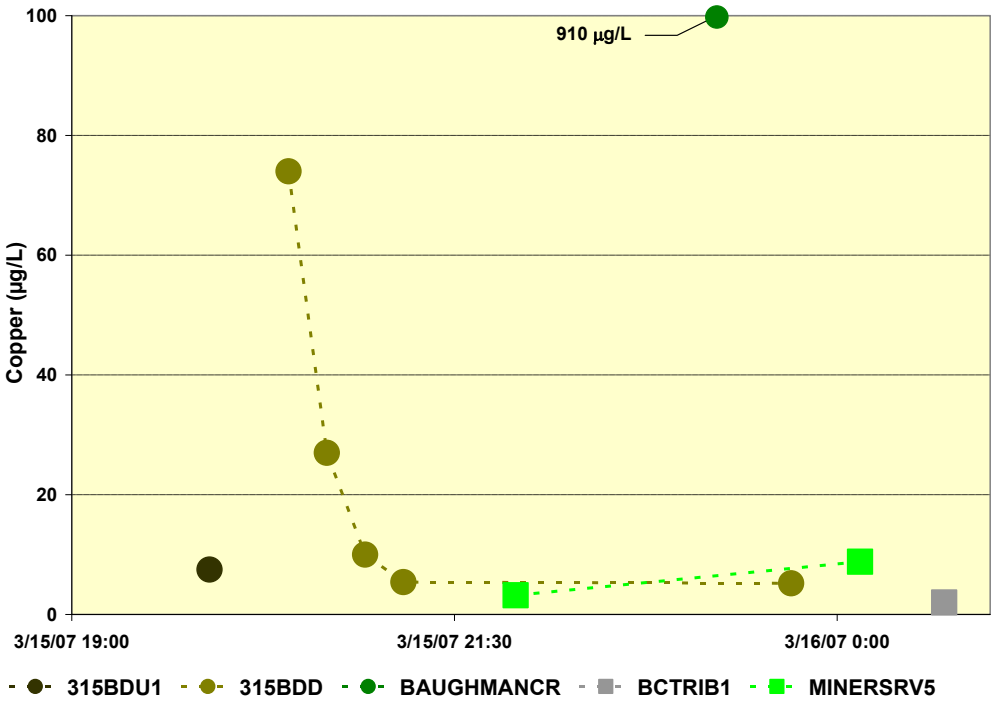

FIGURE 6-30
MEASURED COPPER LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL LINING EVENT

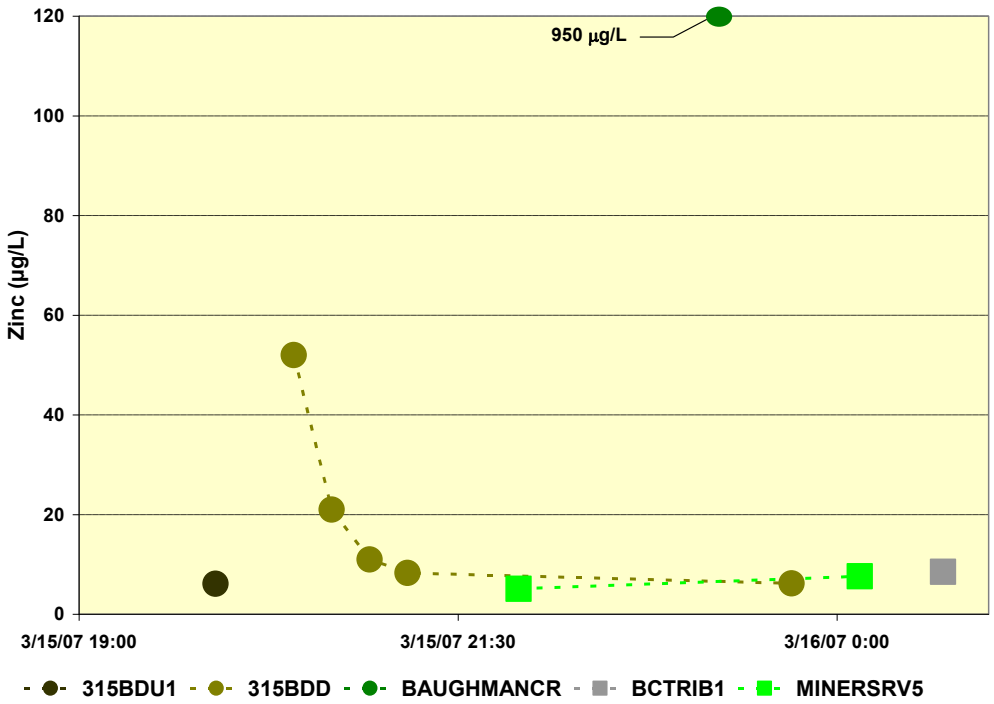

FIGURE 6-31
MEASURED ZINC LEVELS AT MINERS RAVINE WATERSHED SITES DURING MARCH 15, 2007, CANAL LINING EVENT

Soils and Sediment Quality

The potential effects of canal lining/guniting activities are similar to those described above for canal cleaning activities. Canal lining activities may introduce additional copper to study area soils through the removal of sediments from the canal with higher copper concentrations attributed to PCWA's algaecide applications, and deposition of the soils along the canal banks. Additionally, the concrete applied during canal lining activities may increase concentrations of the concrete chemical constituents at the locations of the canal lining activities. Soil compaction and erosion may occur as a result of equipment access and use along canal banks during canal cleaning and lining. Mechanical equipment may also introduce chemical contaminants (i.e., petroleum products) to soils at access sites.

Biological Resources

Terrestrial Habitat and Species

Minimal streamflow decreases in study area streams due to a short duration reduction of flows in the PCWA canal system during canal lining could result in temporary and very minimal decreases in the extent of wetland habitats that may be directly or indirectly supported by canal system operations. This could have minimal effects on species that use these wetland habitats, such as foraging birds and breeding amphibians, by decreasing the amount of available habitat. Reductions in water levels could expose amphibian eggs in the shallow, vegetated margins of drainages or adjacent wetlands. Any potential effects from temporary water reductions on species that use these habitats are expected to be minimal because canal system contributions to

flow within study area streams through unregulated releases from canal outlets are variable. The typical timing of canal lining is during winter, generally outside of the breeding period for most amphibian species; however, canal lining activities can occur throughout the year.

Lining sections of unlined canals may indirectly affect adjacent habitat and species historically supported by canal seepage. Through lining sections of previously unlined canals, oak trees and wetlands may be negatively affected by the decreased seepage along the sections and the resultant change in soil moisture and geochemical conditions.

Potential effects on water quality discussed above could indirectly affect terrestrial habitats and species. Increased loading of sediments and sedimentation from flushing activities could bury amphibian eggs. Increased concentrations of trace elements (such as aluminum and copper) could have some negative effects on plants and wildlife on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to such water quality changes, although effects vary dramatically by type and concentration of contaminant, species, and water quality parameters. Elevated pH values are toxic to amphibians, and may be particularly harmful in combination with other contaminants, such as heavy metals or herbicides, particularly glyphosates (Pesticide Action Network U.K. 1996, Edginton et al. 2004, Horn and Dunson 1995). However, glyphosates and triclopyr have been found to break down faster under higher pH conditions (Tu et al. 2001).

Habitats and species could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used during canal lining, including compaction, erosion, and introduction of petroleum products. Effects on habitats and species could include plant mortality or decreased plant growth. These types of impacts are expected to be relatively minimal and small in aerial extent.

Some potential negative effects could occur if raptors are nesting near canal lining work areas that may be disturbed by noise. Raptors potentially occurring in the study area include Red-shouldered Hawk, American Kestrel, Red-tailed Hawk, and Great Horned Owl. The nesting period for raptors is generally March 1 to August 15.

Aquatic Habitat and Species

Potential effects to of canal lining activities on aquatic habitat and species are likely similar to those discussed described above for canal cleaning activities.

Special Status Species

As described above, minimal streamflow decreases in study area streams due to a short duration reduction of flows in the PCWA canal system during canal lining could result in temporary and very minimal decreases in the extent of wetland habitats that may be indirectly supported by canal deliveries. This could have minimal effects on special status species that use these wetland habitats, such as special status foraging birds and breeding amphibians, by decreasing the amount of available habitat. Reductions in water levels could expose special status amphibian eggs in the shallow, vegetated margins of drainages or adjacent wetlands. Any potential effects from temporary water reductions on species that use these habitats are expected to be minimal because canal system contributions to flow within study area streams through unregulated

releases from canal outlets are variable. Potential effects may be greater during the breeding season for special status amphibian species. The California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds between mid-March through early June, and the western spadefoot toad breeds late January through July (Stebbins 2003).

Sediment loading to streams after flows are restored to canals following canal lining activities and sedimentation may bury special status amphibian eggs, if present. Increases in concentrations of trace elements, such as aluminum and copper, could have some negative effects on special status plants and wildlife, if present, on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to changes in water quality conditions, although effects vary dramatically by species, life stage, and water quality parameters. Also, increases in pH levels, which were observed at sites after canal lining activities during water quality monitoring events, have been found to be toxic to amphibians, and may be particularly harmful in combination with other contaminants, such as heavy metals or herbicides (Pesticide Action Network U.K. 1996, Edginton et al. 2004, Horn and Dunson 1995).

Special status plant species (**Tables 3-12** and **3-13**), if present, could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used during canal lining, including compaction, erosion, and introduction of petroleum products. Effects on special status plant species could include mortality or decreased growth. These types of impacts are expected to be unlikely to occur.

Some potential negative effects could occur if special status raptor species are nesting near work areas that may be disturbed by noise. Special status raptors potentially occurring in the study area include Swainson's hawk, Cooper's hawk, Northern Goshawk, White-tailed Kite, and Northern Harrier. As mentioned above, the nesting period for raptors is generally March 1 to August 15.

Potential effects of canal lining activities on Chinook salmon and steelhead are the same as described for aquatic habitat and species, and likely similar to those discussed for canal cleaning activities.

6.1.2.2 Canal Repair

PCWA performs repair and/or replacement of canals, flumes, outlet structures, flow-control structures, and customer delivery points throughout the PCWA canal system on a scheduled and as-needed basis. These activities may involve minor repairs with minimal disturbance to customer deliveries and minor effects on environmental resources, while others requiring onsite construction may become more involved. The potential effects of canal repair activities on natural resource conditions are dependent of the nature and extent of the canal repair, as well as the specific environmental setting for the activity. These activities should require project-specific environmental resources analyses to assess the potential effects of the activity on natural resources, and an evaluation to determine measures to minimize potential negative effects. The following sections provide an overview of the types of effects on natural resources that may occur during PCWA's canal repair activities.

Physical Resources

The following sections describe potential effects of PCWA canal repair activities on physical resources in the study area.

Hydrology

Most canal repair activities would result in short-duration interruptions to water flow within segments of the raw water distribution system. These short-duration interruptions to flow are not are likely to affect hydrologic conditions in study area streams.

Canal repair activities requiring onsite construction and canal dewatering for more than a day should warrant a project-specific evaluation to determine potential effects on hydrologic conditions in study area streams.

Water Quality

Although no water quality data was collected during canal repair events, potential effects for canal repair activities are expected to be similar to other canal dewatering and flushing activities. In some cases, equipment may be staged inside the canal during repair. The settling, then mobilization of sediments, organic material, and constituents associated with particulates during flushing activities may result in temporary fluctuations in constituent concentrations. For example, a temporary increase in water temperatures and associated decrease in DO levels may occur. In the case of canal repair, temporary increases in TSS and turbidity are likely because sediment may be disturbed along the canals during repair work. However, these temporary changes are not likely to have substantial effects, if any, along drainage or stream sites downstream from canal repair activities.

Canal repair projects may involve the use of mechanical equipment that require hazardous materials, such as gasoline and diesel fuels, engine oil, and hydraulic fluids. Accidental spills of these substances may contaminate the canal water and receiving water tributaries and streams, adjacent soils, and other riparian habitat.

Soils and Sediment Quality

Soils and sediment quality in the study area may be affected by canal repair activities. Soil compaction and erosion may occur as a result of construction equipment access and use along canal banks. Construction equipment may also introduce chemical contaminants (i.e., petroleum products) to soils at project sites.

Biological Resources

Terrestrial Habitat and Species

Effects on terrestrial habitat and species from canal repair would vary based on the type of repair required, but would be similar to those from canal lining, though generally less severe and smaller in scale.

As with canal lining, minimal streamflow decreases in study area streams due to a short duration reduction of flows in the PCWA canal system during canal repair could result in temporary and very minimal decreases in the extent of wetland habitats that may be directly or indirectly supported by canal system operations. This could have minimal effects on species that use these wetland habitats, such as foraging birds and breeding amphibians, by decreasing the amount of

available habitat. Reductions in water levels could expose amphibian eggs in the shallow, vegetated margins of drainages or adjacent wetlands. Any potential effects from temporary water reductions on species that use these habitats are expected to be minimal.

As with canal lining, potential effects on water quality discussed above could indirectly affect terrestrial habitats and species. Increased loading of sediments and sedimentation from flushing activities could bury amphibian eggs. Increased concentrations of trace elements (such as aluminum and copper) could have some negative effects on plants and wildlife on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to such water quality changes, although effects vary dramatically by type and concentration of contaminant, species, and water quality parameters.

Habitats and species could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used during canal repair, including compaction, erosion, and introduction of petroleum products. Effects on habitats and species could include plant mortality or decreased plant growth. These types of impacts are expected to be relatively minimal and small in aerial extent.

Minimal loss of habitat could occur due to limited trimming or removal of vegetation necessary to access repair areas.

Some potential negative effects could occur if raptors are nesting near canal repair work areas that may be disturbed by noise. Raptors potentially occurring in the study area include Red-shouldered Hawk, American Kestrel, Red-tailed Hawk, and Great Horned Owl. The nesting period for raptors is generally March 1 to August 15.

Aquatic Habitat and Species

Potential effects to of canal repair activities on aquatic habitat and species are likely similar to those discussed described above for canal cleaning activities. In addition, construction-related contaminants could result in a reduction in the growth, survival, and reproductive success of aquatic species. The potential exists for fuel and concrete to spill into the waterway during construction. Various contaminants introduced into the water system, either directly or through surface runoff, may be toxic to fish or cause altered oxygen diffusion rates and acute and chronic toxicity to aquatic organisms, thereby reducing growth and survival.

Special Status Species

Effects on special status species from canal repair would vary based on the type of repair required, but would be similar to those from canal lining, though generally less severe and smaller in scale.

As described above, minimal streamflow decreases in study area streams due to a short duration reduction of flows in the PCWA canal system during canal repair could result in temporary and very minimal decreases in the extent of wetland habitats that may be indirectly supported by canal deliveries. This could have minimal effects on special status species that use these wetland habitats, such as special status foraging birds and breeding amphibians, by decreasing the amount of available habitat. Reductions in water levels could expose special status amphibian eggs in the shallow, vegetated margins of drainages or adjacent wetlands. Any potential effects

from temporary water reductions on species that use these habitats are expected to be minimal because canal system contributions to flow within study area streams are variable. Potential effects may be greater during the breeding season for special status amphibian species. California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds between mid-March through early June, and the western spadefoot toad breeds late January through July (Stebbins 2003).

Sediment loading to streams after flows are restored to canals following canal repair activities and sedimentation may bury special status amphibian eggs, if present. Increases in concentrations of trace elements, such as aluminum and copper, could have some negative effects on special status plants and wildlife, if present, on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to changes in water quality conditions, although effects vary dramatically by species, life stage, and water quality parameters.

Special status plant species (**Tables 3-12** and **3-13**), if present, could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used during canal repair, including compaction, erosion, and introduction of petroleum products. Special status plant species, if present, could also be damaged or killed during limited trimming or removal of vegetation necessary to access repair areas. Effects on special status plant species could include mortality or decreased growth. These types of impacts are expected to be unlikely to occur.

Some potential negative effects could occur if special status raptor species are nesting near work areas that may be disturbed by equipment noise during canal repair activities. Special status raptors potentially occurring in the study area include Swainson's hawk, Cooper’s hawk, Northern Goshawk, White-tailed Kite, and Northern Harrier. As mentioned above, the nesting period for raptors is generally March 1 to August 15.

Potential effects of canal repair activities on Chinook salmon and steelhead are the same as for the aquatic habitat and species described above.

6.1.2.3 Pipe Repair

PCWA performs repair and/or replacement of pipes, culverts, and siphons throughout the PCWA canal system on a scheduled and as-needed basis. These activities may involve minor repairs with minimal disturbance to customer deliveries and minor effects on environmental resources, while others requiring onsite construction may become more involved. As described above for canal repair activities, the potential effects of pipe repair activities on natural resource conditions are dependent of the nature and extent of the pipe repair, as well as the specific environmental setting for the activity. These activities should require project-specific environmental resources analyses to assess the potential effects of the activity on natural resources, and an evaluation to determine measures to minimize potential negative effects. The following sections provide an overview of the types of effects on natural resources that may occur during PCWA’s pipe repair activities.

Physical Resources

Hydrology

Most pipe repair activities would result in short-duration interruptions to water flow within segments of the raw water distribution system. These short-duration interruptions to flow are not are likely to affect hydrologic conditions in study area streams.

Pipe repair activities requiring onsite construction and canal dewatering for more than a day should warrant a project-specific evaluation to determine potential effects on hydrologic conditions in study area streams.

Water Quality

Although no water quality data was collected during pipe repair events, potential effects for pipe repair activities are also expected to be similar to other canal dewatering and flushing activities. During pipe repair, sediment is often excavated and heavy machinery may be used. The equipment may be staged inside the canal and/or along canal banks during repair. The settling, then mobilization of sediments, organic material, and constituents associated with particulates during flushing activities may result in temporary fluctuations in constituent concentrations. The largest effects, if any, are likely to be temporary increases in TSS and turbidity downstream from pipe repair work.

Soils and Sediment Quality

Soils and sediment quality in the study area may be affected by pipe repair activities. Soil compaction and erosion may occur as a result of construction equipment access and use along canal banks. Construction equipment may also introduce chemical contaminants (i.e., petroleum products) to soils at project sites.

Biological Resources

Terrestrial Habitat and Species

Effects on terrestrial habitat and species from pipe repair would vary based on the type and magnitude of repair required, but would be similar to those from canal repair.

As with canal lining and repair, minimal streamflow decreases in study area streams due to a short duration reduction of flows in the PCWA canal system during pipe repair could result in temporary and very minimal decreases in the extent of wetland habitats that may be directly or indirectly supported by canal system operations. This could have minimal effects on species that use these wetland habitats, such as foraging birds and breeding amphibians, by decreasing the amount of available habitat. Reductions in water levels could expose amphibian eggs in the shallow, vegetated margins of drainages or adjacent wetlands. Any potential effects from temporary water reductions on species that use these habitats are expected to be minimal.

As with canal repair, potential effects on water quality discussed above could indirectly affect terrestrial habitats and species. Increased loading of sediments and sedimentation from flushing activities could bury amphibian eggs. Increased concentrations of trace elements (such as aluminum and copper) could have some negative effects on plants and wildlife on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to such water quality

changes, although effects vary dramatically by type and concentration of contaminant, species, and water quality parameters.

Habitats and species could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used during pipe repair, including compaction, erosion, and introduction of petroleum products. Effects on habitats and species could include plant mortality or decreased plant growth. These types of impacts are expected to be relatively minimal and small in aerial extent.

Minimal loss of habitat could occur due to limited trimming or removal of vegetation necessary to access repair areas.

Some potential negative effects could occur if raptors are nesting near pipe repair work areas that may be disturbed by noise. Raptors potentially occurring in the study area include Red-shouldered Hawk, American Kestrel, Red-tailed Hawk, and Great Horned Owl. The nesting period for raptors is generally March 1 to August 15.

Aquatic Habitat and Species

Potential effects of pipe repair activities on aquatic habitat and species are likely similar to those discussed for canal repair activities.

Special Status Species

Effects on special status species from pipe repair would vary based on the type and magnitude of repair required, but would be similar to those from canal repair.

As described above, minimal streamflow decreases in study area streams due to a short duration reduction of flows in the PCWA canal system during pipe repair could result in temporary and very minimal decreases in the extent of wetland habitats that may be indirectly supported by canal deliveries. This could have minimal effects on special status species that use these wetland habitats, such as special status foraging birds and breeding amphibians, by decreasing the amount of available habitat. Reductions in water levels could expose special status amphibian eggs in the shallow, vegetated margins of drainages or adjacent wetlands. Any potential effects from temporary water reductions on species that use these habitats are expected to be minimal. Potential effects may be greater during the breeding season for special status amphibian species. The California red-legged frog breeding occurs between late November and March, though most frogs lay eggs in March (USFWS 2002, Stebbins 2003). The foothill yellow-legged frog breeds between mid-March through early June, and the western spadefoot toad breeds late January through July (Stebbins 2003).

Sediment loading to streams after flows are restored to canals following canal repair activities and sedimentation may bury special status amphibian eggs, if present. Increases in concentrations of trace elements, such as aluminum and copper, could have some negative effects on special status plants and wildlife, if present, on the margins of canals and tributaries. Amphibians in particular are known to be sensitive to changes in water quality conditions, although effects vary dramatically by species, life stage, and water quality parameters.

Special status plant species (**Tables 3-12** and **3-13**), if present, could potentially be affected directly or indirectly by impacts to soils and sediments from equipment used during pipe repair, including compaction, erosion, and introduction of petroleum products. Special status plant species, if present, could also be damaged or killed during limited trimming or removal of vegetation necessary to access repair areas. Effects on special status plant species could include mortality or decreased growth. These types of impacts are expected to be unlikely to occur.

Some potential negative effects could occur if special status raptor species are nesting near work areas that may be disturbed by equipment noise during pipe repair activities. Special status raptors potentially occurring in the study area include Swainson's hawk, Cooper's hawk, Northern Goshawk, White-tailed Kite, and Northern Harrier. As mentioned above, the nesting period for raptors is generally March 1 to August 15.

Potential effects of pipe repair activities on Chinook salmon and steelhead are the same as for the aquatic habitat and species described above and likely similar to those discussed for canal repair activities.

6.2 REGULATORY FRAMEWORK FOR POTENTIAL EFFECTS OF MAINTENANCE ACTIVITIES

The following sections provide the regulatory framework for the potential effects of PCWA maintenance activities described above. The regulatory framework discussion is organized by Federal, State, and local regulations, and is summarized in **Table 6-11**.

6.2.1 Federal Regulations

Federal laws and regulations associated with the potential effects of PCWA maintenance activities are described below.

6.2.1.1 Clean Water Act

PCWA activities during canal cleaning activities were found to have minimal effects on water quality conditions in study area streams. Effects of canal cleaning (i.e., increases in temperature, TSS, turbidity, calcium, magnesium, nitrates, aluminum, barium, zinc, and decrease in DO level) were observed at canal release points (e.g., YANKEECR, HANSENR), but not at stream sites. Aluminum, barium, and copper levels increased slightly at stream sites (MINERSRV5 and BCTRIB1). These effects may indicate the transport of fine sediments and potential mobilization of constituents bound to sediments into receiving waters of the United States. As with yearly PG&E outages, PCWA activities during canal cleaning activities are subject to the provisions under the CWA, but they are not required to be permitted.

TABLE 6-11
SUMMARY OF REGULATORY FRAMEWORK AND POTENTIAL BEST MANAGEMENT PRACTICES APPLICABLE TO PCWA MAINTENANCE ACTIVITIES

PCWA Maintenance Activity							Effect	Natural Resource Areas Potentially Affected												Relevant Regulations														Best Management Practices (BMP)	Type of BMP		
	Scheduled				As-Needed Site Specific			Physical			Biological									Federal				State						Local							
		Weed and Brush Control									Terrestrial Habitat and Species				Special Status																						
Canal Cleaning	Physical Removal	Algaecide Application	Herbicide Application	Canal Lining	Canal Repair	Pipe Repair		Hydrology	Water Quality	Soils and Sediment Quality	Wetlands	Nesting birds	Other	Aquatic Habitat and Species	Salmonids	Amphibians	Raptors	Plants	Clean Water Act	Endangered Species Act	Magnuson-Stevens and Sustainable Fisheries Act	Migratory Bird Treaty Act	California Environmental Quality Act	Porter-Cologne	California Endangered Species Act	Fully Protected Species	Fish & Game Code §1602	Native Plant Protection Act	Placer County Conservation Plan	Placer County Stormwater Management Plan	Tree Preservation Ordinance	Oak Woodland Management		Pre-Implementation	Implementation	Ongoing/Post-Implementation
✓				✓	✓	✓	Bank erosion along unlined canals and at canal outlets and sediment loading to receiving waters	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓					
																																		Improve Canal Bank Stability and Install Sediment Traps at Canal Outlets			
																																		Install velocity dissipaters at canal outlets	✓		
																																		Line banks below canal outlets			
																																		Install erosion-control blankets			
																																		Install temporary fiber rolls			
																																		Apply spray-on soil binders			
																																		Avoid Potential Wet Weather Effects			
																																		Plan and design projects to minimize land disturbance	✓		
																																		Identify areas susceptible to erosion for future canal lining activities			
																																		Choose canal crossing sites where erosion potential is low			
																																		Install erosion and sedimentation control measures after land-disturbing activities			✓

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TABLE 6-11
SUMMARY OF REGULATORY FRAMEWORK AND POTENTIAL BEST MANAGEMENT PRACTICES APPLICABLE TO PCWA MAINTENANCE ACTIVITIES (CONTINUED)

PCWA Maintenance Activity							Effect	Natural Resource Areas Potentially Affected												Relevant Regulations														Best Management Practices (BMP)	Type of BMP		
	Scheduled				As-Needed Site Specific			Physical			Biological									Federal				State							Local						
		Weed and Brush Control									Terrestrial Habitat and Species			Aquatic Habitat and Species	Special Status																					
Canal Cleaning	Physical Removal	Algaecide Application	Herbicide Application	Canal Lining	Canal Repair	Pipe Repair		Hydrology	Water Quality	Soils and Sediment Quality	Wetlands	Nesting birds	Other		Salmonids	Amphibians	Raptors	Plants	Clean Water Act	Endangered Species Act	Magnuson-Stevens and Sustainable Fisheries Act	Migratory Bird Treaty Act	California Environmental Quality Act	Porter-Cologne	California Endangered Species Act	Fully Protected Species	Fish & Game Code §1602	Native Plant Protection Act	Placer County Conservation Plan	Placer County Stormwater Management Plan	Tree Preservation Ordinance	Oak Woodland Management		Pre-Implementation	Implementation	Ongoing/Post-Implementation
✓	✓	✓	✓	✓	✓	✓	Disturbance or damage to sensitive species and habitat potentially present in the area.				✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		✓	✓		✓	✓	**Protect Sensitive Species Habitat**			
																																Provide staff with species identification training	✓		
																																Evaluate sites with sensitive species and mark/protect sensitive species habitat			
																																Stockpile materials away from sensitive species habitat areas		✓	
										✓	✓	✓	✓			✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	**Avoid Sensitive Species Areas**			
																																Avoid disturbance to sensitive species		✓	
																																Avoid active raptor nesting areas			
								✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	**Strategic Scheduling of O&M Activities**	✓		

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TABLE 6-11
SUMMARY OF REGULATORY FRAMEWORK AND POTENTIAL BEST MANAGEMENT PRACTICES APPLICABLE TO PCWA MAINTENANCE ACTIVITIES (CONTINUED)

PCWA Maintenance Activity							Effect	Natural Resource Areas Potentially Affected										Relevant Regulations													Best Management Practices (BMP)	Type of BMP		
	Scheduled				As-Needed Site Specific			Physical			Biological							Federal				State					Local							
		Weed and Brush Control									Terrestrial Habitat and Species				Special Status																		
Canal Cleaning	Physical Removal	Algaecide Application	Herbicide Application	Canal Lining	Canal Repair	Pipe Repair		Hydrology	Water Quality	Soils and Sediment Quality	Wetlands	Nesting birds	Other	Aquatic Habitat and Species	Salmonids	Amphibians	Raptors	Plants	Clean Water Act	Endangered Species Act	Magnuson-Stevens and Sustainable Fisheries Act	Migratory Bird Treaty Act	California Environmental Quality Act	Porter-Cologne	California Endangered Species Act	Fully Protected Species	Fish & Game Code §1602	Native Plant Protection Act	Placer County Conservation Plan	Placer County Stormwater Management Plan	Tree Preservation Ordinance	Oak Woodland Management		Pre-Implementation	Implementation	Ongoing/Post-Implementation
✓				✓	✓	✓	Constituent loading to receiving waters from O&M activities		✓	✓				✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓			**Prevent Degraded Water from Entering Streams after Maintenance Activities**			
																															Modify reservoir operations to gradually restore reservoir releases to canals at slower rate		✓	
				✓					✓	✓				✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓		✓	✓			Apply sediment trap at storm drains for dewatering before lining activities			
																															Treat first flush flows to reduce downstream water quality effects			
	✓	✓	✓																												Implement an Aquatic Weed Management Program			✓
✓		✓	✓	✓	✓	✓	All potential effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	**Implement PCWA BMP Program**			✓
✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	**Regulatory Compliance Management for O&M Activities**	✓		
✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	**Good Housekeeping Practices**			
																																Ensure proper handling of materials and wastes			
																																Use proper cleanup procedures after material use		✓	
																																Implement onsite debris and trash management practices			
																																Store materials under a roof or covering with secure tarp			

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PCWA weed and brush control practices may have minimal to no water quality effects on receiving water tributaries and streams during implementation. Physical removal of vegetation may have minimal effects on TSS and turbidity if the removal of vegetation results in the dislodging or loosening pf soil along canal banks and causes loose sediment to be deposited into the canals. Algaecide applications were observed to have minimal effects on pH, which increased slightly at both canal and stream sites (YANKEECR and YHTRIB2). Copper concentrations were observed to increase at YANKEECR, and minimal effects on copper concentrations were observed at YHTRIB2 and SECRETRV3. Minimal to no effects were observed with PCWA's herbicide applications. Temporary decreases in DO levels at ANTSTUBCR and ANTC3B are likely not directly related to herbicide applications. PCWA maintains active status with their General NPDES Permit for Discharges of Aquatic Pesticides, and has an active Aquatic Weed Management Program. As part of this program, PCWA completes an evaluation for each algaecide and herbicide application which includes water quality monitoring and treatment efficacy (PCWA 2003b). PCWA also routinely monitors algaecide and herbicide product releases in an effort to identify suitable algaecides and/or herbicides for applications that may have lesser potential effects on natural resources.

PCWA canal lining/guniting practices were observed to result in temporary moderate effects on the water quality of receiving water tributaries and streams. Increases in temperature, pH, TSS, turbidity, aluminum, zinc, and copper were observed at canal outlets (ANTCR, BOARDMANCR, and BAUGHMANCR) and stream sites (CLVRC6, CLVRC3, and MINERSRV5). Although no water quality permits are required for PCWA canal lining practices, compliance with water quality standards is required. Overall, these effects are temporary and can be prevented or minimized with effective BMPs.

Canal and pipe repair activities may have minimal water quality effects on receiving water tributaries and streams. Potential minimal effects are associated with temporary increases in TSS and turbidity from sediment and/or debris entering the canals as a result of soil disturbance from heavy machinery used for canal or pipe repair. With effective BMP implementation, these temporary effects are not likely to have large or long-term impacts, if any, along drainage or stream sites downstream from repair activities. If a canal or pipe repair activity involves any discharge of dredged or fill material into waters of the United States, a Section 404 permit is required with the USACE. Obtaining a Section 404 permit also requires a Section 401 water quality certification with the RWQCB ensuring that any discharge will not violate State water quality standards. Under Section 402 of the CWA, a canal or pipe repair project may also require a general permit for construction activities and compliance under the Placer County Municipal Stormwater Management Program. Associated regulations are further described under the Porter-Cologne Water Quality Control Act.

6.2.1.2 Endangered Species Act

PCWA canal cleaning activities potentially have minimal effects on special status species. Flushing activities after canal cleaning may cause increased TSS and other constituents, and result in minimal effects on special status species, including slight decreases in the extent of

wetland habitats for special status species. Special status species habitat could be damaged by heavy equipment use or by placement of debris and soil near canals and nesting raptors in the vicinity could be disturbed by equipment noise. Under the Federal ESA, regulated by USFWS and NMFS, habitat modification or degradation could be considered a "take" of federally listed species. In which case, an incidental take permit, under Section 10 of the Federal ESA, or a federal interagency consultation, under Section 7 of the Federal ESA, is required.

Potential effects of weed and brush removal activities may require an incidental "take" permit under the Federal ESA if there is a potential for federally listed as endangered or threatened species to be affected. Physical removal of vegetation would result in direct loss of vegetation and habitat. Physical removal of vegetation often require mechanical harvesters, weed rollers, rotovators, and dredging equipment that dislodge contaminated sediments and may affect special status species, such as fish and amphibians (PCWA 2003b). However, this equipment is only used if necessary, and with precautions. Effective BMPs can be implemented to minimize the effects of physical removal of vegetation that would prevent or minimize effects on special status species. Algaecide applications may have minimal effects on special status species, particularly fish and amphibians, from potential toxicity of copper associated with the algaecide. Only slight increases in copper concentrations were observed in receiving streams during monitoring for algaecide application events. Copper concentrations likely associated with algaecide applications were observed to increase during other canal maintenance activities, and are discussed in **Chapter 7**. Herbicide applications may have minimal effects on special status terrestrial species and vegetation along PCWA reservoirs or canal banks from direct exposure to the herbicide.

PCWA canal lining/guniting practices potentially have minimal effects on special status species. Measured pH values in portions of the canal downstream from canal lining activities were high for a short time after flows were restored to the canal system. High pH values can be toxic to federally listed as endangered or threatened fish and other aquatic species.

PCWA canal and pipe repair activities may have variable effects on special status species. Heavy equipment may disturb vegetation along canal banks from access routes and increased noise levels. Construction work along canal banks could cause increased TSS and other constituents in receiving water tributaries and streams, which could affect special status species, particularly fish and amphibians, and the extent of wetland habitats for special status species. Project-specific environmental resources analyses should be performed to assess the potential effects of canal and pipe repair activities on special status species and to determine measures to minimize potential negative effects.

6.2.1.3 Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act

PCWA canal cleaning activities may have minimal effects on suitable fishery habitat. As described previously, measures recommended to protect EFH by NMFS are advisory, not prescriptive.

PCWA weed and brush control practices, particularly algaecide application practices, may have minimal effects on fishery resources with respect to potential copper contributions in waters of the United States. Although copper concentrations did not exceed water quality objectives in receiving water tributaries, it was observed to temporarily increase at canal outlets. The toxicity of copper to fish varies with the species and the physical and chemical characteristics of the water. Its toxicity to fish generally decreases as water hardness increases. Fish eggs are more resistant than young fish fry to the toxic effects of copper (Gangstad 1986). Because PCWA applies algaecides and herbicides consistent with NPDES permit requirements, and implements BMPs and other actions specified in a detailed PCWA Algaecide Application Program, these effects are likely reduced.

PCWA canal lining/guniting practices may have minimal effects on suitable fishery habitat. Several constituents, such as pH, turbidity, TSS, SC, and other ions temporarily increased at canal outlets, but minimal to no effects were observed in receiving water tributaries and streams. However, these effects are easily avoidable with effective BMP implementation.

PCWA canal and pipe repair activities may have minimal effects on fishery habitat. Potential sediment loading from construction activities can increase turbidity and limit the ability for fish to hide from predators. Hazardous waste runoff from construction sites can have toxic effects on fish. However, these effects are easily avoidable with effective BMP implementation. Project-specific environmental resources analyses should be performed to assess the potential effects of canal and pipe repair activities on EFH and to determine measures to minimize potential negative effects.

6.2.1.4 Migratory Bird Treaty Act

PCWA canal cleaning activities, weed and brush control practices, and canal lining/guniting practices potentially have minimal effects on migratory bird species from the use of equipment and machinery. However, it is unlikely that these effects would constitute a "take" of a migratory bird species or habitat (as defined by the MBTA) and therefore would not be subject to the MBTA.

PCWA canal and pipe repair activities may have minimal effects on migratory bird species. Noise disturbance and improper equipment staging can cause birds to abandon their nests or resting sites, and the removal of trees that provide habitat for migratory birds can reduce their populations in the vicinity of the construction site. However, with effective BMP implementation, these effects can be dramatically reduced or eliminated.

6.2.2 State Regulations

Laws and regulations governed by the State of California and associated with the potential effects of PCWA maintenance activities are described below.

6.2.2.1 California Environmental Quality Act

PCWA maintenance activities may be considered projects requiring CEQA review if there is potential for resulting in direct change in the environment, or a reasonably foreseeable indirect change in the environment. Some PCWA maintenance activities may be exempt from CEQA. Relevant exemptions include emergency projects (Section 15269), statutory exemptions described in State of California CEQA Guidelines Section 15282, and Class 1 and Class 2 categorical exemptions described in Sections 15301 and 15302. Each PCWA maintenance activity or project should be given a preliminary review to determine whether CEQA applies and whether the project may be eligible for an exemption from CEQA. If an exemption is not applicable, an initial study must be prepared to determine if the project may have a significant effect on the environment. The purposes of an initial study are to:

(1) Provide the lead agency with information to use as a basis of deciding whether to prepare an EIR or negative declaration.

(2) Enable an applicant or lead agency to modify a project, mitigating adverse impacts before an EIR is prepared, thereby enabling the project to qualify for a negative declaration.

(3) Assist the preparation of the EIR on the effects determined to be significant.

A. Focusing the EIR on the effects determined to be significant.

B. Identifying the effects determined not to be significant.

C. Explaining the reasons for determining that potentially significant effects would not be significant.

D. Identifying whether a program EIR, tiering, or another appropriate process can be used for analysis of the project's environmental effects (Section 15063.c).

An initial study prepared by PCWA for maintenance activities or projects should include, in brief form, the following:

(1) A description of the project including the location of the project.

(2) An identification of the environmental setting.

(3) An identification of environmental effects by use of a checklist, matrix, or other method, provided that entries on a checklist or other form are briefly explained to indicate that there is some evidence to support the entries. The brief explanation may be either through a narrative or a reference to another information source such as an attached map, photographs, or an earlier EIR or negative declaration. A reference to

another document should include, where appropriate, a citation to the page or pages where the information is found.

(4) A discussion of the ways to mitigate the significant effects identified, if any.

(5) An examination of whether the project would be consistent with existing zoning, plans, and other applicable land-use controls.

(6) The name of the person or persons who prepared or participated in the Initial Study (Section 15063.d).

A Negative Declaration or Mitigated Negative Declaration must be prepared by PCWA for maintenance activities or projects subject to CEQA when (1) the initial study shows that there is no substantial evidence that the project may have a significant effect on the environment; or, (2) the initial study identifies potentially significant effects, but:

(1) Revisions in the project plans or proposals (i.e., BMPs) made by, or agreed to by the applicant before a proposed mitigated negative declaration and initial study are released for public review would avoid the effects or mitigate the effects to a point where clearly no significant effects would occur.

(2) There is no substantial evidence, in light of the whole record before the agency, that the project as revised may have a significant effect on the environment (Section 15070).

A Negative Declaration prepared by PCWA and circulated for public review should include:

(a) A brief description of the project, including a commonly used name for the project, if any.

(b) The location of the project, preferably shown on a map, and the name of the project proponent.

(c) A proposed finding that the project will not have a significant effect on the environment.

(d) An attached copy of the Initial Study documenting reasons to support the finding.

(e) Mitigation measures, if any, included in the project to avoid potentially significant effects (Section 15071).

As described in **Chapter 4**, if an Initial Study concludes that a PCWA activity or project is determined to have significant effects on the environment, and EIR must be prepared. The EIR for the activity or project should evaluate the potential significant effects on environmental resources, identify a range of feasible alternatives to the project that would avoid or reduce its impacts, and identify mitigation measures that would minimize or avoid those impacts.

6.2.2.2 Porter-Cologne Water Quality Control Act

As described previously in **Chapter 4**, the CWA defines Water Quality Standards as provisions of State or Federal law, which consist of U.S. EPA and California water quality criteria and water quality objectives for designated beneficial uses for the waters of the United States.

The regulatory framework and effects for PCWA canal cleaning activities are similar to those described previously under the CWA. PCWA canal cleaning activities were found to be in compliance with State water quality standards and objectives regulated by the Central Valley RWQCB. Of the Criteria for Priority Toxic Pollutants in the State of California, cadmium, copper, and zinc were three criteria parameters monitored for during PCWA canal cleaning activities. Cadmium levels were not exceeded. The freshwater CMCs for zinc (120 µg/L) and copper (9 µg/L) were exceeded at some canal release sites monitored during the canal cleaning activities, but no exceedances were observed within receiving water tributaries or streams within the Secret Ravine and Miners Ravine watersheds. Therefore, PCWA canal cleaning activities were observed to be in compliance with state water quality standards. However, if an exceedance did occur within receiving waters of the United States, they are temporary and can be prevented and/or minimized through effective BMP implementation. Of the water quality objectives associated with beneficial uses of the Sacramento River in the Sacramento-San Joaquin Basin Plan, barium, copper, iron, zinc, DO, pH, and turbidity were monitored during PCWA canal cleaning activities. The basin plan water quality objectives for trace elements barium, copper, and zinc were exceeded at canal release points during cleaning events, but no exceedances were recorded in receiving water tributaries and streams within the Secret Ravine and Miners Ravine watersheds. Therefore, PCWA canal cleaning activities were observed to be in compliance with basin plan trace element water quality objectives for the Sacramento River. Basin plan water quality objectives for basic parameters were observed to be slightly exceeded in receiving water tributaries and streams. The DO level in the FRGTRIB1 (6.1 mg/L) was observed to be slightly below the minimum DO level for waters with designated coldwater fishery beneficial uses (7.0 mg/L) during the March 27, 2007, cleaning event. Some pH and turbidity levels at canal release points were observed to exceed the water quality objectives, but none was observed within receiving water tributaries or streams during canal cleaning events. Due to the DO decrease being so slight and temporary, it is not a large concern that PCWA can meet water quality objectives for basic parameters during canal cleaning events.

The regulatory framework for PCWA weed and brush control practices is similar to the framework described previously under the CWA. Of all water quality standards and objectives, the basin plan water quality objective for turbidity has the most potential for exceeding the limit during the physical removal of vegetation. However, increases in turbidity and suspended sediments can easily be avoided or minimized through effective BMP implementation. As described in **Chapter 4**, an NPDES permit is now required under the CWA for aquatic pesticide applications. NPDES permits for discharges to surface waters must meet the most protective (lowest) and appropriate limits in order to protect all designated beneficial uses of the receiving water, which constitute state water quality criteria and Central Valley RWQCB basin plan water quality objectives. PCWA's algaecide applications currently comply with NPDES permit requirements. Although copper levels temporarily increased at canal outlets, they remained well below water quality standards and objectives for copper during monitoring for algaecide application events. Herbicide applications were also found to be in compliance with state water quality standards and objectives regulated by the Central Valley RWQCB.

The regulatory framework and effects for PCWA canal lining/guniting practices are similar to those described previously under the CWA. No water quality standards were observed to be exceeded in waters of the United States during canal lining activities. DO concentrations were lower than the minimum level water quality objective at canal outlets, but not at tributary or stream sites. Recorded pH levels reached 11.7 at canal sites downstream from lining activities and canal outlets, but the basin plan water quality objective range for pH (6.5 to 8.5) was not exceeded at tributary or stream sites. Turbidity levels exceeded the basin plan water quality objective (increase by greater than 20 percent) in Miners and Secret ravines, but remained below 100 NTUs. Barium, iron, zinc, and copper levels were increased at canal sites downstream from the lining activity and at canal outlets, but they did not exceed water quality objectives in receiving water tributaries and streams. Turbidity was the only parameter observed to exceed water quality objective levels during canal lining activities, and may be controlled by effective BMP implementation.

The regulatory framework and effects for PCWA canal and pipe repair activities are similar to those described for the CWA. If a Section 401 certification is required, an application should be prepared and submitted for approval before project implementation. Increases in turbidity in receiving water tributaries and streams are of primary concern during these activities, and increases in turbidity and suspended sediments can easily be avoided or minimized through effective BMP implementation. The Placer County Stormwater Management Program (required under the RWQCB Phase II MS4 permit) provides guidance on the implementation of BMPs that minimize the potential effects of construction activities. A pipe repair project that results in the disturbance of greater than 1 acre of land requires a General Construction General Permit with the RWQCB. Under Construction General Permit requirements, a SWPPP is required to be prepared, be on site at all times, and be followed by a designated construction contractor to ensure that contaminants are not discharged into the river. Water quality monitoring and observation reports at construction sites is required during at least two precipitation events, the first one being the first-flush rain event. Monitoring results and other information are to be submitted in annual reports each June to the RWQCB for compliance review. Monitoring results are compared to nonenforceable EPA Parameter Benchmark Levels (see **Chapter 3**) that, if exceeded, a warning letter is sent to the permittee advising implementation of more effective BMPs to minimize waste discharges.

6.2.2.3 California Endangered Species Act

Under the California ESA, the effects on special status species from PCWA maintenance activities during PCWA canal cleaning activities, PCWA weed and brush control practices, canal lining/guniting practices, and canal and pipe repair activities are similar to those described previously under the Federal ESA. However, the California ESA addresses the incidental take of State-listed species as threatened or endangered.

6.2.2.4 California Fish and Game Code-Fully Protected Species

Under the Fish and Game Code-Fully Protected Species, the effects on special status species from PCWA canal cleaning activities, PCWA weed and brush control practices, canal

lining/guniting practices, and canal and pipe repair activities, are similar to those described previously under the Federal ESA. However, this code addresses the incidental take of fully protected species. DFG is unable to authorize incidental take of fully protected species, such as White-tailed Kite and the California Black Rail, when activities are proposed in areas inhabited by those species. Therefore, the take of any fully protected species for project implementation is prohibited.

6.2.2.5 California Fish and Game Code Section 1602 – Lake and Streambed Alteration Program

In accordance with the Lake and Streambed Alteration Program, PCWA is required to notify DFG of any proposed activity that may substantially modify study area streams or lakes. Potential PCWA maintenance activities that may require notification include actions that will substantially divert or obstruct the natural flow of any river, stream, or lake; substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake; or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake. If PCWA canal repair or pipe repair activities have the potential to modify streams or lakes as described above, PCWA should provide notification to DFG under the Lake and Streambed Alteration Program.

6.2.2.6 California Native Plant Protection Act

This act applies to endangered and "rare" plant species, subspecies, and varieties of wild native plants in California. PCWA canal cleaning, weed and brush control, canal lining/guniting, and canal and pipe repair activities may affect endangered and "rare" plant species during the use of equipment and machinery in canals and along canal banks. PCWA weed and brush control practices may also have moderate effects on endangered and "rare" plant species. Physical removal of vegetation could result in direct loss of vegetation and habitat. Herbicide applications near special endangered and "rare" plant species may expose it to the toxic effects of herbicides. However, with proper application and effective BMP implementation, these effects can be prevented or minimized.

6.2.3 Local Requirements and Considerations

The following sections describe the framework for local requirements during PCWA maintenance activities.

6.2.3.1 Placer County Conservation Plan

As described in **Chapter 4**, the PCCP includes plans with goals to protect fish and wildlife and their habitat and protect streams, wetlands and other water resources, as well as coverage under several environmental permits to be issued to Participating Entities. With PCCP long-term environmental permits described in **Chapter 4**, PCWA will be covered for activities projects that require it.

The regulatory framework for PCWA maintenance activities related to the PCCP are the same as the those described for CWA, ESA, Porter-Cologne Water Quality Control Act, California ESA, California Fish and Game Code-Fully Protected Species, and Lake and Streambed Alteration Program.

6.2.3.2 Placer County Stormwater Management Plan

PCWA construction activities during canal and pipe repair projects may be subject to Construction Site Stormwater Runoff Control guidelines the Placer County SWMP. Projects within Placer County will be designed using BMPs for stormwater discharges. The SWMP provides guidance in establishing BMPs before, during, and after construction activities, as well as long-term maintenance BMPs.

Placer County has established procedures specified in the county Grading and Erosion Prevention Ordinance for applying and enforcing construction site pollution control measures, including site plan reviews, requiring erosion and sediment control BMPs, inspections, and enforcement of violations.

6.2.3.3 Placer County Code, Tree Preservation Ordinance

Lining of previously unlined section of PCWA's canal system may indirectly affect adjacent trees historically supported by canal seepage. Also, PCWA canal and pipe repair activities may require the removal of trees. Placer County's tree ordinance sets county-wide requirements for projects within riparian zones, permit requirements for removal of landmark trees, removal of more than 50 percent of trees, and commercial firewood cutting, and establishes tree preservation zones. For example, the removal of more than 50 percent of existing native trees (equal to or greater than 6 inches in diameter at breast height), and of any landmark tree, is subject to the issuance of a tree permit. A "landmark tree" means a tree or grove of trees designated by resolution of the board of supervisors to be of historical or cultural value, an outstanding specimen, an unusual species and/or of significant community benefit (i.e., palms, along English Colony Road, oak canopy tree areas, Deodar cedars on Highway 49, major heritage oak trees). Tree preservation zone provisions are applicable to the Dry Creek-West Placer Community Plan, Granite Bay Community Plan, portions of the Loomis Basin General Plan, and the Auburn-Bowman Community Plan. A tree preservation zone map is available in the Placer County Planning Office for more details on zoning areas

6.2.3.4 Placer County Oak Woodland Management Plan

As described above, PCWA's canal lining, canal repair, and pipe repair activities may affect trees, including oaks, adjacent to canals. The regulatory framework related to the Placer County Oak Woodland Management Plan for canal lining, and canal and pipe repair activities are similar to those described in the Placer County Tree Preservation Ordinance. As part of this plan, projects are subject CEQA assessments for oak woodland habitats.

6.3 BEST MANAGEMENT PRACTICE OPTIONS TO ADDRESS POTENTIAL EFFECTS OF MAINTENANCE ACTIVITIES

Potential BMPs to reduce potential effects of PCWA maintenance activities on natural resources are summarized in Table 6-11, and described below. The list of BMP options is not comprehensive; instead, it provides examples of BMPs that may be implemented to minimize particular potential effects of PCWA canal maintenance activities. Several BMP options for maintenance activities are similar to those for operations activities described in Section 5.3; therefore, are not described as thoroughly in this section.

6.3.1 Pre-Implementation Best Management Practices

Below are potential pre-implementation BMPs for reducing potential effects of PCWA maintenance activities on natural resources in the study area.

6.3.1.1 Improve Canal Bank Stability and Install Sediment Control Measures at Canal Outlets

Canal bank erosion along unlined canals may occur after canal flows are restored following dewatering activities associated with canal cleaning and lining activities. The following measures to improve canal bank stability are described in **Chapter 5**:

- Install velocity dissipaters at canal outlets
- Line banks below canal outlets

Additional BMP options to address potential effects of bank erosion below canal outlets and sediment loading in receiving waters from dewatering during maintenance activities are described below.

Install Erosion-Control Blankets in Areas of Soil Disturbance

Erosion-control blankets and turf reinforcement mats combine vegetative growth with synthetic materials to form a high-strength mat that prevents soil erosion in drainage areas and on steep slopes. Where applicable, PCWA may apply a geotextile blanket or biodegradable mat on graded slopes to minimize actively bared and easily eroded soils. These blankets also enhance vegetative growth and provide removal of particulates through sedimentation and soil infiltration (EPA 2005b). PCWA is already implementing this type of BMP, where possible.

Install Temporary Fiber Rolls in Areas of Soil Disturbance

Fiber rolls (also called fiber logs or straw wattles) are tube-shaped erosion-control devices filled with straw, flax, rice, coconut fiber material, or composted material (EPA 2008a). Temporary fiber rolls are typically made of rice straw, are contained in tubular black netting, and can be staked down along a sloped area. Rice straw is weed free and naturally biodegradable, which can enhance the soil and help vegetation become established. Each roll is wrapped with ultraviolet (UV)-degradable polypropylene netting for longevity or with 100 percent

biodegradable materials like burlap, jute, or coir. Fiber rolls are used on slopes to reduce runoff velocity and control or capture eroded sediment to prevent sediment loading in receiving water streams. On steep slopes, fiber rolls used in conjunction with a properly designed and installed erosion-control blanket may be very effective in reducing erosion and sedimentation.

Apply Spray-On Soil Binders in Areas of Soil Disturbance

Spray-on emulsion is often used as a temporary tackifier for hydroseeding or mulch, or a stand-alone, heavy-duty soil binder for erosion control. Plant-based, polymer, and cementious-based emulsions penetrate the topsoil and bind soil particles together. These agents form a protective, flexible film to strengthen the soil surface and provide bank stabilization and erosion control. Polymer emulsions may be applied with hydroseeders, water trucks, or other spraying devices. Spraying devices with a mechanical agitator or mixing apparatus or hydraulic recirculation are known to be most effective. These emulsions are best applied to low or moderate slopes, and best avoided in areas where the binder would likely be removed in the near future or in areas with high-volume sheet flow because it has a tendency to be washed away. Reapplication of soil binders may be necessary to effectively stabilize the soil throughout the season.

6.3.1.2 Avoid Potential Wet Weather Effects

Avoidance of potential adverse effects of PCWA maintenance activities during wet weather, when and where feasible, can be very effective. BMP options to avoid potential wet weather effects for PCWA maintenance activities are described below.

Plan and Design Projects to Minimize Land Disturbance

Scheduled maintenance activities, particularly canal and pipe repair, can be planned and designed with consideration in minimizing excavation and land disturbance. This BMP involves avoiding land disturbance during periods of high precipitation, and land disturbance in areas vulnerable to erosion. PCWA is already implementing this type of BMP, when possible.

Identify Areas Susceptible to Erosion for Future Canal Lining Activities

During maintenance activities, PCWA staff may identify segments of unlined canals or lined areas along the canal that are visibly disturbed and/or susceptible to bank erosion for future canal lining activities. Future lining of these segments typically reduces erosion and sloughing of canal banks. PCWA already implements this type of BMP.

Choose Canal Crossing Sites Where Erosion Potential is Low

Maintenance activities, such as canal lining and canal cleaning, may require hoses and/or other equipment to rest across the canal. Areas along canals with visible erosion or loose sediment should be avoided and equipment should be located along stable canal sections. PCWA is already implementing this type of BMP.

6.3.1.3 Protect Sensitive Species and Sensitive Species Habitat

Before conducting maintenance activities, special status species and sensitive species habitat can be protected by the following BMPs described in **Chapter 5**:

- Provide staff with species identification training.
- Evaluate sites with sensitive species and mark/protect sensitive species habitat.

In addition to options described in **Chapter 5** for the "Evaluate sites with Sensitive Species and Mark/Protect Sensitive Species Habitat" BMP option, a protective curtain can be placed around sensitive plant species and/or habitat near herbicide application areas to minimize the exposure of special status species and/or habitat to the potential toxic effects of herbicides. Types of protective curtains include tarps or a pesticide containment pad made of impermeable materials, such as synthetic liners.

6.3.1.4 Strategic Scheduling of Maintenance Activities

Maintenance activities can be scheduled, or BMPs implemented, at specific times of the year to avoid or minimize potential effects on terrestrial and aquatic biological resources. Activities can be planned to avoid species sensitive periods and to avoid wet weather erosion effects. For example, a project or activity can be scheduled to avoid periods during bird nesting and/or amphibian breeding seasons. Projects requiring equipment and machinery can be scheduled during a time of low erosion potential, such as the dry season. PCWA is already implementing this type of BMP, when possible.

6.3.1.5 Regulatory Compliance Management for Operations and Maintenance Activities

Before maintenance activity or project implementation, permits may need to be obtained and BMPs implemented to comply with rules and regulations. BMP checklists are available from many governmental resources as planning guides for environmental compliance. An example is EPA's "Managing Your Environmental Responsibilities: A Planning Guide for Construction and Development" that describes BMPs that should be implemented before, during, and after canal and pipe repair activities. In addition, there are several guidance documents online providing information on delegating specific tasks to employees for a construction project with an associated General NPDES Construction Stormwater Permit, such as a manager who would be responsible for knowing the location and ensuring implementation of a project SWPPP. Regulatory compliance activities include periodically updating documents, such as PCWA's Aquatic Weed Management Program, which is reviewed annually and updated, as needed.

6.3.2 Implementation Best Management Practices

The following sections identify potential BMPs to reduce potential effects associated with PCWA maintenance activities on natural resources within the PCWA raw water distribution area that should be considered during implementation of PCWA maintenance activities.

6.3.2.1 Protect Sensitive Species and Sensitive Species Habitat

Special status species and sensitive species habitat can be protected during implementation of some maintenance activities by applying the following BMP:

Stockpile Materials Away from Sensitive Species Habitat Areas

Before conducting canal cleaning or canal lining activities, PCWA may designate areas that should be avoided based on observed sensitive species or known sensitive species habitat areas. During canal cleaning or canal lining activities, PCWA personnel would stockpile any debris (i.e., vegetation, sediment, and/or gunite removed from canals) away from these known occurrences or areas of sensitive species habitat, or only in previously disturbed areas, to minimize potential effects of these materials on natural resources through physical damage to vegetation/species by deposition of material or constituent loading to receiving streams. PCWA is already implementing this type of BMP.

6.3.2.2 Avoid Sensitive Species Areas

During operations activities, PCWA personnel can do several things to prevent potential effects on terrestrial species and disturbance to terrestrial species habitat. Several BMP options for PCWA maintenance activities are similar to those described in **Chapter 5** for operations activities, including:

- Avoid disturbance to sensitive species

An additional BMP option to avoid sensitive species during maintenance activity implementation is described below.

Avoid Active Raptor Nesting Areas

PCWA staff can avoid potential impacts to raptors through avoiding active raptor nesting areas during maintenance activities. PCWA may conduct raptor survey at locations of scheduled maintenance activities during the breeding season (generally March through August) to scan for active nests. If active nests are observed, the area should be avoided to the maximum extent possible. If activities do occur in the area, noise and other disturbance should be kept to a minimum. PCWA is already implementing this type of BMP for canal lining activities, when possible.

6.3.2.3 Prevent Degraded Water from Entering Streams After Operations and Maintenance Activities

Water flows restored to the canal system immediately following maintenance activities that involve canal dewatering may flush accumulate debris and sediment, along with associated constituents, to receiving streams. BMPs may be implemented to prevent or reduce the amount of degraded water from PCWA's canal system from entering streams. BMP options for maintenance activities previously described in **Chapter 5** include:

- Modify reservoir operations to gradually restore reservoir releases to canals at a slower rate

Additional BMPs that may prevent degraded water from entering streams after maintenance activities are described below.

Apply Sediment Trap at Storm Drains for Dewatering Before Canal Lining

For some types of maintenance activities that require complete dewatering of ponded water, such as canal lining, water remaining in canals is pumped out of a canal segment before preparing segments for canal lining. These waters may exhibit elevated concentrations of constituents and should not be discarded to receiving waters or storm drains. Temporary sediment traps can be installed at nearby storm drains to filter sediment and associated constituents from small volumes of water removed from canals.

Treat First Flush Flows to Reduce Downstream Water Quality Effects

Results from water quality monitoring associated with canal lining activities at locations below newly lined canal segments demonstrated pH values that were higher in comparison to sites upstream from newly lined segments. Water with elevated pH values may be treated to buffer potential changes to pH that may occur through geochemical interactions of ions in canal waters with newly lined gunite sections. Nontoxic solutions that may lower pH and neutralize potential effects of canal lining on pH would reduce potential water quality effects on receiving streams.

6.3.3 Ongoing or Post-Implementation Best Management Practices

Potential ongoing or post-implementation BMPs for maintenance include the following option described in **Chapter 5**:

- Implement PCWA BMP Program

Additional ongoing or post-implementation BMP options for maintenance activities are described below.

6.3.3.1 Avoid Potential Wet Weather Effects

Install Erosion- and Sedimentation-Control Measures After Land-disturbing Activities

If PCWA maintenance activities may disturb land during the wet season, loose sediment and/or material in the vicinity of the canal system should be contained using sediment-control measures, such as a tarp surrounded with fiber rolls, to protect the materials from being transported into downstream waterways. PCWA already implements this type of BMP, when possible.

6.3.3.2 Prevent Degraded Water from Entering Streams After Operations and Maintenance Activities

Implement an Aquatic Weed Management Program

PCWA currently implements an Aquatic Weed Management Program. As part of this program, PCWA completes an evaluation for each algaecide and herbicide application which includes water quality monitoring and treatment efficacy (PCWA 2003b). PCWA also routinely monitors algaecide and herbicide product releases in an effort to identify suitable algaecides and/or herbicides for applications that may have lesser potential effects on natural resources.

6.3.3.3 Good Housekeeping Practices

Good housekeeping is practiced to maintain clean and orderly work sites and to prevent materials originating in the work site area from affecting natural resources. Good housekeeping practices include plans, procedures, and activities designed to prevent or minimize potential pollutant runoff into waterways. PCWA's Hazardous Materials Plan describes these practices in detail. Examples of good housekeeping BMPs are as follows:

Ensure Proper Handling of Materials and Wastes

Spill kits should be kept nearby and used to prevent further contamination if wastes are accidentally spilled. If a spill is large, the spill should be reported to the Office of Environmental Health Hazard Assessment (OEHHA). PCWA is already implementing this type of BMP.

Use Proper Cleanup Procedures After Material Use

PCWA staff should not wash excess gunite into canals following completion of canal lining activities. Once canal lining activities are completed, excess gunite should be contained and properly disposed. If equipment used for canal lining activities needs to be rinsed, wastewater should be captured, contained in a storage vessel, and exported to a disposal facility. PCWA is already implementing this type of BMP.

Implement Onsite Debris and Trash Management Practices

During PCWA maintenance activities, PCWA should (1) keep debris and trash under cover either in an enclosed trash container, (2) prevent waste materials to accumulate on the ground, and (3) inspect maintenance sites daily for litter and debris. If feasible, construction and demolition debris such as wood, metal, and concrete, should be recycled. PCWA is already implementing this type of BMP.

Store Materials Under a Roof or Covering with a Secure Tarp

Proper storage of pollutant materials, such as fuel, oil, concrete, and other hazardous liquids, should be considered for materials used for maintenance activities. When pollutant materials must be stored on site, they should be stored in a secure, covered location with secondary containment provisions. Additional options include designating specific areas on site for material delivery and storage, location of material storage areas away from waterways and storm drain outlets, installation of containment berms between stored materials and site drainage system, proper labeling of materials and containers, and keeping material containers tightly sealed after use. Maintenance site supervisors should check for leaching or spreading of contaminants from areas where potentially hazardous materials are stored. PCWA already implements this type of BMP.

6.4 SUGGESTIONS FOR FURTHER STUDIES

Based on results of NRMP studies, PCWA maintenance may affect natural resources conditions within the study area. Higher concentrations of trace metals, particularly aluminum and copper, were observed at sites monitored within the PCWA canal system compared to stream sites for sampling events associated with PCWA's maintenance activities that involved dewatering of canal segments. These data may inconclusively suggest that the PCWA canal system is a source for loading of some constituents to study area streams.

Additional water quality monitoring should be conducted at sites to characterize potential effects of PCWA maintenance activities on water quality conditions. Water quality monitoring sites for maintenance event-based monitoring should include:

- Canal sites immediately upstream and downstream from the maintenance activities within the PCWA canal system
- End of canal outlets downstream from maintenance activities
- Stream sites upstream and downstream from canal system contributions

Nearby routine water quality monitoring sites within the same watersheds as the maintenance sites should also be included during maintenance event-based water quality monitoring to characterize effects of maintenance activities. One of the focal points for additional studies should be to evaluate aluminum and copper inputs to study area streams from the PCWA canal system. During algaecide application events, additional and more frequent water quality monitoring at select canal outlets downstream from Clover Valley and Mammoth reservoirs during and after algaecide applications. Water quality results for these events, coupled with flow data at algaecide application points and canal outlets, would provide PCWA with the data to calculate the mass balance for copper and estimate mass loading of copper to study area streams during algaecide applications. Water quality monitoring should also be conducted upstream and downstream from BMPs implemented by PCWA to reduce potential impacts to water quality to evaluate BMP effectiveness. Sample timing for all maintenance event-based water quality monitoring should be determined based on hydrologic conditions at each site to characterize potential constituent loading to study area streams following maintenance activities.

As described in **Chapter 5**, additional sediment quality monitoring at numerous sites exhibiting variable soil conditions along the canal system and study area streams may help to determine potential sources of trace metals in PCWA canals and study area streams. Soil sampling for representative soil types should be coordinated with maintenance event-based water quality monitoring. Soil samples should be collected from sediments removed from canals during canal cleaning and canal lining activities, and from undisturbed sites of representative soil types, as characterized by PCWA (2005), near and upstream from canal and stream water quality monitoring sites within watersheds of Clover Valley Creek, Antelope Creek, Secret Ravine, and Miners Ravine.

Additionally, effects of canal lining activities on wetlands and/or trees, including oak trees, located adjacent to canals are not clearly understood. Further studies should be conducted to evaluate potential effects of canal lining on wetlands and/or trees adjacent to canals. Studies may include evaluating potential changes to moisture and geochemical conditions of soils near potentially affected wetlands and/or trees before and after canal lining activities.

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CHAPTER 7.0
POTENTIAL EFFECTS, REGULATORY FRAMEWORK, AND BEST MANAGEMENT PRACTICES FOR INTERRELATED PCWA OPERATIONS AND MAINTENANCE ACTIVITIES

This chapter provides an overview of the potential effects of interrelated PCWA O&M activities on natural resource conditions in the study area, the regulatory framework for effects, and potential BMPs to reduce effects of interrelated PCWA O&M activities on natural resources.

7.1 POTENTIAL EFFECTS OF INTERRELATED PCWA OPERATIONS AND MAINTENANCE ACTIVITIES ON NATURAL RESOURCES

This section describes potential effects of PCWA O&M activities that, when combined, may increase adverse effects to natural resources. Interpretations of the potential effects of interrelated PCWA activities are based on the potential effects of operations activities discussed in **Chapter 5** and potential effects of PCWA maintenance activities discussed in **Chapter 6**. Potential interrelated effects associated with canal or pipe repair, however, are not addressed in this chapter. As described in **Chapter 6,** canal repair and pipe repair activities should require project-specific environmental resources analyses to assess the potential effects of the activity on natural resources, and an evaluation to determine measures to minimize potential negative effects.

7.1.1 Yearly Outages

PCWA operations during the PG&E yearly outages in combination with other PCWA O&M activities may increase adverse effects to natural resources. No interrelated effects are anticipated on natural resources during PCWA operations related to yearly outages and:

- Seasonal delivery schedule changes
- Seasonal flood management practices
- Maintenance related to physical removal of vegetation along PCWA's raw water distribution system
- Maintenance related to herbicide applications along PCWA's raw water distribution system

The following summarizes potential effects of PCWA operations during yearly outages that may be interrelated to potential effects observed during other PCWA O&M activities:

- Routine Operations – During routine PCWA operations, the PCWA canal system provides direct contributions to flows within study area streams through regulated releases to streams used for conveyance to customers, unregulated releases from canal

outlets, and indirect contributions through customer return flows (USACE and PCWA 2008). These canal system contributions to streamflow have a positive effect on hydrologic conditions in study area streams, creating and sustaining suitable habitat conditions for many aquatic species during the dry season. These positive effects on natural resources, when combined with potential negative effects on hydrological conditions associated with PCWA's operations during the outages, likely result in interrelated effects to natural resources. Potential interrelated effects to biological resources, including wetlands supported by canal contributions, Central Valley steelhead, and Chinook salmon, are representative of historic conditions within the study area.

- Canal Cleaning – Removal of debris and sediment from the canals during canal cleaning activities potentially reduces adverse interrelated effects of PCWA operations during yearly outages on water quality conditions in study area streams. PCWA's canal cleaning activities remove much of the unconsolidated sediment, organic material, and associated copper from algaecide applications that may settle in canals when canals are dewatered during the outage.

- Weed and Brush Control – Algaecide Application: Interrelated effects of PCWA operations during yearly outages and PCWA's algaecide applications were observed during water quality monitoring events for yearly outages, particularly within the Secret Ravine watershed. Measured copper values at canal and stream sites in the Secret Ravine watershed during the October 2007 sampling event increased after flows were restored to the canal system. The higher copper values observed during the yearly outages were likely attributed to mobilization of copper associated with fine sediment and organic material remaining within the canals after canal cleaning activities, or that had accumulated and settled when canals were dewatered during the outage. The affects on water quality from these interrelated activities likely result in adverse effects on terrestrial and aquatic biological resources.

- Canal lining – Removal of debris and sediment from the canals during canal preparation for lining activities, along with improved canal bank stability when canals are lined, likely decreases potential adverse effects of PCWA operations during PG&E yearly outages on water quality conditions in study area streams.

7.1.2 Seasonal Delivery Schedule Changes

No interrelated effects are anticipated on natural resources during PCWA operations related to seasonal delivery schedule changes in combination with other PCWA O&M activities.

7.1.3 Seasonal Flood Management Practices

PCWA operations during seasonal flood management practices in combination with other PCWA O&M activities may increase adverse effects to natural resources. No interrelated effects

are anticipated on natural resources during PCWA operations related to seasonal flood management practices and:

- Yearly outages
- Seasonal delivery schedule changes
- Routine operations
- Maintenance from physical removal of vegetation along PCWA's raw water distribution system
- Maintenance from herbicide applications along PCWA's raw water distribution system

The following summarizes potential effects of PCWA operations during seasonal flood management practices that may be interrelated to potential effects observed during other PCWA O&M activities:

- Canal Cleaning – Removal of debris and sediment from the canals during canal cleaning activities potentially reduces adverse interrelated effects of PCWA operations during seasonal flood management practices on water quality conditions in study area streams. PCWA's canal cleaning activities remove much of the unconsolidated sediment and organic material that accumulates in canals and may be flushed from canals during seasonal flood management practices. These effects are likely similar to conditions generally exhibited across study area streams during periods of high precipitation runoff.

- Weed and Brush Control – Algaecide Application – Flood management practices have the potential to cause adverse effects to natural resources when combined with algaecide applications along PCWA's raw water distribution system. Potential adverse effects may occur through loading of copper remaining within the canals after canal cleaning activities to wetlands and streams, and accumulation of copper in wetland and stream sediments may affect biological resources.

- Canal Lining – Within sections of the canal system that are lined or recently lined before PCWA seasonal flood management practices, canal lining activities potentially result in reduced adverse interrelated effects from PCWA operations during seasonal flood management practices. Removal of debris and sediment from the canals during canal preparation for lining activities, along with improved canal bank stability when canals are lined, potentially decreases adverse effects of PCWA operations during seasonal flood management practices on water quality conditions in study area streams, similar to conditions generally exhibited across study area streams during periods of high precipitation runoff.

7.1.4 Routine Operations

Routine PCWA operations in combination with other PCWA O&M activities may increase adverse effects to natural resources. No interrelated effects are anticipated on natural resources during PCWA operations related to routine operations and:

- Seasonal delivery schedule changes
- Seasonal flood management practices
- Routine operations
- Canal cleaning along PCWA's raw water distribution system
- Physical removal of vegetation along PCWA's raw water distribution system
- Herbicide applications along PCWA's raw water distribution system

The following summarizes potential effects of PCWA operations during routine operations that may be interrelated to potential effects observed during other PCWA O&M activities:

- Yearly Outages – When combined with operations during PG&E yearly outages, negative effects on hydrological conditions associated with PCWA's routine operations during the yearly outages may increase adverse effects to natural resources. These potential interrelated effects are summarized above in the section describing interrelated effects associated with PCWA operations during PG&E yearly outages. As described in **Chapter 5**, flow contributions associated with PCWA routine operations have an overall positive effect on hydrologic conditions in study area streams.
- Canal Lining – Removal of debris and sediment from the canals during canal preparation for lining activities, along with improved canal bank stability when canals are lined, likely decreases potential adverse effects of routine operations on water quality conditions in study area streams.

7.1.5 Canal Cleaning and Flushing

PCWA operations during canal cleaning in combination with other PCWA O&M activities may increase adverse effects to natural resources. No interrelated effects are anticipated on natural resources during PCWA operations related to canal cleaning and:

- Seasonal delivery schedule changes
- Routine operations
- Physical removal of vegetation along PCWA's raw water distribution system

- Herbicide applications along PCWA's raw water distribution system
- Canal lining along PCWA's raw water distribution system

The following summarizes potential effects of PCWA operations during canal cleaning that may be interrelated to potential effects observed during other PCWA O&M activities:

- Yearly Outages – As described above, removal of debris and sediment from the canals during canal cleaning activities likely decreases potential adverse effects of PCWA operations during yearly outages on water quality conditions in study area streams.
- Seasonal flood management practices – As described above, removal of debris and sediment from the canals during canal cleaning activities likely decreases potential adverse effects of PCWA operations during seasonal flood management practices on water quality conditions in study area streams.
- Weed and Brush Control – Algaecide Application – PCWA's canal cleaning activities, when combined with algaecide applications along PCWA's raw water distribution system, likely have adverse interrelated effects to natural resources. Water quality data collected during canal cleaning activities, summarized in **Chapter 6**, show increased concentrations of copper at study area stream sites immediately following canal cleaning. Increased concentrations of copper are likely the result of the mobilization of copper associated with fine sediment and organic material remaining within the canals after canal cleaning activities or that had settled within upstream and/or downstream canal sections that were dewatered for canal cleaning. Copper loading to wetlands and streams, and accumulation of copper in wetland and stream sediments may affect biological resources.

7.1.6 Weed and Brush Control – Physical Removal of Vegetation

No interrelated effects are anticipated on natural resources during physical removal of vegetation in combination with other PCWA O&M activities.

7.1.7 Weed and Brush Control – Algaecide Application

Algaecide applications along PCWA's raw water distribution system in combination with other PCWA O&M activities may increase adverse effects to natural resources. No interrelated effects are anticipated on natural resources during algaecide applications and:

- Seasonal delivery schedule changes
- Routine operations
- Physical removal of vegetation along the PCWA canal system

- Herbicide applications along PCWA's raw water distribution system

The following summarizes potential interrelated effects of PCWA algaecide applications when combined with other PCWA O&M activities:

- Yearly Outages – PCWA's algaecide applications, when combined with operations during yearly outages, will likely result in adverse interrelated effects to natural resources. As described above, higher copper concentrations observed at sites during yearly outage water quality monitoring events were likely attributed to mobilization of copper associated with fine sediment and organic material that had settled when canals were dewatered during the outage. Copper loading to wetlands and streams, and accumulation of copper in wetland and stream sediments may affect biological resources.

- Seasonal Flood Management Practices – Algaecide applications along PCWA's raw water distribution system have the potential to cause adverse effects to natural resources when combined with seasonal flood management practices. Potential adverse effects may occur through copper loading to wetlands and streams, and accumulation of copper in wetland and stream sediments may affect biological resources.

- Canal Cleaning – As described above, PCWA algaecide applications, when combined with canal cleaning activities, likely result in adverse interrelated effects to natural resources. Increased concentrations of copper in study area streams following canal cleaning activities are likely the result of the mobilization of copper from algaecide applications associated with fine sediment and organic material that had settled when canals were dewatered for canal cleaning. Accumulation of copper in wetland and stream sediments may affect biological resources.

- Canal Lining – Similar to potential interrelated effects associated with algaecide applications and canal cleaning activities, PCWA algaecide applications, when combined with canal lining activities, likely cause adverse interrelated affects to natural resources. Measured copper values in study area streams following canal lining activities were marginally higher compared to routine operations. The higher values result from the mobilization of copper from algaecide applications associated with fine sediment and organic material that had settled when canals were dewatered for canal lining.

7.1.8 Weed and Brush Control – Herbicide Application

No interrelated effects are anticipated on natural resources during PCWA herbicide applications in combination with other PCWA O&M activities.

7.1.9 Canal Lining

PCWA canal lining activities in combination with other PCWA O&M activities may increase adverse effects to natural resources. No interrelated effects are anticipated on natural resources during PCWA operations related to canal lining and:

- Yearly outages
- Seasonal schedule delivery changes
- Seasonal flood management practices
- Canal cleaning along PCWA's raw water distribution system
- The physical removal of vegetation along PCWA's raw water distribution system
- Herbicide applications along PCWA's raw water distribution system

The following summarizes potential effects of PCWA operations during canal lining that may be interrelated to potential effects observed during other PCWA O&M activities:

- Routine Operations – Similar to conditions for seasonal flood management practices and described above, removal of debris and sediment from the canals during canal preparation for lining activities, along with improved canal bank stability when canals are lined, likely decreases potential adverse effects of routine operations on water quality conditions in study area streams.
- Weed and Brush Control – Algaecide Application – As described above, canal lining activities, when combined algaecide applications, likely have adverse interrelated effects to natural resources. Higher concentrations of copper observed in study area streams following canal lining activities were likely due to the mobilization of copper from algaecide applications associated with fine sediment and organic material that had settled when canals were dewatered for canal lining. Accumulation of copper in wetland and stream sediments may affect biological resources.

7.2 REGULATORY FRAMEWORK FOR POTENTIAL EFFECTS OF INTERRELATED PCWA OPERATIONS AND MAINTENANCE ACTIVITIES

The regulatory framework for potential effects of PCWA operations activities described in **Chapter 5**, along with the regulatory framework for potential effects of PCWA maintenance activities described in **Chapter 6**, apply to the potential interrelated effects described in this chapter. The regulatory framework for each of the potential interrelated PCWA O&M activities described that may have adverse effects on natural resources when combined with other O&M activities is summarized in **Tables 5-3** and **6-11**. The following sections provide an overview of

the Federal and State regulations, and local requirements and considerations applicable to the potential effects of interrelated O&M activities described above.

7.2.1 Federal Regulations

Federal laws and regulations associated with the potential effects of interrelated PCWA O&M activities are described in **Chapters 5** and **6**, and listed below:

- CWA
- ESA
- Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act
- MBTA

7.2.2 State Regulations

Laws and regulations governed by the State of California and associated with the potential effects of interrelated PCWA O&M activities are described in **Chapters 5** and **6**, and listed below:

- CEQA
- Porter-Cologne Water Quality Control Act
- California ESA
- California Fish and Game Code-Fully Protected Species
- California Fish and Game Code Section 1602 – Lake and Streambed Alteration Program
- California Native Plant Protection Act

7.2.3 Local Requirements and Considerations

The following local requirements and considerations are associated with the potential effects of interrelated PCWA O&M activities are described in **Chapters 5** and **6**:

- PCCP
- Placer County SWMP
- Placer County Code, Tree Preservation Ordinance

- Placer County Oak Woodland Management Plan

7.3 BEST MANAGEMENT PRACTICE OPTIONS TO ADDRESS POTENTIAL EFFECTS OF INTERRELATED PCWA OPERATIONS AND MAINTENANCE ACTIVITIES

The BMPs to address potential effects of PCWA operations activities described in **Chapter 5**, along with the regulatory framework for potential effects of PCWA maintenance activities described in **Chapter 6**, also apply for the potential interrelated effects described in this chapter. Potential BMPs to reduce potential effects of interrelated PCWA O&M activities on natural resources are summarized in **Tables 5-3** and **6-11**, and listed below. The list of BMP options is not comprehensive; instead, it provides examples of BMPs that may be implemented to minimize particular potential effects of interrelated PCWA O&M activities.

7.3.1 Pre-Implementation Best Management Practices

Below are potential pre-implementation BMPs for reducing potential effects of interrelated PCWA O&M activities on natural resources in the study area.

- Improve canal bank stability and install sediment traps at canal outlets
    - Install velocity dissipaters at canal outlets
    - Line banks at canal outlets
    - Install erosion-control blankets in areas of soil disturbance
    - Install temporary fiber rolls in areas of soil disturbance
    - Apply spray-on soil binders in areas of soil disturbance
- Avoid potential wet weather effects
    - Patrol canals and remove potential obstructions to prevent erosion and propery damage
    - Minimize amount of water purchased from PG&E during periods of high precipitation
    - Distribute flood releases from canal system by releasing flows at numerous intermediate outlets
    - Plan and design projects to minimize land disturbance
    - Install erosion and sedimentation control measures after land-disturbing activities
    - Identify areas susceptible to erosion for future canal lining activities
    - Choose canal crossing sites where erosion potential is low
- Protect sensitive species and sensitive species habitat

  - Provide staff with species identification training
  - Evaluate sites with sensitive species and mark/protect sensitive species habitat
  - Stockpile materials away from sensitive species habitat areas
- Strategic scheduling of maintenance activities

7.3.2 Implementation Best Management Practices

The following sections are implementation BMPS to reduce potential effects of PCWA maintenance activities on natural resources:

- Avoid sensitive species areas
  - Avoid disturbance to sensitive species
  - Avoid active raptor nesting areas
- Prevent degraded water from entering streams after O&M activities
  - Modify canal operations to gradually restore reservoir releases to canals at slower rate
  - Apply sediment trap at storm drains for dewatering before canal lining
  - Treat first flush flows to reduce downstream water quality effects

7.3.3 Ongoing or Post-Implementation Best Management Practices

The following are ongoing post-implementation BMPs to reduce the potential interrelated effects of PCWA O&M activities on natural resources:

- Regulatory compliance management for O&M activities
- PCWA Best Management Practice Program
- Good housekeeping
  - Ensure proper handling of materials and wastes
  - Use proper cleanup procedures after material use
  - Implement onsite debris and trash management practices
  - Store materials under a roof or covering with a secure tarp

CHAPTER 8.0
REFERENCES

American River Basin Cooperating Agencies. 2003. Regional Water Master Plan, Final Report. Prepared by MWH.

Applied Biogeochemists. 2007. Product Information: Algimycin®-PWF. http://www.appliedbiochemists.com/products/algimycin.htm. Last updated August 2003.

Bass, R.E., A.I. Herson, K.M. Bogdan. 1999. CEQA Deskbook: A Step-by-Step Guide on How to Comply With the California Environmental Quality Act (2nd ed.). Point Arena, CA: Solano Press Books.

Bidlack, H.D. 1978. The hydrolysis of triclopyr EB ester in buffered deionized water, natural water, and selected soils. DowElanco. Data package Report No. ABM-106279-E. DPR# 51566-001.

British Columbia Ministry of Water, Land and Air Protection. Ecosystem Standards and Planning Biodiversity Branch. 2004. Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia. November 2004. http://www.env.gov.bc.ca/wld/BMP/herptile/HerptileBMP_final.pdf

Brussard, P.F. 1999. A Guide to Placer County Ecological Zones. Appendix F of the Placer Legacy Open Space and Agricultural Conservation Program. Implementation Report. June 2000.

CALFED. 2001. Guide to Regulatory Compliance for Implementing CALFED Actions: Vol. 2: Environmental Regulatory Processes. June 2001.

California Department of Fish and Game (CDFG). 2007. Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California. Aquatic Bioassessment Laboratory. February.

———. 2003. Memorandum to Elizabeth Ayres, Bren School of Environmental Science and Management, University of California, Santa Barbara. Fishes in Secret Ravine (Dry Creek Drainage, Placer County). February 5, 2003.

———. 2001. Memorandum on Perennial Rearing Habitat for Juvenile Steelhead in the Dry Creek Drainage (Placer County). Prepared by Dr. Rob Titus for the Stream Evaluation Program. November 5.

California Department of Water Resources. 2006. California's Groundwater Bulletin 118. 6 pp.

Central Valley Regional Water Quality Control Board (RWQCB). 2008. Executive Officer's Report to the Board, April 24 and 25. [http://www.swrcb.ca.gov/rwqcb5/board_info/exec_officer_reports/0804eo.pdf]

———. 2007. The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region, Sacramento River and San Joaquin River Basins. Fourth Edition (Revised October 2007).

City of Lincoln. 1999. Community Development Department. City of Lincoln Wastewater Treatment and Reclamation Facility Draft EIR. State Clearinghouse No. 98122071. Prepared by Jones & Stokes Associates, Inc., September.

City of Rocklin. 2006. Clover Valley Large and Small Lot Tentative Subdivision Maps, Recirculated Draft Environmental Impact Report. Project # SD-98-05, SCH# 93122077. Prepared by Raney Planning & Management, Inc. January.

Cryer, S.A. et al. 1993. The dissipation and movement of triclopyr in a Northern U.S.A. forest ecosystem. DowElanco. Study No:PM91-2502. Data package Report No. ABM-143895-.DPR# 51566-021.

Cylinder, P.D., K.M. Bogdan, A.I. Zohn, and J.B. Butterworth. 2004. Wetlands, Streams, and Other Waters: Regulation, Conservation, Mitigation Planning (2nd ed.). Point Arena, CA: Soloano Press Books.

Dow AgroSciences. 2006. Environmental information sheet, Nomix Garlon4. MAPP 12081 version 4, June.

Drapper, D., R. Tomlinson, and P. Williams. 2000. Pollutant concentrations in road runoff: Southeast Queensland case study. J. Environ. Eng.-ASCE 126:313–320.

Edginton, A.N., P.M. Sheridan, G.R. Stephenson, D.G. Thompson, and H.J. Boermans (2004). Comparative effects of pH and Vision herbicide on two life stages of four anuran amphibian species. Environmental Toxicology and Chemistry 23(4): 815-822.

Eisler, R. 1998. Copper hazards to fish, wildlife, and invertebrates: A synoptic review. U.S. Geological Survey, Biological Resources Division, Biological science report USGS/BRD/BSR-1997-0002.

_____. 1993. Zinc Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish and Wildlife Service, Publication No. 103-142-715. Washington, D.C. 106 pp.

Extension Toxicology Network of Cornell University, Michigan State University, Oregon State University, and University of California at Davis (EXTOXNET). 1994. Pesticide Information Profile: Glyphosate. http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html. Last updated May 1994.

Ferguson, P. L., C. R. Iden, and B. J. Brownawell. 2001. Distribution and Fate of Neutral Alkylphenol Ethoxylate Metabolites in a Sewage-Impacted Urban Estuary. Environ. Sci. Technol. 2001, 35, 2428-2435

Ganapathy, Carissa. 1997. Environmental fate of triclopyr. California Department of Pesticide REguluation, Environmental Monitoring and Pest Management Branch, Sacramento. January.

Gangstad, E. O. 1986. Freshwater vegetation management. Fresno, CA: Thomson Publications.

Good, J. C. 1993. Roof runoff as a diffuse source of metals and aquatic toxicity in storm water. Water Sci. Technol. 28:317–321.

Holmgren, G.G.S., M.W. Meyer, R.L. Chaney, and R.B. Smith.1993. Cadmium, Lead, Zinc, Copper, and Nickel in Agricultural Soils of the United States of America. Journal of Environmental Quality, 22: 335-348.

Horn, M.T. and W.A. Dunson. 1995. Effects of low pH, metals, and water hardness on larval amphibians. Archives of Environmental Contamination and Toxicology. Volume 29, Number 4 / November, 1995.

Linders, L. B. H. J., et al., 1984. Pesticides:benefaction or Pandora's box? A synopsis of the environmental aspect of 243 pesticides. Research for Man and Environment. National Institute of Public Health and Environment. Bilthoven, the Netherlands. Report # 7101014.

Maguire, J. 1999. Review of the Persistence of Nonylphenol and Nonylphenol Ethoxylates in Aquatic Environments. Water Quality Research Journal of Canada, 34(1): 37-78 (1999).

Mayer, K.E. and W.F. Laudenslayer, Jr. 1988. A Guide to Wildlife Habitats of California. State of California, Resources Agency, Department of Fish and Game. Sacramento, CA. 166 pp.

McCreary, Douglas. 2004. Oak Woodland Conservation Act of 2001. Agriculture & Natural Resources Research & Extension Centers, Sierra Foothill Research & Extension Center (University of California, Davis).

Moyle, P.B. 2002. Inland Fishes of California. Berkeley, CA: University of California Press.

Ode, P.R., A.C. Rehn and J.T. May. 2005. A quantitative tool for assessing the integrity of southern coastal California streams. Environmental Management Vol. 35, No. 4, pp. 493-504. Springer Science+Business Media, Inc.

Olmsted, Franklin Howard. 1961. Geology of the pre-Cretaceous rocks of the Pilot Hill and Rocklin quadrangles, California; Thesis. Bryn Mawr College, Bryn Mawr, Pennsylvania. 193 pp.

Pesticide Action Network U.K. 1996. Pesticides News No.33, September 1996, p28-29 http://www.pan-uk.org/pestnews/Actives/glyphosa.htm

Pimentel, D. 1971. Ecological effects of pesticides on nontarget species. Executive Office of the President's Office of Science and Technology. Washington, DC: U. S. Government Printing Office. June.

Placer County. 2004. Stormwater Management Plan, 2004-2008. Revised March 1, 2004.

_____. 2002. Auburn Ravine/Coon Creek Ecosystem Restoration Plan, Coordinated Regional Management Plan Review Draft. June.

_____. No Date. Placer County Code, Article 12.16. http://qcode.us/codes/placercounty/

Placer County and Sacramento County (Placer and Sacramento Counties). 2003. Public Review Draft: Dry Creek Watershed Coordinated Resource Management Plan. Roseville, CA. Prepared by ECORP Consulting, Inc., November 13.

Placer County Flood Control and Water Conservation District and Sacramento County Water Agency (Placer County and SCWA). 1992. Dry Creek Watershed Flood Control Plan, Final Report. Prepared by James M. Montgomery, Inc. (JMM). April.

Placer County Planning Department. 2007. Dry Creek Greenway Regional Vision-Draft Environmental Impact Report, Prepared by Foothill Associates, May 2007

_____. 2005a. Native Tree Mitigation Policy Report. Appendix D in Placer County Conservation Plan: Western Placer County. Agency Review Draft, February 22, 2005.

_____. 2005b. Assessment of Habitat Conditions for Chinook Salmon and Steelhead in Western Placer County, California. Prepared by Jones & Stokes. May.

_____. 2003. Streams of Western Placer County: Aquatic Habitat and Biological Resources Resource Assessment. Prepared by Bailey Environmental. December.

_____. 2002. Auburn Ravine/Coon Creek Ecosystem Restoration Plan, CRMP Review Draft. June.

_____. ND. Placer County Oak Woodland Management Plan. http://www.placer.ca.gov/Departments/CommunityDevelopment/Planning/PCCP/~/media/cdr/Planning/PCCP/OakWoodlands/OakWoodlandMgtPlan.ashx

Placer County Water Agency (PCWA). 2006. Annual Newsletter to Irrigation Water Customers, Volume 20, Number 2, April-May.

_____. 2005. Draft Canal and Reservoir Feasibility Study Report. Submitted to the California Department of Water Resources Pursuant to Water Conservation Feasibility Study Grant Contract F63108 (as amended). Prepared by Davids Engineering, Inc. May.

_____. 2004. Draft. Criteria for Evaluating the Impact on Important Natural Resources at Canal Guniting Maintenance Sites. January.

_____. 2003a. Placer County Water Agency Water Systems Infrastructure Plan. Prepared by MWH. October.

_____. 2003b. PCWA Aquatic Weed Management Program; CEQA Initial Study and Notice of Intent to Adopt a Mitigated Negative Declaration. Prepared by Foothill Associates. December.

Ross, Merrill A. and Lembi, Carole A. 1985. Applied Weed Science. Purdue University. Burgess Publishing Co. Minneapolis, Minnesota. 340 pp.

Sierra Business Council. 2003. Streams of Western Placer County: Aquatic Habitat and Biological Resources Literature Review. Prepared by Bailey Environmental. December.

Somasundaram, L. and J.R. Coats. 1991. Pesticide transformation products: fate and significance in the environment. American Chemical Society. Washinton D.C. 232-234.

Staples, C. A., J. Weeks, J. F. Hall, and C. G. Naylor. 1998. Evaluation of Aquatic Toxicity and Bioaccumulation of C8- and C9-Alkylphenol Ethoxylates. Environmental Toxicology and Chemistry, Vol. 17, No. 12, pp. 2470-2480, USA.

State Water Resources Control Board (SWRCB). 1958. State Water Rights Board Decision No. D 902, May 14.

Stebbins, R. C. 2003. A Field Guide to Western Reptiles and Amphibians. Third Edition. Houghton Mifflin Company, Boston. 533 pp.

Swanson, Samuel E. 1978. Petrology of the Rocklin pluton and associated rocks, western Sierra Nevada, California. Geological Society of America Bulletin 89: 679-686.

Syngenta. 2002. Material Safety Data Sheet, Reward Landscape and Aquatic Herbicide, Product No. A12872A.

Thomas, P. R., and G. R. Greene. 1993. Rainwater quality from different roof catchments. Water Sci. Technol. 28:291–299.

Thompson, D. M. Berrill, H. Boermans, C. Chen, D. McKenney, G. Stephenson. 2007. Multiple Stressors: Effects on Native Amphibian Species of Forested Environments. 3-Year Research Project (1999-2002). http://www.hc-sc.gc.ca/sr-sr/finance/tsri-irst/proj/persist-org/tsri-121-eng.php

Timmer, Kerri, M. Suarez-Brand, J. Cohen, and J. Clayburgh (Sierra Nevada Alliance). 2006. State of Sierra Waters, A Sierra Nevada Watersheds Index. March.

U.S. Army Corps of Engineers (USACE) and Placer County Water Agency (PCWA). 2008. East Loomis Basin Canal Efficiency Study. Prepared by MWH. June.

U.S. Court of Appeals for the Sixth Circuit (U.S. Sixth Circuit Court of Appeals). 2009. The National Cotton Council of America, et al., v. United States Environmental Protection Agency, On Petition for Review of Final Action of the United States Environmental Protection Agency. Nos. OW-2003-0063; 40 CFR Part 122. Argued April 29, 2008. Decided and Filed January 7, 2009.

U.S. Department of Agriculture, Forest Service (USDA). 1979. Habitat Requirements of Anadromous Salmonids. Prepared by Resier, D.W., and Bjornn, T.C. October.

U.S. Department of Commerce, National Atmospheric and Oceanic Administration (NOAA), National Marine Fisheries Service (NMFS). 2007. An Overview of Sensory Effects on Juvenile Salmonids Exposed to Dissolved Copper: Applying a Benchmark Concentration Approach to Evaluate Sublethal Neurobehavorial Toxicity. NOAA Technical Memorandum NMFS-NWFSC-83. Prepared by S.A. Hecht, D.H. Baldwin, C.A. Mebane, T. Hawkes, S.J. Gross, and N.L. Sholz. October.

_____. 2006. Biological Opinion for the Mountain House Wastewater Treatment Plant Expansion Project. September 6, 2006.

U.S. Department of Interior, Bureau of Reclamation (Reclamation) and PCWA. 2002. American River Pump Station Project Final EIS/EIR. State Clearinghouse No. 1999062089. Prepared by Surface Water Resources, Inc., June.

U. S. Environmental Protection Agency (U.S. EPA). 2008a. National Pollutant Discharge Elimination System (NPDES). Website accessed December 3, 2008. http://cfpub.epa.gov/npdes/stormwater/menuofbmps.

_____. 2008b. Region 5 Superfund Ecological Toxicity Information. http://www.epa.gov/R5Super/ecology/html/toxprofiles.htm

_____. 2006. National Recommended Water Quality Criteria (Doc# 4304T). Office of Water. http://www.epa.gov/waterscience/criteria/wqctable/

_____. 2005a. Ecological risk assessment for re-registration copper-containing pesticides (Case#0636 copper sulfate, Case#0649 Group II copper compounds, Case#4029 copper salts, and Case#4025 copper and oxides (Cuprous oxide)). Screening level risk assessment. Environmental Protection Agency, Office of Pesticide Programs, Washington, DC.

_____. 2005b. National Management Measures to Control Nonpoint Source Pollution from Urban Areas. Office of Water. Washington DC.

_____. 1986. The U.S. EPA, Quality Protection for Water (The Gold Book). May. http://www.epa.gov/waterscience/criteria/library/goldbook.pdf

_____. Title 40 Code of Federal Regulations Part 131, Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

U.S. Fish and Wildlife Service (USFWS). 2008. Critical Habitat Portal. http://criticalhabitat.fws.gov/

_____. 2005. Habitat Conservation Plans: Section 10 of the Endangered Species Act [brochure]. December 2005. Arlington, VA.

_____. 2002. Recovery Plan for the California Red-legged Frog (Rana aurora draytonii). U.S. Fish and Wildlife Service, Portland, Oregon. viii + 173 pp.

U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1998. Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. March 1998.

_____. 1996. Habitat Conservation Planning and Incidental Take Permit Processing Handbook. November 1996.

Wagner, D.L, C.W. Jennings, T.L. Bedrossian, and E.J. Bortugno. 1987. Geologic Map of the Sacramento Quadrangle Map No. 1A. California Division of Mines and Geology.

Waters, T.F. 1995. Sediment in streams – sources, biological effects and control. American Fisheries Society Monograph 7. Bethesda, MD. 251 pp.

Wilbur-Ellis. 1999. Material Safety Data Sheet, Mor-Act Adjuvant.

Woodburn, K.B., F.R. Batzer, F. H. White and M.R. Schultz. 1993. The aqueous photolysis of triclopyr. J. of Environ. Toxicol. and Chem. Vol. 12. 43-55.

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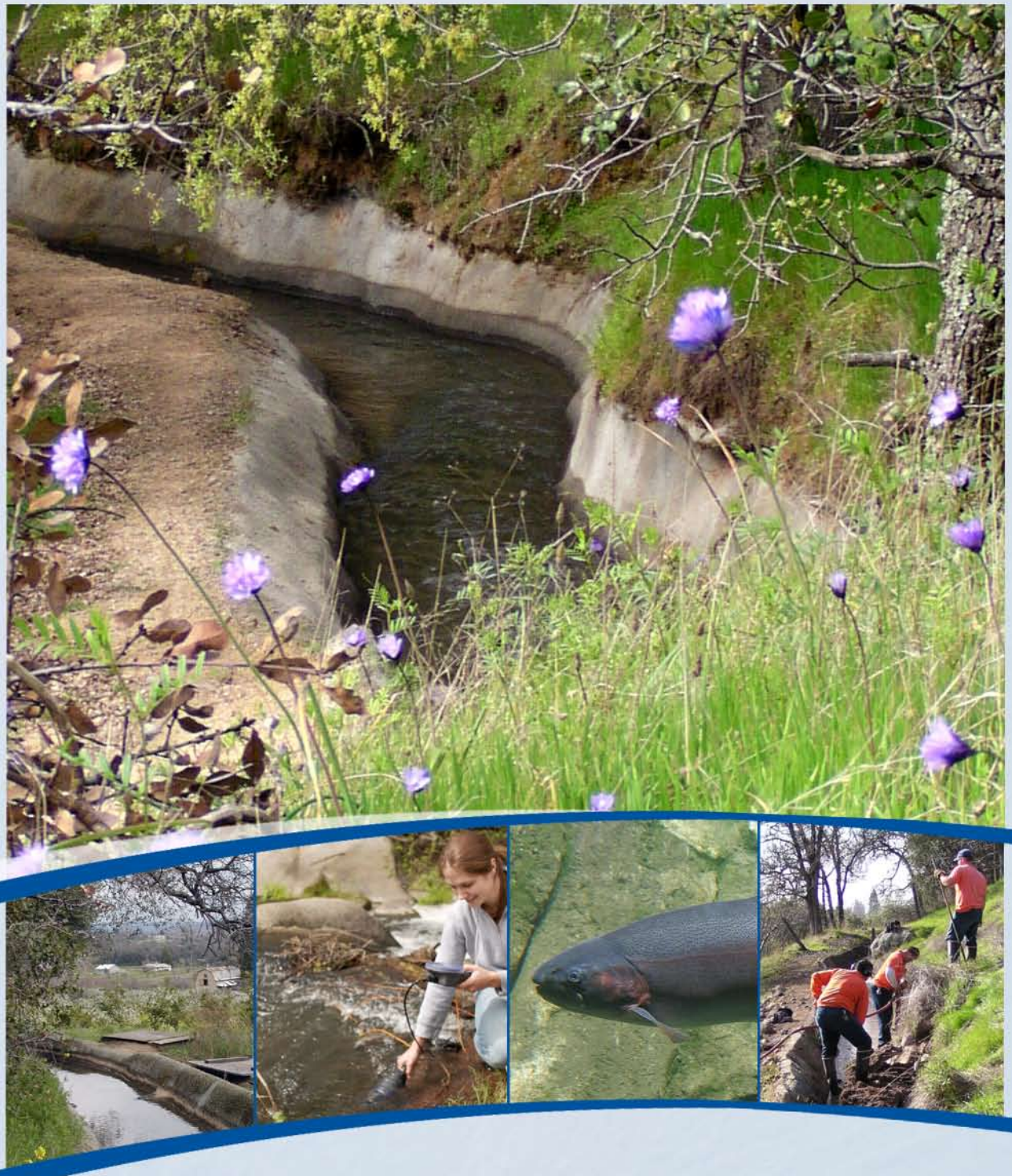
Appendix A



APPENDIX A
BENTHIC MACROINVERTEBRATE DATA REPORT

APPENDIX A. BENTHIC MACROINVERTEBRATE DATA REPORT

CONTENTS:

Report Summary

Report on Benthic Macroinverebrate Data

ATTACHMENTS

Attachment 1 - BMI data

- Fields 500 organism protocol
- Data standardized to CAMLnet taxa list

Attachment 2 - IBI data

Including tolerance value, functional feeding groups, metrics, and IBI scores

Summary
This Project was developed by MWH to characterize the stream health of areas related to canal inputs from the Placer County Water Agency operations.

Bioassessment is a widely accepted method of evaluating water quality and watershed health. Dry Creek Conservancy gathers data in accordance with the California Stream Bioassessment Procedure. Samples were identified by Wayne Fields of Hydrozoology. Tom King of BioAssessment Services analyzed the data and calculated an index of biotic integrity (IBI) for each sample site based on the Southern California IBI method. This IBI is considered appropriate for local watersheds in the absence of a foothill or valley IBI.

Three sites chosen for the study were:

- A site on Auburn Ravine immediately downstream of the outlet of the American River tunnel.
- A Secret Ravine site in Loomis Basin Park near King Road.
- A Miners Ravine Site immediately downstream of the off-stream detention basin recently constructed by Placer County Flood Control and Water Conservation District.

Results of the analysis were:

- The Secret Ravine site IBI value was higher than any previously sampled sites in Dry Creek Watershed.
- The Auburn Ravine site IBI value was higher than most Dry Creek Watershed sites but lower than might be expected by its apparently excellent habitat.
- The Miners Ravine site IBI value fell within the range expected.

The project results suggest that upstream areas of Secret Ravine may provide the best habitat in Dry Creek Watershed. The surprisingly low IBI score for the Auburn Ravine site may be related to tunnel operations. Further sampling is necessary to confirm that these results are a true representation of the sites and not normal variation. Sampling should be designed to discover the reason for the high IBI score at the Secret Ravine site, to discover the reason for the lower than expected IBI score at the Auburn Ravine site, and to track the evolution of the Miners Ravine stream channel as it adjusts to the newly constructed detention basin.

Report on Benthic Macroinverebrate Data

Introduction

Biological monitoring (bioassessment) is becoming a widely used and accepted method for evaluating water quality throughout the United States (SWRCB, 2003). Periphyton, aquatic vertebrate and benthic macroinvertebrates (BMI) are commonly monitored aquatic assemblages in bioassessment monitoring (U.S. EPA, 1999). In order to conduct a cost-effective, scientifically valid rapid biological assessment, monitoring may be reduced to one aquatic assemblage (U.S. EPA, 1999). BMI are the common aquatic assemblages measured in rapid monitoring protocols. They are useful in evaluating the overall health of flowing water systems, and are affected by changes in a stream's chemical and or physical structure (Karr and Kerans, 1991). Their sensitivity to stresses (temperature, dissolved oxygen, chemical and organic pollution) makes them effective indicators of specific anthropogenic disturbances (House et al., 1993). Streams within the California central valley have been greatly altered to accommodate urban and agricultural development. Physical habitat (vegetation and substrate) is often reduced or removed completely, greatly impacting aquatic organisms within the stream. (The paragraph above is from Department of Pesticide Regulation Environmental Monitoring Branch Study Proposal #233)

Purpose

This Project was developed by MWH to characterize the stream health of areas related to canal inputs from the Placer County Water Agency operations.

Methods

DCC collects and processes samples following the targeted riffle method of *Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California*, February 2007, Aquatic Bioassessment Laboratory, California Department of Fish and Game. (http://www.dfg.ca.gov/abl/Field/datacollection.asp) The protocol describes methods to sample eight square feet of riffle area in a 150 meter reach. Previous to fall 2005 DCC sampled with the California Stream Bioassessment procedure protocol. DCC recently engaged BioAssessment Services to standardize the pre 2005 data so metrics from the two protocols could be compared. Since 2000 DCC has sent samples to the professional taxonomy laboratory of Wayne Fields for identification. Wayne sub samples 500 organisms and identifies them to the lowest taxa possible; his identification is attached as Attachment 1.

Tom King of BioAssessment Services analyzed the data by calculating an index of biotic integrity (IBI) for each sample site. After standardizing the data to be used in the IBI calculation (shown in Attachment 1) Tom used the Index of Biotic Integrity for coastal southern California (SoCal B-IBI) described in *Ode, P.R., A.C. Rehn and J.T. May. 2005. A quantitative tool for assessing the integrity of southern coastal California streams. Environmental Management Vol. 35, No. 4, pp. 493-504. Springer Science+Business Media, Inc.* as being the most appropriate for our area. The following description of the SoCal ecoregion from Ode et al shows similarities to our local watersheds.

> The SoCal B-IBI is the most comprehensive assessment to date of freshwater biological integrity in California. As in other Mediterranean climate regions, the combination of aridity, geology, and high-amplitude cycles of seasonal flooding and drying in southern coastal California makes its streams and rivers particularly sensitive to disturbance (Gasith and Resh 1999). This sensitivity, coupled with the burgeoning human population and vast conversion of natural landscapes to agriculture and urban areas, has made it the focus of both state and federal attempts to maintain the ecological integrity of these strained aquatic resources.

The SoCal B-IBI assigns scores to data based on the relative quality of BMI assemblages as defined by seven metrics described in Ode et al. The seven metrics are:

- Coleoptera Richness – the total number of Coleoptera taxa present in the sub samples.
- EPT Richness – the total number of taxa from the Ephemeroptera, Plecoptera and Trichoptera insect orders.
- Predator Richness – total number of taxa categorized as predators.
- Collectors (%) – the percent of individuals present in the sub sample categorized as collectors.
- Intolerant Organisms (%) (0-3) - the percent of individuals present in the sub sample categorized as having a tolerance value of 0 to 3.
- Non-insect Taxa (%) – The percent of the sub sample taxa that are non-insect.
- Tolerant Taxa (%) – The percent of taxa from the sub sample that are considered tolerant of stream degradation.

The IBI is based on scores assigned to empirically determined ranges of metric values from very large regional data sets. The IBI scores are calculated by applying the scoring ranges as described in Ode et al. to each mean metric value. A factor of 1.43 is multiplied to the summed metric scores yielding the IBI. The IBI can range from 0 to 100. Because an IBI hasn‘t been developed for the local ecoregion, Tom warns that the metrics and IBI should be used with caution.

Sampling Sites

Because of limited funds only three sites were chosen for sampling.

- The site on Auburn Ravine (ARTM) is immediately downstream of the outlet of the American River tunnel and incorporated flows from that source as well as flows from Auburn Ravine.
- The Secret Ravine site (SRLB) is in Loomis Basin Park near King Road which is considerably upstream of the most upstream regular DCC sampling site at Rocklin Road (DCC5). It reflects a different set of PCWA outputs than the regular DCC sampling sites since it is upstream of the Boardman Canal output.
- The Miners Ravine Site (MRSC) is immediately downstream of the off-stream detention basin recently constructed by Placer County Flood Control and Water Conservation District. This sample can be a baseline for assessing changes after construction of the detention basin. It also reflects input from the Placer County Wastewater Treatment Plant near Dick Road and all PCWA canal tributaries to Miners Ravine.

Auburn Ravine - top of reach. Tunnel is to left.

Riffle habitat with riparian vegetation.

Secret Ravine - reach with eroded bank.

Gravel habitat at eroded bank

Miners Ravine – bottom of reach looking up.

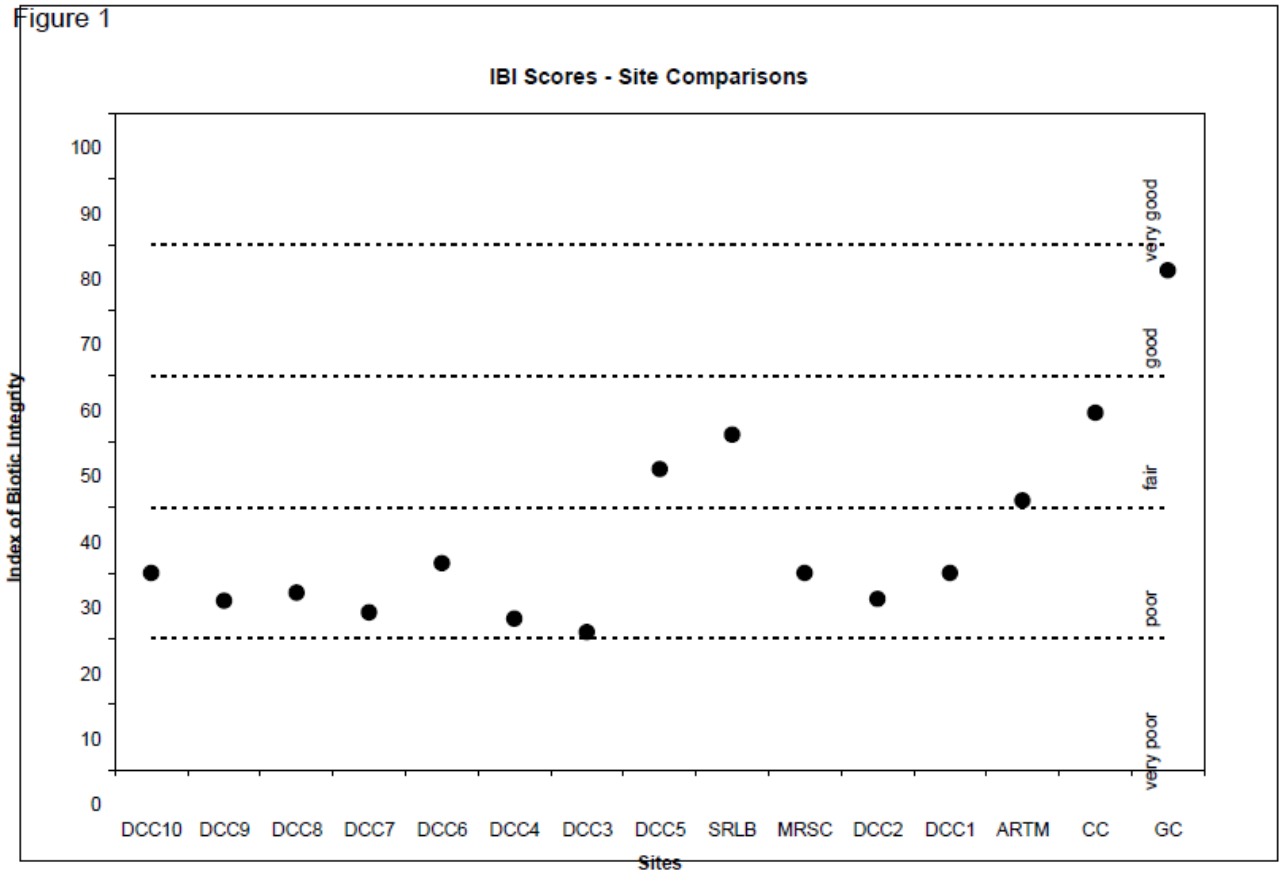
Riffle habitat.

Results

Figure 1 shows a plot of IBI scores for the three project sample sites, as well as comparison data for sample sites in the Dry Creek Watershed from 2000 through 2006, a composite of four sites from Coon Creek in 2005 (CC), and from Greenwood Creek(GC). Observations from the plot are:

- All but one Dry Creek site (DCC5, Secret Ravine at Rocklin Road) previously sampled fell in the poor range.
- The score for the Secret Ravine site sampled for the project is higher than any previous Dry Creek sites. There is no other data from this site for comparison.
- The score for the Auburn Ravine site fell at the break between poor and fair and was higher than all but one previously sampled Dry Creek site (DCC5).
- The score for the Miners Ravine site sampled for the project fell in the poor range along with previous Dry Creek sites but was slightly higher than the Dry Creek sites previously sampled, DCC7 and DCC 2.

Figure 1



Site codes represent the following streams:

DCC: streams draining the Dry Creek watershed including -

1) Antelope Creek at King Road
2) Miner's Ravine above Cottonwood Dam and at Dick Cook Road
3) Linda Creek at Barton
4) Clover Valley Creek u/s Golf course

5) Secret Ravine at Sierra College
6) Secret Ravine at Miner's Ravine
7) Miner's Ravine at Secret Ravine
8) Antelope at Atlantic
9) Linda/Kirby u/s Dry Creek Confluence
10) Dry Creek above Rio Linda Blvd Bridge
CC: Coon Creek
GC: Greenwood Creek at an elevation of approximately 600 feet, which drains into the South Fork American River

MWH Project sites –
SRLB: Secret Ravine at Loomis Basin Park
MRSC: Miners Ravine downstream of Sierra College Blvd.
ARTM: Auburn Ravine at the tunnel mouth

Table 1 shows IBI scores for each of the seven metrics for the three project sites and for additional sites shown for comparison.

Table 1 –Scores for the seven metrics

(IBI scores are calculated by multiplying metric scores by a factor of 1.43.)						
	DCC5	CC	GC	ARTM	SRLB	MRSC
Coleoptera taxa	0	6	5	4	4	0
EPT taxa	6	5	10	5	6	5
Predator Taxa	8	5	8	2	5	4
Collectors (%)	6	4	6	5	5	4
Intolerant (%)	3	4	6	1	2	1
Non-Insect (%)	4	6	8	4	7	2
Tolerant (%)	5	8	10	8	7	5
Total	32	38	53	29	36	21

Along with BMI sampling the California Stream Bioassessment Procedure specifies a set of physical habitat assessments that may be used to explain BMI data. Some data from the physical habitat assessment that might be useful to explain BMI results are shown in Table 2 below.

Table 2 – Selected Physical Habitat Scores	DCC5	ARTM	SRLB	MRSC
	2006			
Flow (cfs)	6.9	9.6	3.0	1.7
Temp (C)	15.9	14.1	13.2	12.9
Habitat types: (% riffle)	10	41	15	11
Slope (average %)	1.45	2.5	0.5	1.4
Instream Habitat (20 possible)	13	14	11	5
Sediment Deposition (20 possible)	10	19	11	5
Channel Alteration (20 possible)	15	15	11	18

Discussion
The data suggest the following questions:

- Why are SRLB scores higher than previously sampled Dry Creek sites?

The Physical habitat data don't seem to offer an explanation since several of the parameters actually indicate higher quality at the DCC5 site. The most notable difference in IBI metric scores shown in Table 1 is for Coleoptera taxa which are 4 at SRLB and 0 at DCC5. The absence of Coleoptera taxa has been noted in *Preliminary Report on Benthic Macroinverebrate Data Dry Creek Conservancy Bioassessment Program 2000 to 2006, Dry Creek Conservancy, June 2007.* No good explanation has been offered other than the general high level of sediment in Dry Creek Watershed. It may be that the healthier bmi community at SRLB is simply a reflection of fewer urban inputs due to less impervious surface.

- Why aren't ARTM scores higher given its high physical habitat scores?

The habitat quality at the Auburn Ravine site is strikingly good compared to any site in Dry Creek Watershed. There is a high percentage of riffles and very little sediment as shown in Table 2. The major human influence is a gravel road that runs parallel to the bank about 30 feet from the stream channel and about 12 feet above water surface elevation. In spite of the road there is very little sediment in the substrate; the cobble and gravel are very clean.

There are several possible impacts on the bmi community at ARTM. The American River Tunnel operations may flush the channel of bugs and biotic material leaving it clean of sediment but relatively barren of bmi. Less manipulation of instream flows has been suggested as a reason that DCC5 has a much higher score than other Dry Creek sites as discussed in the excerpt below. (Dry Creek Conservancy, June 2007.)

> "The Dry Creek Watershed receives imported water in its major tributaries.
>
> - Can water deliveries explain the very low Clover Valley IBI since Clover Valley flows in summer are almost entirely due to imported water?
> - Can the higher quality BMI community in Coon Creek be explained by relatively smaller amounts of imported water?
> - Can the higher quality BMI community at SR5 be due to it being above the outlet of the Boardman Canal, a major contributor to dry season Secret Ravine flows? In a 1999 report on BMI fauna in Secret Ravine Wayne Fields noted in-stream flow changes as follows:
>
> The almost daily occurrence of an artificial increase in flow which was observed during habitat mapping and was estimated to sometimes double or even triple the flow in the stream…since the fauna in streams at this elevation is adapted to a regime in which fluctuations in flow are limited to the rainy period, the addition of this much extra water on an irregular basis can only serve to disrupt the usual pattern of life.
>
> In fact, much recent work has been done on the impact on BMI of allochthonous material, which in streams is organic material from outside the stream flow that contributes to stream ecology and the vigor of BMI. (Tom King, personal communication; Lotic System Ecology, Wikipedia) Manipulated flows have been shown to flush this material from streams resulting in a depressed BMI community."

Another impact could be inputs from the City of Auburn wastewater treatment plant upstream. But the lack of algae growth suggest that there is not a high level of nutrients in the water as

might be expected downstream of a treatment plant. Other water quality parameters such as dissolved oxygen, pH, and conductivity are similar to other sampling sites and at healthy levels.

The MRSC IBI scores don't raise questions since they are similar to previous Dry Creek Watershed and Miners Ravine results. Low scores can be explained by lack of habitat complexity and high amounts of sediment. It is also worth noting that the channel immediately upstream of the sampling reach which is alongside the detention basin is very lacking in instream habitat. The channel is straight due to constraint by a levee. Previous to the project there was a large beaver pond alongside the levee that probably held back a large amount of sediment. Currently the substrate is a homogenous run of fine sediment with no boulders, cobble, woody debris or other complexity. It will be interesting to see if the channel can improve from natural processes. A large amount of riparian vegetation planted on the project side of the stream has been established successfully and may contribute to improvement in instream habitat depending on how it's managed. It will also be interesting to see if the lack of complexity will have an impact on the downstream reach that was sampled.

In general we should be cautious about giving too much significance to only one sampling event. There is significant variation from season to season and also within a given season at a site. A longer record is needed to establish that the project results are representative of the sites.

Conclusions and Recommendations

The project results add another site in Dry Creek Watershed to the "fair" range of IBI ranking and suggest that upstream areas of Secret Ravine may provide the best habitat in Dry Creek Watershed. The IBI score for the Auburn Ravine site is surprisingly low given the high quality of the habitat. The low score may be related to tunnel operations. The Miners Ravine site results fall within the range of previous sampling results in Dry Creek Watershed. Habitat alongside the detention basin immediately upstream of the sampling site is notably lacking in complexity. Further sampling is necessary to confirm that these results are a true representation of the sites and not normal variation. Sampling should be designed to discover the reason for the high IBI score at the Secret Ravine site and the lower than indicated IBI score at the Auburn Ravine site.

PHYLUM/	FAMILY	GENUS and SPECIES	Level I Final ID	AUBURN RAVINE (11/01/2007)	SECRET RAVINE (11/02/2007)	MINERS RAVINE (11/05/2007)
	NON-INSECTS					
PHYLUM/CLASS/ORDER						
Platyhelminthes	Planariidae	*Dugesia tigrina*	Turbellaria	66	8	66
Nemertea	Tetrastemmatidae	*Prostoma graecense*	*Prostoma*	8	27	9
Annelida/Oligochaeta			Oligochaeta	36	87	152
Hirudinea	Erpobdellidae	*Mooreobella microstoma*	*Mooreobella*			1
Arthropoda/Amphipoda						
Amphipoda	Crangonyctidae	*Crangonyx floridanus*	*Crangonyx*	7	15	6
		Stygobromus sp.	*Stygobromus*	2		
	Hyalellidae	*Hyalella azteca*	*Hyalella*			17
Arachnida/						
Hydracarina	Sperchontidae	*Sperchon sp. A*	*Sperchon*		6	4
Mollusca/						
Gastropoda	Ancylidae	*Ferrissia californica*	*Ferrissia*			3
	Planorbidae	*Gyraulus deflectus*	*Gyraulus*	8		
		Micromenetus dilatatus	*Micromenetus*	3		1
		Planorbella tenuis	*Planorbella*			1
Bivalvia	Corbiculidae	*Corbicula fluminea*	*Corbicula*		6	15
	Sphaeriidae	*Pisidium casertanum*	*Pisidium*	4		
	INSECTS					
ORDER	FAMILY	GENUS and SPECIES				
Ephemeroptera	Baetidae	*Baetis tricaudatus*	*Baetis*	310	52	41
		Fallceon quilleri	*Fallceon quilleri*		4	8
	Caenidae	*Caenis latipennis*	*Caenis*			1
	Ephemerellidae	*Eurylophella lodi*	*Eurylophella lodi*	1		
	Leptohyphidae	*Tricorythodes minutus*	*Tricorythodes*	1	24	14
Odonata	Gomphidae	*Ophiogomphus occidentis*	*Ophiogomphus*		1	
	Libellulidae	*Brechmorhoga mendax*	*Brechmorhoga mendax*		12	5
	Calopterygidae	*Hetaerina americana*	*Hetaerina americana*		1	1
	Coenagrionidae	*Argia vivida*	*Argia*		15	9
Plecoptera	Perlodidae	*Isoperla sp.*	*Isoperla*		2	
Trichoptera	Brachycentridae	*Brachycentrus occidentalis*	*Brachycentrus*	5		
		Micrasema sp.	*Micrasema*		11	
	Glossosomatidae	*Glossosoma sp.*	*Glossosoma*	1	2	
		Protoptila sp.	*Protoptila*	1	3	1
	Helicopsychidae	*Helicopsyche borealis*	*Helicopsyche*			1
	Hydropsychidae	*Hydropsyche californica*	*Hydropsyche*	45	33	102
	Hydroptilidae	*Hydroptila sp. A*	*Hydroptila*		1	
		Leucotrichia pictipes	*Leucotrichia pictipes*		1	
		Oxyethira sp.	*Oxyethira*			3
	Leptoceridae	*Nectopsyche gracilis*	*Nectopsyche*		3	1
	Philopotamidae	*Chimarra sp.*	*Chimarra*	2	19	31
	Rhyacophilidae	*Rhyacophila coloradensis*	*Rhyacophila*	1		
Lepidoptera	Pyralidae	*Parapoynx sp.*	*Parapoynx*		2	
Coleoptera	Elmidae	*Cleptelmis sp.*	*Cleptelmis*	2	1	
		Dubiraphia giulianii	*Dubiraphia*		1	
		Ordobrevia nubifera	*Ordobrevia nubifera*	7		
Diptera	Chironomidae	*Pentaneura sp.*	Tanypodinae	1		
			Orthocladiinae	4	40	44
		Rheotanytarsus sp.	Tanytarsini		16	6
	Simuliidae		*Simulium*	0	84	23
	Tipulidae	*Antocha monticola*	*Antocha*	1		
		Tipula sp.	*Tipula*		1	
	Empididae	*Neoplasta sp.*	*Neoplasta*	1		
	Stratiomyidae	*Caloparyphus sp.*	*Caloparyphus*			1
				517	478	567
			NUMBER OF SPECIES	**29**	**48**	**41**
		TOTAL NUMBER OF ORGANISMS		**517**	**494**	**570**
		TOTAL NUMBER OF SQUARES PICKED (OF 24)		**3**	**5**	**4**
		EXTRAPOLATED NUMBER OF ORGANISMS		**4136**	**2371**	**3420**

Appendix A
Attachment 2

Level I Final ID[1]	CTV[2]	FFG[3]	AUBURN RAVINE 110107	SECRET RAVINE 110207	MINER'S RAVINE 110507
Cleptelmis	4	cg	2	1	
Dubiraphia	6	cg		1	
Ordobrevia nubifera	4	sc	7		
Tanypodinae	7	p	1		
Orthocladiinae	5	cg	4	40	44
Tanytarsini	6	cg		16	6
Simulium	6	cf		84	23
Antocha	3	cg	1		
Tipula	4	ot		1	
Neoplasta	6	p	1		
Caloparyphus	7	cg			1
Baetis	5	cg	310	52	41
Fallceon quilleri	4	cg		4	8
Caenis	7	cg			1
Eurylophella lodi	1	cg	1		
Tricorythodes	4	cg	1	24	14
Isoperla	2	p		2	
Brachycentrus	1	ot	5		
Micrasema	1	ot		11	
Glossosoma	1	sc	1	2	
Protoptila	1	sc	1	3	1
Helicopsyche	3	sc			1
Hydropsyche	4	cf	45	33	102
Hydroptila	6	ot		1	
Leucotrichia pictipes	6	sc		1	
Oxyethira	3	ot			3
Nectopsyche	3	ot		3	1
Chimarra	4	cf	2	19	31
Rhyacophila	0	p	1		
Parapoynx	5	sh		2	
Ophiogomphus	4	p		1	
Brechmorhoga mendax	9	p		12	5
Hetaerina americana	6	p		1	1
Argia	7	p		15	9
Turbellaria	4	p	66	8	66
Prostoma	8	p	8	27	9
Oligochaeta	5	cg	36	87	152
Mooreobella	8	p			1
Crangonyx	4	cg	7	15	6
Stygobromus	4	cg	2		
Hyalella	8	cg			17
Sperchon	8	p		6	4
Ferrissia	6	sc			3
Gyraulus	8	sc	8		
Micromenetus	6	sc	3		1
Planorbella	6	sc			1
Corbicula	10	cf		6	15
Pisidium	8	cf	4		
Total			**517**	**478**	**567**

Taxa Richness (mod level 1)		23	29	28
CG CF		70	50	51
SoCal IBI Metrics [4]		9.9	30	30
Coleoptera Taxa		2	2	0
EPT Taxa		9	12	10
Predator Taxa		5	8	7
CG Taxa + CF Individuals (%)		80	80	81
Intolerant Organisms (%) (0-3)		1.9	4.4	1.1
Non-insect Taxa (%)		35	21	39
Tolerant Taxa (%)		13	14	21
SoCal IBI Scores [4]				
Coleoptera Taxa		4	4	0
EPT Taxa		5	6	5
Predator Taxa		2	5	4
CG Taxa + CF Individuals (%)		5	5	4
Intolerant Organisms (%) (0-3)		1	2	1
Non-insect Taxa (%)		4	7	2
Tolerant Taxa (%)		8	7	5
Score Sum		**29**	**36**	**21**
SoCal IBI (possible range: 0-100)	**1.429**	**41**	**51**	**30**

[1] Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) level 1 with modification including chironomids to subfamily/ tribe
Nematodes removed from list

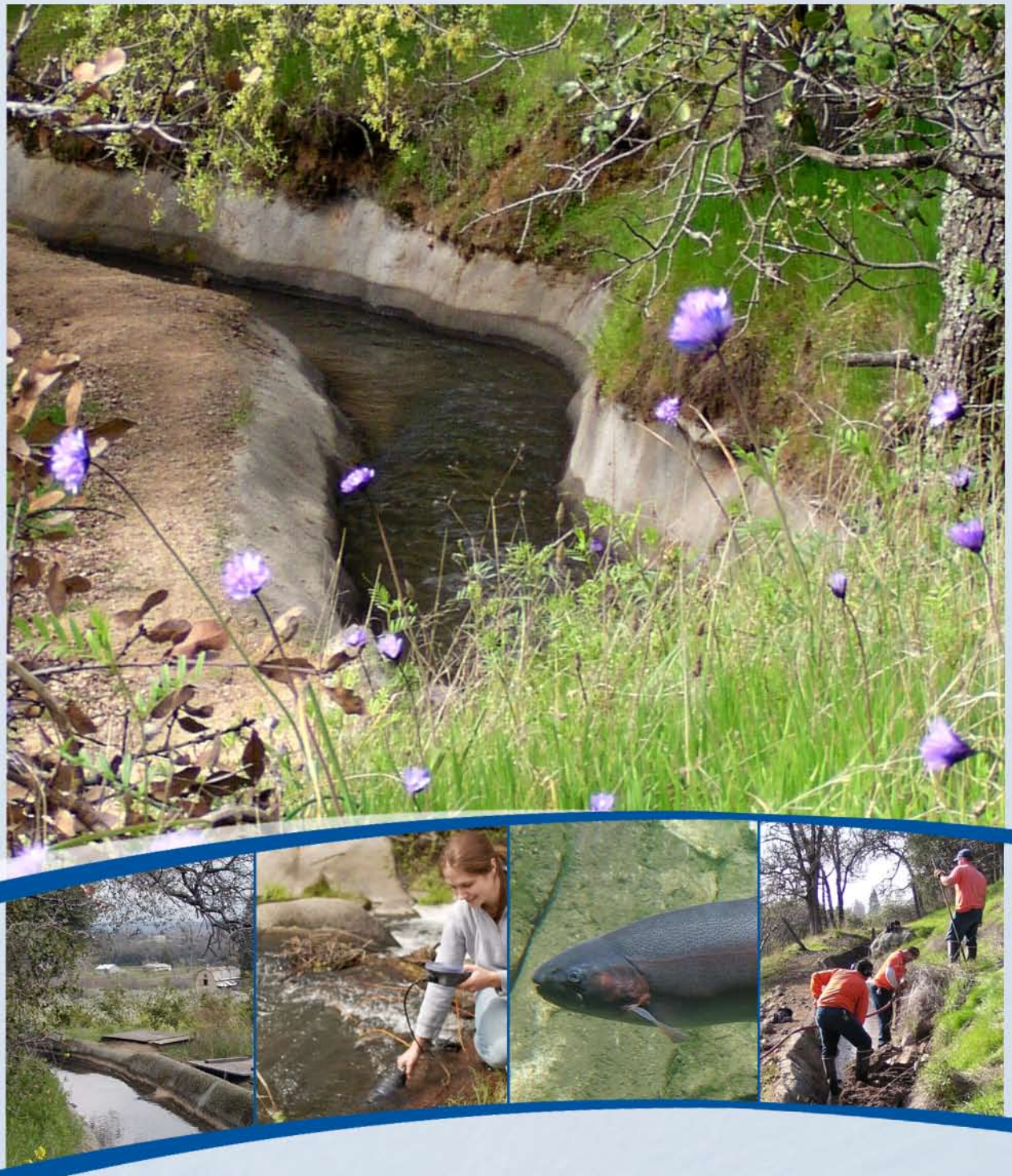
[2] California Tolerance Value from California Aquatic Macroinvertebrate Laboratory Network (CAMLnet), 27 January 2003 revision

[3] Functional Feeding Groups from CAMLnet, 27 January 2003 revision

[4] Ode, P.R., A.C. Rehn and J.T. May. 2005. A quantitative tool for assessing the integrity of southern coastal California streams.
Environmental Management Vol. 35, No. 4, pp. 493–504. Springer Science+Business Media, Inc.

Note: Use SoCal IBI for this data set with caution. While relative biological signals are insightful, the metrics and scoring criteria were not optimized for the Dry Creek watershed.

Appendix B



APPENDIX B
WATER QUALITY CONDITIONS FOR SYSTEMWIDE OPERATIONS

B.1 WATER QUALITY CONDITIONS AT CANAL AND STREAM SITES DURING YEARLY OUTAGES

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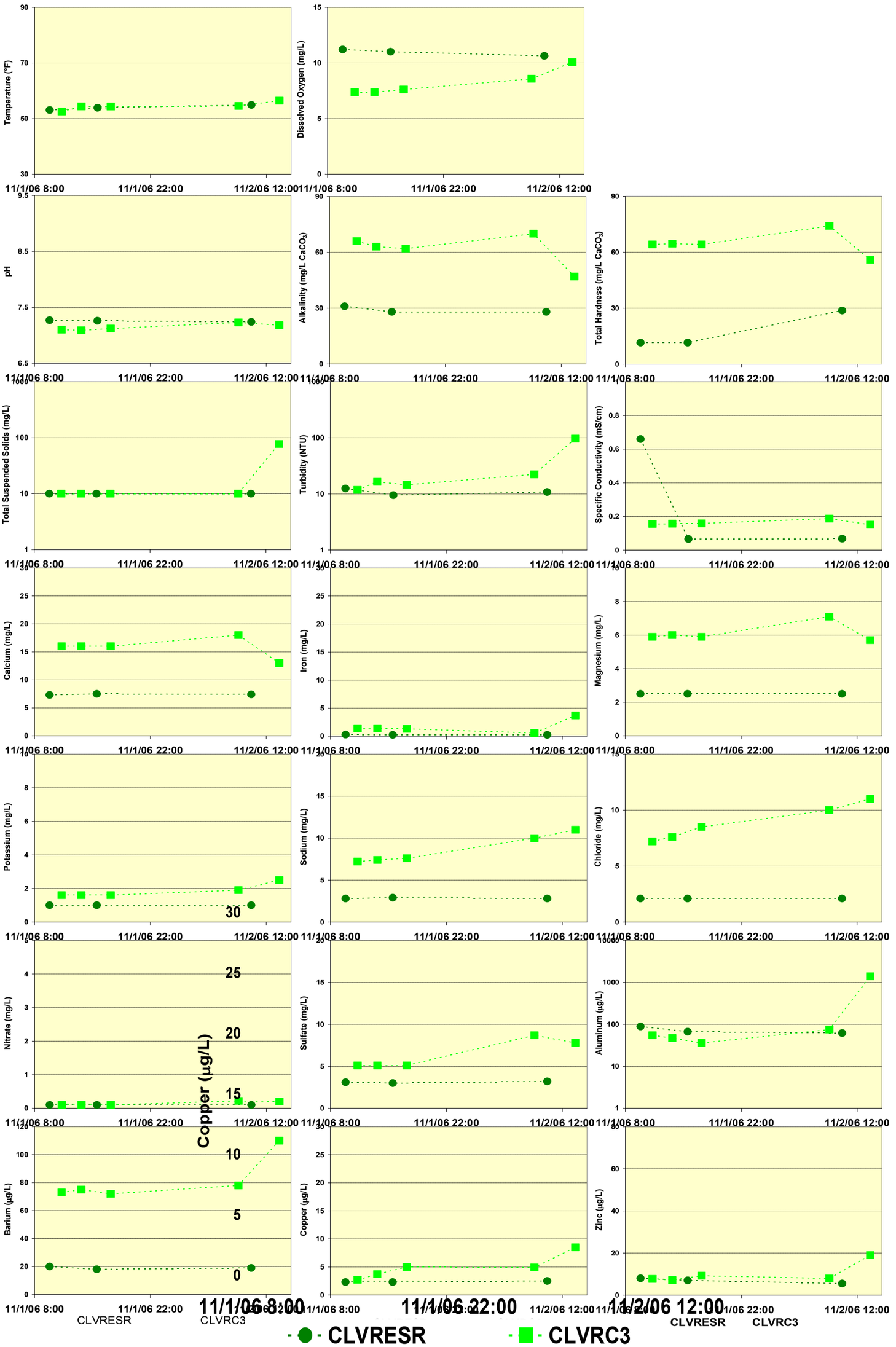

FIGURE B-1A
WATER QUALITY CONDITIONS AT CLOVER VALLEY CREEK WATERSHED SITES DURING YEARLY OUTAGES

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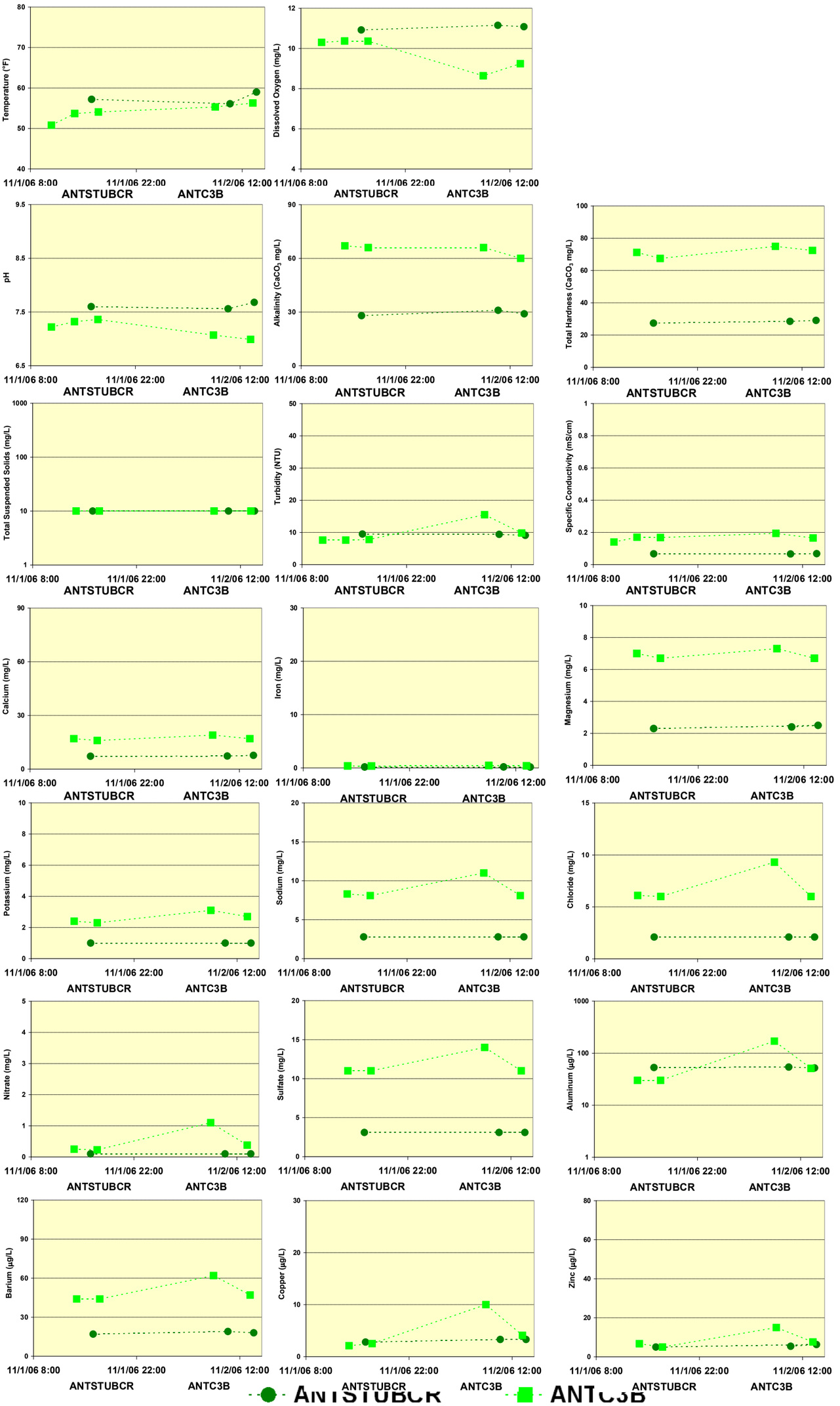

FIGURE B-2B
WATER QUALITY CONDITIONS AT ANTELOPE CREEK WATERSHED SITES DURING YEARLY OUTAGES

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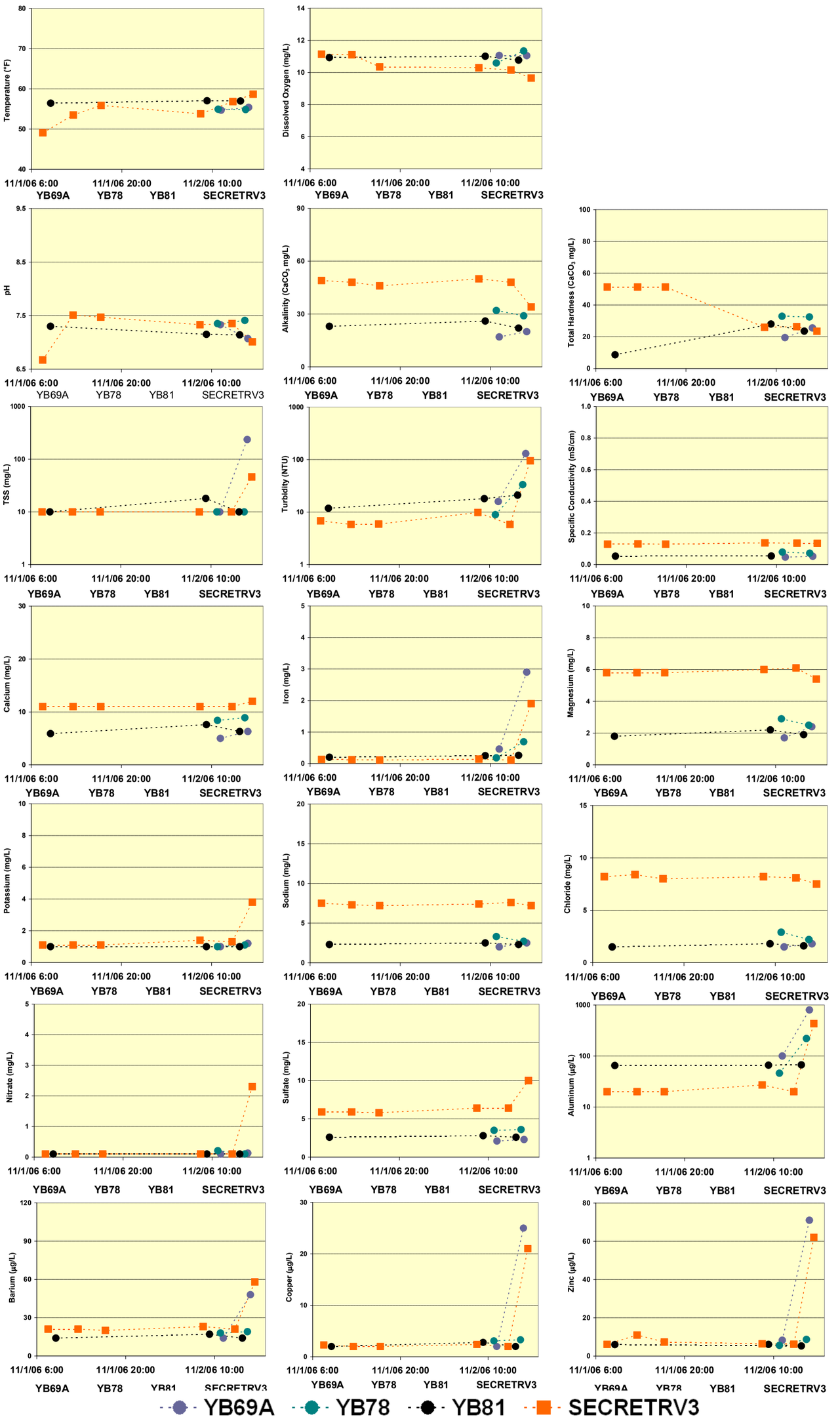

FIGURE B-1C
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING YEARLY OUTAGES

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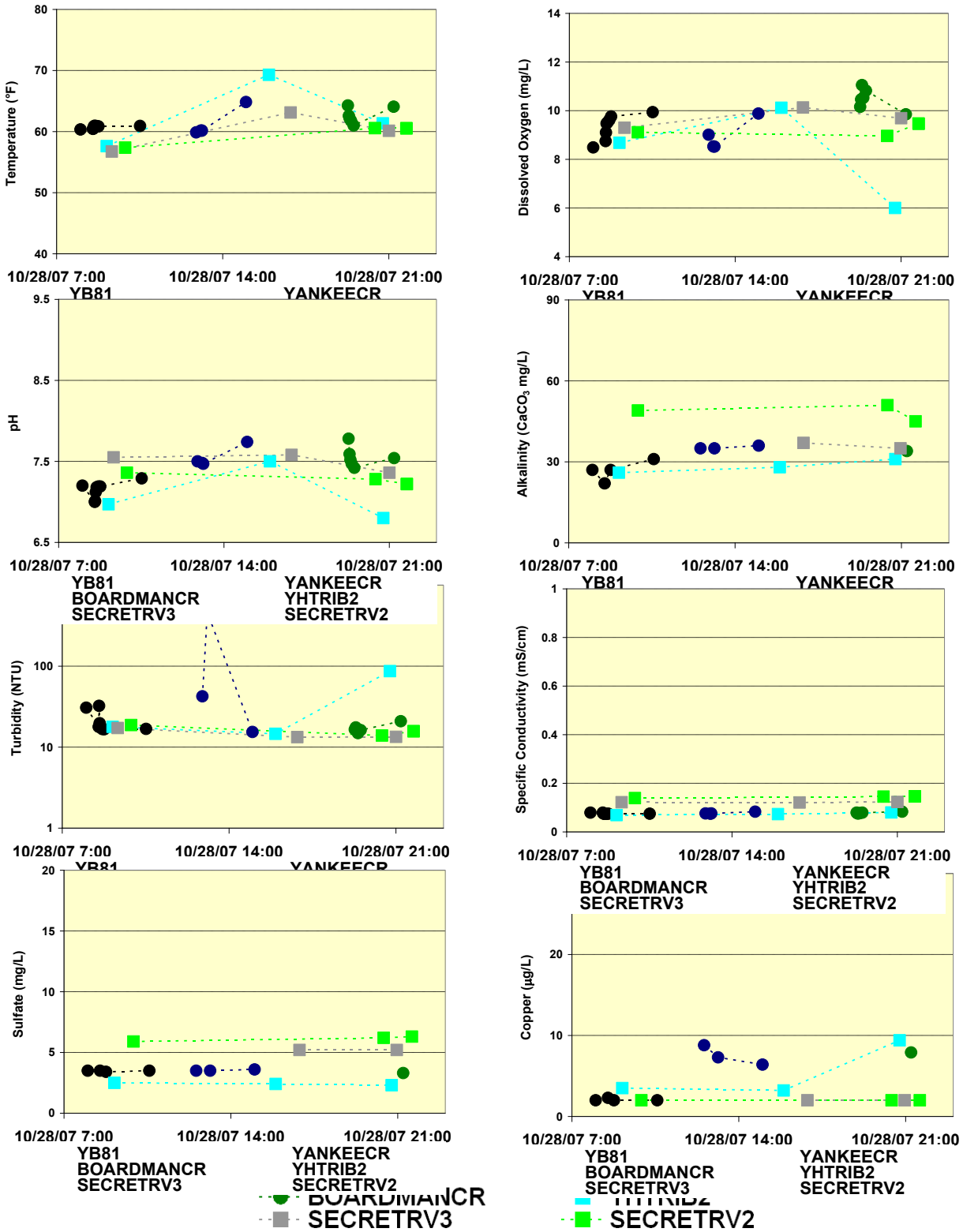

FIGURE B-1D
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING YEARLY OUTAGES

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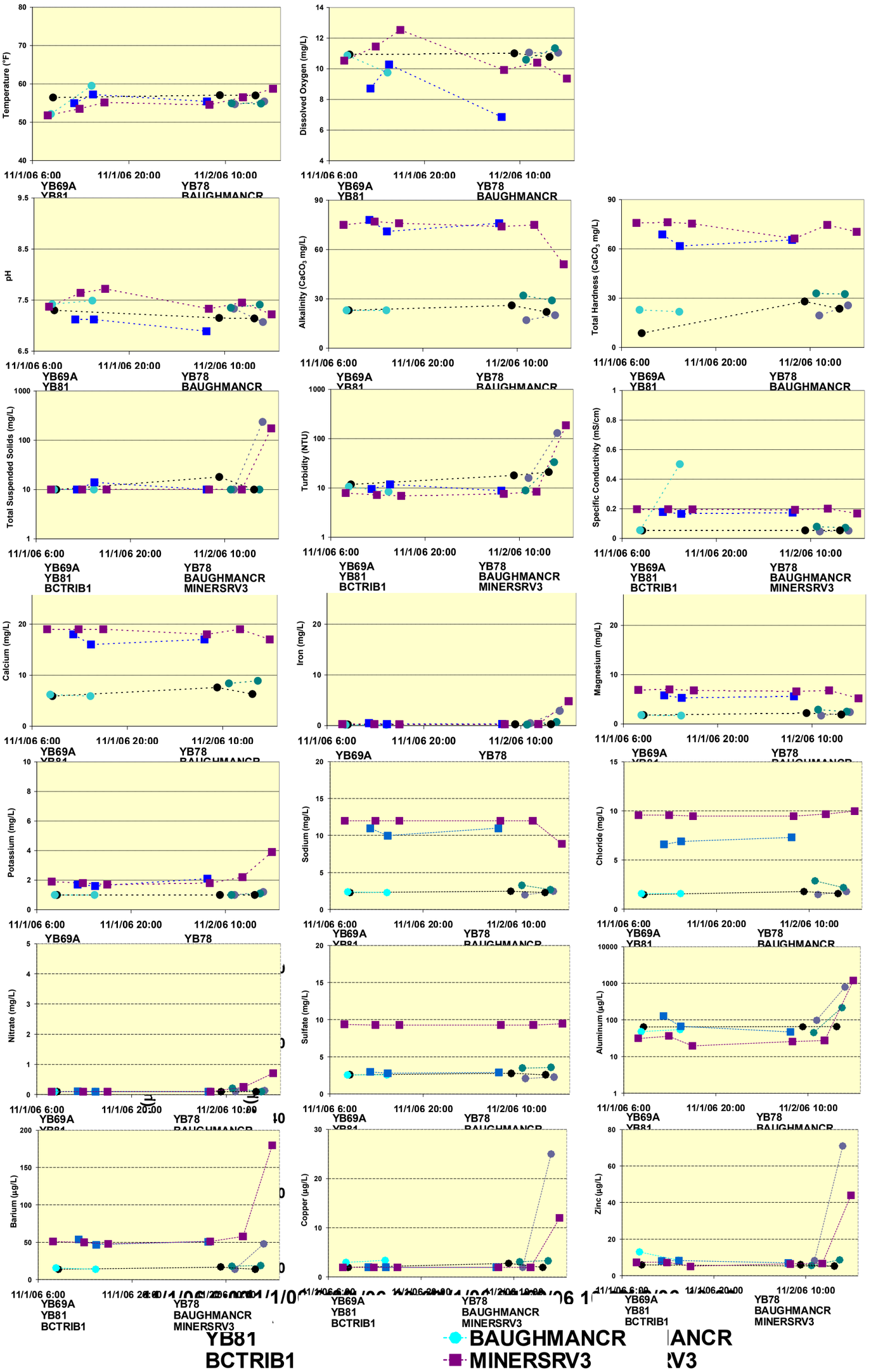

FIGURE B-1E
WATER QUALITY CONDITIONS AT MINERS RAVINE WATERSHED SITES DURING YEARLY OUTAGES

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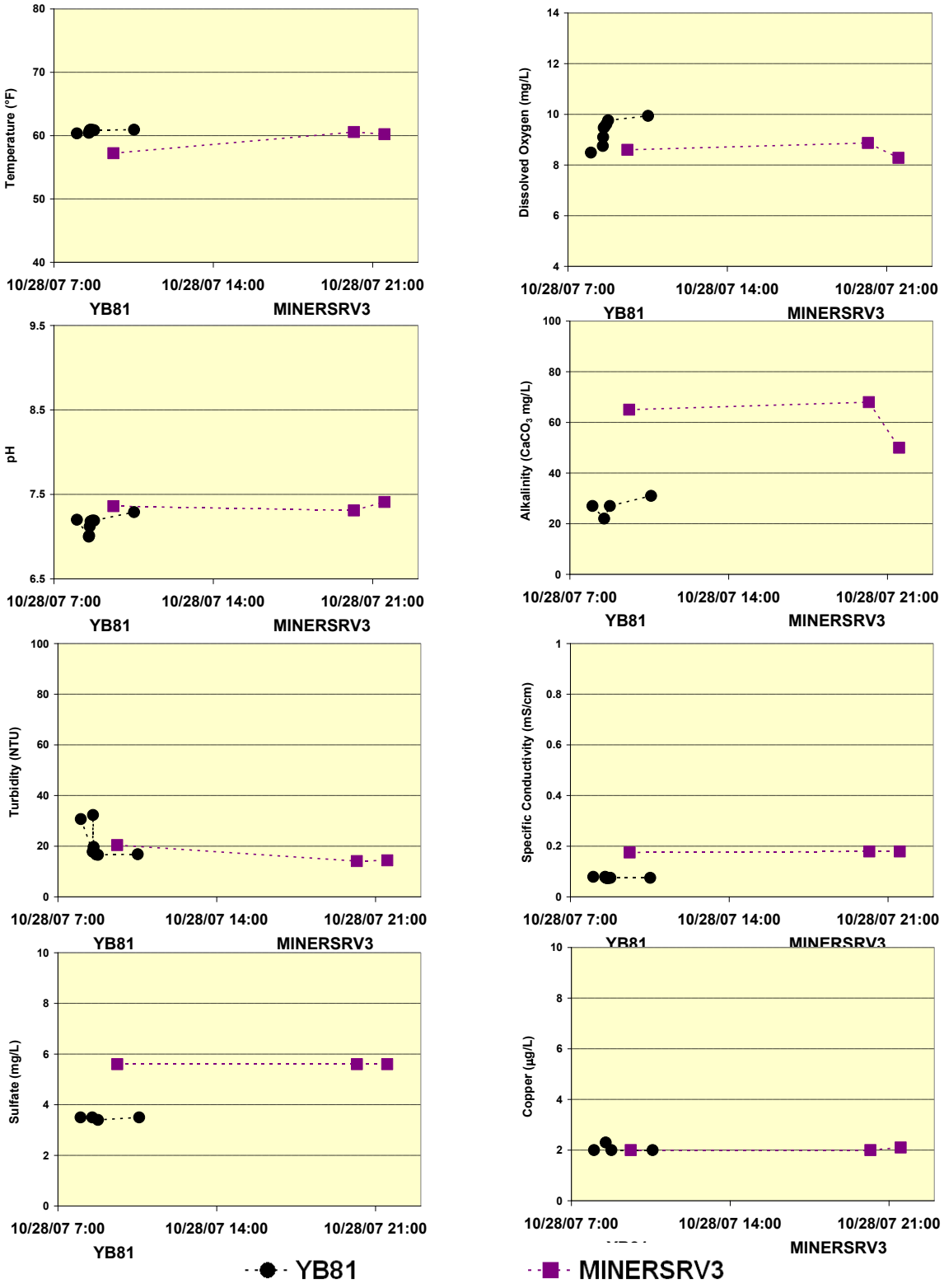

FIGURE B-1F
WATER QUALITY CONDITIONS AT MINERS RAVINE WATERSHED SITES DURING YEARLY OUTAGES

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B.2 WATER QUALITY CONDITIONS AT CANAL AND STREAM SITES DURING ROUTINE PCWA OPERATIONS

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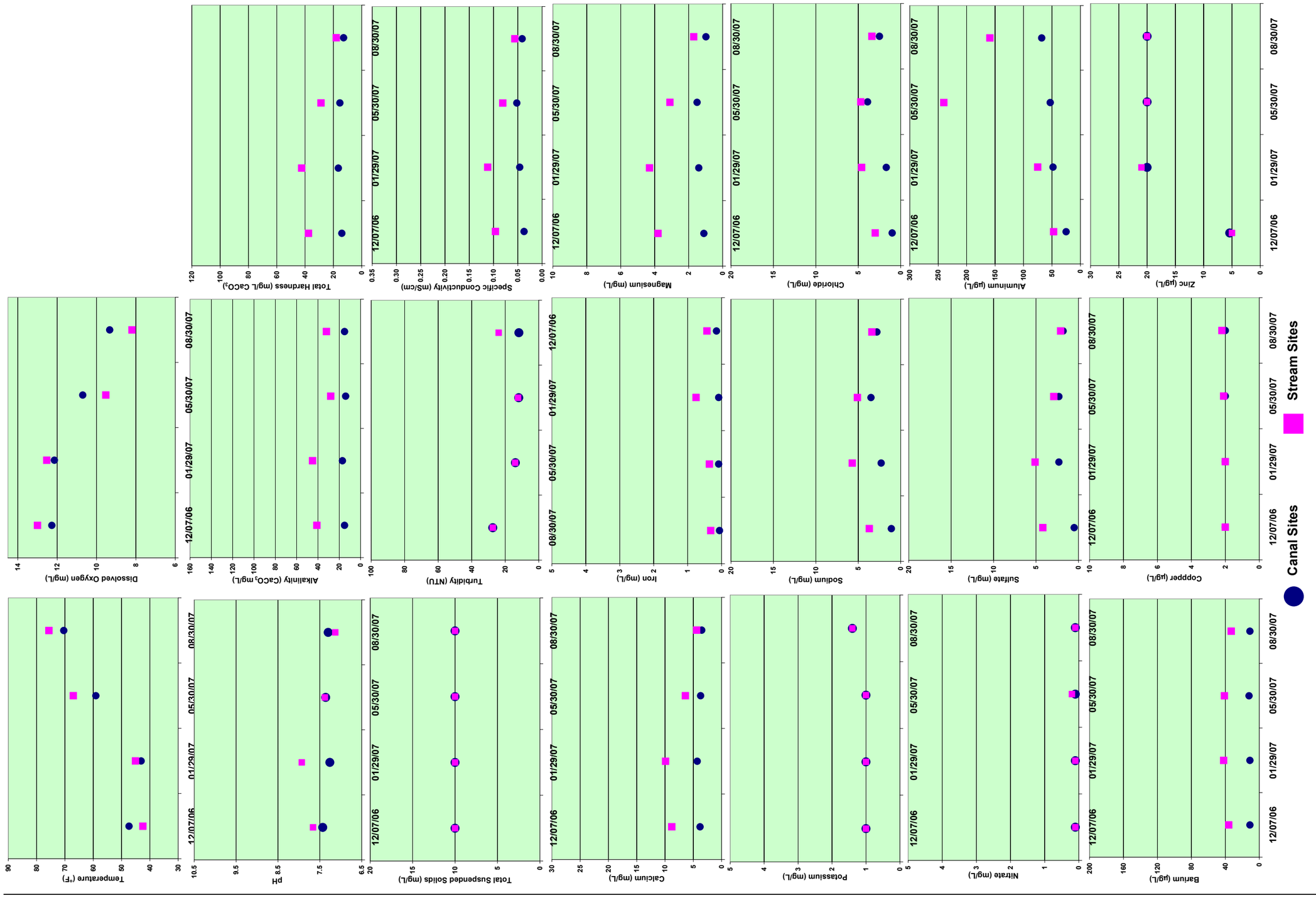
FIGURE B-2A
WATER QUALITY CONDITIONS AT CLOVER VALLEY CREEK WATERSHED SITES
DURING PCWA ROUTINE OPERATIONS
Stream Sites
Canal Sites
Zinc (µg/L)
Aluminum (µg/L)
Chloride (mg/L)
Magnesium (mg/L)
Specific Conductivity (mS/cm)
Total Hardness (mg/L CaCO3)
Copper (µg/L)
Sulfate (mg/L)
Sodium (mg/L)
Iron (mg/L)
Turbidity (NTU)
Alkalinity (CaCO3 mg/L)
Dissolved Oxygen (mg/L)
Barium (µg/L)
Nitrate (mg/L)
Potassium (mg/L)
Calcium (mg/L)
Total Suspended Solids (mg/L)
pH
Temperature (°F)
12/07/06
01/29/07
05/30/07
08/30/07

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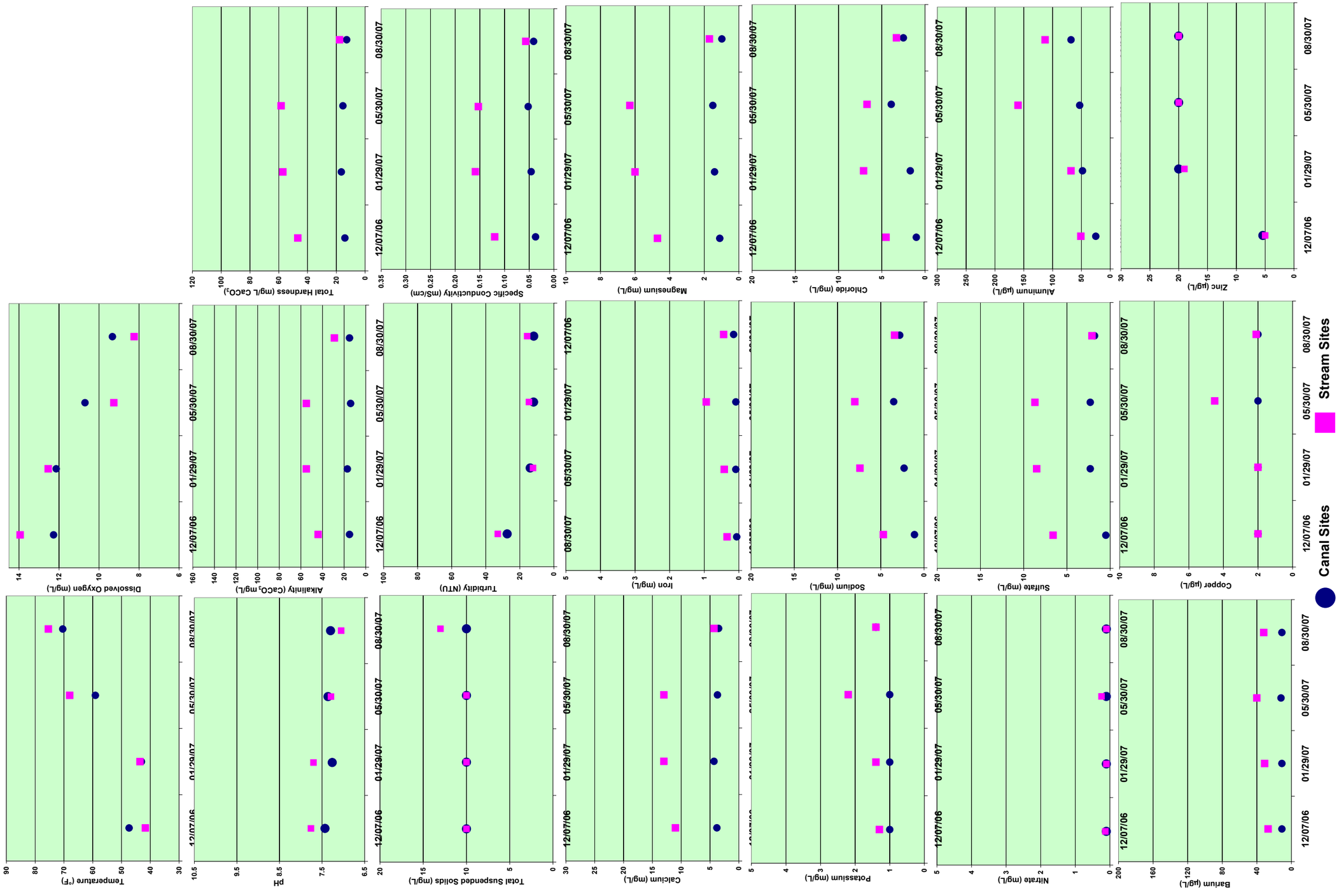

FIGURE B-2B
WATER QUALITY CONDITIONS AT ANTELOPE CREEK WATERSHED SITES DURING PCWA ROUTINE OPERATIONS

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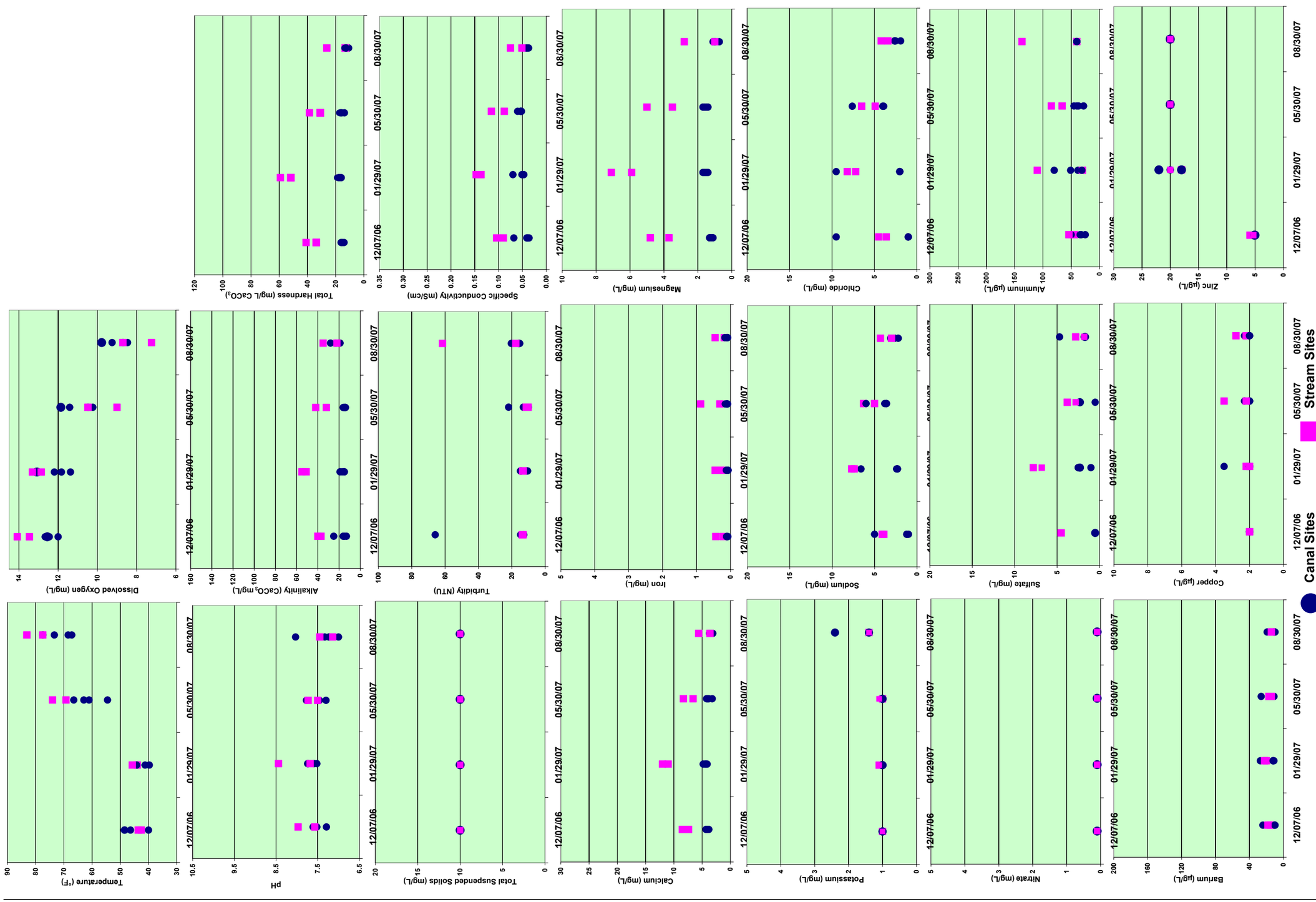

FIGURE B-2C
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING PCWA ROUTINE OPERATIONS

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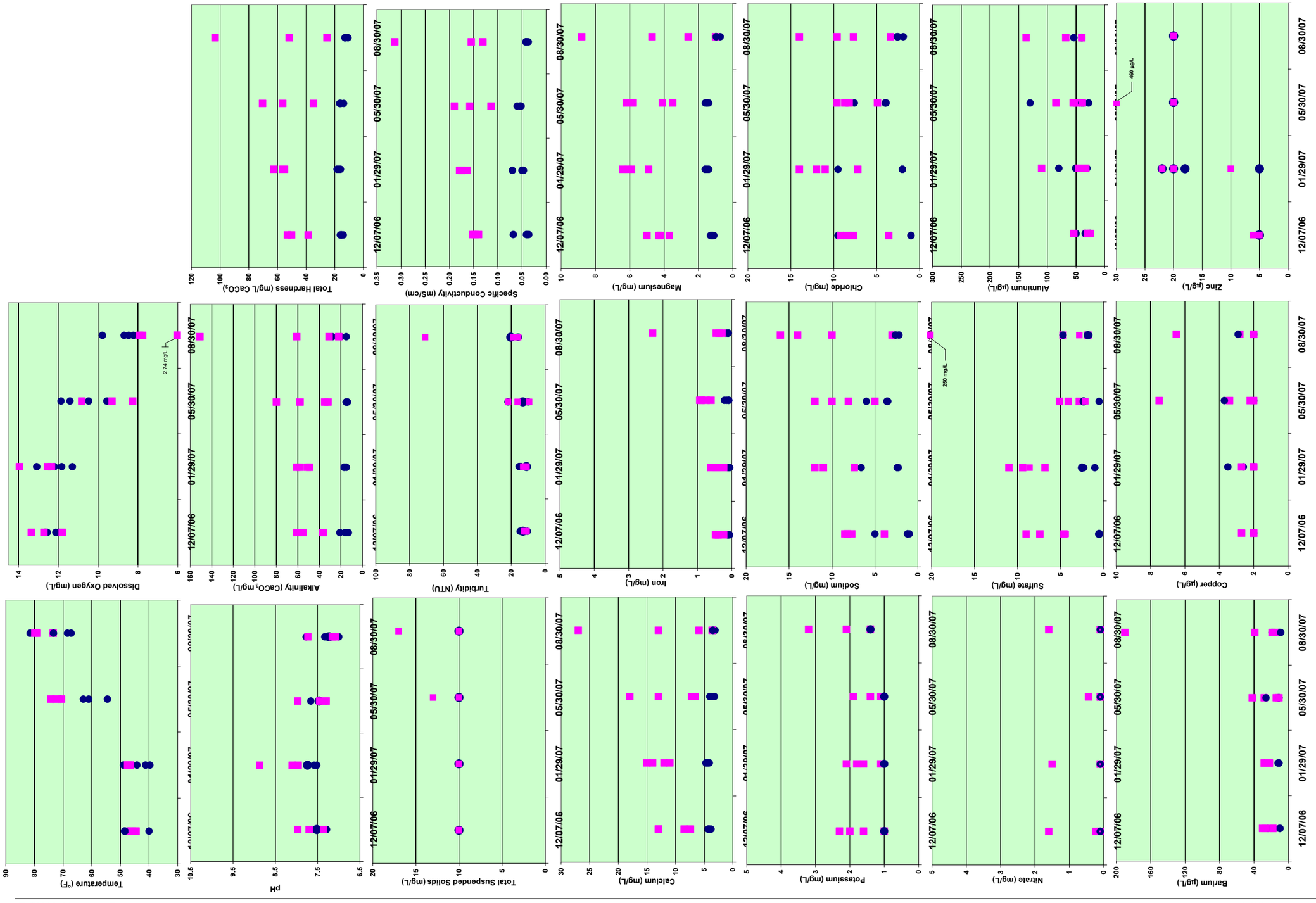

FIGURE B-2D
WATER QUALITY CONDITIONS AT MINERS RAVINE WATERSHED SITES DURING PCWA ROUTINE OPERATIONS

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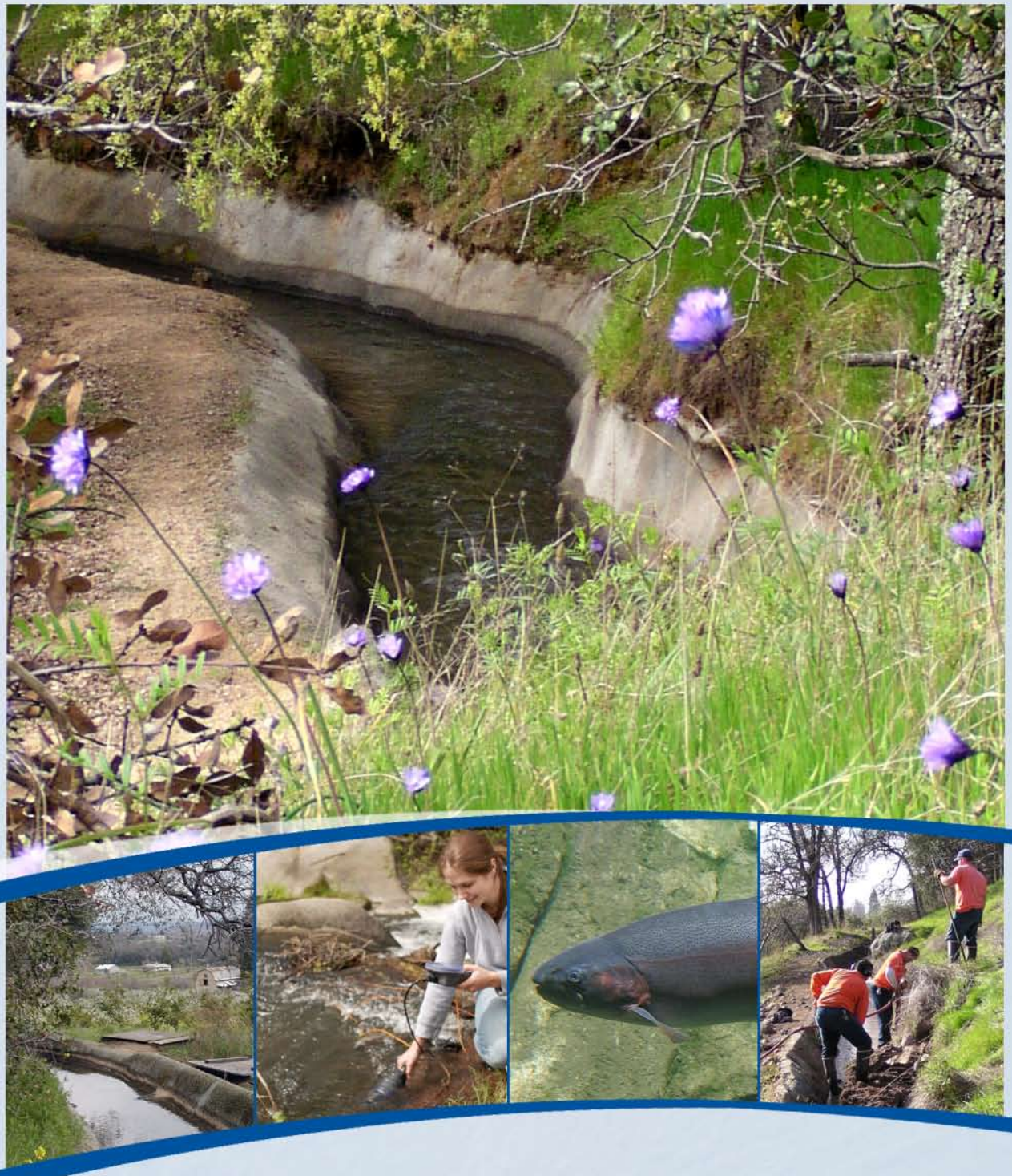
Appendix C



APPENDIX C
WATER QUALITY CONDITIONS DURING MAINTENANCE ACTIVITIES

C.1 WATER QUALITY CONDITIONS AT CANAL AND STREAM SITES DURING CANAL CLEANING ACTIVITIES

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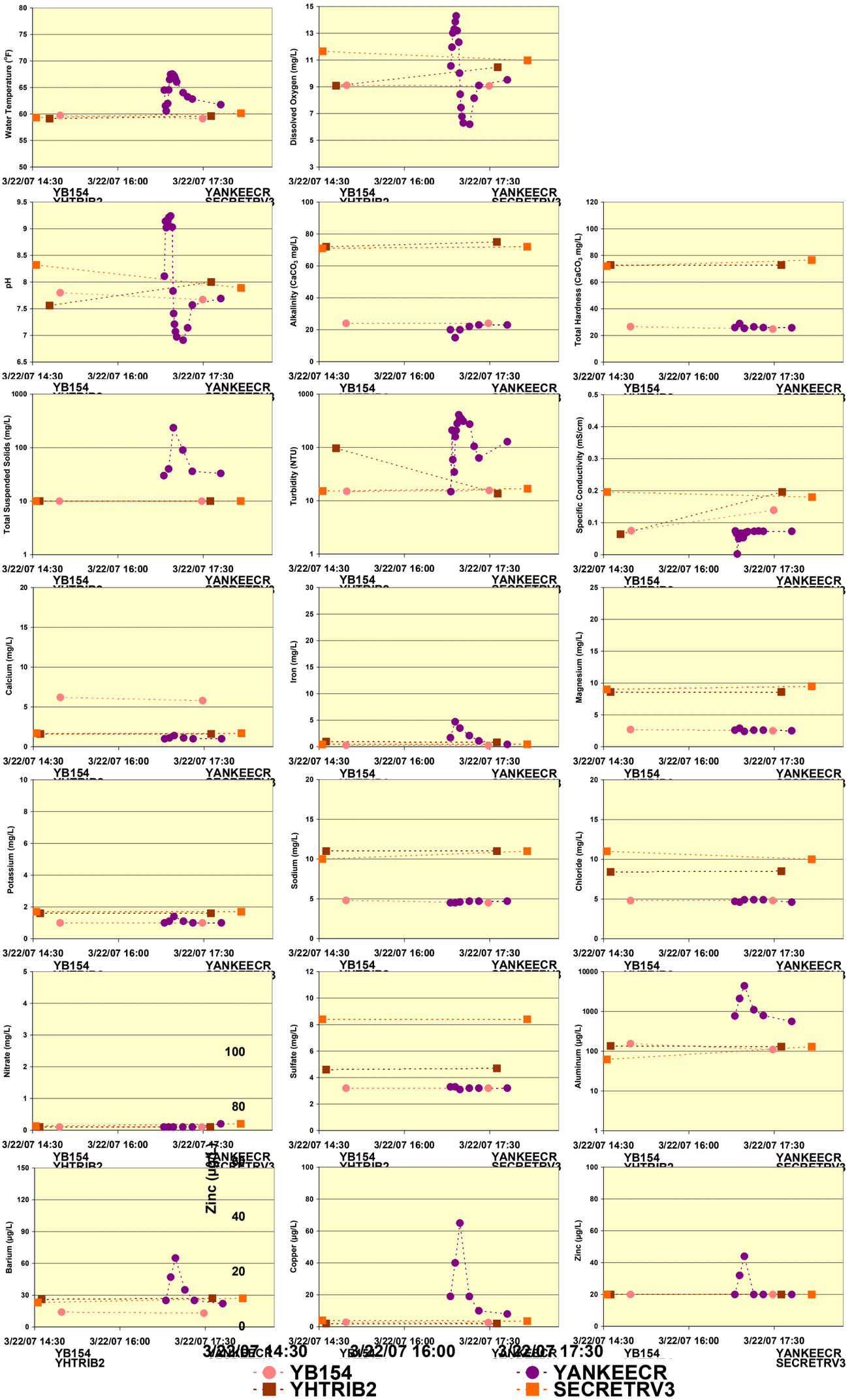

FIGURE C-1A
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING CANAL CLEANING ACTIVITIES

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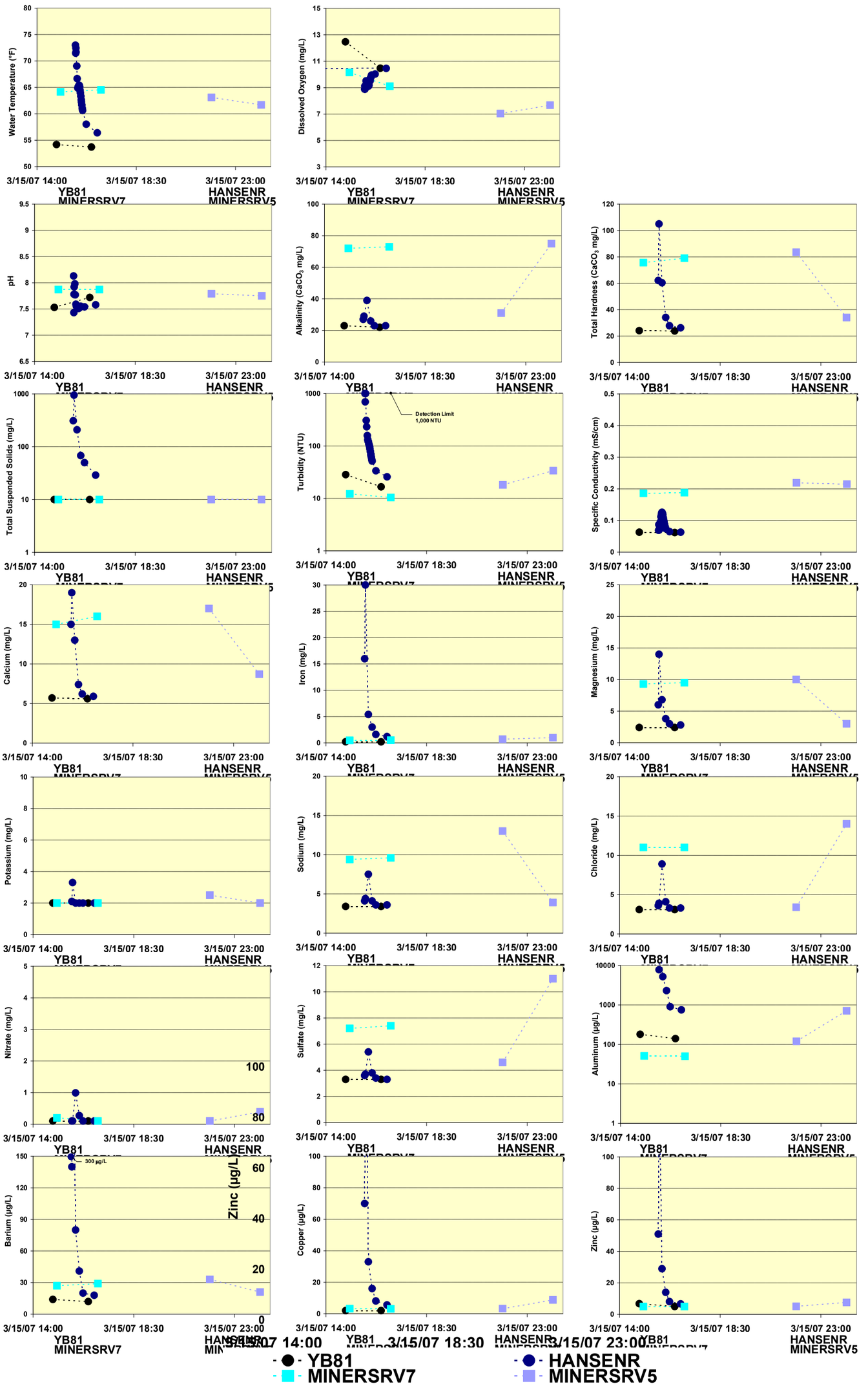

FIGURE C-1B
WATER QUALITY CONDITIONS AT MINERS RAVINE WATERSHED SITES DURING CANAL CLEANING ACTIVITIES

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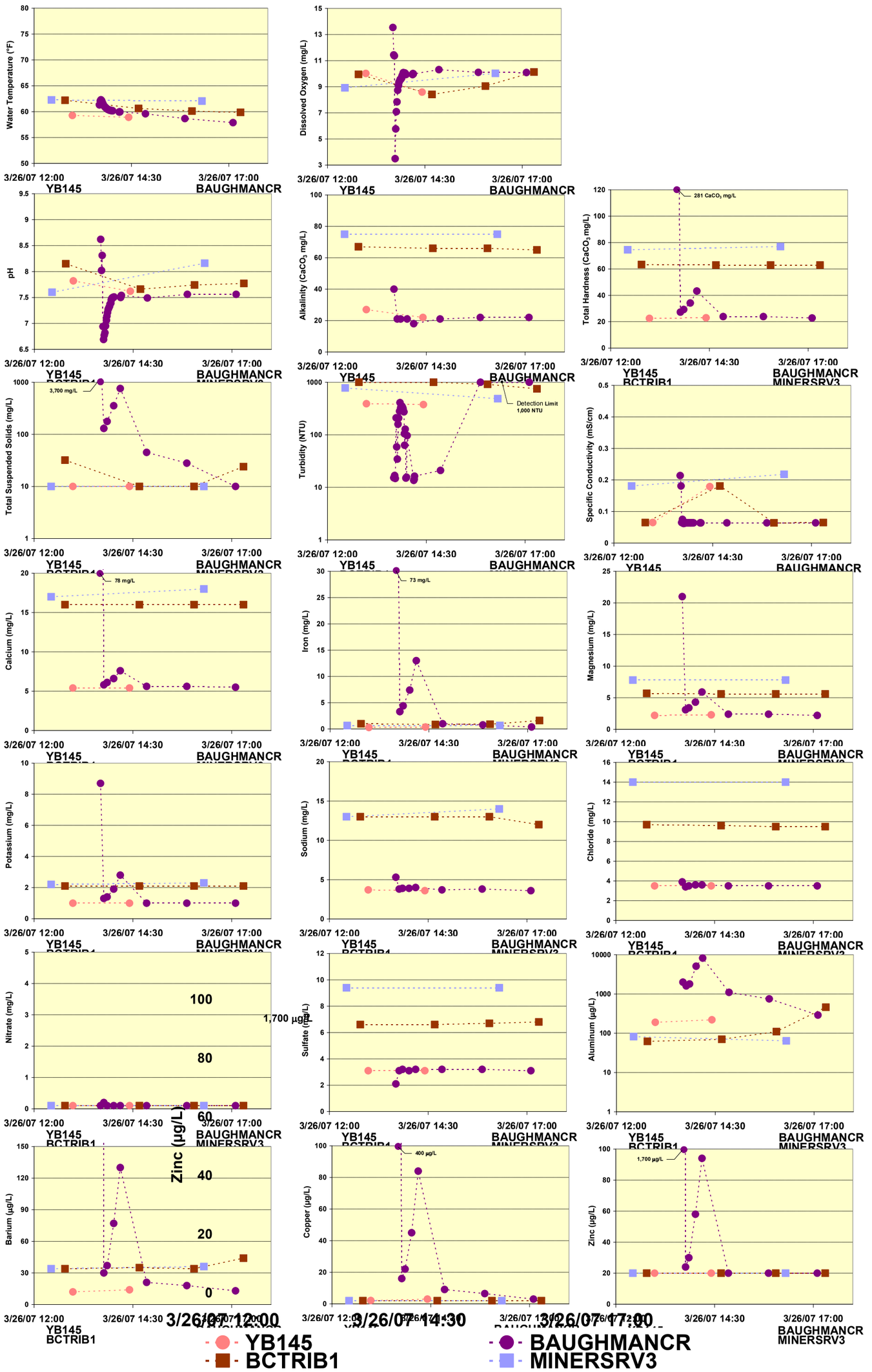

FIGURE C-1C
WATER QUALITY CONDITIONS AT MINERS RAVINE WATERSHED SITES
DURING CANAL CLEANING ACTIVITIES

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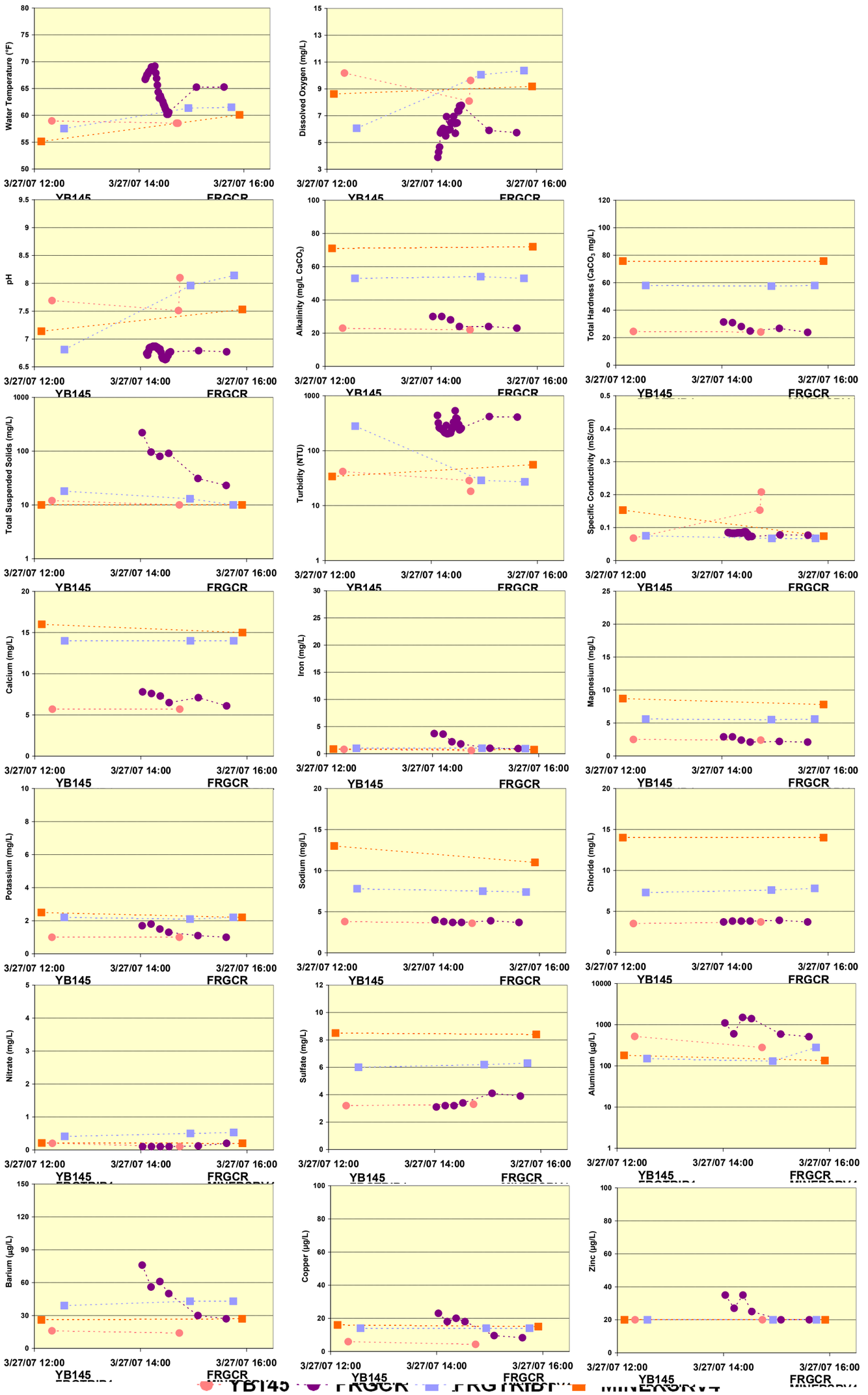

FIGURE C-1D
WATER QUALITY CONDITIONS AT MINERS RAVINE WATERSHED SITES DURING CANAL CLEANING ACTIVITIES

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C.2 WATER QUALITY CONDITIONS AT CANAL AND STREAM SITES DURING ALGAECIDE APPLICATIONS

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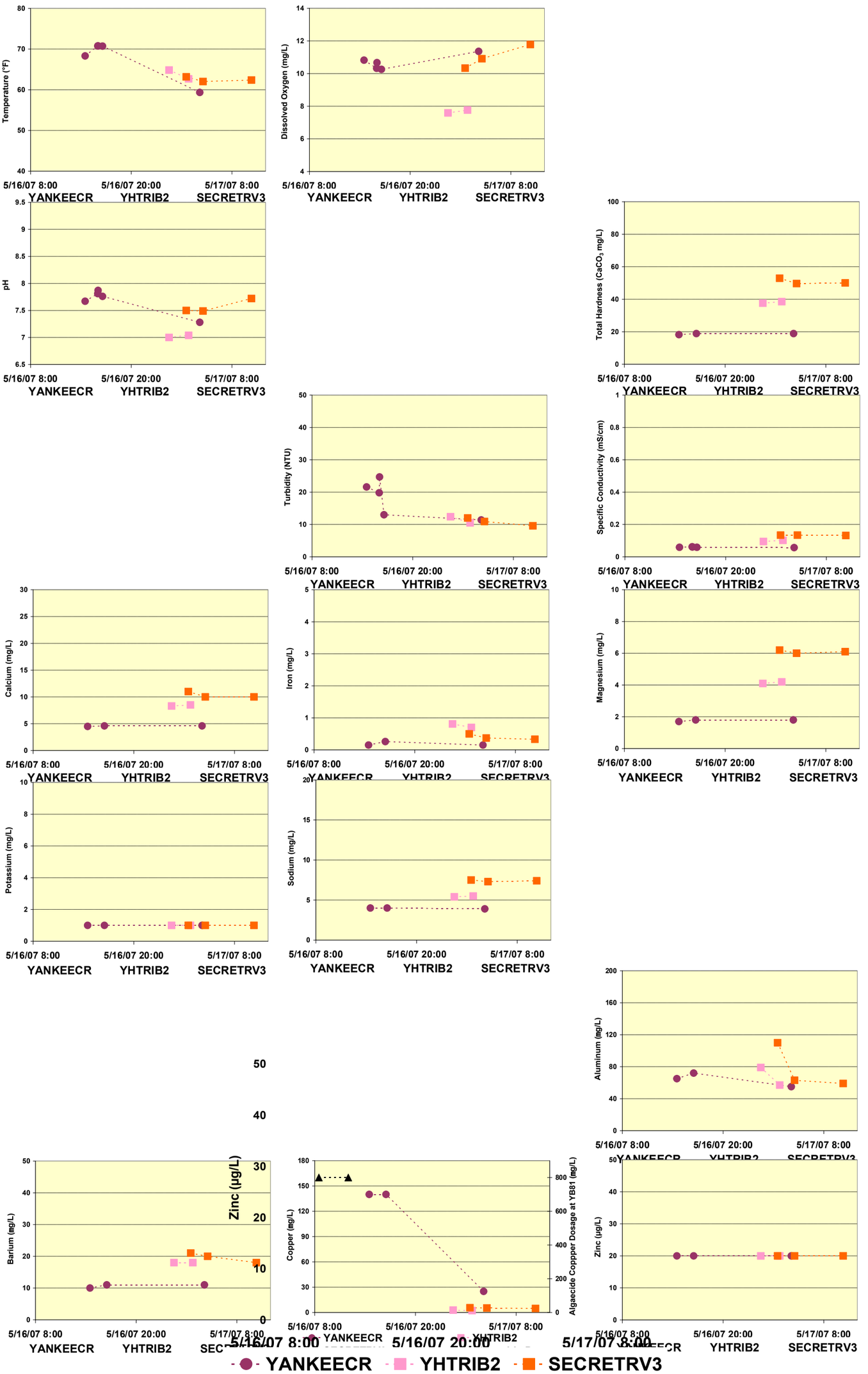

FIGURE C-2A
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING ALGAECIDE APPLICATIONS

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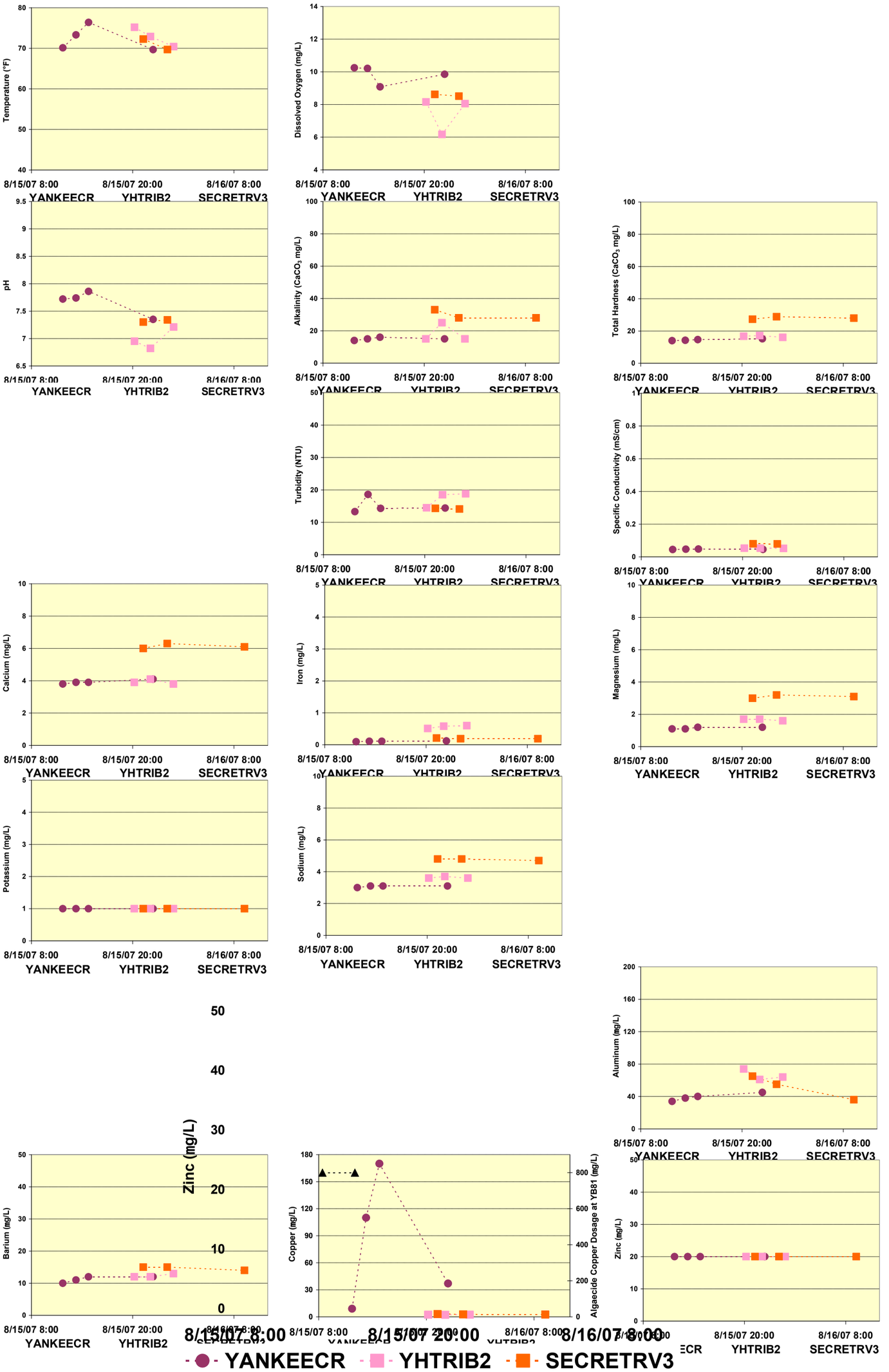

FIGURE C-2B
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING ALGAECIDE APPLICATIONS

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C.3 WATER QUALITY CONDITIONS AT CANAL AND STREAM SITES DURING HERBICIDE APPLICATIONS

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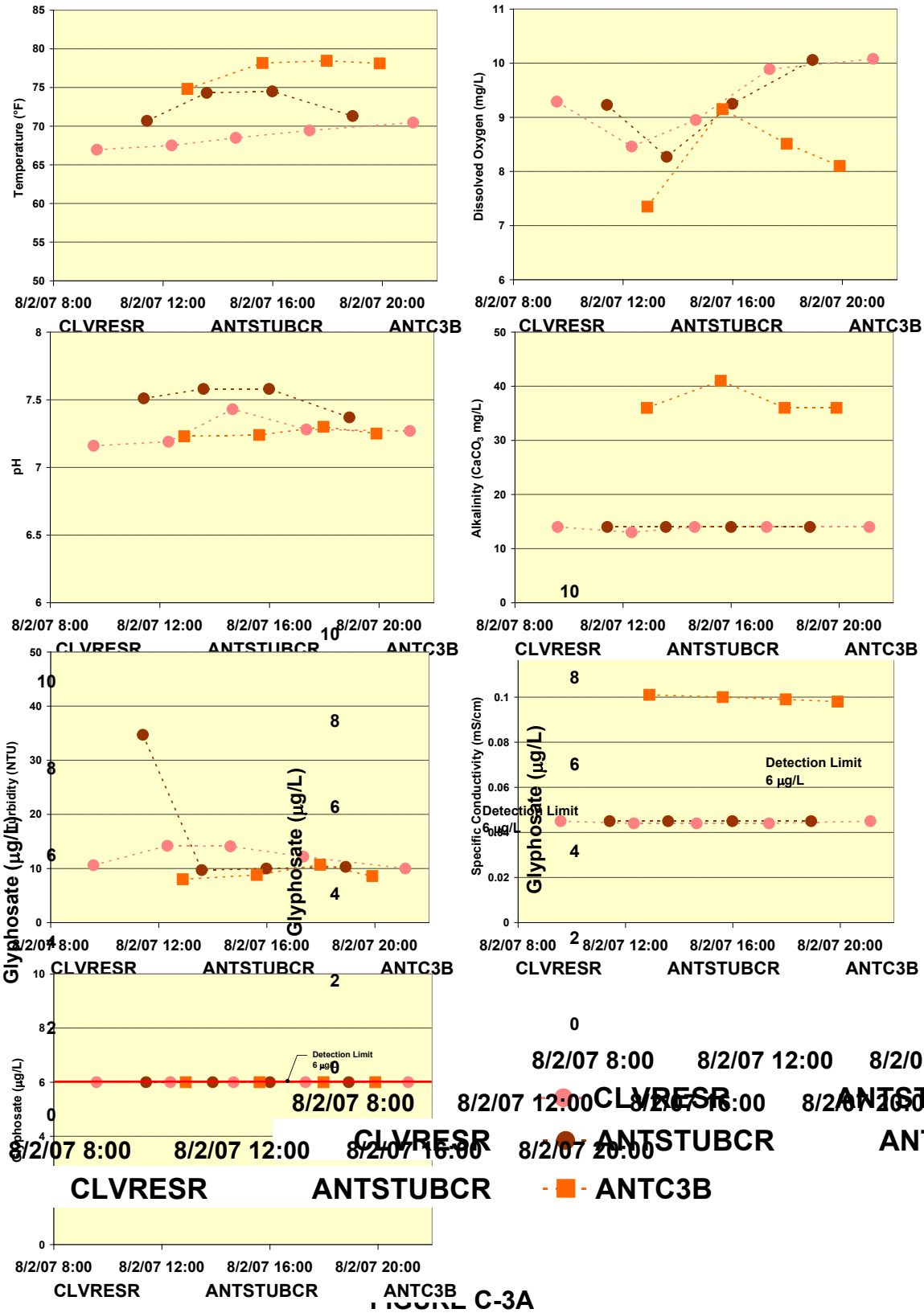

FIGURE C-3A
WATER QUALITY CONDITIONS AT ANTELOPE CREEK WATERSHED SITES DURING HERBICIDE APPLICATIONS

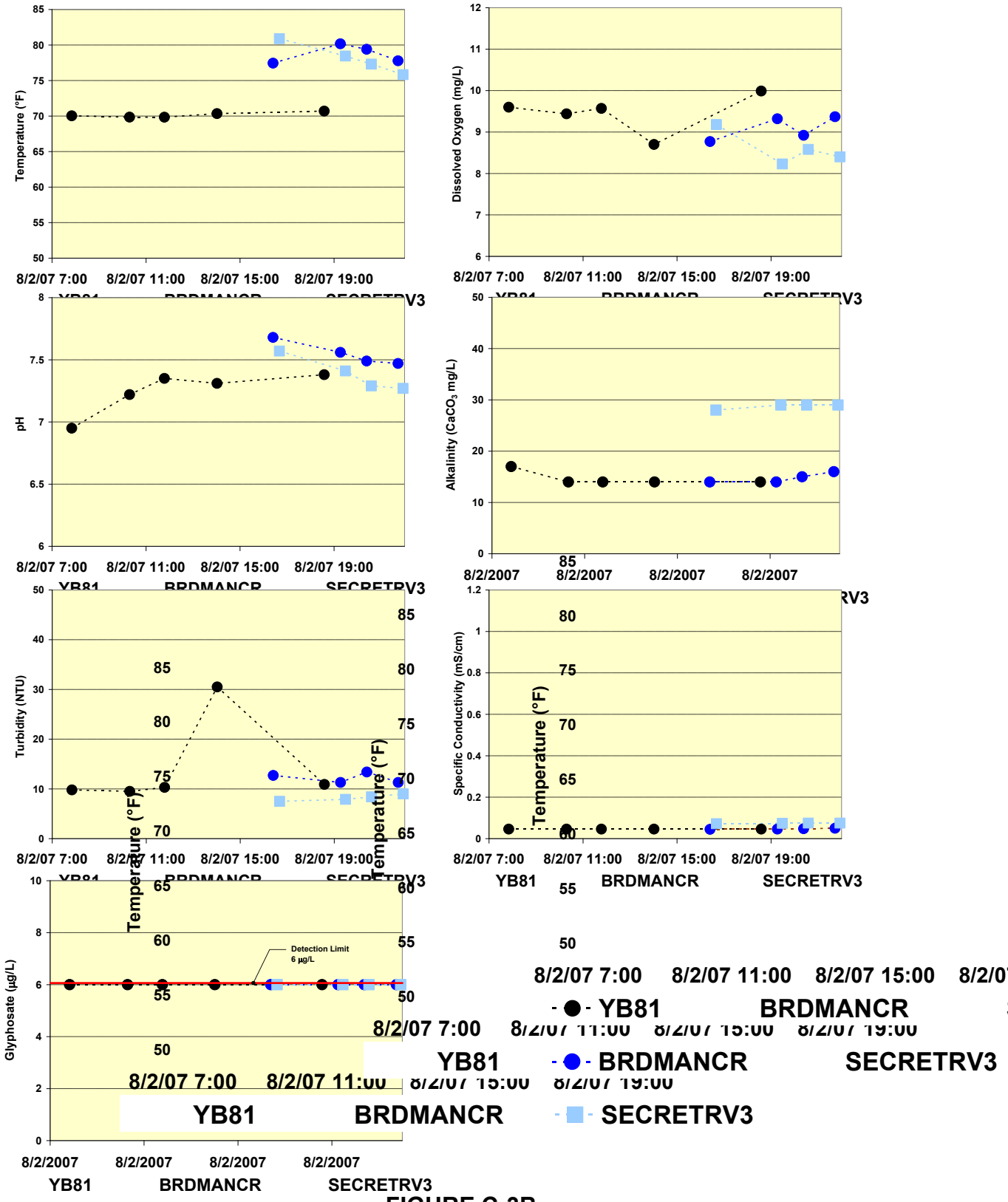

FIGURE C-3B
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING HERBICIDE APPLICATIONS

C.4 WATER QUALITY CONDITIONS AT CANAL AND STREAM SITES DURING CANAL LINING ACTIVITIES

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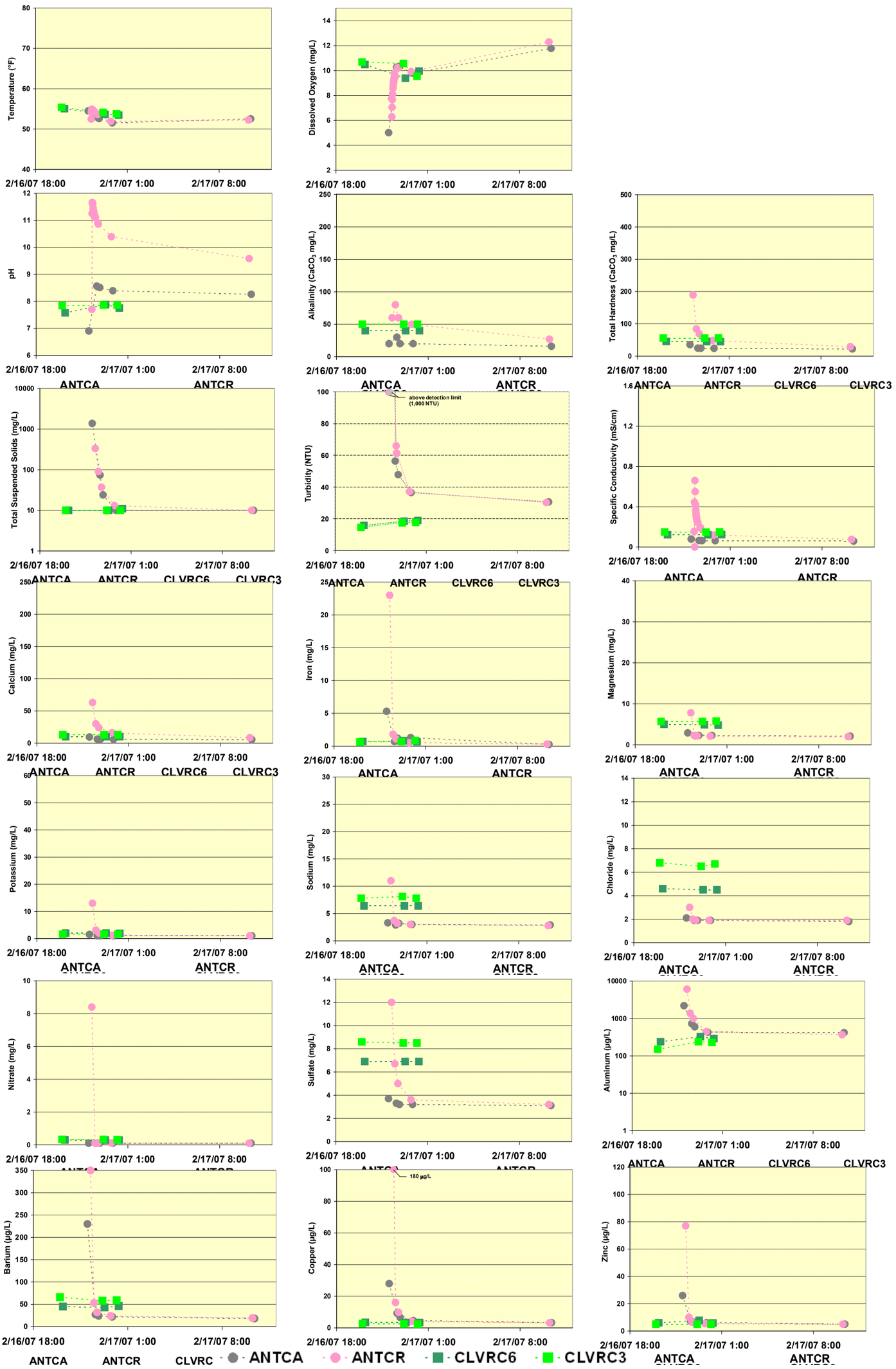

FIGURE C-4A
WATER QUALITY CONDITIONS AT CLOVER VALLEY CREEK WATERSHED SITES DURING CANAL LINING ACTIVITIES

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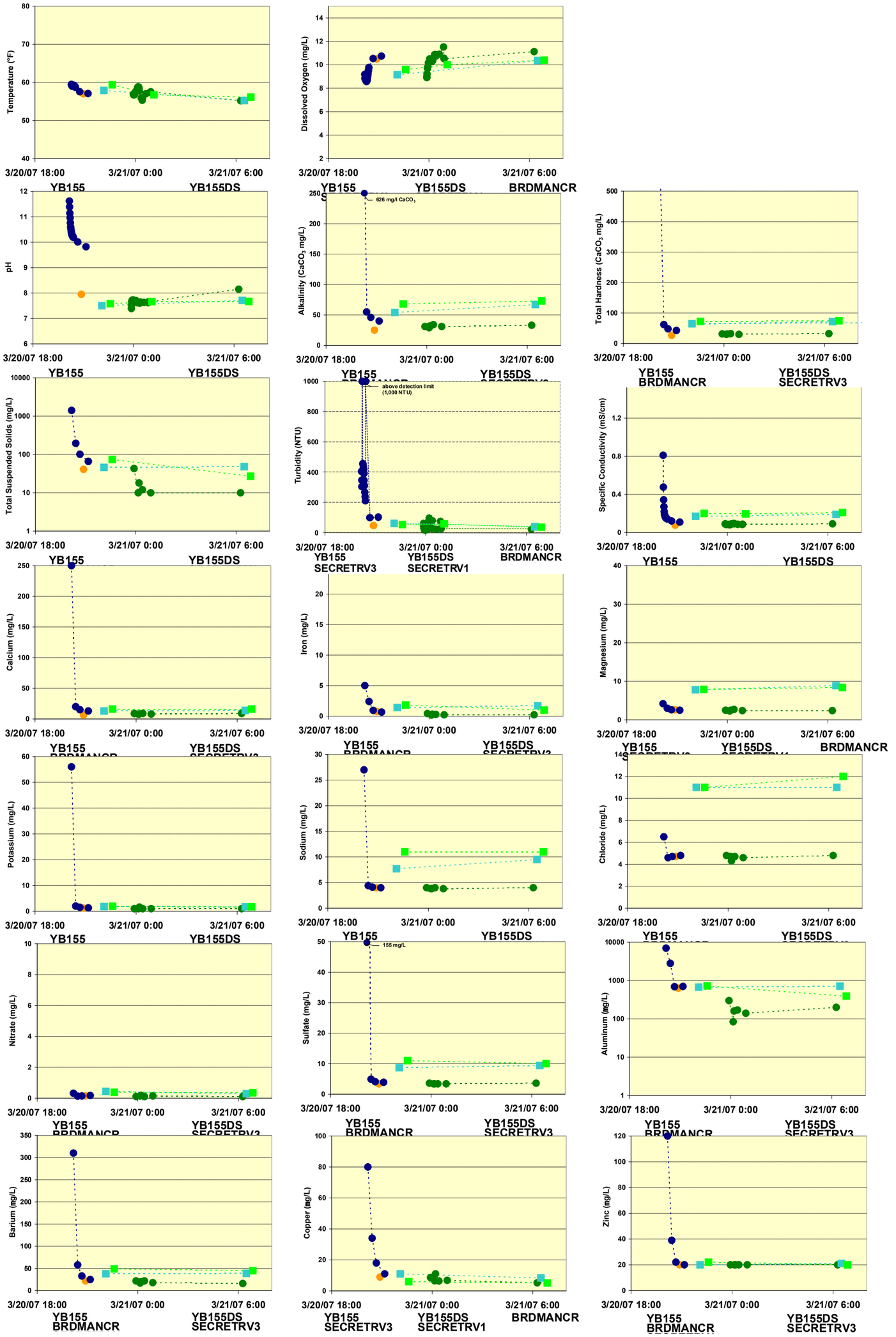

FIGURE C-4B
WATER QUALITY CONDITIONS AT SECRET RAVINE WATERSHED SITES DURING CANAL LINING ACTIVITIES

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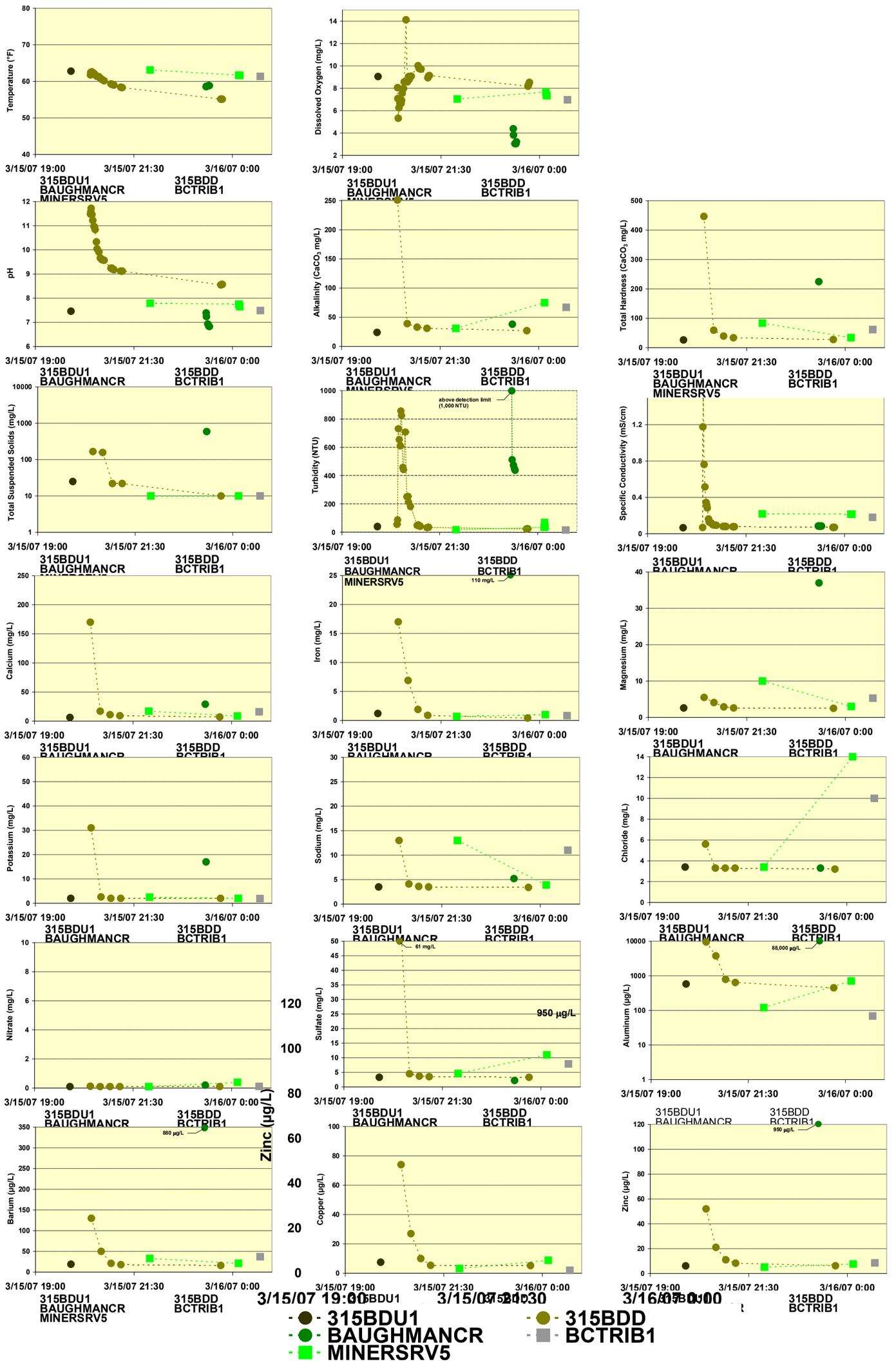

FIGURE C-4C
WATER QUALITY CONDITIONS AT MINERS RAVINE WATERSHED SITES DURING CANAL LINING ACTIVITIES

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Appendix F
Fuel Management

WILD FIRE MANAGEMENT IN THE PLACER COUNTY CONSERVATION PLAN RESERVE SYSTEM

1.0 INTRODUCTION

Implementation of the Placer County Conservation Plan (PCCP) will result in the permanent protection of approximately 63,000 acres in the Reserve System by the year 2060 (nearly 16,000 acres of existing reserves plus 47,000 acres of new acquisitions). To assure that these lands will be preserved in perpetuity, they should be managed to reduce their susceptibility to wild fire. In addition, if a fire occurs within a conservation reserve, measures should also be in place to reduce potential damage that might otherwise result due to suppression activities.

This document contains policies, procedures and prescriptions for managing wild fire risk in conservation reserves primarily through treatment of fuels. Further, it recommends that each reserve have a fire management component included within a PCCP-mandated management plan. The fire management component should describe site-specific conditions and actions required to: 1) reduce existing fuel loads; 2) re-introduce fire as a natural process of the ecosystem (if relevant); 3) minimize environmental impacts and protect sensitive resources; and 4) enhance and/or restore natural community characteristics. The emphasis of this document is on fuels treatments. Addendum 1 discusses the impacts that fire suppression actions can have once a fire starts. It describes approaches to minimize those impacts in conservation reserves.

2.0 APPLICABILITY

These guidelines apply to conservation reserves that are either owned by or that have conservation easements held by the PCCP implementing entity. Within those lands, vegetation management will be a Covered Activity under the PCCP.

3.0 EXISTING COUNTY POLICIES AND ORDINANCES

3.1 Placer County General Plan

The Placer County General Plan provides very limited policy guidance on wild fire management. It was adopted in 1994 when public awareness of wild fire impacts in the “wildland-urban interface” was not as acute as it is today. It advocates the use of prescribed fire for environmental management but provides no guidance on where that should occur.

3.2 Strategic Plan for the Placer County Wildfire Protection and Biomass Utilization Program

This strategic plan was developed in 2007 and revised in 2014. The plan's purpose is to ".... seek ways to reduce the effects of catastrophic wildfires, and convert unwanted

woody biomass into a beneficial commodity" (Placer County 2014). The plan was prepared by a collaboration of county departments and agencies including county supervisors, emergency services executives and the local air pollution control district. Plan proposals and strategies pertain to wildfire protection though planning and enforcement of defensible space regulations, utilization of woody biomass for energy production, improvement of air quality through reduction in wildfire emissions and implementation of the Community Wildfire Protection Plan for the county (cited below). The strategic plan is relevant to management of the PCCP conservation reserves in that it supports fuels management to reduce fire hazard. The plan would also be viewed as supportive of any efforts to utilize the products of conducting fuels management in conservation reserves for energy production.

3.3 Placer County Tree Ordinance

The Placer County Tree Ordinance regulates tree removal in defined tree preservation zones or when a discretionary permit approval is required for a project. The Tree Ordinance provides an exemption that allows: “Tree removal necessary to comply with CDF (CAL FIRE) Fire Safety Regulations (i.e., clearing around homes) or tree removal undertaken as a part of a fuel reduction/fire safety/fire protection program in conformance with commonly accepted CDF (CAL FIRE) policies.” The Tree Ordinance will be revised to ensure consistency with the PCCP after the PCCP has been adopted.

3.4 Placer County Fire Hazard Reduction and Fire Prevention Code Sections

Chapter 9, Article 9.32, Part 3 of the Placer County Code requires the maintenance of "fire breaks" around structures and clearing of roofs to prevent structural fires in the "wildland-urban" interface. This code section along with Public Resources Code Section 4291 are commonly referred to as "defensible space regulations". They would apply to any structures that exist or might be built on PCCP conservation reserves.

Chapter 9, Article 9.32, Part 4 of the Placer County Code requires that hazardous vegetation be abated on unimproved parcels in the county. Abatement of hazardous fuels is required if the unimproved parcel is adjacent to an improved parcel where implementation of required defensible space would extend onto the unimproved parcel. Abatement is also required along roads if in the opinion of the county fire marshal the presence of hazardous fuels constitutes a potential obstacle to emergency access. These provisions would apply to PCCP conservation reserves and any proposed fuel treatments would likely be compatible with the code requirements.

3.5 Community Wildfire Protection Plan

There is a “Community Wildfire Protection Plan for the West Slope of the Sierra Nevada in Placer County” (Holl 2008). The Community Wildfire Protection Plan (CWPP) provides information on changes in historic recurrence intervals, potential fuels treatments, costs for treatments and other background. It proposes treatments for areas of the county with existing Fire Safe Councils e.g., Greater Auburn Area, Foresthill, etc.

The CWPP was updated in 2012 to include the Lincoln/Sheridan/Mount Pleasant Area. If future fuel treatments are proposed within the Reserve System pursuant to the CWPP they would be Covered Activities and subject to these guidelines.

3.6 Proposed PCCP Policies

The PCCP is currently being prepared (as of January 2017). The following information is derived from the 2016 review draft PCCP and various background papers and reports.

Landscape Level Goals and Objectives advise the preparation of management plans for all conservation reserves. These plans will address wild fire management. The use of prescribed fire and targeted grazing for managing certain vernal pool grasslands is recommended within the goals and objectives.

Some “Best Management Practices” (BMPs) currently recommended for oak woodlands include:

- Maintain current oak canopy coverage (i.e., percentage of land occupied by oak canopy).
- Maintain a variety of size and age classes of oak trees.
- Protect stump sprouts, retain snags, dead trees and downed wood.
- Incorporate fire into the management regime.

As a Covered Activity under the Plan actions to reduce fire hazard will be subject to all avoidance and mitigation requirements of the PCCP and its implementing ordinances.

4.0 OTHER POLICIES AND REGULATIONS

Fuels management projects in PCCP conservation reserves may undergo review pursuant to the California Environmental Quality Act (CEQA) and/or National Environmental Policy Act (NEPA). For projects funded under state and federal cost sharing programs, the lead agency responsible for conducting environmental review may be different than the PCCP implementing entity. As a Covered Activity under the PCCP, separate permits from the Army Corps of Engineers, Regional or State Water Quality Control Boards will not be required unless a Stream Alteration Agreement from the Department of Fish and Wildlife is required. Permits from the Air Quality Management District for projects involving burning will be required.

Projects in PCCP conservation reserves potentially affecting special status wildlife or plant species listed under state or federal Endangered Species Acts that are not covered under the PCCP may be subject to regulation by the Department of Fish and Wildlife and/or U.S. Fish and Wildlife Service.

5.0 WILD FIRE RISK

5.1 Definition

Risk is here defined as the probability that a wild fire will cause significant environmental and ecological damage to a conservation reserve and/or surrounding properties. The primary determinant of wild fire risk is the potential for ignition. Sources of ignition may be natural (lightning) or human use related. Susceptibility to lightning strikes varies in Placer County depending on elevation. Lightning is generally rare within the limits of the Plan Area. Human-caused ignition is more likely. In addition to arson, use-related sources of ignition may be legal or illegal recreational uses, vehicles, power lines and railroads.

Once a fire starts, a second determinant of risk is the likelihood that a fire will be sustained and spread. Putting aside for the moment the importance of environmental and fuel conditions, three scenarios are possible: 1) a fire may start within a reserve and be confined therein; 2) a fire may start within a reserve, burn there to some degree and spread to adjacent lands; and 3) a fire may start on adjacent lands and spread to the reserve. In any of these cases, there could be damage to the reserve from both wild fire and suppression activities.

A third determinant of risk is fire severity. As used in this document, fire severity means the degree to which existing vegetation is destroyed by a fire. An extremely severe fire is one in which essentially all vegetation is lost. Less severe fires may destroy under-story vegetation but leave most trees alive. Fire severity can also be expressed in terms of damage to soils and water quality. Extremely severe fires may change soil characteristics to the extent that regeneration and recovery are impaired. They may also cause short-term and long-term water quality impacts.

Other secondary determinants of fire risk include public attitudes and perceptions of risk and methods used to reduce risk e.g., fuels removal, prescribed fire, etc., regulatory constraints on risk management tools and costs for fuel management treatments. An additional unknown is the long-term effect of global climate change on weather and vegetation.

A manager can minimize wild fire risk to some degree by reducing the likelihood of ignition (restricting uses, patrolling, etc.) and improving access and suppression capabilities but the main way to minimize risk is to manipulate vegetation to reduce the chances that a fire will spread and cause severe damage

5.2 Factors Affecting the Extent and Severity of a Wild Fire

After a fire starts, there are several things that affect how it spreads and its severity. Fire weather has an overriding effect on fire behavior. Under certain weather conditions (low

humidity, high temperature, high wind velocities) wild fire is essentially uncontrollable. These weather conditions are relatively infrequent but occur annually in Placer County.

Topography is a second condition that affects wild fire behavior. In general, steeper lands have a higher level of risk for two reasons. First, steep terrain affects local wind patterns and microclimate. Wind-driven wild fires tend to run up slopes, often at a fast pace. Second, the steepness of terrain affects actions to suppress wild fires. Suppression may be limited to breaks in slope at ridgelines when fast moving fires are racing up slopes. On very steep lands, suppression may be limited to aerial attack with air tankers and fire retardant. Prevailing weather at the time of the fire (temperature, relative humidity, winds) can exacerbate the effects of topography on fire behavior.

Access and suppression capability is a third condition that influences risk and damage when a fire starts. Particularly in the northern portion of the Plan Area, conservation reserves may be located at some distance from the nearest fire station. Aerial suppression capabilities may not be available. During times of dangerous fire weather and multiple starts, fire-fighting priorities and resource allocations will focus on places where human resources, rather than natural resources are in danger.

The fourth condition affecting the extent of a fire and its severity is fuel loading and more specifically the interconnectedness between surface, under-story and over-story vegetation (ladder fuels). Continuity of fuels throughout a property and across property boundaries along with terrain, weather and other factors determine the potential for a fire spreading. The abundance of fuel at a given location largely determines its severity.

Vegetation type influences fuel loads and the potential for development of ladder fuels. The PCCP targets most habitat acquisitions to occur in vernal pool grasslands, oak woodland and riparian/stream system/wetlands. Fuel loads at a specific location within a given vegetation type are affected by land uses, fire history, natural processes of mortality caused by insects and disease, and presence or absence of invasive species with high fire hazard (e.g., brooms and Himalayan blackberry). Climatic and weather cycles affect fuel loads, particularly in vegetation types where grasses and other herbaceous plants are a significant component. For example, when wet years occur and lead to high productivity of annual grasses, there can be significantly increased risk of wild fire in the summer and fall when the grasses are dried out. Conversely, consecutive years of drought can increase the susceptibility of trees and shrubs to disease and insect attacks that cause mortality and thereby increase fuel loads.

Of the vegetation types proposed for conservation in the PCCP, oak woodlands have the highest inherent fire risk because they tend to have higher fuel loads relative to the other vegetation types, they are commonly located in steeper terrain and are least accessible. Riparian woodlands may have high fuel loads but mesic conditions may reduce inherent fire risk. Vernal pool grasslands are generally subject to a lower level of wild fire risk in the sense that they usually only have surface fuels and fires are generally not going to cause permanent damage. It should be acknowledged, however,

that any vegetation type can have a wild fire risk varying from low to high depending on site-specific fuel loads and other factors.

6.0 REDUCING RISKS THROUGH FUELS MANAGEMENT

6.1 Fuels Management Objectives

Fuels are managed to obtain desired changes in fire behavior and approaches to management vary by fuel type (Table 1). Treating fuels may reduce rates of fire spread and may reduce the severity of a fire. Treating fuels cannot prevent a fire from occurring. Reinhardt et al. (2008) discuss many aspects of fuels treatments and concluded that "treatment in wild lands should focus on creating conditions in which a fire can occur without devastating consequences rather than creating conditions conducive to fire suppression." For some conservation reserves this may be a useful operating principle. In other cases, however, where reserves are situated near neighborhoods or other infrastructure, enhancing suppression capability or reducing the rate of spread may be key goals for fuels treatments.

Table 1: Fuels management objectives and prescriptions (after Finney 2004).

Fuel Target	**Prescription(s)**	**Change in Fire Behavior**
Surface fuels (live grass and brush, and dead and downed woody material)	Mechanical treatments and prescribed burning to remove, compact or reduce continuity of surface fuels	Reduce spread rate and intensity, limit ignition of tree crowns* and other aerial fuels
Ladder fuels (small trees, brush, low limbs)	Thinning (small-diameter trees) and prescribed burning (scorching and killing small trees and brush) to decrease vertical continuity between surface and crown fuels	Limit ability for fire to transition from surface to crown fire by separating surface fuels from crown fuels
Canopy fuels (fine fuels like dried leaves and small twigs in tree crowns)	Thinning to reduce horizontal continuity of crowns (e.g., overstory thin)	Limit spread of crown fire

*The crown of a tree is the entirety of its foliage. A crown fire refers to one which occurs within the canopy and is carried from tree to tree by ignited crowns.

6.2 Environmental Constraints on Fuels Treatments

Environmental constraints affecting fuels treatments depend on the community. In vernal pool grasslands, fine surface fuels are predominant (Figure 1). Management may entail using prescribed fire, grazing or mowing to keep fuel loads under control. Environmental impacts will be limited with most concern centered on biological and

hydrologic effects of treatments, including effects on PCCP Covered Species and other wildlife.

Figure 1: Vernal pool grasslands generally only have surface fuels. Hardpan soils limit establishment and growth of shrub and tree cover.

Treatments intended to reduce fuel loads in forest and woodland settings are more complex. Surface, ladder and canopy fuels are often all present. Highest priority is usually placed on reducing ladder and surface fuels because they connect the tree canopy with the ground.

Methods for fuels management fall into four general categories: 1) mechanical (mechanized) harvesting; 2) hand harvesting; 3) prescribed fire; and 4) grazing and browsing mainly to reduce surface fuels. Depending on the method used, potential environmental impacts may occur due to site disturbance and changes in the plant community. In the context of managing conservation reserves, considering these impacts and mitigating them is of equal or greater priority than reducing fire risk. The main reason for acquiring conservation reserves is to secure permanent protection for important ecosystems. These ecosystems will provide habitat for covered animal and plant species and other organisms. Therefore, a principal constraint on fuels management is maintaining the habitat and ensuring that there are no significant impacts on Covered Species.

Additional environmental constraints include:

- Fuels treatments will be constrained by topography and geologic hazards on acquired parcels. These constraints are most important in upland oak woodland habitats. Topography and geologic hazards will limit the use of mechanized harvesting for fuels reduction.

- Water courses and wetlands found on conservation reserves require special attention so that water quality and other impacts can be avoided during fuels treatments. Protection is normally provided with stream and wetland buffers wherein vegetation removal and ground disturbance are prohibited or limited.

- It is likely that some acquired parcels will have significant historical and archeological resources that should be protected during fuels treatment activities. These may not be known to exist before discovery during project implementation.

- Regarding the use of prescribed fire, smoke and air pollution are critical issues for both residents and for assuring attainment of air quality standards.

- Existing and planned land uses near conservation reserves will affect the feasibility of managing fuels, particularly the use of prescribed fire.

6.3 Potential Impacts of Treatments

As a rule, mechanized treatments involving heavy equipment have the potential for creating the greatest level of site disturbance and potential impact (PSW 2008). There are machines that have been developed to minimize site disturbances such as soil compaction (Poff 2006; Rheinberger 2008). When mechanized operations are conducted with this type of machine and further restricted from environmentally sensitive areas such as steep slopes and riparian zones, environmental impacts can be imperceptible.

Hand harvesting is labor intensive, potentially dangerous and can be slow work. Conservation and inmate crews are commonly used to do fuels management manually. Hand harvesting may be the only acceptable approach in sensitive areas.

Prescribed fire, including broadcast burning or “jackpot” pile-and-burn is an attractive alternative for fuels management. Broadcast burning can be designed to mimic natural processes and to re-introduce fire into the ecosystem. Given the fuel loadings in many Placer County woodlands, re-introduction of fire can only be considered after preparatory treatments with mechanical or hand methods. Either broadcast burning or pile-and-burn may be used after a thinning to remove residues and reduce surface fuel loads.

Over the long-term, it would be desirable to use prescribed fire in appropriate locations as a tool to manage fuel loads in conservation reserves. For several reasons, this may not be entirely feasible. First, under today’s air quality control regulations, use of prescribed fire is substantially restricted due to impacts from smoke and particulate matter. Second, some, if not many conservation reserves may be too near to urban and rural residential areas to be effectively managed with fire. Third, prescribed fire has the potential to adversely affect resident and migratory wildlife if conducted at the wrong time of the year (especially in the spring). Finally, the liability associated with an

escaped fire may deter risk-averse managers from using it. A viable alternative to burning in either oak woodland with grass under-story or vernal pool grasslands is the use of grazing and browsing animals (Figure 2).

Figure 2: Surface fuel loads in this conservation reserve located near Loomis are effectively managed with grazing animals (sheep and goats).

In considering the environmental impacts of a specific practice in a specific place, there are several relevant questions:

- Are there sensitive areas such as steep slopes or riparian zones located within the proposed treatment area?

- Are any special status wildlife or plant species present? Have surveys been conducted to determine their presence or absence? Note that species covered under the PCCP need not be surveyed.

- What will be the prescription? Will over-story trees be removed? Will under-story trees, shrubs and/or herbaceous vegetation be removed? What is the desired future condition of the vegetation and how will the prescription serve to achieve that condition (considering both wild fire risk and habitat requirements of covered species and other wildlife and plant species)?

- How will residues be treated? Will they be removed from the site, lopped and scattered, chipped and distributed across the site or piled and burned? Will mastication be employed (Figure 6)?

- What time of the year will the treatments be done? Impacts to wildlife and special status plants can be significant if treatments are improperly timed relative to their habitat requirements, breeding behavior and phenology.

- What mitigation measures will be required to offset potential impacts?

Figure 3: Mastication is the use of a grinding head to literally "chew" up brush and small trees. It is particularly effective in very dense young stands of trees or in brush fields. At Sacramento National Wildlife Refuge Complex, mastication is used to remove patches of Himalayan blackberry (Joe Silveira, personal communication).

Two concerns for operations within conservation reserves are protection of habitat for Covered Species and maintenance of biological diversity. Restricting removal of large trees and snags, limiting times and types of operations and avoiding habitats may all be required to ensure against taking these species. Protecting biological diversity may require additional measures. For example, the treatment of residues can have impacts on regeneration of under-story plants. A layer of masticated residues can impair germination and burn piles can lead to sterilized soils. In situations where restoration of native herbaceous communities is a desired outcome, treatments of residues may need adjustment. Another potential conflict arises when surface fuels treatments such as prescribed fire or mowing occur when ground-nesting birds are present. These effects are transitory and can be avoided through proper timing of treatments (Farris et al. 2010).

Projects with the least likelihood of causing significant impacts will:

- Avoid sensitive areas and/or limit operations in sensitive areas to minimize impacts (including cultural sites, wetlands, steep slopes, etc.).

- Minimize impacts on Covered Species and other wildlife and plant species not covered by the PCCP.
- If in woodlands, focus on removing ladder fuels while retaining larger trees.
- Retain some under-story and leave as much residual material on-site as possible (while minimizing surface fuel loads).

Generic prescriptions can only suffice to cover broad issues and avoid relatively obvious problems. In all cases, site-specific assessments and prescriptions for fuels treatments will be required. These may include field surveys to determine presence or absence of special-status wildlife or plant species not covered by the PCCP and/or Covered Species. Fuels treatment projects in conservation reserves managed by the PCCP implementing entity will be a Covered Activity under the PCCP. As such, they will be subject to programmatic mitigation. They will also be subject to CEQA. The lead agency responsible for environmental analysis may differ from the PCCP implementing entity in cases where funding is obtained from other sources e.g., CAL FIRE or Sierra Nevada Conservancy. In cases where federal funding is involved, they could be subject to NEPA. An environmental review process for fuels treatments has been incorporated into the framework for PCCP implementation. Consideration might be given to developing a programmatic environmental document covering the fuels management program comparable to a “Program Timber Environmental Impact Report” under the State Forest Practice Rules (Baldwin, Blomstrom, Wilkinson and Associates 2004).

7.0 WILD FIRE MANAGEMENT GOALS

The primary goal for wild fire management in conservation reserves is to minimize the potential direct and indirect (suppression-related) impacts of wild fire. This is to be achieved by reducing the probabilities that a fire will spread from a reserve to adjacent lands or vice versa and reducing the potential severity of fire within a reserve. Additional goals are:

- Minimize the environmental impacts of fuels management treatments and wild fire suppression.
- Minimize costs and requirements for maintenance.
- Use fire management as a tool to maintain and enhance the ecological characteristics of reserves.

8.0 FUELS TREATMENT ZONES

Reduction of fuels has three main purposes: 1) reduce fire severity within reserves; 2) reduce the ability for a fire to spread from a reserve to adjacent lands; and 3) reduce the ability for a fire to spread from adjacent lands to a reserve. An added benefit of fuels reduction is to create places where fire-fighting forces can stage and conduct suppression actions. It should be noted, however, that under extreme weather conditions, any fuels treatment could be ineffective. Therefore, fuels treatments are generally aimed at reducing fire severity and spread under mild to moderate fire weather conditions.

In forest and woodland vegetation types, reducing fire severity is achieved by limiting the potential for a fire to escalate from the ground where it typically starts to shrub and tree vegetation layers. A “crown fire” occurs when a fire reaches the tree layer and then spreads from tree to tree. When this occurs, burning crowns produce brands or embers that can travel large distances, especially under strong wind conditions, and cause spot fires. Separating vegetation layers vertically and horizontally can help to confine fires to the ground. It is necessary to also reduce surface fuels because build-ups of surface fuels lead to increased flame lengths that can then even reach separated vegetation layers (Figure 4).

Figure 4: This photograph illustrates the effects of surface fuel loads on flame length. The grass fuel in the foreground is burning at a few inches above the ground. The accumulation of woody material in the center of the picture has a flame length of several feet. Even if ladder fuels have been treated, fuel lengths of this magnitude have the capacity to reach shrub and tree canopies.

The issue of reducing fire severity in vernal pool grasslands is not as critical as it is in woodland communities because shrub and tree vegetation is nearly always limited or is absent altogether. Vernal pool grasslands can be managed to reduce surface fuels over relatively large areas with tools such as prescribed fire and targeted grazing.

In oak woodlands and riparian communities, it is not feasible to uniformly reduce fuel loads over extensive areas due to costs. Also, since conducting fuels treatments usually entails simplifying vegetation structure (i.e., reducing canopy height diversity) there are potential impacts on wildlife that may be unacceptable in a conservation reserve.

One approach that is being used for spatially extensive treatments in conservation areas in the Pacific Northwest is called “variable density” or “mosaic thinning” (Stringer 2004; Martinez 2008). In this approach, tree and shrub groups are vertically and horizontally separated to reduce potential crown fires and threat of spread. To minimize

habitat impacts, some groups may be left untreated and relatively dense. One objective of this approach is to maintain all species, all age and size classes of trees, and shrub cover for wildlife habitat.

Fuels treatments in woodlands that provide vertical and horizontal separation between trees, shrubs and ground cover can effectively prevent tree and shrub mortality due to fire. The results after a fire may be comparable to what would have occurred under historic fire regimes (Figures 5 and 6).

Figure 5: This picture illustrates a situation in which a ground fire burned through oak woodland without spreading to the tree canopy, resembling potential fire behavior under pre-European settlement conditions.

Figure 6: Some oak woodland in Placer County is naturally resistant to severe damage during fires because trees are separated from each other, ladder fuels are absent and surface fuels are maintained at low levels due to grazing. For the relatively dense riparian corridor traversing the lower part of this picture some selective thinning could reduce fuel loads.

While treatments within the interior of a reserve can reduce fire severity, reducing the potential for a fire to spread to or from a reserve may require treatments along roads used by the public and along property boundaries. Generally, these are treated by reducing ladder fuels and thinning to create a “shaded fuel break” in forested areas. In grasslands and shrub fields, fuel breaks along roads and property boundaries can be created by mowing, disking, prescribed fire or grazing.

Shaded fuel breaks range in size from 50 feet on either side of a road to a quarter mile in cases where fire-prone areas are adjacent to neighborhoods or other sensitive areas. They may not stop a fire but they are intended to make a fire drop from the canopy to the ground. Therefore, treatment of ground fuels is essential. Shaded fuel breaks serve to provide staging areas for fire suppression forces (Figure 7; CAL FIRE 2005; Ferrier et al. 2007).

Figure 7: Shaded fuel break at Hidden Falls Regional Park in oak woodland. The combination of the treated area and road will impair the spread of a fire, provide access to fire fighters and provide a staging area to fight the fire.

There is considerable information that demonstrates the effectiveness of shaded fuel breaks in reducing fire spread and enhancing suppression activities. For example, shaded fuel breaks in the 2007 Angora fire area performed well in protecting some neighborhoods (Murphy et al. 2007).

A comprehensive fire management plan for a conservation reserve will include mapping of treatment areas as described above and prescriptions for each area that balance ecological and environmental constraints with fire protection. In the next section, general prescriptions for fuels treatments in PCCP communities are described. These are followed by best management practices recommended for environmental protection.

9.0 FUELS MANAGEMENT OBJECTIVES AND PRESCRIPTIONS

9.1 Introduction

The overarching desired outcome of the PCCP fuels management program is to reduce the risk of habitat destruction caused by moderate to high severity wild fires. Risk reducing treatments must be undertaken without sacrificing the ecological values of conservation reserves or having significant impacts on Covered Species.

A second desired outcome for fuels management is to create conditions under which historic fire regimes or surrogates may be re-introduced to PCCP communities. For some communities, that entails reversing the ecological changes that have occurred over the past 100 years due to past land uses and fire suppression i.e., implementing pre-treatment to reduce excessive fuels before re-introducing fire. Re-introduction of fire is not considered feasible for all locations. Consequently, surrogates for fire both mechanical e.g., mowing, thinning, etc. or biological e.g., use of grazing or browsing animals may be used.

It is important to acknowledge the potential area of conservation reserves to put prescriptions and feasibility of implementation into perspective. Table 2 indicates the amount of land within the Plan Area currently in reserve status under Placer County and other management. It also indicates the area by community type that may be acquired as conservation reserves. Some lands may be acquired in fee title while other lands will be protected with easements or other tools, including regulation.

Table 2: Existing Conservation Reserves, by PCCP Community Type and Area Designated for Future Acquisitions (rounded numbers; accurate as of January 2017)

Vegetation Type	**Existing Reserves (acres)**	**Proposed Reserves (acres)**
Vernal pool/grassland	8000	24,000
Oak woodland	6000	10,000
Riparian*	500	2000

*Note that riparian only includes riparian woodland cover and does not include associated vegetation types or floodplain that is currently in reserves or potentially in new reserves.

The area of existing reserves in the Plan Area currently under management to reduce fire risk is unknown except for the County's Hidden Falls Regional Park (1,100 acres of oak woodland) which is actively managed to reduce risk, primarily with shaded fuel breaks (Ferrier et al. 2007).

At full implementation, the PCCP implementing entity will be faced with managing a relatively large amount of land to reduce fire risk. In cases where a conservation reserve is owned by other public or private entities and the implementing entity holds a conservation easement, that owner may bear some of the responsibility for reducing fire risk as required by county ordinances. In any case, it is presumed that priorities for

treatments will be programmatically based on inherent wild fire risk, proximity to human settlement, reserve uses and available funding.

9.2 Prescriptions by Treatment Zone and Community Type

Table 3 indicates what treatment zones, as previously described are found in the PCCP community types. Oak woodland conservation reserves have all treatment zones. They may be bounded by or traversed by public roads, they may have boundaries with other mainly private properties, or they may require internal fuel breaks and they may have fuels treatments applied to entire parcels and at the landscape scale.

Table 3: Treatment Zones within PCCP Community Types

Community Type	**Treatment Zone**			
	Road corridors	**Property boundaries**	**Fuel breaks (internal)**	**General (parcel)**
Oak woodland	X	X	X	X
Vernal pool/grassland	X	X	N/A	X
Riparian woodland	N/A	X	X	X*

*Riparian woodlands may be found in association with other community types and may be treated as part of a fuels management plan for the entire parcel.

Vernal pool grasslands may also have adjacent or intersecting roads and be adjacent to private properties. They are unlikely to require internal fuel breaks but they may require fuels treatments on a parcel scale.

Riparian woodlands will be components of conservation reserves mainly comprised of other community types or they may be separate conservation reserves (Figure 8). In either event, most will only have road crossings at defined locations. When created as separate parcels as for example in a conservation easement, they may have boundaries in common with private lands. As discussed below, fuel treatments within and adjacent to riparian woodlands may be an important step in reducing risk.

Figure 8: This picture illustrates a situation in which two conservation reserves are bounded by roads and private properties (oak woodland left center and riparian woodland at bottom). Fuels management would occur along roads and at property boundaries to prevent wild fire spreading either onto the reserves or from the reserves onto adjacent properties. Within the reserves, ladder fuels may be reduced to prevent crown fires.

9.2.1 Oak Woodlands: Roads, Property Boundaries and Fuel Breaks

In oak woodlands, the prescription for road corridors, property boundaries, and fuel breaks will be the same: shaded fuel break. In a shaded fuel break larger trees are retained and under-story ladder fuels are removed. Surface fuel treatment may include lopping and scattering slash, broadcast burning, pile and burn, grazing and/or spreading of chips or masticated materials. Shaded fuel breaks function by causing crown fires to drop to the ground when fire enters them. The width of a shaded fuel break at a specific location should be determined based on access, topography and existing vegetation structure. As a rule, 50 feet is considered a minimum effective width.

The shaded fuel break prescription proposed for conservation reserves requires retention of larger trees (>10 inches diameter breast height (dbh)), pruning of larger trees to a height of 8-10 feet above the ground and separation of residual trees by a distance ranging from 20 feet between trunks or up to 15 feet between drip lines (CAL

FIRE 2005). Small dead and down material (5-8 inches diameter, up to 5 feet long) is removed or treated in place. Trees with wildlife use and snags >18 inches that are not adjacent to a road or structure should be retained. Some under-story shrub cover may be retained, particularly species that provide wildlife food or cover. Shrub cover should be left in patches that are separated from trees (not within their drip lines). To minimize fire risk patches should be <5 feet tall and <5 feet wide. Larger patches are superior habitat for wildlife and may be retained where they are sufficiently separated from tree cover and potential sources of ignition.

A successful shaded fuel break will not only reduce fire severity but it will also promote development of larger trees by reducing competition on the treated site. This will move the treated area towards a future condition resembling pre-settlement oak woodland: relatively open stand with larger trees and open under-story. Re-introduction of fire or grazing to maintain the open under-story will be an essential maintenance practice.

9.2.2 Oak Woodlands: Parcel and Landscape Scales

The objective for oak woodlands at the parcel and landscape scales is to reduce wild fire risk while simultaneously moving the woodland into a more resilient ecological state. Where feasible this will include re-introducing fire as a critical ecological process.

Oak woodlands in Placer County are diverse in structure and composition and consequently, every parcel where large-scale treatment is proposed must have its own site-specific prescription.

Many oak woodlands are currently in an even-aged state that resulted from historical events such as clearing and/or wild fire. The desired future conditions in many cases will be a mosaic of tree age classes that is spatially patterned to mimic both individual tree and group mortality. Large residual trees should be retained as the “ecological anchors” of future stands (Martinez 2008). Emphasis should be placed on thinning from below to reduce ladder fuels and to enhance the vitality and growth of residual trees. Some smaller trees should be left so that all pre-treatment age and size classes are represented (Figure 9).

Figure 9: This picture illustrates the results of a treatment in which under-story trees are removed and larger trees are left. In the background of the picture, an untreated denser patch is left to reduce habitat impacts. The resultant stand consists of a mosaic of open and denser areas in which the treatments are strategically placed to reduce fire severity. Follow-up treatments would entail use of prescribed fire or grazing animals to control surface fuel loads.

To maintain habitat values, some proportion of defined treatment areas should be left un-thinned but pruned to reduce connectivity to surface fuels. Shrub patches should be retained as well but separated horizontally and vertically from residual trees.

Slash derived from thinning may be piled for later burning, chipped and spread or lopped and scattered. Piles to be burned should be located to avoid sensitive habitat areas. Larger materials may be piled for use by wildlife. In the latter instance, slash piles should be separated from residual trees and shrubs and surrounded by 5-foot wide fuel breaks. In certain instances, there may be opportunities for materials to be transported off-site for use as biomass power feedstock or firewood.

9.2.3 Riparian Woodlands

Riparian woodlands consist of linear corridors. Fuels treatments may be required at their edges where they interface with other vegetation types within conservation reserves or within private properties. For larger riparian reserves, they may require treatments in their interior. Riparian areas rarely support high severity wild fires unless they have been degraded (Figures 10 and 11; Beche et al. 2005). For example, in cases where exotic plants have invaded riparian areas and increased fuel loads they may be susceptible to devastating fire effects. This was the case in the 2008 Gladding Fire at the Doty Ravine Conservation Reserve. A fire that started in grassland was spread down Doty Ravine and off-site by dense Himalayan blackberry. Fire risk in

riparian areas can also be increased when de-watered floodplains have been invaded by upland species that have less resistance to fire (lower fuel moisture) than riparian species.

In general, fire hazard is greater along intermittent and ephemeral streams than perennial streams that tend to have more mesic microclimates, higher levels of soil moisture and higher levels of moisture in plants.

Figure 10: As indicated in this photograph, riparian vegetation along streams may survive wild fire in at least some cases because of fire behavior (fire tends to run up slopes rather than down slopes) and relatively mesic microclimate.

Figure 11: Fire occurred within this riparian woodland in 2001 eight years prior to the photograph. Mortality was spotty but several large trees were killed. Shrubs and deciduous trees have recovered. This pattern is typical for fires in riparian zones.

The actual width of a riparian woodland corridor will vary depending on stream type, geomorphology and location in a watershed. Studies of streams in western Placer County indicated that riparian corridors range from less than 50 feet up to several hundred feet on either side of a stream (Jones and Stokes 2005).

Rather than specify buffers based on stream class, treatment prescriptions presented here are based on the concept of different ecological zones. That is, they acknowledge that different locations within a riparian corridor perform different ecological functions, as described below. This concept was used by the State Board of Forestry to develop regulations for timber operations in watersheds known to support threatened or endangered fish species or listed as impaired under Section 303-d of the Clean Water Act (California State Board of Forestry 2009). The Board's regulatory approach is based on an extensive review of riparian functions conducted by a consultant group and input from a Technical Advisory Committee (Liquori et al. 2008).

The following prescriptions apply to perennial, intermittent and ephemeral streams supporting woody riparian vegetation. These are general and the actual prescription will be based on site-specific analysis. The distances provided below are based on regional analysis (Liquori et al. 2008) and should not be considered rigid standards.

1. The bed and banks of the stream (bankful limits) and the vegetation closest to the channel is referred to as the "core zone". This zone may extend up to 30 feet landward from the stream bank or to the outer edge of riparian vegetation whichever is less. Vegetation located in the core zone functions to maintain bank stability, provide shade to cool water temperatures and enhance instream productivity and habitats by providing litter and wood inputs.

   No vegetation removal or equipment operations should occur in the core zone unless justified by detailed environmental analysis. As a rule, no new stream crossings, roads or trails would be permitted. Exceptions may be allowed to either re-locate or upgrade deficient stream crossings. If thinning or vegetation management occurs near the stream, the debris should not be allowed to enter or cross the stream.

   It is acknowledged that there will be instances in which vegetation treatments in the core zone are desirable. This would be the case where the core zone is dominated by exotic species such as Himalayan blackberry. Fuels treatments may be permitted if no disturbance occurs within the bankful limits of the stream.

2. For streams with larger floodplains and riparian corridors the "inner zone" extends landward from the core zone for up to 70 feet or to the edge of the riparian vegetation whichever is less (total up to 100 feet). This zone may have the highest diversity of species and vertical vegetation structure diversity. It functions as wildlife habitat and as a source of woody debris and litter to the stream. Taller trees may also provide shade canopy to moderate water temperatures.

Use of ground-based equipment should be avoided within the inner zone. Hand treatments to reduce ladder fuels would be preferable with emphasis on removing exotic plants or upland species that have invaded the riparian zone.

Over-story trees or any tree greater than 10 inches dbh should not be removed except in limited cases to eliminate overlapping crowns, eliminate exotics or to remove trees that pose a hazard. Larger trees may be pruned to a height of 8-10 feet above the ground if live crown ratio can be maintained at 50 percent. Post-treatment canopy cover should be maintained close to pre-treatment levels.

Under-story vegetation may be thinned to reduce both vertical and horizontal continuity of fuels while maintaining wildlife habitat values. Individual plants or groups of plants up to 10 feet in canopy diameter may be retained if separated by 3-5 times the height of residual plants and not within the drip-line of residual trees.

3. Within most of the Plan Area, riparian zones will be 100 feet wide or less on either side of the stream. On larger streams, mainly at lower elevations, the riparian zone may exceed 100 feet. On those streams, the area beyond 100 feet is termed the “outer zone”. The primary objective within the outer zone is to interrupt the spread of fire from the upland to the riparian zone or vice versa.

4. Within riparian areas at distances >100 feet, a shaded fuel break prescription (as previously described for oak woodlands) may be applied if the use of ground based equipment is limited and work will generally be done by hand. If the use of ground based equipment is proposed, adequate mitigation measures should be implemented to prevent environmental impacts.

Figures 12 and 13 provide illustrations of the different management zones along streams in the Plan Area.

Figure 12: The core zone is delineated with the blue lines and includes the channel and adjacent vegetation up to 30 feet from the channel. In this picture, there are no locations where the riparian vegetation extends for more than 100 feet. This is typical for many of the streams in the foothills.

Figure 13: In this location, the floodplain is wide and there is a core zone (within blue lines), inner zone (between blue and yellow lines) and outer zone (between yellow and red lines). Vegetation removal would be avoided in the core zone, ladder fuels could be treated in the inner zone and a shaded fuel break could be implemented in the outer zone. Note that the riparian zone on the south side of the stream is narrower and only has a core zone and inner zone. Fuels treatments there would focus on the interface between upland and riparian vegetation.

On streams with especially large floodplains special conditions may exist. These streams may have multiple channels and riparian corridors (Figure 14). In such cases, the riparian zone boundary corresponds to the boundary between the geomorphic floodplain or channel migration zone and the upland. There may be more than one core zone and/or inner zone. Each of these should be considered independently for purposes of fuels treatments.

Figure 14: This picture illustrates a braided channel reach within Hidden Falls Park on Coon Creek. The channel in the foreground meanders through the floodplain. The main channel is in the background. In considering fuels treatments for this location, each channel should be designated with its own core zone. The inner zone lies between the two channels. The riparian zone boundary would be at the boundary between the geomorphic floodplain and the uplands. This situation can exist even if at certain times of the year only one channel is flowing.

In summary, in any riparian area, disturbance to the channel and vegetation immediately adjacent to it should be avoided. Use of ground based equipment should be minimized unless adequate environmental protection can be demonstrated (Poff 2006). Ladder fuels may be treated within the interior of the riparian woodland. Emphasis should be placed on fuels reduction at the immediate interface between the riparian and upland vegetation to interrupt the spread of fires (Figure 15). In many cases this interface will consist of grasses that can be controlled with grazing.

Figure 15: This picture illustrates a common condition along Placer County streams. The core zone is immediately along the stream (not shown). The inner zone is the relatively dense vegetation dominating the photograph. Fuels management objectives would be to reduce ladder fuels within the inner zone while retaining its ecological functions. More aggressive fuels management would occur at the interface with upland vegetation to reduce potential spread of fire from the riparian zone to the uplands or vice versa.

It should be noted that the County Aquatic Resource Program (CARP) would require implementation of buffers along streams that vary in size depending on stream class. The prescriptions recommended here for fuels treatments in riparian zones would permit limited vegetation management to reduce wild fire risk within CARP buffers.

9.2.4 Vernal Pool Grasslands: Road Corridors and Property Boundaries

The PCCP will advocate the protection of relatively large vernal pool complexes within conservation reserves. There will be circumstances in which vernal pool grassland conservation reserves are contiguous to roads, developed properties or agricultural properties (Figure 16).

Figure 16: This vernal pool conservation reserve is bordered by a road and urban development. The interface between the complex and the road should be managed to reduce fuel loads and interrupt the spread of fire.

Fuels at the interface between roads, other properties and vernal pool grassland complexes can be effectively reduced through grazing, shallow disking that would not disrupt the soil hardpan and/or mowing outside of the vernal pool environment (Joe Silveira, personal communication). Fuel breaks between vernal pool grassland conservation reserves and other properties perform a dual function. They can prevent fire from spreading property to property. They can also help reduce impacts of suppression if a fire occurs by negating the need to construct fire lines. If weather conditions and fuel loads allow, a fire contained within vernal pool grassland may be permitted to burn with little likelihood of permanent environmental damage if it occurs at the appropriate time of year. Use of herbicides should be avoided in vernal pool grassland and no equipment operation should be permitted within the topographic depression(s) defining the vernal pool ecosystem.

9.2.5 Vernal Pool Grasslands: Parcel and Landscape

Options for fuels reduction within vernal pool grasslands include the use of prescribed fire, grazing or mowing. Disking within the topographic depression of a vernal pool is not permissible. Any approach to management must be ecologically sound and have a primary goal of protecting and/or enhancing the resource. As previously noted, the fire hazard associated with vernal pool grasslands is limited as compared to woodland conservation reserves.

Mowing is not considered a feasible option for managing fuels at the parcel or landscape scales. Prescribed fire is sometimes used to reduce the cover of exotic

grasses and pest plants in vernal pool grasslands. These effects vary by site, are not long-lasting and may not result in an increase in native species cover (Jaymee Marty and Joe Silveira, personal communications). Prescribed fire does not appear to have beneficial hydrologic impacts on vernal pools (Jaymee Marty, personal communication). If applied, prescribed fire must be implemented at the right time of year to avoid impacts on special-status plant and wildlife species.

Grazing can effectively reduce fuels in vernal pool grasslands. Grazing may have the added benefits of maintaining native plant and aquatic organism diversity and pool hydrologic integrity and minimizing invasions by exotic species (Marty 2004; Marty 2005; Marty 2007; Pyke and Marty 2005).

Prescriptions for grazing in vernal pool grasslands should be based on site-specific conditions. Summertime grazing should be avoided. Early spring grazing is important for reducing thatch (Jaymee Marty, personal communication). Grazing between October to June is optimal, the grazed area should be as large as possible and cattle should be allowed to move freely while being directed away from sensitive areas with strategic placements of water and salt licks. Standards for residual dry matter, available in handbooks published by UC Cooperative Extension can be applied at the end of the season. Stocking rates should be based on site-specific conditions. In one instance, a stocking rate of one animal unit/six acres was found to be appropriate for a vernal pool grassland pasture (Jaymee Marty, personal communication). An animal unit consists of a cow and its calf.

At the vernal pool conservation reserves at Sun City (Lincoln) and elsewhere, sheep and goats are used for vegetation management. Sheep and goats also effectively reduce fuel loads and control thatch. One drawback of using sheep or goats is that they will prefer to eat forbs and broad-leafed herbaceous plants rather than grass.

The choice of grazing animal probably depends on site-specific conditions and land use history. But regardless whether sheep, goats or cattle are used, grazing is preferable to either fire or mowing as well as more feasible to implement for managing fuels and maintaining vernal pool grasslands. Grazing specialists should be engaged to develop specific prescriptions for vernal pool grassland conservation reserve units.

9.3 Monitoring and Maintenance

Fuels treatments in all treatment areas and all PCCP vegetation types must be considered long-term management commitments. Initial treatments may be done in stages over time or all at once. After initial treatments are completed, e.g., after completing a shaded fuel break along property lines, the clock starts running until follow-up maintenance is required. Therefore, maintenance should be explicitly addressed within prescriptions.

Monitoring provides the data to determine what maintenance should be undertaken and where and when it should be done. Management plans for conservation reserves, as

required by the PCCP, will include procedures for monitoring. Those procedures should address fuels.

Ideally, after initial treatments and some follow-up conservation reserves would be in a state that would be “self-maintaining”. That might mean they would be resilient to the effects of fire. If feasible, prescribed fire may have been re-introduced as a natural process. Although this objective might be relevant at some scale and in some locations, it will be impractical for most PCCP conservation reserves. It is more likely that most if not all conservation reserves will require some level of maintenance over time to retain vegetation conditions that ameliorate or prevent wild fire impacts.

For vernal pool grasslands, grazing, limited mowing and disking (outside the vernal pool environment) and selective use of fire will be viable approaches to both reducing fuels and maintaining the reserves. The principal maintenance issues will apply to oak woodlands and riparian woodlands.

In these woodlands, maintenance will mainly involve removing vegetation attempting to re-establish in the treated area (e.g., shoots of sprouting shrubs or trees, seedlings of undesirable species or in undesirable locations, etc.) (Figure 17). This may be done with machinery, by hand with hand tools, with prescribed fire, with herbicides or with grazing or browsing animals. The choice of approach depends on the vegetation community, environmental constraints, costs and other factors.

Figure 17: These photographs illustrate oak sprout re-growth (upper picture) and invasion of an opened area by exotic shrubs (broom) in treated areas 1-2 years after initial treatment.

Maintenance will be most important when sprouting oaks or shrubs are present or when opportunities for invasion by exotic plants exist. For example, treatments in live oak woodlands may stimulate sprouting and create unfavorable surface fuel loads within a couple of years after treatment. As noted below under “Implementation” costs for maintenance in situations like this can be nearly equivalent to costs for initial treatments especially if hand treatment is required.

9.4 Implementation

An important element of the Conservation Plan will be an estimate of costs for implementation. This includes costs for wild fire risk reduction. It is unknown what the annual or periodic magnitude of treatments (acres) will be. It is assumed that vernal pool grasslands will be treated annually with a combination of mowing (at property boundaries), grazing and perhaps prescribed fire. No initial treatments would be required to create a fire-resistant state. Oak woodland and riparian reserves will likely receive initial treatments (shaded fuel breaks, primarily but including parcel-scale treatments) soon after acquisition and will then be maintained at some interval either with animals, manual, chemical, fire or machine treatments.

Below is a cost table that was compiled from a variety of sources. These costs are for treatments only and do not include the costs for designing and permitting the treatments which will be in the range of 10-15 percent of total project costs. All costs presented below assume operations on moderate terrain (slopes generally <30 percent).

The wide range in costs for the same treatment reflects several factors. Low-end costs apply to treatments conducted with subsidized labor, in readily accessible locations and in less complex fuel conditions. High-end costs apply to treatments conducted by contractors or government employees paid at prevailing wage rates, perhaps in more difficult operating conditions. Another influence on costs is production rates. In relatively simple fuel types (brush) a masticator can operate on 2-5 acres/day. Production rates will be lower in more complex fuels. Production rates for manual treatments depend on the size of the crew but generally will be substantially lower than rates using mechanized harvesting.

Costs are not static and it is not likely that fuels treatment costs will decline in the future because of major technological breakthroughs. This should be considered in estimating future costs for maintaining conservation reserves.

Fees collected from project proponents include the costs for fuel treatment in conservation reserves. Additional sources of funding for fuels treatments may include grants and/or endowments associated with conservation reserves. For projects where a conservation easement is granted but private ownership is retained, the costs of fuel management will be included in required stewardship endowments.

Table 4: Fuel Treatment Costs ($/acre) Current as of October 2009

Initial Treatments			
Treatment	**Oak Woodland**	**Riparian Woodland**	**Vernal Pool Grassland**
Mastication (shaded fuel breaks and parcel scale)	$500-2500	$500-2500	N/A
Hand thin/pile and burn or lop and scatter (shaded fuel breaks and parcel scale)	$650-3500	$650-3500	N/A
Maintenance Treatments			
Mastication (shaded fuel breaks and parcel scale)	$500-800	$500-800	N/A
Hand thin/pile and burn or lop and scatter (shaded fuel breaks and parcel scale)	$1500-2000	$1500-2000	N/A
Broadcast burning	$325-1500	$350-1500	$100 (at property boundaries, along roads)
Graze/browse	$400-700	$400-700	$400-700
Mowing	N/A	N/A	$100 (at property boundaries, along roads)

Miscellaneous Treatments			
Chipping (alternative to pile and burn or lop and scatter)	$200-1100	$200-1100	N/A
Pile and burn	$250-700	$250-700	N/A
Pruning	$325	$325	N/A
Herbicide treatments (hand application)	$50-200	N/A	N/A

Notes: costs depend on economies of scale since costs for planning, moving in people and equipment or animals, preliminary treatments, etc. are relatively fixed. Sources: Pat Shea, Wildlife Heritage Foundation, Jeff Stephens, CAL FIRE, Robert Little, CAL FIRE, Ferrier et al (2007), Jeff Webster, Registered Professional Forester, Mike Brenner, NRCS and Holl (2008). Updated based on recent experience of the author with fuel treatments in El Dorado County (2016-17).

One potential source of revenue would be selling wood derived from fuels treatments. Placer County has a biomass utilization strategy that emphasizes deriving fuels for electricity generation from forestry activities (Placer County 2014). There is a possibility that fuels treatments in conservation reserves could generate materials for power production and be compensated at least in part for treatment costs. Logistic issues that would apply to utilization would include access for chipping equipment and chip trucks, amount of available materials and distance to the power plant. This option should be considered in specific instances where it appears to be feasible.

10.0 BEST MANAGEMENT PRACTICES FOR FUELS TREATMENTS

Every conservation reserve will have environmental and ecological conditions that will dictate specialized protection. Therefore, the BMPs described here should be considered a starting point and may be adapted to fit specific areas. Sources of Best Management Practices (BMPs) for fuels treatments include several Fire Safe Councils as well as Biological Opinions on fuels treatment projects on federal lands (Anonymous no date; Anonymous 2008; Diablo Firesafe Council 2008; USFWS 2003).

Certain constraints will apply to some conservation reserves and not others. Vernal pool grasslands are associated with level to undulating terrain where geologic and soil-related hazards will not be significant constraints on fuels treatments. Conservation reserves with oak woodland and riparian habitats will generally have a higher level of environmental constraint.

Stream Protection

Prescriptions for fuels treatments in or near streams will include the following BMPs:

1. Vehicular operations will be excluded within riparian zones unless adequate environmental protection can be ensured to prevent adverse impacts on soils and water quality.

2. No debris created by fuels treatments will be allowed to enter the channel.

3. No vegetation removal will generally occur in the immediate vicinity of channels (core zone). Exceptions may be permitted to control exotic invasive vegetation that contributes to high fuel loads.

4. Vegetation removal within the inner zone (up to 100 feet from the channel) is limited to under-story thinning to reduce ladder fuels.

5. Species and canopy diversity will be maintained within the inner zone to protect ecological functions.

6. Stream crossings will generally only be permitted at existing locations. Improperly functioning crossings may be upgraded or re-located during fuels treatments.

Seasonal and Permanent Wetlands

Many conservation reserves will be entirely vernal pool grasslands. Prescriptions for wildfire management in vernal pool grasslands incorporate the following BMPs:

1. No equipment operation or herbicide use is permitted within vernal pools and associated swales.
2. To the degree possible, vegetation removal is limited to grasses and other herbaceous species that are not components of the desired vernal pool flora.

In conservation reserves with oak woodland and riparian woodland, there may be inclusions of seasonal and permanent wetlands. CARP provides requirements for avoiding impacts in these wetlands. The general recommendation is that wetlands isolated from streams, flowing springs and seeps have 100-foot buffers wherein disturbance is avoided. For fuels treatments, this would imply exclusion of vehicles and restrictions on vegetation removal. These wetlands will usually have a low fire hazard unless they have been invaded by weedy exotic invasive plants such as Himalayan blackberry or brooms. Additional BMPs include the following:

1. Fuels treatments in seasonal and permanent wetlands, if any, will be confined to reducing exotic invasive vegetation posing a fire hazard.

2. No road or trail crossings through seasonal or permanent wetlands are permitted.

3. No dragging of trees or brush through seasonal or permanent wetlands is permitted.

Topography, Geology and Soils

Fuels treatments that would be considered for conservation reserves would rarely trigger concerns over geologic hazards or soil erosion. The operations that could cause concern would be mechanized harvesting on steep slopes or projects involving road or

trail construction. The following BMPs would be implemented to reduce potential for soil erosion or mass wasting:

1. No equipment operation is permitted on slopes steeper than 50 percent or in areas of known geologic instability except on existing roads.

2. To the degree possible, only existing roads and trails will be utilized for access to fuels treatments.

3. Erosion control measures, including water bars, silt fence, mulches and re-vegetation with native species will be applied to any action resulting in disturbed soils posing a risk to water quality.

Cultural Resources

Placer County has a rich history and a legacy of cultural resources spanning pre-European times, the Gold Rush era and up to the present. The presence and locations of many of these resources are known but many other resources remain to be discovered. In planning and executing fuels treatment projects, CAL FIRE requires consideration of cultural resources including a finding of no significant impacts and/or concurrence on mitigation measures by a CAL FIRE archeologist (Snyder 2007). The same standard will be applied to any fuels treatments planned for conservation reserves. The PCCP implementing entity will consult with affected tribal representatives and the State Historic Preservation Office on proposed projects during the CEQA review process. Surveys by qualified professionals may be required to determine if cultural resources are present in a proposed treatment area.

As a general policy, any cultural resources found within conservation reserves will be preserved. If cultural resources could be adversely affected by a fuels treatment, mitigation will consist of avoidance or modified practices e.g., hand treatments as opposed to mechanical treatments. Rarely will protecting cultural resources cause a fuels treatment to be infeasible.

10.5 Wildlife (General)

Conservation reserves are created to provide habitats for Covered Species and for other wildlife. Fuels treatments can result in direct impacts on wildlife habitat through removal of vegetation as well as displacement of resident wildlife (Manley 2007). These impacts can be minimized if all habitat components are retained and operations are timed to accommodate species' behavior. Typical BMPs will include:

1. Fuels treatment operations will not occur during the bird nesting season of March 1-August 31 (best to operate in fall and winter) unless surveys are conducted and adequate measures are implemented to avoid impacts.

2. On parcel and landscape scale, wildlife movement corridors will be maintained by selective retention of under-story shrub and tree patches.

3. Potentially sensitive habitats such as rock outcrops and wetlands will be flagged or fenced prior to treatment implementation.

4. Habitat components such as snags, mast producing shrubs and trees and large woody debris will be retained to the degree possible consistent with fire hazard reduction requirements.

5. In cases where potentially sensitive or special status species not covered by the PCCP may be associated with habitats proposed for treatments, field surveys may be conducted to determine their presence or absence and appropriate mitigation measures may be required.

10.6 PCCP Covered and Other Listed T&E Species (Plants and Wildlife)

The success of the PCCP as a conservation strategy depends on the effectiveness of the conservation reserves in providing habitat for Covered Species. Incidental take of species is permitted on that basis. If fuels treatments or wild fire result in habitat degradation or take of Covered Species, the basis for the PCCP is undermined. To ensure against those effects, the following BMPs will be applied to fuels treatments:

1. For all projects, potential occurrence of Covered Species and other special status plants or wildlife will initially be evaluated through a search of the California Natural Diversity Data Base and other information sources and an onsite habitat assessment. If special status species are likely to occur, field surveys may be conducted.

2. Temporal and spatial limitations on fuels treatments will be applied to avoid impacts on Covered Species and other special status plants and wildlife. These may include limitations on treatments during nesting and fledging seasons, imposition of buffers on nest sites or other habitat elements such as ponds and wetlands and prohibitions on removing habitat elements such as elderberry bushes, nest trees, etc.

10.7 BMP Implementation

A California Registered Professional Forester (RPF) or Certified Range Manager (CRM) shall be retained to develop fire management prescriptions for conservation reserves. An RPF or CRM should also supervise the work. To ensure that BMPs are properly understood and implemented, contractors or others engaged to do the work will be briefed on environmental conditions and required operational constraints prior to beginning the work. Contracts will include stipulations for BMP implementation and monitoring will be conducted by the RPF or CRM to assess compliance. Penalties may be assessed if contract requirements are violated.

11.0 RESERVE FIRE MANAGEMENT PLANS

The PCCP requires that every conservation reserve have a Habitat Management Plan. One component of that plan will address methods to reduce wild fire risk and prevent degradation of reserve quality by fire suppression actions if a fire occurs. The content of the fire management component is outlined below.

- Goals and Objectives for Reducing Wild Fire Risks
- Wild Fire Risk Assessment
- Prioritized Treatments
- Costs and Funding
- Implementation, including schedule, specified locations for treatments, access routes, and potential sites for suppression staging
- Maintenance
- Monitoring and Adaptive Management

It is assumed that the overall management plan will provide property descriptions, mapping of sensitive areas and resources, environmental analysis and mitigation measures for proposed land management activities.

There are templates and examples of fire management plans that can be used to guide the PCCP implementing entity (TSS Consultants 2007; Ferrier et al. 2007). One topic that deserves consideration here is the way wild fire risk is assessed.

Wild fire risk assessment can potentially be a highly technical process. CAL FIRE Forest and Resource Assessment Program (FRAP) uses modeling to produce generalized maps depicting “fire threat” ranging from moderate to extreme (Figure 18). These maps provide useful snapshots at the landscape scale but may not be adequate for parcel-level evaluations.

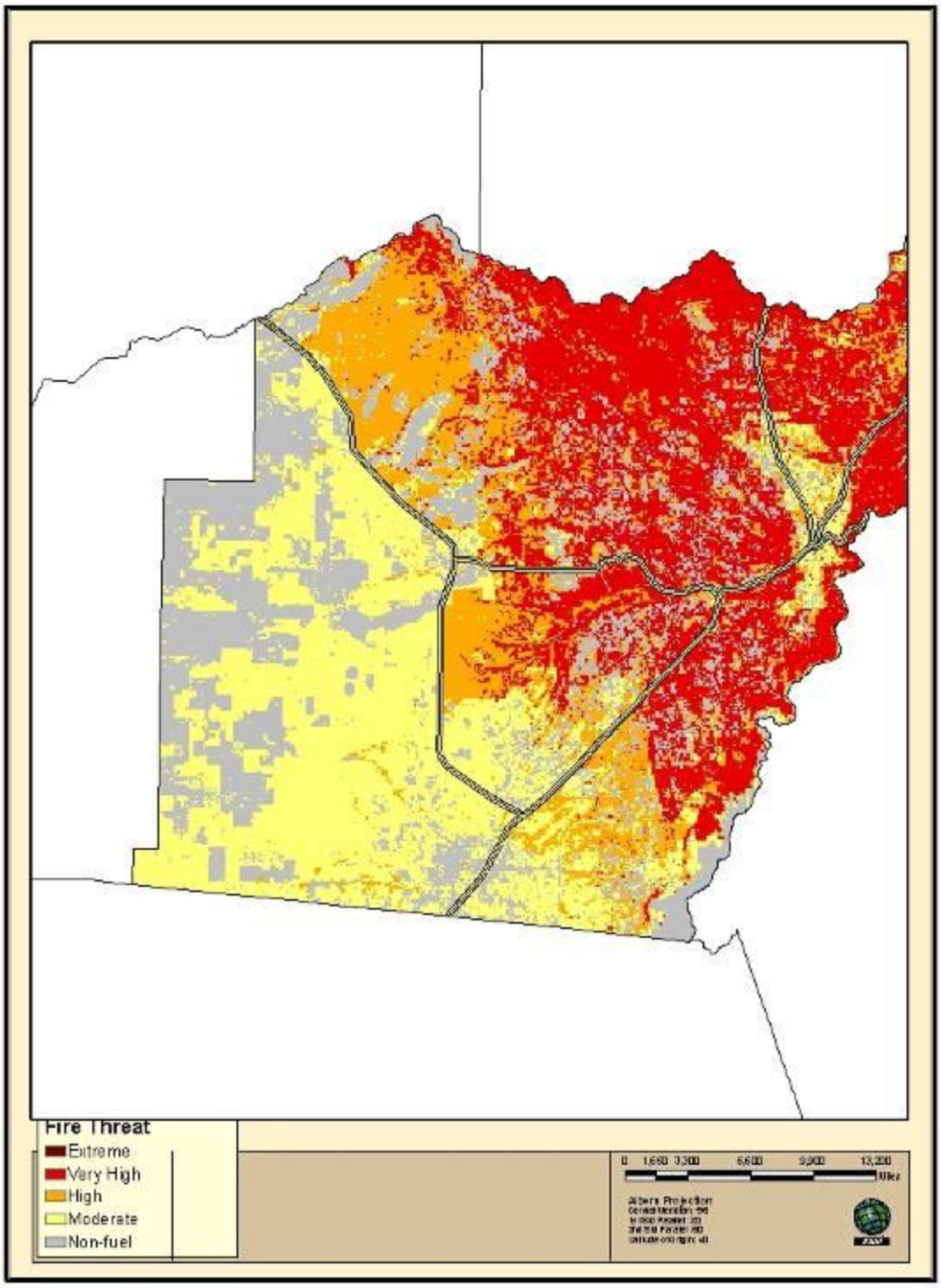

Figure 18: The above map is an example of “fire threat” maps produced by FRAP. It covers the PCCP planning area and beyond to Foresthill. Vernal pool grasslands are generally mapped as “moderate” threat and oak woodlands are mapped as “moderate” to “very high”.

Several land management agencies have identified a need to obtain higher resolution fire hazard mapping for their properties. Some have used FlamMap (available at www.fire.org/tools) to map fire hazard on their properties. As with most fire behavior models, FlamMap utilizes data on fuels, weather and topography to provide spatially explicit fire hazard maps. The results of modeling with FlamMap or similar models include spatial distribution of flame lengths (an important determinant of fire suppression strategies), crown fire potential and rate of spread. These predictions can be extremely useful for planning and prioritizing fuels treatments. Finney (2001; 2004) used FlamMap to develop simulations for strategic placements of fuels treatments and to hypothesize effective spatial patterns.

PCCP conservation reserves will be acquired over time. Although the general area where they will be acquired or where conservation reserves already exist is known, it is not possible to predict what the ultimate reserve pattern will be. Consequently, it is likely that fire risk assessment will be conducted on a parcel-by-parcel basis as properties are acquired. Modeling fire hazard at the parcel scale may not provide sufficient information for designing or locating specific treatments (Jessica Pierce, personal communication). The rationale for parcel-specific modeling would be based on the presence of critical resources such as housing tracts or infrastructure that could be affected by fire. In the absence of those resources, professional judgment of experienced managers along with existing data on fuels, topography and other conditions may suffice for fire risk assessment on conservation reserves.

In the future if a Community Wildfire Protection Plan is prepared for the Plan Area, modeling might be employed to evaluate alternative treatment strategies at the landscape scale. There is potential for a compatible relationship to develop between conservation planning and wild fire management. For example, conservation reserves that are treated to reduce fuels could provide the framework for wild fire protection throughout western Placer County.

12.0 SUMMARY AND CONCLUSIONS

- There are over 14,000 acres of vernal pools, grassland, oak woodland and riparian woodland within existing conservation reserves in western Placer County. These properties are managed by several public, private and non-profit entities. When the PCCP is fully implemented, the area of conservation reserves will increase by approximately 43,000 acres including 36,000 acres of the communities listed above.

- Wild fire presents a significant threat to the sustainability of current and future conservation reserves. Wild fires that may start on conservation reserves pose a threat to adjacent properties.

- The risk that a fire will affect a conservation reserve and the potential severity of a fire are determined by several physical, climatic and biological factors. From a management perspective, the principal thing that can be done to reduce wild fire risk

is to reduce fuel loads. Reducing fuel loads can affect the rate and direction of fire spread and the severity of a fire.

- Oak woodlands have the highest inherent wild fire risk. Overly dense riparian woodlands are second in degree of risk. Vernal pool grasslands have a relatively lower risk because only one fuel type is present (generally no shrubs or trees), terrain is moderate and the vegetation is adapted to fire.

- Several approaches are used to reduce fuels. The choice of approach is affected by environmental constraints, costs and other social and ecological considerations. The highest priority in conservation reserves is to protect the habitat they provide for Covered Species. Any fuels treatment must meet this requirement.

- Fuels treatments are aimed at preventing or at least impairing the spread of a fire and reducing fire severity. Fuels treatment zones include property boundaries, public roads and the interior of reserve parcels. In oak woodlands shaded fuel breaks may be used along roads and at property boundaries and within parcels to impair fire spread. Fuel breaks can be used at the periphery of vernal pool grasslands. Fuels treatments in riparian woodlands should focus on the interface between the upland and riparian vegetation.

- Oak woodland and vernal pool grasslands can be managed on a parcel or landscape basis to reduce fire risk. In woodlands, strategic fuels treatments to reduce ladder fuels would be appropriate. Grazing and limited prescribed fire is recommended for vernal pool grasslands.

- Fuels treatments will only be effective if they are followed up by periodic maintenance. This is most important in oak woodlands where rapid re-growth of woody vegetation is possible.

- Fuels treatments can be costly. Implementation of a fuels treatment program for the PCCP conservation reserve will depend on the ability of the implementing entity to procure funds.

- Best management practices must be included in fuels treatments to prevent or minimize impacts on streams, cultural resources, wetlands, soils, wildlife and PCCP-covered or other special status species. The strategy should emphasize avoidance of impacts.

- Every conservation reserve will have a Habitat Management Plan. Wild fire management will be a component of that plan. Although modeling methods exist for fire management planning, these may not be feasibly applied on a parcel-by-parcel basis. Instead, professional judgment and efficient use of existing information may be used for fire management planning.

- If a CWPP annex is prepared for the Plan Area, there is the possibility that conservation planning and wild fire management can be coordinated to create an overall optimal land use pattern.

- If a wild fire occurs within a conservation reserve it is important that provisions are in place to minimize environmental impacts of suppression activities (see Addendum 1). These are generally termed “minimum impact suppression tactics”.

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15.0 REFERENCES AND LITERATURE CITED

Anonymous. 2008. Best management practices for fuels treatments, San Diego Fire Safe Council. Unpublished manuscript. 13 p.

Anonymous. No date. Best management practices for protecting cultural resources: a guide for California Fire Safe Council managers and landowners for Community Wildfire Protection Plans in San Diego County, CA. Unpublished report. 13 p.

Arthur Carhart National Wilderness Training Center. 2008. Minimum impact suppression tactics implementation guidelines. Available at http://www.wilderness.net/index.cfm?fuse=toolboxes&sec=fire.

Baldwin, Blomstrom, Wilkinson and Associates. 2004. Draft program timberland environmental impact report for the Weaverville community fuel reduction project. Unpublished report prepared for Trinity Resource Conservation and Development Council, Inc., Weaverville, CA. 269 p.

Beche, L.A., S.L. Stephens and V.H. Resh. 2005. Effects of prescribed fire on a Sierra Nevada (California, USA) stream and its riparian zone. Forest Ecology and Management 218:37-59.

California State Board of Forestry. 2009. Board of Forestry Threatened or Impaired Watersheds rule review: draft regulatory proposal, February 27, 2009. Sacramento, CA. 104 p.

CALFIRE. 2005. Nevada-Yuba-Placer fire management plan. Unpublished report. 148 p.

CALFIRE 2007. CEQA Initial Study and Mitigated Negative Declaration: use of fire suppressant chemicals to aid in control of wildfires. CALFIRE, Sacramento CA. 49 p.
Diablo Firesafe Council. 2008. Best management practices guidebook for hazardous fuel treatments in Contra Costa County. Diablo Firesafe Council, Oakland, CA. 160 p.

Ferrier, D., R. Gresham and R. Ingram. 2007. Hidden Falls Regional Park vegetation, fuels and range management plan. Prepared for Placer County Facility Services, Auburn, CA . 89 p.

Field Supervisor, Nevada Fish and Wildlife Office (USFWS). 2003. Programmatic biological opinion for the Elko fire management plan: memorandum to C.R. Oke, Bureau of Land Management, Elko, NV. 53 p.

Finney, M.A. 2001. Design of regular fuel treatment patterns for modifying fire growth and behavior. Forest Science 47:219-228.

Finney, M.A. 2004. Chapter 9, Landscape fire simulation and fuel treatment optimization. In: J.L. Hayes, A.A. Ager, J.R. Barbour, (tech. eds). Methods for integrated modeling of landscape change: Interior Northwest Landscape Analysis System. PNW GTR-610:117-131.

Joint Fire Science Program. 2009. Reality show: SPLATS take a trip from theory to the Tahoe National Forest. Fire Science Brief 40.

Jones and Stokes Associates. 2005. Setback recommendations to conserve riparian areas and streams in western Placer County. Report to Placer County Planning Department, Auburn, CA. 232 p.

Liquori, M., D. Martin, R. Coats, L. Benda and D. Ganz. 2008. Scientific literature review of forest management effects on riparian functions for anadromous salmonids. Report to the California Board of Forestry, Sacramento, CA. 325 p.

Manley, P. 2007. Fuels treatment effects on wildlife. Powerpoint presentation, USDA Forest Service, Pacific Southwest Research Station, Davis, CA.

Martinez, D. 2008. Forest ecocultural restoration prescriptions and ecological principles for the Klamath-Siskiyou ecoregion and the north coast mountains of northwest California. Unpublished report to Yurok Tribe, Klamath, CA. 92 p.

Marty, J.T. 2004. Vernal pools are at home on the range. National Wetlands Newsletter 26(4): 1, 13-14.

Marty, J.T. 2005. Effects of cattle grazing on diversity in ephemeral wetlands. Conservation Biology 19:1626-1632.

Marty, J.T., 2007. Managing for biodiversity in vernal pool grasslands using fire and grazing. Pages 175-185 in R.A. Schlising and D.G. Alexander (eds.). Vernal Pool Landscapes, Studies from the Herbarium, Number 14, California State University, Chico, CA.

Murphy, K., T. Rich and T. Sexton. 2007. An assessment of fuel treatment effects on fire behavior, suppression effectiveness and structure ignition on the Angora fire. USDA Forest Service R5-TP-025, Lake Tahoe Basin Management Unit, South Lake Tahoe, CA. 38 p.

Placer County. 2007. Strategic plan for the wildfire protection and biomass utilization program. Placer County Executive Office, Auburn, CA. 48 p.

Poff, R.J. 2006. The use of mechanized equipment to restore stream environment zones in the Lake Tahoe Basin. Unpublished report to the Tahoe Regional Planning Agency. 17 p.

Pyke, C. R., and J. T. Marty. 2005. Cattle grazing mediates climate change impacts on ephemeral wetlands. Conservation Biology 19**:**1619-1625

Rheinberger, S. 2008. Harvesting systems that minimize impacts on sensitive areas: an overview. Powerpoint presentation, USDA Forest Service, Enterprise Team, Portland, OR.

Reinhardt, E.D., R.E. Keane, D.E Calkin and J.D. Cohen. 2008. Objectives and considerations for wildland fule treatment in forested ecosystems of the interior western United States. Forest Ecology and Management 256:1997-2006.

Snyder, W.E. 2007. California Environmental Quality Act compliance: use of Categorical Exemptions for fuel reduction projects. Letter to CALFIRE Region Chiefs, August 3, 2007.

Stringer, D. 2004. Silvicultural prescriptions and treatment areas for woodland habitats at Dillacourt and Logging Camp properties, Columbia Gorge, WA. Unpublished manuscript. 9 p.

TSS Consultants. 2006. Fire hazard assessment for the Montserrat development, Loomis, CA. Report prepared for Westwood Montserrat Limited, Gold River, CA. 55 p.

USDA Forest Service. 2006. Appropriate management response: guide book for National Forests. Unpublished draft report. 24 p.

USDA Forest Service, Pacific Southwest Research Station (PSW). 2008. Effects of fuels management in the Tahoe Basin: a scientific literature review. Unpublished draft report, USDA Forest Service Pacific Southwest Research Station and the Tahoe Science Consortium, Davis, CA. 326 p.

ADDENDUM 1

WILD FIRE SUPPRESSION IMPACTS

When a wild fire occurs, fire-fighting strategy depends on several goals. For most fires in the wildland-urban interface, preventing the spread of fire to houses, commercial facilities and infrastructure will be the highest priority. A second tier of priorities may include preventing damage to valuable natural resources such as timber. On occasion a high priority may be assigned to protecting biological communities with intrinsic ecological worth.

For conservation reserves situated near urban or rural residential development, suppression attack will be more aggressive than for reserves in remote locations. Aggressive suppression tactics in turn can cause both short- and long-term environmental and ecological damage. The effects of suppression can change the character of conservation reserves to the extent that they no longer serve the purposes for which they were acquired. The duration of suppression impacts depends on many things including resiliency of the vegetation, degree of damage to site conditions and actions taken to rehabilitate and restore the vegetation.

Fire suppression methods include the construction of fire lines, back burning, application of water from pumps or aerial drops, the use of fire retardants and suppressant foams, construction and use of helicopter landings, material storage and refueling areas, and fire camps (USDA Forest Service 2006). Potential environmental effects of these activities include increased erosion and mass wasting (landslides) from fire line construction, destruction of vegetation, contamination of streams, lakes and wetlands and wildlife harassment.

Fire retardants and foams are known to be toxic to aquatic species. They are typically applied to ridge top vegetation and adjacent to natural fire barriers such as roads, meadows, and rock outcrops. The risk to aquatic species is therefore relatively low. In cases where endangered aquatic species are involved, application of retardants and foams may be restricted within 300 feet of surface waters (USFWS 2003). CAL FIRE guidelines stipulate that aerial applications of retardants be limited to areas >300 feet from water courses and that ground applications be prohibited within 100 feet of water courses (CAL FIRE 2007).

Clearly the most significant damage to natural resources due to wild fire suppression is caused by activities such as fire line construction, back burning and encampments (Figures 1A and 1B). Fire line construction in steep terrain can result in the removal of large swaths of vegetation and soil disturbance over a large area.

Figure 1A: Fire line construction with bulldozers can result in short and long term environmental impacts particularly if potential fire lines have not been designated in advance.

Figure 1B: The practice of “back burning” to a fire line to prevent further spread can result in “collateral” damage to large habitat patches.

Other potential effects of suppression include the potential for introducing exotic plants and/or pathogens on machinery and equipment or during rehabilitation efforts.

BEST MANAGEMENT PRACTICES FOR WILD FIRE SUPPRESSION ACTIVITIES

Wild fire suppression impacts in conservation reserves can be limited through implementation of "minimum impact suppression tactics" (MIST). Although developed initially for wilderness areas, MIST procedures have application to any areas with important ecological and environmental values (USDA Forest Service 2006). They pertain to location of camps and helispots, construction of fire lines, protection of resources during suppression and fire fighter behavior. A key source of information on MIST is www.wilderness.net in "Toolboxes" under "Fire Management" (Arthur Carhart National Wilderness Training Center 2008). Additional information on MIST is included in USDA Forest Service (2006). It provides guidance for response to wild fire on National Forests but many of the concepts are applicable to wild fire on any lands. MIST is "any of a wide range of actions to minimize the appearance of suppression tactics". MIST is to be considered "in wilderness, wilderness study areas, or scenic areas…in or near trails, recreation areas or other areas of high concern" if implementation "does not compromise chances of (suppression) success."

To ensure implementation of MIST during an event within a conservation reserve, the PCCP implementing entity should provide mapped information to CAL FIRE and fire-fighting organizations for each conservation reserve that displays, at the minimum: 1) pre-determined fire lines; 2) fuel treatments; 3) potential staging areas, helispots and camps; and 4) key resources e.g., wetlands, habitats for covered species, known areas of instability, cultural sites, etc. The incident commander can use this information to direct suppression actions. Annual meetings should be held to update CAL FIRE on new acquisitions, the status of reserve management and changes in management due to monitoring and adaptive management. Operational meetings should be held annually to inform new personnel about the reserves and appropriate suppression tactics.

The California Department of Parks and Recreation (DPR) has worked with CAL FIRE, which acts as its fire department, to implement MIST (Richard Adams, personal communication). Standard language in DPR wild fire management plans includes:

- Use MIST to extent feasible without compromising firefighter or public safety.
- Include DPR resource advisor during (suppression) planning and strategy sessions.
- Discuss MIST during briefings and ensure MIST implementation.
- No motor vehicles driven off paved or dirt roads in meadows and riparian areas.
- No bulldozers in sensitive resource areas.
- No fire retardant drops near lakes, meadows, and riparian corridors.
- Consider use of natural barriers and cold-trailing.

- Minimize cutting of trees, burned trees, and snags.

DPR advises compartmentalizing reserves into logical units bounded by roads, trails, ridges, water courses, barren areas, fuels treatments or other non-sensitive areas where fire line construction is acceptable. Under favorable weather conditions, a fire can then be allowed to burn to those boundaries and avoid bulldozing through a sensitive area. Compartments immediately adjacent to developed areas will require aggressive direct fire attack. Protection of life and property always takes priority over protection of resources (Richard Adams, personal communication).

Some additional considerations include:

- Outline and map emergency access routes.

- Minimize use of heavy equipment for fire line construction e.g., utilize “wet fire lines” and hand-built lines” where practicable.

- Avoid back firing through sensitive habitats.

- Require post-fire rehabilitation to mitigate potential impacts of suppression actions. Ensure that post-fire rehabilitation efforts do not adversely impact ecological conditions e.g., through introduction of exotic plants.

For further information on fire suppression impacts and methods to avoid them consult www.fusee.org, the website for Firefighters United for Safety, Ethics and Ecology (FUSEE).

Appendix G

Take Assessment Methodology

Placer County Conservation Program

Appendix G. Plan Effects Model

February 2020

Estimates of plan effects on natural communities and covered species presented in the HCP/NCCP are derived from the effects model. The effects model is a series of Excel spreadsheets taking input from Geographic Information System (GIS) analysis of the Plan Area, incorporating a quantitative description of covered activities, and applying assumptions and policy decisions from the Placer County Conservation Program planning team. The Excel spreadsheets are part of a collection of supporting documentation, including the GIS coverages which provided input data. The supporting spreadsheets are maintained in active Excel format rather than as a static printed or PDF format so that reviewers can trace link precedents and dependents and see how information flows from input to output.

This Appendix to the HCP/NCCP describes the structure and content of the supporting documentation. The model set comprises six spreadsheets:

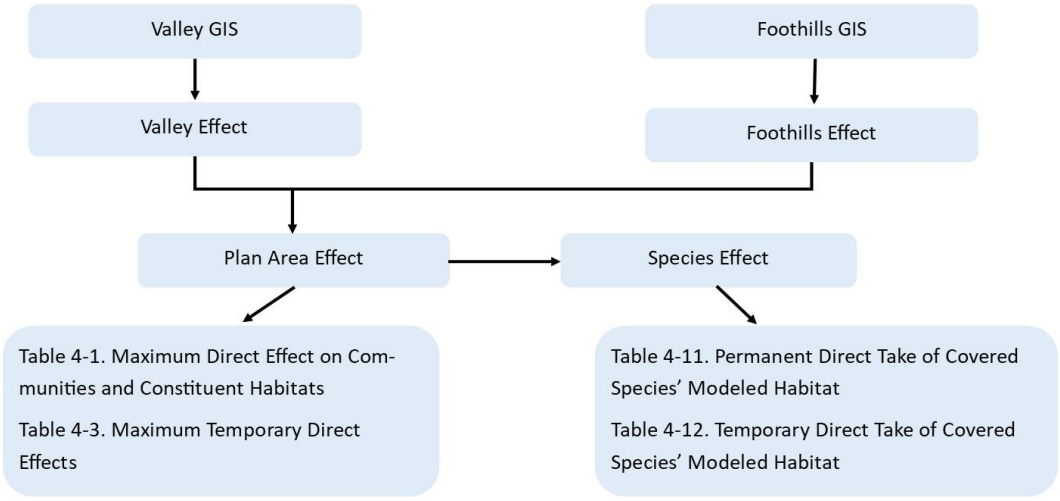
- Foothills Effect
- Foothills GIS
- Plan Area Effect
- Species Effect
- Valley Effect
- Valley GIS

The results match tables as published in the public review draft HCP/NCCP and include references to table numbers and titles. As a protocol, it is intended that a published table reflect the format of results in the effects model with each numerical value of the published table linked to calculations elsewhere in the model. These spreadsheets have gone through several iterations since their origin in 2005 and consequently they may include calculations and results which are no longer in use in the current HCP/NCCP.

The flow of data through the effects model spreadsheets yielding tables in Chapter 4 are illustrated in the flowchart here. The Valley and Foothills GIS spreadsheets input the attribute table from GIS shape files that intersect land cover, Stream System location, PCCP land status, and other data. The GIS spreadsheets use a pivot table to aggregate results of the individual polygons into a standard format for input into the respective Valley and Foothills effects spreadsheets. The effects spreadsheets process the aggregated GIS summary data, compare with estimates of covered activities, apply a factor to estimate constituent habitats embedded within the land cover mapping, and produce overall estimates of land conversion, take of constituent habitats, and conservation opportunities as illustrated in the diagrams found in the PCCP Figures 4-1 and 4-2. The Valley and Foothills effects results are input to the Plan Area effects table which further aggregates and produces results for tables in the HCP/NCCP, as input to the Cost Model developed by Sally Nielsen, Hausrath Economics Group, and quantitative characterization of alternatives to the proposed permit used in the EIR/EIS. The estimate of covered species effects is

based on a habitat model which applies spatial overlays and translates effects on land cover types and certain constituent habitats into estimated take of covered species habitat.

PCCP Effects Model Spreadsheet Flow Chart



Appendix H
Existing Open Space Lands

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1 Protection and Resource Management Status of Open Space Lands

The majority of the open space reserves (including both large and smaller open space areas) fall in the Valley (13,245.69 acres), with over half of that in Lincoln and the Lincoln planning area. Existing reserves in the Foothills within the PCCP boundary total 7,146.32 acres[1]. The total amound of open space within the PCCP boundaries is 20,392.01 acres of reserves. These existing reserves can serve as a foundation for conservation planning in the Plan Area. Most have significant biological values, some already provide habitat for species covered under the Plan and some are located where they could provide an anchor for the establishment of large, interconnected habitats.

Appendix Table H-1 identifies the properties, habitat type, covered species habitat relationship, property and easement ownership and total acres. These open space areas include large regional parks, private non-profit conservation lands, and private for-profit mitigation banks. Properties are further arranged geographically, identifying those open space areas that are in the Valley floor and those that are in the Foothills.

Most of these existing conservation lands will not be enrolled within the ultimate PCCP Reserve System. However, they will help achieve the biological goals and objectives of the PCCP because they provide habitat linkages, are a source of covered species for PCCP reserves and can be the nuclei for future PCCP acquisitions. The properties that are proposed to become part of the ultimate RAA are further described in Chapter 5, Section 5.2.5.

In addition to open space reserves, there is open space located within urban parks and in developments such as Sun City in Lincoln. Some of this land may provide value as wildlife habitat. Also, lands currently under Williamson Act contracts (both agricultural fields and range lands) also serve as open space and habitat. Although these areas have not been included in the acreage count for existing reserves lands, they do provide open space value to the overall Reserve System.

2 Placer County Placer Legacy Properties

The Placer Legacy Open Space and Agricultural Conservation Program was created to protect and conserve open space and agricultural lands and to implement the goals, policies, and programs of the 1994 Placer County General Plan.

The Placer Legacy program is not intended to represent the open space and conservation elements of the County's General Plan, which are already contained in the 1994 General Plan Policy Document. Instead, the program implements the policies within those elements by seeking to protect open space resources. In addition to implementing the General Plan, this program also supplements existing open space and conservation programs. County and city park departments continue to develop park and recreation facilities for County residents, responding to changes occurring in the County. Within the western Placer Plan area, roughly 6,700 acres have already been placed into open space/agricultural conservation under Placer Legacy program of which a

[1] Includes 48-acre Big Gun Preserve (property no. 19) located east of the Foothills sub-area. Property is included in this Appendix because it is a component of the PCCP Plan Area and will be used to implement part of the conservation strategy for the California red-legged frog.

portion is being considered as the initial reserve requirements under the PCCP. The larger parcels, listed below, contain grassland, blue oak woodland, and foothill riparian habitats.

2.1 Foothill Properties

The following four properties are under conservation easements held by Placer Legacy and are in the Foothill region of Placer County.

2.1.1 Hidden Falls Regional Park (Property 1)

Hidden Falls Regional Park is located in the Racoon Creek watershed between Auburn and Lincoln. The 220-acre open space park features seven miles of trails suitable for hiking, running, biking and horseback riding. Visitors can enjoy fishing, picnicking, wildlife viewing, photography and other passive recreational pursuits. A paved, American's with Disabilities-accessible trail, parking lot, equestrian staging area, and restrooms are available.

In addition, Spears Ranch which consists of 979 acres of grassland, live, blue and black oak woodland, foothill riparian woodland and freshwater marsh is part of Hidden Falls. Over two miles of Racoon Creek and its tributaries traverse the site. When combined with the adjacent Didion Ranch, over 1,100 acres will be available for passive recreational activities.

Hidden Falls Regional Park supports several vegetation types, including grey pine-oak woodland, cottonwood-willow riparian forest, vegetated sandbar, and ruderal vegetation. The majority of the property consists of blue oak, valley oak (*Quercus lobata*) woodland, and grasslands. The property contains a 2.5-mile corridor of valley foothill riparian habitat. Annual grassland is present throughout the southern half of the site.

Some of the wildlife species expected to utilize the property for shelter, foraging, and/or breeding habitat include red-tailed hawk, Anna's hummingbird, western rattlesnake, western harvest mouse, northwestern pond turtle, western fence lizard, barn owl, yellow-billed magpie, tree swallow, northern flicker, western bluebird, loggerhead shrike, western meadowlark, house finch, American goldfinch, gopher snake, and numerous other species.

Racoon Creek supports salmon spawning during fall-run Chinook salmon spawning season. Conditions are also appropriate for steelhead and potentially spring-run Chinook salmon. Pool depths are sufficient to maintain critical cool water temperatures for the rearing of fry for both salmon and steelhead.

Other special-status wildlife species have been identified as having the potential to occur at the project site including: Black rail, northwestern pond turtle, valley elderberry longhorn beetle, yellow-legged frog, red-legged frog and. Cooper's hawk, ferruginous hawk, and golden eagle, may occur at the project site as winter migrants or as occasional non-nesting visitors.

2.1.2 Hidden Falls Connectivity Trail (Property 2)

The Hidden Falls Connectivity Trail was acquired by the county in 2013 and is 23.12 acres of land that connects Hidden Falls Regional Park, Blue Oaks Ranch, and Taylor Ranch. The property and conservation easement is owned and held by Placer County. Habitats found on this property include annual grassland, foothill chaparral, and valley foothill riparian. The property is open to the public.

2.1.3 Sidehill Citrus Farm (Property 3)

Sidehill Citrus is a 48-acre, privately-owned organic mandarin farm. The property is privately owned, and Placer County holds the agricultural conservation easement. This easement will preserve the property's agricultural values in perpetuity. 2,500 mandarin trees, in addition to Meyer lemons and grapefruit, are grown on the farm.

2.1.4 Blue Oak Ranch (Property 4)

Through a gift from the long-time property owner, the County secured a conservation easement over 21 residential lots totaling 780 acres in 2004. Adjacent to Hidden Falls Regional Park in the northeast portion of the Plan area, this easement removed approximately 140 units of potential holding capacity from sensitive habitat and limits each remaining parcel to a three-acre use area. The easement preserves the rural residential landscape and open space character of this property, which is dominated by blue oak woodlands and riparian areas. A portion of the site contains an unnamed tributary to Doty Ravine. The easement does not permit public access. Wildlife on the site is the same as found on the adjacent Hidden Falls Regional Park above.

2.1.5 The Natural Trading Company (Property 5)

The Natural Trading Company is a 40-acre, privately-owned organic farm. Placer County acquired an open space and agricultural conservation easement on the farm. The property is comprised predominantly of agricultural and habitat land.

It contains roughly 20 acres of row crops, approximately seven acres of fruit orchards, several residential and agriculture structures, and two acres of riparian/stream habitat consisting of valley oak, live oak and willow. The area supports several migratory bird species and vernal pool fairy shrimp. There is no public access.

2.2 Valley Properties

The following three properties are under conservation easements held by Placer Legacy and are in the Valley region of Placer County.

2.2.1 Kirk Ranch (Property 6)

This 281-acre property in western Placer County near Camp Far West Reservoir is protected through the purchase of a conservation easement, thus preserving the property's long-standing history of grazing activities. Property assets include perennial and seasonal creeks and scenic views. In 2007, the County purchased a conservation easement on the property from owners John and Lynn Kirk to preserve the ranching operation, the blue oak woodland savannah and the scenic qualities of the property in perpetuity. The easement does not allow new permanent structures, cultivation, or the development of permanent crops such as orchard or vineyards. The Sierra Nevada foothill natural communities present on the property include blue oak (*Quercus wislizenii*), valley oak (*Quercus lobata*) woodland-savannah, grasslands, and smaller patch habitats including cliffs and granite rock outcroppings.

2.2.2 Sundance Lakeview Farms (Property 7)

The 577-acre property, located at the western edge of the Plan area, is protected through the purchase of conservation values that include floodwater conveyance and storage, flood management and wildlife habitat and agricultural purposes. The property is protected through a

137-acre easement purchased by the Placer County on Lakeview Farms, and a 440-acre Natural Resource Conservation Service (NRCS) easement on the Sundance Properties. Lakeview Farms represents one of the single largest privately-owned blocks of valley foothill riparian habitat along this section of Racoon Creek. The property extends along 2,820 feet of Racoon Creek and includes 14 acres of riparian habitat. The project was completely funded by a grant from the Department of Water Resources and includes opportunities for riparian restoration. No public access is permitted.

Some of the more common bird species observed on the property, or in Western Placer include: American widgeon, black-chinned hummingbird, black-crowned night heron, black-necked stilt, Canada goose, great blue heron, great egret, greater white-fronted goose, green-winged teal, herring gull, mallard, northern pintail, northern shoveler, ring-necked duck, snow goose, snowy egret, solitary sandpiper, tree swallow, tundra swan, white-faced widgeon, and wood duck. The site also benefits various songbirds.

2.2.3 Dry Creek School Open Space (Property 8)

Located in Roseville, the property adjacent to the Creekview Ranch Middle School was obtained by Placer County in 2013 in a land swap between the county and the Dry Creek Joint Elementary School District. The property is a potential reserve area that would be protected from development because of its importance as riparian habitat. Preserving the open space property could gain the county conservation or environmental mitigation credits that could be used to offset impacts on natural resources in areas where development is allowed. The property also provides a potential site for a segment of a proposed 75-mile bike path loop that would connect an existing Dry Creek trial with Roseville, Granite Bay, Folsom Lake, and Sacramento. The property is open to the public.

2.2.4 Bradley Property (Property 9)

This 399.7-acre property sits one mile east of State Route 65 in Sheridan, CA. The County purchased the property for permanent conservation in 2018 from Westervelt Ecological Services LLC. It hosts many non-irrigated vernal pool grasslands and marshes. The property includes 383.106 acres of vernal pool complex and 16.6 acres of aquatic/wetland complex. The property has been used by the Bradley family for seasonal cattle grazing for generations. Under the conditions of the Bradley property purchase, seasonal grazing would continue in line with a current grazing lease. Westervelt will serve as the interim land manager for a 3 year period during which time species surveys and baseline studies will be completed.

2.2.5 Markham Ravine Ranch (Property 10)

Markham Ravine Ranch will be a 297.2-acre Conservation Easement located immediately west of and adjacent to South Brewer Road and south of Markham Ravine, approximately 0.5 mile south of Nicolaus Avenue on the Placer/Sutter County boundary. The Conservation Easement area covers a Western Placer County In-Lieu Fee Program wetland restoration project constructed in 2018 comprising approximately 35.24 acres of restored vernal pool complex wetlands and 17.0 acres of Riverine/Riparian wetlands, and 244.95 acres of restored vernal pool complex grasslands. The land is owned in fee title and managed by Westervelt Ecological Services, LLC.

2.2.6 Scilacci Property (Property 11)

In 2019 Placer County obtained an agricultural conservation easement on 406 acres of this 456-acre property. The site supports a rice farm and contains portions of Raccoon Creek. The easement would preserve the agricultural production on-site and protect the farm from

development encroaching from the City of Lincoln. The Scilacci property is immediately west of Sundance Farms, and once under conservation, a greenbelt of land encompassing Mariner Conservation Bank, Rockwell Ranch, and Sundance Farms will be preserved.

The County intends to initiate the acquisition of a conservation easement on the roughly 56 acre riparian area associated with Raccoon Creek and pursue future riverine/riparian enhancement projects.

3 Placer Land Trust Properties

Placer Land Trust (PLT) was founded in 1991 as a community-based private nonprofit organization dedicated to preserving lands that hold valuable natural, historic, and agricultural resources in Placer County. Their mission is to work with willing landowners and conservation partners (e.g., Placer Legacy, Trust for Public Land, etc.) to permanently preserve natural and agricultural lands in Placer County for future generations.

Concurrent with the PCCP process, PLT is developing a Strategic Conservation Plan which focuses PLT's long term acquisition strategy on landscape-scale conservation and sustainable management. The Strategic Conservation Plan identifies geographic and programmatic focus areas for PLT, several of which fall within the PCCP boundary.

PLT works with willing landowners to permanently protect land mainly through either acquisition of fee title or by working with the landowner to place a conservation or agricultural easement on the land.

Fee title ownership allows PLT to have direct control over the land. As such, PLT actively manages these lands and may decide to restore portions of the land in keeping with their mission, allow public access, construct public recreation trails, or otherwise enhance the land and its public benefits. Fee title ownership is not ideal for all lands, especially lands that require involved management or in cases where the landowner desires to continue to live on the land.

PLT currently holds over a dozen conservation easements and agricultural easements. Conservation and agricultural easements are legal agreements between a landowner (including successors) and a land trust that permanently limits a property's uses in order to preserve its "conservation values". Conservation easements are commonly used to restrict future subdivision and land development. An "agricultural conservation easement" is very similar to a "conservation easement" except that an agricultural easement includes as part of its purpose the perpetuation of agricultural uses. Conservation and agricultural easements keep land in private ownership. Landowners can negotiate to retain certain rights to farm, graze, harvest timber, and build structures that are needed to manage the land, etc.

The following properties located within western Placer County have been preserved through PLT's partnerships outside of the County's Placer Legacy Program. Many of these properties may provide additional biological benefits to the PCCP and provide an opportunity for connectivity to the PCCP reserve area.

3.1 Foothill Properties

The following thirteen properties are under conservation easements held by PLT are in the Foothill region of Placer County.

3.1.1 Shutamul Bear River Preserve (Property 12)

The 40-acre Shutamul Bear River Preserve was acquired by PLT in fee title as part of PLT's Bear River Protection Program. The Bear River flows along two sides of the Preserve, which also contains valuable oak woodland and riparian habitat. The Preserve is one of the few foothill locations that host a large population of the rare California dogface butterfly, the California state insect, and its equally rare host plant, false indigo. The Bear River and the adjacent riparian area supports fish, otters, frogs, turtles, snakes, and various birds.

There is currently no public access on the Preserve. Aside from an unimproved dirt access road, the property is relatively untouched by man - a prime example of the dwindling wilderness left in Placer County.

3.1.2 Liberty Ranch Big Hill Preserve (Property 13)

Although secured by PLT, the County also contributed funds towards this 313-acre conservation and public access trail easement. PLT holds the conservation easement. Previously known as the Freiheit property, the preserve is located in the Big Hill-Garden Bar area spanning the Racoon Creek and Bear River watersheds in the northeast portion of the Plan area. The property has two perennial streams and numerous ephemeral drainages that flow northward into the Bear River from the northern side of Big Hill, as well as ephemeral drainages that flow southward into Racoon Creek from the southwest corner of the property south of Big Hill.

The property contains significant oak woodlands, granite rock outcroppings, seasonal streams and habitat for numerous wildlife species. The property supports cattle grazing. Liberty Ranch offers panoramic views of the Central Valley, Sutter Buttes, Coast Range and Sierra Nevada.

The property adjoins two Land Trust properties (the 160-acre Kotomyan Big Hill Preserve and the 321-acre Taylor Ranch Preserve), creating an 800-acre open space preserve that is very near to Hidden Falls Regional Park. The purchase includes a public access trail easement to be improved once additional trail connections are obtained.

Wildlife present includes Giant garter snake, Northwestern pond turtle, California horned lizard, Willow flycatcher, Foothill yellow-legged frog, mountain lion, bobcat, Valley elderberry long-horned beetle, Stebbins's morning glory, several species of hawk, and Pine Hill flannelbush.

3.1.3 Taylor Ranch Preserve (Property 14)

The Placer Legacy program was a funding partner in this acquisition effort led by PLT and the Trust for Public Land. PLT owns this property in fee title. The ranch property consists of 321 acres of oak woodlands situated less than a mile from Hidden Falls Regional Park. The site features a wide range of riparian and oak woodland and grassland habitat and is traversed by Racoon Creek. The property supports cattle grazing. The purchase includes a public access trail easement to be improved once additional trail connections are obtained. Taylor Ranch is designated as Type 4 open space.

Wildlife includes mountain lions, bobcats, and several species of hawk, including Swainson 's hawk, rodents, snakes, owls, and songbirds. Racoon Creek and its riparian area supports fish including Central Valley steelhead and Chinook salmon, otters, frogs, snakes, and several species of songbird.

3.1.4 Garden Bar Preserve (Property 15)

Garden Bar Preserve is a 912-acre blue oak woodland property along the Bear River that is permanently protected by a conservation easement held by PLT as part of its Bear River Protection Program. The goal of this program is to protect the Bear River watershed from Lake Combie to Camp Far West Reservoir. This area contains some of the last road less areas in western Placer County, as well as significant oak woodland, rangelands, and wilderness areas. Wildlife includes mountain lions, bobcats, and several species of hawk including Swainson's hawk, rodents, snakes, owls, and songbirds.

The Preserve contains the historic Garden Bar crossing and has historically been an important gathering and trading site for the Nisenan and other Native Americans. The property supports cattle and bison grazing. There is no public access to the Preserve.

3.1.5 Kotomyan Big Hill Preserve (Property 16)

Kotomyan Big Hill Preserve is a 160-acre preserve adjacent to both Liberty Ranch Big Hill Preserve and Taylor Ranch Preserve. The Preserve is owned by PLT in fee title. The site is primarily oak woodlands and supports cattle grazing. Wildlife includes mountain lions, bobcats, and several species of hawk including Swainson 's hawk, rodents, snakes, owls, and songbirds. There is currently limited public access to the Preserve. PLT is working with Placer County and area landowners to construct a public recreational trail connecting Hidden Falls Regional Park along Racoon Creek and up to the Bear River through this property.

3.1.6 Outman Big Hill Preserve (Property 17)

The Skip Outman Big Hill Preserve is an 81-acre parcel south of Bruin Ranch in the Auburn Valley area. It is owned by the PLT and the County has an Irrevocable Offer of Dedication for a multi-purpose trails across the property leading to the Harvego Bear River Preserve. The trail is part of a trail system originating at Hidden Falls Regional Park and extending north to the Bear River. The property contains a mix of blue oak woodlands, foothill pine, Sierra hardwood, annual grasslands/rangelands, and riparian habitat.

3.1.7 Bruin Ranch (Harvego Bear River Preserve) (Property 18)

The Bruin Ranch is a 1,773-acre property located along the Bear River in the Garden Bar/Big Hill Area in the foothills northwest of Auburn. The property is owned in fee by PLT and has a conservation easement on the property held by Placer County. The site is dominated by blue oak woodlands and represents the largest intact oak woodland under single ownership within the PCCP coverage area. The site also contains mixed hardwood/conifer forest, grassland, rock outcroppings, dry land pasture, ponds, and a significant amount of riverine habitat associated with a 3-mile reach of the Bear River along the property's northern boundary. A number of intermittent streams (31,388 linear feet of delineated streams) are on the property predominately within the Bear River watershed.

The County's conservation easement includes rights for trail construction for passive trail use as well as a staging area for a parking lot and restroom. No active recreation will be allowed. Ranching activities will continue as well as the establishment of one home site for an onsite caretaker.

This property provides high quality natural, restored and/or enhanced habitat for a number of sensitive species including vernal pool fairy shrimp, vernal pool tadpole shrimp, valley foothill elderberry longhorn beetle, Swainson's hawk, Central Valley steelhead, Chinook salmon,

California black rail, western pond turtle, burrowing owl, tri-colored blackbird, white-tailed kite, and the northern harrier.

3.1.8 Big Gun Preserve (Property 19)

The Big Gun Preserve is a 48-acre property east of the Foothills sub-area near Foresthill that provides habitat and protection for the largest known population of Federally Threatened California red-legged frog in the Sierra Nevada.[2] The Preserve is permanently protected by a conservation easement held by PLT and has been protected since 2010 through a public-private partnership with Westervelt Ecological Services and the US Fish & Wildlife Service. Habitat on the Preserve includes mixed conifer woodland, wetlands, and ponds. The Preserve also provides habitat for an array of Sierra Nevada foothill plant and wildlife species.

3.1.9 Columbia Wetlands Preserve (Property 20)

The Columbia Wetlands Preserve conservation easement protects 11 acres of wetlands and stream habitat adjacent to Labadie Farm. This area supports migratory birds including Swainson's hawk, western burrowing owl, northern harrier, tricolored blackbird, and white-tailed kite as well as other wildlife and preserves open space and scenery. This preserve also includes habitat for the vernal pool fairy shrimp. The Columbia Wetlands Preserve is not open to the public.

3.1.10 Labadie Farms (Property 21)

Labadie Farms is a 30-acre farm in Newcastle that has been protected since 1999. The Labadie family worked with PLT to place an agricultural easement on this property along a riparian corridor in western Placer County. The easement protects the farm from development encroaching from the west. This property will remain in agricultural production forever. The Labadie family grows a variety of products on the farm, including vegetables, fruits, and flowers, and crops are rotated from year to year. The agricultural easement prohibits development and harmful activities such as grading, dumping, and mining, while allowing the landowner to continue to use the property for sustainable agricultural use. Labadie Farms is not open to the public.

3.1.11 Oest Ranch (Property 22)

Oest Ranch is comprised of five separate Agricultural Conservation Easements totaling 427.4-acres. Oest Ranch is one of the oldest continuously producing ranches in Placer County, dating back to the Gold Rush era. In 2015 and 2016, Placer County acquired two easements for 113.4-acres, and an additional three easements in 2018 for 314-acres.

Traveling north on Hwy 49 as you leave the North Auburn area, Oest Ranch provides the first large open-space vistas on both sides of the highway. It offers separation between Auburn and the Lake of the Pines population center. Oest Ranch contains a large un-fragmented foothill oak woodland community, grasslands and irrigated pasture used for seasonal livestock grazing, and is located within the Placer County Conservation Plan (PCCP) Reserve Acquisition Area.

3.1.12 Bettencourt Preserve (Property 23)

Bettencourt Preserve is 85 acres of canyon land in Auburn along the American River. The Preserve has been protected since 2003 with a conservation easement by PLT. Habitat types in the Preserve include oak woodlands, canyon scenery, and wildlife habitat. Trails on the property

[2] The property is included in this Appendix as part of the Foothills open space properties because it is a component of the PCCP Plan Area and will be used to implement part of the conservation strategy for the California red-legged frog.

lead down to the river south of the confluence of the North and Middle Forks. The preserve also protects public access to the Western States Trail. The property is located between the Auburn State Recreation Area and Folsom Lake State Recreation Area, and the property connects these two public areas. Bettencourt Preserve is open to the public.

3.1.13 Beard Ranch (Property 24)

In 2019, PLT and County in cooperation with the State of California Sustainable Agricultural Land Conservation program purchased a conservation easement for a 137-acre property located at 4845 Bell Road in Auburn, CA. Since 1955 the property has been used by the Beard family for cattle operations and has been recognized by the state as high priority “Farmland of Local Importance”. Racoon Creek is located immediately adjacent to the ranch. The property boasts a 78 acres of blue oak woodland habitat and provides important connectivity to Raccoon Creek and other open space and viewshed benefits.

3.1.14 Laursen Bear River Preserve (Property 25)

In 2018, PLT in cooperation with the Emigrant Trails Greenway Trust and California Wildlife Conservation Board acquired the 361-acre preserve. The preserve is comprised of blue oak woodland and approximately 1.5 miles of riverine/riparian habitat associated with the Bear River. This property is adjacent to the Shutamul and Harvego preserves, does not include public access, but will be utilized for dogface butterfly research in association with the Bohart Museum of Entomology, U.C. Davis.

3.1.15 Meyer Preserve (Property 26)

In 2017, the PLT acquired an Agricultural Conservation Easement on the 21-acre Meyer Preserve located off Mount Vernon Road near Auburn. The property comprises an orchard and grazing pasture for cattle and sheep. The Conservation Easement was not funded with Placer County or state/federal funding.

3.1.16 Rock Creek Preserve (Property 27)

In 2017, PLT recorded a Conservation Easement on the 182-acre Rock Creek property, owned by PG&E. The land comprises oak woodlands, seasonal wetlands, and an open water reservoir providing public access and recreational opportunities. The easement protects the land as open space in cooperation with PG&E and the Pacific Forest and Watershed Lands Stewardship Council.

3.1.17 Odayan Preserve (Property 28)

In 2016, PLT acquired a Conservation Easement over 27 acres of oak woodlands with cultural resource protection associated with the Amazing Facts, Inc. project southeast of Sierra College Boulevard adjacent to the incorporated city limits of Rocklin and Roseville in the Granite Bay community. The land includes a seasonal wet meadow, pond, and riparian corridor.

3.2 Valley Properties

The following four properties are under conservation easements held by PLT are in the Valley region of Placer County.

3.2.1 Doty Ravine Preserve (Property 29)

Doty Ravine Preserve is a 427-acre native grassland property owned by PLT in fee title and the County holds a conservation easement on the property. The preserve includes native grasslands,

vernal pools and a stretch of Doty Ravine, which supports salmonids. The preserve also supports grazing opportunities for local grass-fed lamb and cattle, and local honey production. PLT makes use of the Preserve for various restoration and enhancement projects (stream and floodplain restoration, riparian and upland habitat restoration, wildlife breeding, wetland creation, etc.) as well as scientific research and limited public access (community tours, educational opportunities and related activities). PLT installed nesting boxes for native bird species including western bluebirds, wood ducks, American kestrels, and ash-throated flycatchers.

Keeping livestock out of sensitive riparian areas and re-planting degraded areas with native plants protects the health of these rich ecosystems. In the fall of 2008, Westervelt Ecological Services and High Ranch Nursery planted over 5,000 California native trees and shrubs in a 20-acre restoration site located along Doty Ravine.

3.2.2 Swainson's Grassland Preserve (Property 30)

Swainson's Grassland Preserve is a 469-acre native grassland property owned by PLT in fee title as part of PLT's West Placer Habitat Protection Program. The Preserve contains 19 acres of vernal pools, two acres of seasonal wetlands, three acres of seasonal wetland swales, and six acres of fresh emergent wetlands providing critical habitat for a host of waterfowl as well as the endangered vernal pool fairy shrimp.

Working with Westervelt Ecological, PLT is proposing to restore 17 acres of pasture to seasonal wetlands and wildlife habitats. The proposed work is currently undergoing environmental review.

The property supports cattle grazing. PLT makes use of the Preserve for scientific research and limited public access (community tours, educational opportunities and related activities). PLT has also created several artificial burrows to encourage Burrowing owl habitation. As of this writing, the burrows at Swainson's Grassland Preserve support a small population of burrowing owls.

The Preserve includes native grasslands and various wetlands which provides essential habitat for a wide variety of birds, notably Swainson's hawk and western burrowing owl. Other California State Protected or California Species of Special Concern that can be found on the Preserve include: Northern Harrier, White-tailed Kite, and Tricolored Blackbird.

3.2.3 Reason Farms Environmental Preserve (Property 31)

Reason Farms Environmental Preserve is 227 acres along Pleasant Grove Creek north of Roseville and has been protected since 2005 through PLT's West Placer Habitat Protection Program. The Preserve is owned by the City of Roseville and PLT holds the conservation easement for this property, which prohibits development and promotes habitat restoration. Reason Farms is part of over 2,000 contiguous acres of permanently protected habitat and an additional 1,700 acres currently maintained as open space by the City of Roseville. Annual grasslands, mixed oak woodland, and vernal pools are found on the preserve. Pleasant Grove Creek also contains valley riparian habitat and is used by great blue herons, egrets, and trout. The City of Roseville is re-creating vernal pools which will provide habitat for fairy shrimp. Reason Farms is not open to the public.

4 City of Lincoln Open Space Preservation

The City of Lincoln has several areas set aside as open space within the Plan area. Some were established to mitigate impacts of development projects. These preserved areas include biological resources that will remain protected in perpetuity.

4.1 Foskett Ranch (Property 32)

Foskett Ranch is south of Lincoln Boulevard surrounding Foskett Park. There are three separate preserve areas that are owned by the City of Lincoln and all carry deed restrictions (perpetual conservation easements). They are zoned Open-Space and were all required to be set aside for project mitigation. The northerly preserve is 55.1-acres in size and has Fairy Shrimp habitat within Hardpan Merhten vernal pools. There are also seasonal wetlands and a drainage swale with freshwater marsh habitat. Located in the mid-eastern portion is a 48.5-acre preserve, which has hardpan Merhten vernal pool Fairy Shrimp habitat, seasonal wetlands; and the riparian area of the Markham Ravine which is also a 100-year flood plain. At the south end is a 16.4-acre parcel that is primarily a seasonal wetland and the riparian area of the Markham Ravine which is also a 100-year flood plain.

4.2 Markham Ravine (Property 33)

The Markham Ravine open space properties are within and adjacent to a developed residential area. This open space was required to be set aside as for the mitigation for several project areas and contains a portion of Markham Ravine These consist of the Brookview I, II & III projects, Foskett Ranch, many subdivisions in the Aircenter project, and the closed (now in the decommissioning process) Nicolaus Road Wastewater Treatment Plant. More specifically:

- Brookview I, II & III projects: The approximate 13.5-acres are owned by the City of Lincoln in fee. They carry deed restrictions (perpetual conservation easements) a maintenance annuity was filed with the City to help offset maintenance costs of the Lighting and Landscape District.

- Foskett Ranch Project: Discussed above, the Markham Ravine Riparian area.

- Aircenter Project: Approximate 81.0-acres of Open-Space are owned by the City of Lincoln in fee. They carry deed restrictions (perpetual conservation easements) a maintenance annuity was filed with the City to help offset maintenance costs of the Lighting and Landscape District.

- Nicolaus Road WWTP: When fully decommissioned, the former wastewater treatment plant will have approximately 99.5-acres of Bulrush, Open Water, Valley Oak, California Annual Grassland, Riverine Seasonal Wetlands, Depressional Seasonal Wetlands, and the Ravine's 100-year flood plain. The area is owned in fee by the City of Lincoln.

Markham Ravine consists of seasonal ponds, marshes, wetlands, vernal pools, and valley-riparian habitats. Swainson's hawk, northern harrier, tricolored blackbird, white-tailed kite, Cooper's hawk, Vernal pool fairy shrimp, and vernal pool tadpole shrimp are supported in Markham Ravine. The Ravine is not accessible to the public.

4.3 Ingram Slough (Lincoln Crossing) Main, North, and South (Property 34)

This is a part of the Lincoln Crossing Project Area required to be set aside for mitigation. It surrounds several residential developments, including Meritgate Homes, The Courtyards, and Sorento subdivisions. Small strips of land north east of the main portions within the Lincoln Crossing subdivision are also included in Ingram Slough. This open space area includes portions of Ingram Slough, and includes Blue Oak woodland, grassland, fresh emergent wetland, Valley-foothill riparian and irrigated pasture habitats.

The 150.5 acres of open space located within Lincoln Crossing is owned by the City and has deed restrictions on what activities can be conducted in the preserve areas. The areas are maintained through the city's Lighting and Landscaping District. There are multi-purpose trails within the open space areas.

4.4 Ingram Slough East (Del Webb) (Property 35)

The Ingram Slough-East preserve is a 225.5-acre open space area within the Del Webb project. The Ingram Slough-East Preserve is to the west of the smaller Northwest Preserve Area, which is also part of the Del Web subdivision. Ingram Slough-East is intersected by Sun City Boulevard and Ingram Parkway. The area includes seasonal wetlands, vernal pools, saline wetlands, ponds, elderberry bushes. All Open-Space areas within the Sun City Lincoln Hills are owned and maintained by the Sun City Lincoln Hills Community Association and has limited public access.

4.5 Auburn Ravine (Property 36)

The 76.6-acre Auburn Ravine Natural Preserve Area located between Highway 65 and Lincoln Boulevard. It was required to be set aside for mitigation for the Lincoln Crossing Project and the 3D-North projects. The area also contains a 10.3 acre-park site within it, and NID has a gaging station within the park. The preserve comprises of riparian woodland and Blue Oak woodland. The Auburn Ravine supports a high diversity of aquatic plant and animal species including anadromous populations of steelhead trout and Chinook salmon. The area was dedicated in fee to the City of Lincoln and is subject to a perpetual conservation easement and is maintained by the City's Lighting and Landscaping District. The Auburn Ravine Natural Preserve Area is accessible to the public.

4.6 McBean Park Expansion (Auburn Ravine) (Property 37)

The 66-acre preserve area is located east of Highway 65 and west of Highway 193. It carries seasonal wetlands and is a heavily wooded riparian habitat within a 100-year flood plain. A portion of the McBean Park expansion can be access from McBean Park at the northwest corner of the property. The area has 4,700 linear feet of riverine habitat for endangered native Steelhead Trout and Salmon, waterfowl and other numerous species of indigenous wildlife. It was dedicated to the City by Del Webb in fee for mitigation of the Sun City project. It carries a perpetual conservation easement and is managed by the Wildlife Heritage Foundation. The McBean Park Expansion limited public access.

4.7 Northeast Preserve Area (Del Web) (Property 38)

This 65.3 area within the Del Web community was required to be set aside for mitigation - includes intermittent stream, seasonal ponds, oak groves, rock outcroppings, and wetland areas. The Northeast Preserve area is owned and maintained by the Sun City Lincoln Hills Community Association with assistance from the Wildlife Heritage Foundation. The site is accessible by multi-purpose trails.

4.8 Sterling Pointe (Formerly Eastpark) (Property 39)

Sterling Pointe is a small open space area that includes 9.5 acres of land that was required to be set aside as wetland mitigation for the 76.8-acre Sterling Pointe project area. It is immediately north of the 150-Acre Preserve and the Orchard Creek Lake Preserve. The 9.5 acres is made up

of two separate preserve areas. Within the 1.8± acre preserve along the northeast boundary, a total of 1.11 acres of jurisdictional waters will be preserved including 0.03 acre of seasonal wetland, 1.01 acres of freshwater marsh, and 0.07 acre of perennial stream. Within the 7.7-acre preserve that lies along the southeast boundary, a total of 1.34 acres of jurisdictional waters will be preserved. These consist of 1.03 acres of vernal pools, 0.21 acre of seasonal wetland, 0.06 acres of spring, and 0.04 acres of seep. Overall 2.45 acres of waters of the United States are preserved.

Sterling Pointe is not accessible to the public. The area has been dedicated to the City of Lincoln as a perpetual conservation easement with an endowment to manage and monitor the site in perpetuity. Maintenance of the site is also augmented through the Lighting and Landscaping District.

4.9 150 Acre Preserve (AKA Rodeo Grounds Preserve) (Property 40)

This are is required to be set aside for mitigation of the Del Webb project. The 145.3-acre area on the east side of Lincoln Parkway includes Orchard Creek and associated wetlands, a wetland preserve area, vernal pools, grasslands, and elderberry bushes. The area is owned by the City of Lincoln in fee, caries a perpetual conservation easement and is managed by the Wildlife Heritage Foundation. It was created to preserve habitat for vernal pool fairy shrimp. The 150 Acre Preserve is not open to the public.

4.10 Orchard Creek Lake Preserve (Del Webb) (Property 41)

This area is required to be set aside for mitigation of the Del Webb project and is west of East Joiner Parkway. The 60.4-acre area includes various wetlands, a small year-around lake on the north branch, and another year-around lake on the south branch. Owned and maintained by the Sun City Lincoln Hills Community Association with assistance from the Wildlife Heritage Foundation. There is a multi-purpose trail along the edge of the site.

4.11 Orchard Creek Preserve (Property 42)

The Orchard Creel Preserve is a fragmented 106.9-acre open space area within the Del Webb project containing intermittent streams, seeps and wetlands. Owned and maintained by the Sun City Lincoln Hills Community Association with assistance from the Wildlife Heritage Foundation. Public access is limited via multi-purpose trails in the preserve areas.

4.12 Twelve Bridges (Property 43)

The Twelve Bridges site is an 899.4 acre-area required to be set aside for mitigation. Includes habitat preserve and enhancement areas, stream corridors, vernal pools, wetlands, blue oak woodlands, blue oak-digger pine woodland, includes riverine environs, sensitive biotic habitat, annual grasslands. The mitigation site is owned by the City of Lincoln, Placer Holdings, and B&Z TB LLC, & JTS Communities. The multiple properties that comprise the Twelve Bridges mitigation area are spread throughout several large subdivisions. This preserve is classified as Type 2 open space. There is limited public access in the form of multi-purpose trails.

4.13 Seep Preserve (Property 44)

This 42.9-acre open space was required to be set aside for mitigation of the Del Webb project. It is a continuous located along the north side of Twelve Bridges Drive. The area includes natural wetlands and environs. Owned and maintained by the Sun City Lincoln Hills Community Association with assistance by the Wildlife Heritage Foundation. There are multi-purpose trails along the edges of the site.

4.14 Environmental Education Center (Property 45)

This 150.3-acre parcel of land was set aside as mitigation for the Twelve Bridges project area as an Open-Space Reserve. It was donated via a conservation easement to the Western Placer Education Foundation in 1999 to establish an interpretative center near the site of an ancient Native American encampment known as CA-PLA-606H; and to allow for exploration and study of this culturally and biologically significant area. The archeological site also contains terraced hillsides developed by J. Parker Whitney to cultivate citrus. The site also has elderberry bush resources, oak woodlands, jurisdictional wetlands and riparian wetlands (a portion of Pleasant Grove Creek). It is located at the southeastern-most corner of the City of Lincoln and borders Rocklin. The Environmental Education Center is a continuous open space area and is not intersected by residential development. This site has limited public access.

4.15 Three D Preserve (Property 46)

The 9.74-acre preserve was required to be set aside to mitigate for the 3D Project. It is south of Highway 65 and supports 6.52-acres of vernal pools and drainage swales considered habitat for vernal pool crustaceans. The wetland includes 6.255-acres of vernal pools and 0.268-acres of wetland swale. A conservation easement was granted to the City of Lincoln in March of 2005, together with sufficient funds to manage and monitor the site in perpetuity. Maintenance of the site is also augmented through the Lighting and Landscaping District. The 3d Preserve is not open to the public.

4.16 Three D South Preserve (Property 47)

The Three D South Preserve (also known as the John D. Vincent Vernal Pool Preserve) covers 312 acres and preserves grassland, seasonal wetlands, freshwater marsh, and natural and restored vernal pools and swales. The Preserve is located on East Catlett Road southwest of the city of Lincoln. The federally-listed vernal pool fairy shrimp has been found is some Preserve pools. Wildlands, Inc. owns and manages the Preserve. The Wildlife Heritage Foundation has oversight responsibilities.

4.17 Highway 65 Self Storage Preserve (Property 48)

The Highway 65 Self-Storage Preserve is an 11-acre grassland and vernal pool preserve near Athens Avenue between Lincoln and Rocklin. It is owned by the Highway 65 Self-Storage LLC and managed by the Wildlife Heritage Foundation. The preserve supports vernal pools and swales and seasonal wetlands embedded in annual grassland. A variety of grassland birds use the property for foraging.

4.18 Lincoln Hills Offsite Preserves (Property 49)

The Lincoln Hills Off-site Preserves encompasses 205 acres and include the Rodeo Grounds along Highway 65 and the McBean Parkway Expansion along Auburn Ravine in Lincoln. This preserve is owned and managed by the City of Lincoln, and the Wildlife Heritage Foundation has oversight responsibilities to ensure that the conditions of the conservation easement are enforced.

4.19 Lincoln Hill Orchard 80/Riparian Zone Preserves Preserve (Property 50)

The 80-acre Orchard Creek and Riparian Preserve is located within a portion of land roughly between Twelve Bridges Drive and Stonebridge Avenue. Wildlands, Inc. owns and manages the Preserve, and the Wildlife Heritage Foundation has oversight responsibilities. The Preserve protects annual grassland, vernal pools and swales, and an ephemeral stream channel within a developed residential area.

4.20 Orchard Creek Conservation Bank (Property 51)

The Orchard Creek Conservation Bank covers 648 acres north of Athens Road between Lincoln and Rocklin. It is a continuous property and includes annual grassland, vernal pools and swales, and Orchard Creek. The vernal pool fairy shrimp, vernal pool tadpole shrimp, and several special-status plant species are known to occur in Bank habitats. The Bank is owned and managed by Wildlands, Inc. and the Wildlife Heritage Foundation has oversight responsibilities.

4.21 St. Joseph's Church Preserve (Property 52)

The St. Joseph's Church Preserve is a two-acre open space area in the City of Lincoln. It is owned by the Roman Catholic Diocese and managed by the Wildlife Heritage Foundation. The Preserve supports seasonal wetlands, annual grassland, oak woodland, and a small seasonal stream.

4.22 West Placer Schools Conservation Bank (Property 53)

The Western Placer Schools Conservation Bank encompasses 225 acres north of Moore Road and west of Dowd Road west-southwest of the City if Lincoln. The Wildlife Heritage Foundation has oversight responsibilities. Habitats in the bank include grassland, vernal pools, and swales. Both the vernal pool fairy shrimp and vernal pool tadpole shrimp have been found in the Bank pools.

5 Other Open Space within the Plan Area

There are other areas that are protected within the Plan area that include conservation easements, private or public land holdings or mitigation lands. Although these lands have been protected for various reasons, they contribute to connectivity and help build upon the PCCP reserve area. They are as follows:

5.1 Foothill Properties

The following open space property is owned by the Bureau of Land Management and is in the Foothill region of Placer County.

5.1.1 Bureau of Land Management (Property 54)

The Federal Bureau of Land Management owns and manages approximately 143 acres located along the south side of the Bear River. This area has similar habitat types as those found on the Garden Bar Preserve and includes blue oak woodlands and other hardwoods. The northern boundary of the property is the Bear River that separates Placer and Nevada Counties. There is no public access to the site.

5.2 Valley Properties

The following 23 properties are in the Valley. The ownership of these properties varies between private, public and non-profit entities.

5.2.1 Hanley Ranch (Property 55)

The 185.95-acre Hanley Ranch is located in the Racoon Creek watershed approximately 5 miles north of the City of Lincoln. The property is bisected by one mile of Racoon Creek at the transition between the central valley and the Sierra Nevada foothills. It was acquired by Caltrans for mitigation for state highway construction impacts outside of Placer County. The site contains blue oak woodland, grassland, valley foothill riparian and riverine habitats. The site will be maintained in perpetuity as habitat. No public recreation or uses are proposed and no public access is available.

5.2.2 Sheridan East Vernal Pool Preserve (Property 56)

The Wildlands Sheridan East Mitigation Bank preserve encompasses 342 acres and provides compensatory mitigation for the following habitats which have been created and restored by Wildlands: vernal pools and swales; seasonal and perennial marsh; seasonal wetland; perennial stream channel; oak woodland; open water marsh; elderberry scrub and savanna; riparian scrub and woodland. Public access is not permitted.

5.2.3 Silvergate Mitigation Bank (Property 57)

The Silvergate Mitigation Bank (SMB), which is owned by the Sheridan Mitigation Corp and maintained by Restoration Resources, Inc., is a mitigation bank established in 1993 providing wetland mitigation credits, the first in the western U.S. to be authorized to sell compensatory mitigation credits. The 655-acre SMB contains constructed vernal pools, seasonal wetlands, riparian wetlands and emergent marsh. In addition, valley oak /elderberry savannah habitat was constructed at this site to provide mitigation for the valley elderberry longhorn beetle (VELB) and future valley oak impacts. The bank has additional oak, VELB, and vernal pool creation credits available. The SMB is not open to the public.

5.2.4 Yankee Slough Conservation Bank (Property 58)

Located on 732 acres of rolling foothills in Placer County, the Environmental Stewardship Foundation manages Yankee Slough Conservation Bank for property owner Conservation Resources LLC. Yankee Slough contains oak savannah, riparian, and grassland habitat. In addition, vernal pools and seasonal wetlands have been created and preserved at the site. Species that may occur onsite include vernal pool fairy shrimp, VELB and Swainson’s hawk. Yankee Slough is not open to the public.

5.2.5 Rockwell Ranch (Property 59)

This 519-acre property was acquired by Caltrans to preserve existing vernal pool resources as part of the mitigation requirements for the construction of the Highway 65 Bypass. The property

contains grassland and vernal pools and is adjacent to the Lakeview Farms conservation area. There is no public access to the site.

5.2.6 Nicolaus Road Preserve (Property 60)

This 80-acre preserve is located along Markham on the north side of Nicolaus Road, east of Brewer Road, within the floodplains of Markham Ravine. It contains floodplains, riparian areas and aquatic habitat. The preserve is not accessible to the public.

5.2.7 Mariner Vernal Pool Conservation Bank (Property 61)

This bank is approximately a 160-acre site located adjacent to the conserved Rockwell Ranch property outside of Lincoln. It is managed by Westervelt Ecological Services. The Center for Natural Lands Management holds a conservation easement on the property. The land is comprised of vernal pools, wetlands, and uplands, and provides high quality habitat for vernal pool tadpole shrimp and vernal pool fairy shrimp. Monitoring on the site also resulted in the positive identification of a conservancy fairy shrimp; the first occurrence in Placer County. This site is not accessible to the public.

5.2.8 Lincoln Global Communications Site (United States Air Force) (Property 62)

This 160-acre property is a US Air Force facility off Moore Road. According to Placer County parcel data, the property is split into two parcels and is still owned by the Federal government under the jurisdiction of the Beale Air Force Base and is functionally part of the 2049th Communication Group. PCCP community types potentially found on site are grasslands, vernal pools and seasonal wetlands. The USAF site is not open to the public.

5.2.9 Moore Ranch Conservancy (Property 63)

This property is located along the southern bank of Orchard Creek within the Lincoln area owned and managed by the Moore Ranch Conservancy. It's approximately 145 acres and includes created vernal pools, wetlands, riparian, and grassland habitats as well as floodplain areas. An HRN Off-Site Environmental Endowment has been created to provide permanent funding for the maintenance, monitoring and reporting requirements of the 404 Permit for the HRN Off-Site preserve. The Moore Ranch Conservancy does not have public accessibility.

5.2.10 Warm Springs (Property 64)

Warm Springs is a privately-owned 96.2-acre area with a conservation easement with PLT. It abuts the Moore Ranch Conservancy in the Lincoln area. The site consists of grassland, wetlands, and vernal pools. Bird species like the Swainson's hawk, northern harrier, tricolored blackbird, and white-tailed kite. Vernal pool fairy shrimp are also supported in this area.

5.2.11 Aitken Ranch (Property 65)

Aitken Ranch is a 312.55-acre property located along Auburn Ravine that is protected by a habitat conservation easement held by the Department of Fish and Wildlife. It contains a relatively large area (approximately 67 acres) of valley foothill riparian habitat, one mile of Auburn Ravine, related sloughs and wetlands, valley grasslands and preserved and created vernal pools. The property, owned by Wildlands, Inc., is managed for its habitat conservation values and includes grazing activities for habitat management purposes. No public trail access is presently permitted on this property however there is a 30' wide access easement allowing for Placer County to establish a public, non-vehicular, multipurpose trail parallel to Auburn Ravine in the future.

5.2.12 Cummings (Property 66)

This is a habitat conservation easement that encumbers approximately 62 acres in size and located in the southwest portion of the Plan area along Lower Curry Creek. The site is encumbered in order to protect a vernal pool compensatory mitigation area and existing habitat values. The area is not open to the public.

5.2.13 Locust Road Mitigation Bank (Property 67)

The Locust Road Mitigation Bank is a 79-acre site owned and managed by Wildlands, Inc. as a mitigation bank for seasonal wetlands, compensatory vernal pool replacement and Swainson's hawk foraging habitat. The site is located near the Sutter County line between Locust Road and Brewer Road. There is no public access.

5.2.14 Dry Creek Greenway (Property 68)

The Dry Creek Greenway is a 133-acre public land holding along Dry Creek west and north of the City of Roseville. This is a portion of the larger Dry Creek Greenway open space area envisioned to provide a continuous system of preserved lands and habitat while providing areas for passive recreation. This open space greenway contains natural waterways, riparian corridors and other aquatic habitat. The area is open to public access.

5.2.15 Ahart Preserve (Property 69)

The Ahart Preserve contains about 94 acres of vernal pool grassland and supports both natural and constructed vernal pools. The predominant soils in the preserve are derived from the Mehrten Formation, an ancient volcanic mudflow. Mehrten soils are fairly thin and overlay an impermeable layer of cemented volcanic ash and cobble. The Ahart Preserve has both natural and constructed vernal pools. The preserve supports populations of *Gratiola heterosepala* (Bogg's Lake hedge-hyssop), a plant listed as endangered under the California Endangered Species Act, in both natural and in constructed vernal pools. The upland and aquatic habitats on-site support a variety of native plants, amphibians, reptiles, birds, and mammals. The site is managed by Habitat Management Foundation.

5.2.16 Toad Hill Ranch Mitigation Bank (Property 70)

The Toad Hill Ranch Mitigation Bank is 1,631 acres of land located northwest of Roseville, including a PLT 1,000-acre conservation easement, on which Wildlands, Inc. owns and manages a mitigation bank for vernal pool creation/restoration credits, seasonal wetland credits and Swainson's hawk foraging area credits. The site includes native grasslands, created/restored vernal pools and other wetlands, and provides essential habitat for a variety of wildlife. The property supports cattle grazing as part of the reserve management plan for the property. There is no public access. It is adjacent to PLT's 221-acre conservation easement on the Reason Farms Environmental Preserve in Roseville and over 2,000 contiguous acres of permanently protected habitat currently maintained as open space by the City of Roseville. The Toad Hill Ranch Mitigation Bank has no public access.

5.2.17 Douglas Ranch Preserve (Property 71)

Douglas Ranch Preserve is a 31-acre preserve in 11 lots within the Douglas Ranch subdivision in Granite Bay. The Center for Natural Lands Management is the preserve steward for the conservation easement. The Preserve contains 6.73 acres of existing seasonal wetlands and 0.96 acres of constructed seasonal wetlands. The remaining acreage is a mixture of foothill oak woodland and grassland. The Preserve was established for wetland and oak tree mitigation. Douglas Ranch Preserve is not open to the public.

5.2.18 Greyhawk Preserve (Property 72)

Greyhawk Preserve is a 31-acre preserve in 4 lots within the Gladstone Park subdivision in Granite Bay. The Center for Natural Lands Management is the preserve steward for the conservation easement. Greyhawk Preserve protects oak woodlands, annual grassland, and approximately 11 acres of riparian woodland and wetlands and 1 acre of seasonal wetlands. Blue and interior live oaks, foothill pine, cottonwoods, and willows are present in the Preserve. Greyhawk Preserve was established for wetland mitigation and is not open to the public.

5.2.19 Miner's Creek Preserve (Property 73)

Miner's Creek Preserve is a 25-acre preserve within the Monte Sereno subdivision in western Placer County. The Center for Natural Lands Management is the preserve steward for the conservation easement. The Preserve contains oak woodlands, annual grassland, riparian woodland, seasonal wetlands, and valley-foothill riparian corridor along Miner's Ravine. The Preserve was established for wetland mitigation and is not open to the public.

5.2.20 The Grove Preserve (Property 74)

The Grove Preserve consists of several plots for a total of 9.75 acres of open space for a planned development in Granite Bay. The Center for Natural Lands Management holds a conservation easement for The Grove, and there is no public access. Habitat types at The Grove are mixed oak woodland and annual grassland.

5.2.21 Croftwood Preserve (Property 75)

The Croftwood Preserve in Rocklin is a 22-acre site that supports approximately 12 acres of marshes and ponds, and riparian habitat along Secret Ravine Creek. Oak woodland and non-native grasslands are also present at this property. Croftwood Preserve is owned by Tim Lewis Communities, and the easement is held by the Habitat Management Foundation. There is no public access to the preserve.

5.2.22 Auburn Honda Preserve (Property 76)

The Auburn Honda Preserve is a small riparian corridor located off Highway 49 in Auburn and owned by Auburn Honda. The Habitat Management Foundation holds the conservation easement. The property is approximately 2.6 acres, and includes a riparian corridor with woody and herbaceous vegetation.

5.2.23 Antonio Mountain Ranch Conservation Bank (Property 77)

Antonio Mountain Ranch Conservation Bank is a 797.9-acre parcel located southwest of Lincoln and northwest of Roseville. The property is situated between Orchard Creek Conservation Bank to the east and Moore Ranch Conservancy to the west. The Bank provides a critical linkage and creates a larger continuous metapopulations among protected tracts of habitat. The site is comprised of diverse, high-quality vernal pool/swale complexes that support a diverse assemblage of native plant species and sensitive vernal pool endemic plan and animal species. Portions of Orchard Creek and its tributaries run through the site.

5.2.24 Baldwin Reservoir Wetland and Wildlife Preserve (Property 78)

The Baldwin Reservoir Wetland and Wildlife Preserve is a 42-acre property that includes 4.7 miles of wetlands and tree plantings and a 2.5 mile public trail. It is owned and managed by the San Juan Water District, and straddles the Placer-Sacramento County line in Granite Bay. On the property is a reservoir created in 1928. Wetlands, riparian woodland, and foothill-pine woodlands are present at the Baldwin Reservoir Wetland and Wildlife Preserve. Public access is allowed via

the Baldwin Reservoir Trail. 39.8 acres of the property are in Placer County, and the remaining 2.2 acres is within Sacramento County. Two adult northwestern pond turtles were observed at Baldwin Reservoir in 1997.

6 Other Open Space and Conservation Programs

6.1 Spenceville Conceptual Area Protection Plan (CAPP)

The Wildlife Conservation Board (WCB) acquires real property or rights in real property on behalf of the Department of Fish and Game (DFG) and can also grant funds to other governmental entities or nonprofit organizations to acquire real property or rights in real property. A significant amount of the recent bond money for habitat protection has been administered through the WCB. A CAPP is a planning document that is used to support acquisitions. Each DFG region develops plans relevant to their area. DFG Region 2, which includes Placer County, developed the Spenceville CAPP for the foothill blue oak woodland ecosystem of Placer, Nevada, Yuba, and Butte Counties. It includes about 25,000 acres of blue oak woodland habitat in the Plan area north of Racoon Creek. When the PCCP is adopted, the PCCP managing entity will be able to access WCB funds available only to acquire areas designated as CAPP priorities by DFG.

7 Central Valley Joint Venture

The Central Valley Joint Venture (CVJV) is a partnership dedicated to the conservation of wetlands and other habitats within the California Central Valley for the benefit of waterfowl, shorebirds, and riparian-dependent songbirds. The CVJV has been in existence for over 20 years and was created in response to widespread concern over declining populations of migratory and resident bird species. In 2006, the CVJV published an implementation plan that establishes objectives for habitat protection, restoration, and management. The implementation plan explicitly acknowledges the important role that agriculture plays in sustaining populations of migratory and resident birds. Neither the CVJV nor its implementation plan has regulatory authority. The CVJV depends on voluntary partnerships to achieve its objectives.

The American and Sutter Basins Working Group (ASBWG) is a consortium of public agencies and non-governmental organizations that emerged as a sub-group of the CVJV. The mission of the ASBWG is to further the goals of the CVJV through wetland and riparian habitat conservation and preservation of agricultural uses in the American and Sutter Basins. The American Basin covers the entire Plan area from the Bear River watershed south to the American River watershed. The primary conservation focus of ASBWG in Placer County is the area between the Bear River and Pleasant Grove watersheds west of SR 65.

Key partners in the ASBWG include Ducks Unlimited, Placer County Resource Conservation District, Sutter County Resource Conservation District, California Wildlife Conservation Board, Placer County, Sutter County, California Waterfowl Association, California Department of Fish and Game, US Fish and Wildlife Service, and the Trust for Public Land.

The ASBWG is developing a Working Landscape Strategy for the American and Sutter Basins. The basis for the Strategy is the concept of a “working landscape” within which agricultural uses support the protection and enhancement of biodiversity. Agricultural uses in turn, are supported by policies and actions aimed at reducing pressures to convert agricultural lands to urban development. The Strategy is entirely voluntary and represents a blueprint for conserving and

improving wildlife habitat, recognizing the key role that agriculture plays in sustaining wildlife populations.

8 Regional Advance Mitigation Planning

State and federal agencies in California have been working together to develop an innovative way to advance needed infrastructure projects more efficiently and provide more effective conservation of our natural resources – through Regional Advance Mitigation Planning (RAMP). The *Statewide Framework for Regional Advance Mitigation Planning in California* will occur at a regional scale rather than on a statewide basis. A 1,500 square mile area in the Central Sacramento Valley has been selected to test how RAMP could be implemented at the local level, and to demonstrate how RAMP could integrate with regional conservation priorities. The Central Sacramento Valley Pilot RAMP boundary identifies portions of the Plan Area (see Figure 5-4)

Regional advance mitigation planning incorporates both a “regional” geographic component and an “advance” time frame. The regional component will allow state and federal agencies to consider the environmental impacts of several planned infrastructure projects at once. The “advance” time frame will identify regional mitigation opportunities that will satisfy anticipated mitigation requirements early in the project planning and environmental review process, before the projects are in the final stages of approval. Working together, natural resource and infrastructure agencies can estimate mitigation needs early in the projects’ timelines, avoiding permitting and regulatory delays and allowing public mitigation dollars to stretch further by securing and conserving valuable natural resources on a more economically efficient scale and before related real estate values escalate.

Some of the projects that have resulted from these efforts include the following:

8.1 Fickworth/Janson Contiguous Properties – Riparian Restoration

This riparian restoration project to improve aquatic habitat will involve two contiguous landowners along Racoon Creek. The project will enhance a major stream crossing with a large culvert across the stream channel that will keep farm vehicles out of the stream bed and provide erosion control. The stream crossing will be safe for fish and will provide up-stream fish passage. Revegetation at the project site will include creation of approximately 18 acres that include valley oak woodland with a native grass understory and a functioning riparian wetland. In addition, 180 lineal feet of actively eroding stream bank will be stabilized using accepted brush revetment techniques and earth work. Riparian enhancements will include large valley oaks and in-stream willows, cattails, rushes and sedges that will significantly contribute to providing important fish habitat in Racoon Creek. Other in-stream fish-habitat enhancement structures such as in-stream logs and boulders will be installed. Plantings will be wildlife friendly and will not affect agricultural production. Restoration work on the Jansen property will create mixed valley oak woodland and riparian woodland. Riparian woodland will be planted along approximately 600 linear feet of Racoon Creek, incorporating a diverse mix of woody riparian species.

8.2 Gallagher-Majors Property – Wetland and Riparian Restoration

The project will create 20 acres of wetland along Racoon Creek in two managed wetland areas of approximately 10 acres each. Wetland areas will create buffers between agricultural areas and the creek. The creek levee will be relocated to the adjacent agricultural field creating two managed wetlands. These wetlands will support a diverse wetland ecosystem and will enhance the property owner's hunting leases on the site. This will further develop the working landscape where landowners have incentive to support wildlife habitat. Water is available both spring and fall, making the wetlands usable by both winter and spring migrating and or nesting birds. The property will also be improved by replacing a creek crossing with a new fish-friendly crossing that will keep vehicles out of the streambed and facilitate travel to and from fields.

Appendix H-1 Table
Open Space Lands in the Plan Area

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
1	Hidden Falls Regional Park	Annual Grassland Oak-Foothill Pine Woodland Oak Woodland Savannah Valley Foothill Riparian Stock Ponds	Yes	Coon Creek	Black rail, California red-legged frog, northwestern pond turtle, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon, foothill yellow-legged frog	Ownership: Placer County Easement: Placer County	1,182.8
2	Hidden Falls Connectivity Trail	Annual Grassland Valley Foothill Riparian Foothill Chaparral	Yes	Coon Creek	Black rail, California red-legged frog, northwestern pond turtle, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon, foothill yellow-legged frog	Ownership: Placer County Easement: Placer County	23.12
3	Sidehill Citrus Farm	Orchard	No	Auburn Ravine	Black rail, California red-legged frog, Foothill yellow-legged frog, valley elderberry longhorn beetle, northwestern pond turtle	Ownership: Private Easement: Placer County	48
4	Blue Oak Ranch	Annual Grassland Blue Oak Woodland Valley Foothill Riparian	No	Coon Creek	Black rail, California red-legged frog, northwestern pond turtle	Ownership: Private Easement: Placer County	780
5	The Natural Trading Company	Oak-Foothill Pine Woodland Oak Woodland Savannah Rural Residential Valley Foothill Riparian Orchard	No	Auburn Ravine and Coon Creek	Valley elderberry longhorn beetle, California red-legged frog, northwestern pond turtle	Ownership: Private Easement: Placer County	40
6	Kirk Ranch	Annual Grassland Blue Oak Woodland	No	Bear River	California red-legged frog, Swainson's hawk	Ownership: Private Easement: Placer County	281
7	Sundance Lakeview Farms Conservation Easement	Annual Grassland Valley Foothill Riparian Pasture Riverine Rice Crops Urban/Suburban	No	Coon Creek and Bear River	Swainson's hawk, burrowing owl, tricolored blackbird, giant garter snake, northwestern pond turtle, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Private Easement: Placer County	577
8	Dry Creek School Open Space	Annual Grassland Valley Foothill Riparian Urban/Suburban	Yes	Dry Creek	Swainson's hawk, burrowing owl, tricolored blackbird, valley elderberry longhorn beetle, Central Valley steelhead trout, Chinook salmon, northwestern pond turtle, vernal pool fairy shrimp vernal pool tadpole shrimp	Ownership: Placer County Easement: Placer County	8.5

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
9	Bradley Property	Valley Vernal Pool Complex	No	Raccoon Creek	Black rail, vernal pool fairy shrimp, vernal pool tadpole shrimp, Swainson's hawk, burrowing owl, tricolored blackbird, northwestern pond turtle, valley elderberry longhorn beetle	Ownership: Placer County Easement: Placer County	399.7
10	Markham Ravine Ranch	Valley Vernal Pool Complex/Riverine/Riparian	No	Markham Ravine	Black rail, vernal pool fairy shrimp, vernal pool tadpole shrimp, Swainson's hawk, burrowing owl, tricolored blackbird, northwestern pond turtle, valley elderberry longhorn beetle	Ownership: Westervelt Easement: Placer County	297.2
11	Scilacci	Rice, Riverine/Riparian	No	Raccoon Creek	Swainson's hawk, burrowing owl, tricolored blackbird, giant garter snake, northwestern pond turtle, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Scilacci Easement: Placer County	406
12	Shutamul Bear River Preserve	Foothill Hardwood Woodland Riverine	No	Bear River	California red-legged frog	Ownership: Placer Land Trust Easement: Placer Land Trust	40
13	Liberty Ranch Big Bill Preserve	Oak-Foothill Pine Woodland	Yes	Bear River and Coon Creek	California red-legged frog	Ownership: Private and the Placer County Flood Control & Water Conservation District Easement: Placer Land Trust	313
14	Taylor Ranch Preserve	Foothill Hardwood Woodland Oak-Foothill Pine Woodland Oak Woodland Savannah Blue Oak Woodland Valley Foothill Riparian Stock Ponds	Yes	Coon Creek	California red-legged frog, northwestern pond turtle, , foothill yellow-legged frog	Ownership: Placer Land Trust Easement: Placer Land Trust	321
15	Garden Bar Preserve	Annual Grassland Blue Oak Woodland Foothill Hardwood Woodland Oak-Foothill Pine Woodland Oak Woodland Savannah Riverine	No	Bear River	California red-legged frog, northwestern pond turtle	Ownership: Private Easement: Placer Land Trust	912
16	Kotomyan Big Hill Preserve	Oak-Foothill Pine Woodland	Yes	Coon Creek	California red-legged frog,	Ownership: Placer Land Trust Easement: Placer Land Trust	160
17	Outman Big Hill Preserve	Oak-Foothill Pine Woodland	Yes	Bear River	California red-legged frog	Ownership: Placer Land Trust Easement: Placer Land Trust	81

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
18	Bruin Ranch (aka Harvego Bear River Preserve)	Blue Oak Woodland Oak-foothill Pine Woodland Oak Woodland Savannah Foothill Hardwood Woodland Barren (Rock outcrops/cliffs) Fresh Emergent Wetland Annual Grassland Riverine Urban Golf Courses Stock Ponds Lacustrine	Yes	Bear River	California red-legged frog, northwestern pond turtle	Ownership: Placer Land Trust Easement: Placer County	1,773
19	Big Gun Preserve	Oak Foothill Pine Woodland	No	Middle Fork of the American River	California red-legged frog (PCCP Purchased 4 credits from the bank in 2017)	Ownership: Westervelt Ecological Services and US Fish & Wildlife Service Easement: Placer Land Trust	48
20	Columbia Wetlands Preserve	Annual Grassland Lacustrine Oak-Foothill Pine Woodland Valley Foothill Riparian	No	Auburn Ravine	California red-legged frog northwestern pond turtle, valley elderberry longhorn beetle	Ownership: Private Easement: Placer Land Trust	11
21	Labadie Farms	Row crop	No	Auburn Ravine	Black rail, valley elderberry longhorn beetle, California red-legged frog, northwestern pond turtle	Owner: Private Easement: Placer Land Trust	30
22	Oest Ranch	Oak-Foothill Pine Woodland Valley	No	Bear River	Black rail, northwestern pond turtle, Foothill yellow-legged frog, California red-legged frog, oak	Owner: Private Easement: Placer Land Trust	427.4
23	Bettencourt Preserve	Oak-foothill Pine Woodland Valley Foothill Riparian	Yes	American River	California red-legged frog, northwestern pond turtle	Owner: Private Easement: Placer Land Trust	85
24	Beard Ranch	Blue Oak Woodland Annual Grassland	No	Raccoon Creek	California red-legged frog, northwestern pond turtle	Owner: Beard Easement: Placer Land Trust	137
25	Laursen Bear Rvier	Oak Foothill Pine Woodland, Bear River riparian	No	Bear River	California red-legged frog, northwestern pond turtle	Owner: Placer Land Trust	361
26	Meyer Preserve	Orchard/Grazing	No	Raccoon Creek	California red-legged frog, northwestern pond turtle	Owner: Private Easement: Placer Land Trust	21
27	Rock Creek Preserve	Oak Foothill Pine Woodland Foothill Riparian Open Water	Yes	Raccoon Creek	Black rail, California red-legged frog, northwestern pond turtle, oak	Owner: PG&E Easement: Placer Land Trust	182
28	Odayan Preserve	Oak Foothill Pine Woodland Valley Foothill Riparian	No	Dry Creek	Black Rail, northwestern pond turtle, Foothill yellow legged frog	Owner: Private Easement: Placer Land Trust	27

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
29	Doty Ravine Preserve	Annual Grassland Blue Oak Woodland Pasture Valley Foothill Riparian Woodland Urban/Suburban Riverine Vernal Pools	No	Coon Creek	Swainson's hawk, black rail, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon	Ownership: Placer Land Trust Easement: Placer County	427
30	Swainson's Grassland Preserve	Annual Grassland Urban/Suburban Pasture Fresh Emergent Wetlands Riverine Lacustrine	No	Coon Creek and Markham Ravine	Swainson's hawk, burrowing owl, tricolored blackbird northwestern pond turtle vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Private and Placer Land Trust Easement: Placer Land Trust	469
31	Reason Farms Environmental Preserve	Annual Grassland Valley Foothill Riparian Mixed Oak Woodland Vernal Pools	No	Pleasant Grove Creek	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake, northwestern pond turtle	Owner: City of Roseville Easement: Placer Land Trust	227
32	Foskett Ranch	Annual Grassland Vernal Pool Complex Fresh Emergent Wetland Spring and Seep	No	Markham Ravine	Swainson's hawk, California black rail, burrowing owl, tricolored blackbird, northwestern pond turtle, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: City of Lincoln Easement: City of Lincoln	120
33	Markham Ravine	Seasonal Wetlands Spring and Seep Vernal Pool Complex Valley Foothill Riparian Irrigated Pasture	No	Markham Ravine	Swainson's hawk, California black rail, burrowing owl, tricolored blackbird, northwestern pond turtle, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: City of Lincoln Manager: City of Lincoln Easement: City of Lincoln and Wildlife Heritage Foundation	194
34	Ingram Slough (Lincoln Crossing)	Blue Oak Woodland Annual Grassland Seasonal Wetlands Irrigated Pasture	Yes	Auburn Ravine	Swainson's hawk, California black rail, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, northwestern pond turtle	Ownership: City of Lincoln Manager: City of Lincoln	150.5
35	Ingram Slough East (Del Webb)	Seasonal Wetlands Vernal Pool Complex Spring and Seep	Yes	Auburn Ravine	Swainson's hawk, California black rail, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, California red-legged frog, northwestern pond turtle	Ownership: Private Manager: Sun City HOA Oversight: Wildlife Heritage Foundation	225.5

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
36	Auburn Ravine	Blue Oak Woodland Valley Foothill Riparian	Yes	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, northwestern pond turtle, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: City of Lincoln Manager: City of Lincoln	76.6
37	McBean Parkway Expansion	Valley Oak Woodlands Valley Foothill Riparian	Yes	Auburn Ravine	Swainson's hawk, black rail, burrowing owl, tricolored blackbird, northwestern pond turtle, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon	Ownership: City of Lincoln Oversight: Wildlife Heritage Foundation	66
38	Northeast Preserve Area (Del Web)	Valley Oak Woodland Seasonal Wetlands Spring and Seep	Yes	Auburn Ravine	Swainson's hawk, California black rail, burrowing owl, tricolored blackbird, California red-legged frog, northwestern pond turtle	Ownership: Private Manager: Sun City HOA/Wildlife Heritage Foundation	65.3
39	Sterling Pointe	Vernal Pool Seasonal Wetlands Spring and Seep	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, northwestern pond turtle	Ownership: City of Lincoln Manager: City of Lincoln	9.5
40	150-acre Preserve (AKA Rodeo Grounds Preserve)	Vernal Pool Wetlands Valley Foothill Riparian	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: City of Lincoln Oversight: Wildlife Heritage Foundation	145.3
41	Orchard Creek Lake Preserve (Del Webb)	Seasonal Wetlands Lacustrine	Yes	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, northwestern pond turtle	Ownership: Wildlands, Inc. Manager: Sun City HOA/Wildlife Heritage Foundation	60.4
42	Orchard Creek Preserve	Annual Grassland Valley Foothill Riparian Seasonal Wetlands Springs and Seeps	Yes	Auburn Ravine	Swainson's hawk, California black rail, burrowing owl, tricolored blackbird, California red-legged frog, northwestern pond turtle	Ownership: Private Manager: Sun City HOA	106.9
43	Twelve Bridges	Annual Grassland Vernal Pool Complex Seasonal Wetlands Valley Oak Woodland Valley Foothill Riparian	Yes	Auburn Ravine	Swainson's hawk, California black rail, burrowing owl, tricolored blackbird, valley elderberry longhorn beetle, California red-legged frog, northwestern pond turtle	Ownership: City of Lincoln Manager: City of Lincoln	899.4
44	Seep Preserve	Seasonal Wetlands Spring and Seep	Yes	Auburn Ravine	Swainson's hawk, black rail, burrowing owl, tricolored blackbird, valley elderberry longhorn beetle, California red-legged frog, northwestern pond turtle	Ownership: Private Manager: Sun City HOA/Wildlife Heritage Foundation	42.9
45	Environmental Education Center	Valley Oak Woodland Seasonal Wetlands Valley Foothill Riparian	Yes	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, valley elderberry longhorn beetle, California red-legged frog	Ownership: Western Placer Education Foundation	150.3

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
46	Three D Preserve	Annual Grassland Vernal Pool Complex Spring and Seep	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: City of Lincoln	9.74
47	Three D South Preserve (John D. Vincent Vernal Pool Preserve)	Annual Grassland Vernal Pool Complex Spring and Seep	No	Markham Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, , vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake, northwestern pond turtle	Ownership: Wildlands, Inc. Manager: Wildlands, Inc. Easement: Wildlife Heritage Foundation	312
48	Highway 65 Self Storage Preserve	Annual Grassland Vernal Pool Complex Seasonal Wetlands	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, California red-legged frog	Ownership: Highway 65 Self Storage LLC Manager: Wildlife Heritage Foundation	11
49	Lincoln Hills Offsite Preserves	Valley Foothill Riparian Annual Grassland	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, California red-legged frog,	Ownership: City of Lincoln Easement: Wildlife Heritage Foundation	205
50	Lincoln Hills Orchard 80 & Riparian Zone Preserves	Annual Grassland Vernal Pools Riparian Wetlands	No	Pleasant Grove	Swainson's hawk burrowing owl, tricolored blackbird, valley elderberry longhorn beetle, California red-legged frog, northwestern pond turtle	Ownership: Wildlands, Inc. Manager: Wildlands, Inc. Easement: Wildlife Heritage Foundation	80
51	Orchard Creek Conservation Bank	Annual Grassland Vernal Pools Riparian Wetlands	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird	Ownership: Private Manager: Wildlands, Inc. Easement: Wildlife Heritage Foundation	648
52	St. Joseph Church Preserve	Annual Grassland Wetlands	No	American River	Swainson's hawk, black rail, burrowing owl, tricolored blackbird, northwestern pond turtle	Ownership: Private Easement: Wildlife Heritage Foundation	2
53	West Placer Schools Conservation Bank/Lincoln School Preserve	Wetlands Vernal Pools	No	Markham Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, giant garter snake, northwestern pond turtle, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Wildlands, Inc. Easement: Wildlife Heritage Foundation	225
54	Bureau of Land Management	Blue Oak Woodland Foothill Hardwood Woodland Riverine Barren (Rock outcrops/cliffs)	No	Bear River	Black rail, California red-legged frog	Ownership: Bureau of Land Mgt.	143

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
55	Hanley Ranch	Annual Grassland Blue Oak Woodland Foothill Hardwood Woodland Oak Woodland-Savannah Rural Residential Seasonal Wetland Valley Foothill Riparian Riverine Pasture	No	Coon Creek	Black rail, tricolored blackbird, California red-legged frog northwestern pond turtle, valley elderberry longhorn beetle, Central Valley steelhead, Chinook salmon	Ownership: Private and Caltrans Easement: Caltrans	185.95
56	Sheridan East Vernal Pool Preserve	Annual Grassland Vernal Pool Complex Oak Woodland Seasonal Wetland Riverine	No	Bear River	Swainson's hawk, tricolored blackbird, burrowing owl, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Private and Wildlands, Inc. Easement: California Department of Fish and Wildlife	342
57	Silvergate Mitigation Bank	Annual Grassland Fresh Emergent Lacustrine Rice Pasture Riverine Rural Residential Urban/Suburban	No	Bear River	Swainson's hawk, black rail, burrowing owl, tricolored blackbird vernal pool fairy shrimp, vernal pool tadpole shrimp, Valley elderberry longhorn beetle, giant garter snake northwestern pond turtle	Ownership: Sheridan Mitigation Corp. Easement: Restoration Resources, Inc. Oversight: Wildlife Heritage Foundation	655
58	Yankee Slough Conservation Bank	Annual Grassland Fresh Emergent Wetland Pasture Riverine	No	Bear River	Swainson's hawk, black rail, burrowing owl, tricolored blackbird, northwestern pond turtle, Valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Conservation Resources, LLC Easement: Environmental Stewardship Foundation	732
59	Rockwell Ranch	Annual Grassland Fresh Emergent Wetland Lacustrine Pasture Rural Residential	No	Coon Creek	Swainson's hawk, black rail, burrowing owl, tricolored blackbird vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake, northwestern pond turtle	Ownership: State of California Easement: Center for Natural Lands Management	519
60	Nicolaus Road Preserve	Annual Grassland Fresh Emergent Wetland Rice Riverine	No	Markham Ravine	Swainson's hawk, black rail, burrowing owl, tricolored blackbird vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake northwestern pond turtle	Ownership: Private Easement: Wildlife Heritage Foundation	80

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
61	Mariner Conservation Bank	Annual Grassland Vernal Pools Wetlands	No	Markham Ravine and Coon Creek	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake	Ownership: Private Manager: Westervelt Ecological Services Easement: Center for Natural Lands Management	160
62	US Air Force Property (Lincoln Global Communications Site)	Annual Grassland Rice Riverine Rural Residential	No	Markham Ravine and Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird giant garter snake, vernal pool fairy shrimp vernal pool tadpole shrimp	Owner: US Government	160
63	Moore Ranch Conservancy	Annual Grassland Valley Foothill Riparian	No	Auburn Ravine	Swainson's hawk, burrowing owl, vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, northwestern pond turtle	Ownership: Private Easement: Wildlife Heritage Foundation	145
64	Warm Springs	Annual Grassland Vernal Pools Wetlands	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Private Easement: Placer Land Trust	96.2
65	Aitken Ranch Conservation Easement	Annual Grassland Valley Foothill Riparian Fresh Emergent Wetland Pasture Unidentified Croplands Rural Residential	No	Auburn Ravine	Swainson's hawk, black rail, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, giant garter snake, Central Valley steelhead trout, Chinook salmon, northwestern pond turtle	Ownership: Private Easement: Department of Fish and Wildlife	312.55
66	Cummings	Annual Grassland Fresh Emergent Wetland Pasture Rural Residential	No	Pleasant Grove	Swainson's hawk, black rail, burrowing owl, tricolored blackbird vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake northwestern pond turtle	Ownership: Private Easement:	62
67	Locust Road Mitigation Bank	Annual Grassland Rural Residential	No	Pleasant Grove	Swainson's hawk, burrowing owl, tricolored blackbird, giant garter snake, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Wildlands, Inc. Easement: Wildlife Heritage Foundation	79
68	Dry Creek Greenway	Annual Grassland Valley Foothill Riparian Urban/Suburban Riverine	Yes	Dry Creek	northwestern pond turtle, Swainson's burrowing owl, tricolored blackbird, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp, , Central Valley steelhead trout Chinook salmon	Ownership: Private and Placer County Easement: Placer County	133
69	Ahart Preserve	Annual Grassland Vernal Pools	No	Coon Creek	Swainson's hawk, black rail, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, northwestern pond turtle	Ownership: Private Easement: Wildlife Heritage Foundation	94

Reference	Open Space Name	PCWHR Habitat	Public Access?	Primary Watershed	Covered Species Habitat Relationship	Owner	Acreage
70	Toad Hill Ranch Mitigation Bank	Annual Grassland Vernal Pools Spring and Seep	No	Coon Creek	Swainson's hawk, burrowing owl, tricolored blackbird, vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake, northwestern pond turtle	Ownership: Private Manager: Wildlands, Inc. Easement: Wildlife Heritage Foundation; Placer Land Trust	1,631
71	Douglas Ranch	Oak-Foothill Pine Woodland Wetlands	No	Dry Creek	Black rail, California red-legged frog, valley elderberry longhorn beetle, northwestern pond turtle	Ownership: HOA Manager/Easement: Center for Natural Lands Management	31
72	Greyhawk Conservation	Oak-Foothill Pine Woodlands Mixed Oak Woodland Seasonal Wetlands Valley Foothill Riparian	No	American River	Black rail, valley elderberry longhorn beetle, California red-legged frog, northwestern pond turtle	Ownership: HOA Easement: Center for Natural Lands Management	31
73	Miner's Creek	Annual Grassland Mixed Oak Woodland Seasonal Wetlands Valley Foothill Riparian	No	American River	Valley elderberry longhorn beetle, steelhead trout, Chinook salmon, Foothill yellow-legged frog, California red-legged frog, northwestern pond turtle	Ownership: HOA Manager/Easement: Center for Natural Lands Management	25
74	The Grove Preserve	Mixed Oak Woodland Annual Grassland	No	American River	Black rail, California red-legged frog, valley elderberry longhorn beetle, northwestern pond turtle	Ownership: The Grove Home Owner's Association Manager/Easement: Center for Natural Lands Management	9.75
75	Croftwood Preserve	Annual Grassland Mixed Oak Woodland Valley Foothill Riparian	No	American River	Valley elderberry longhorn beetle, California red-legged frog, northwestern pond turtle	Ownership: Tim Lewis Communities Easement: Habitat Management Foundation	22
76	Auburn Honda Preserve	Riparian	No	Auburn Ravine	California red-legged frog	Ownership: Auburn Honda Easement: Habitat Management Foundation	2.6
77	Antonio Mountain Ranch Conservation Bank	Seasonal Wetlands Vernal Pools Lacustrine Spring and Seep Annual Grassland	No	Auburn Ravine	Swainson's hawk, burrowing owl, tricolored blackbird, northwestern pond turtle, valley elderberry longhorn beetle, vernal pool fairy shrimp, vernal pool tadpole shrimp	Ownership: Lewis Antonio Mountain Ranch, LLC Easement: Placer Land Trust	797.9
78	Baldwin Reservoir Wetland and Wildlife Preserve	Seasonal Wetland Riparian Woodland Valley Foothill Riparian	Yes	American River	Northwestern pond turtle	Ownership/Manager: San Juan Water District	42
	TOTAL						**20,392.01**

Appendix I

Project Specific Take and Mitigation Assessment Example

Appendix I

Project Specific Take and Mitigation Assessment Example

I.1 Background

This document gives several examples of how the Western Placer County Habitat Conservation Plan and Natural Community Conservation Plan (HCP/NCCP) Development Fees would apply to a range of private sector development projects with an emphasis on the Valley. The presentation here is a schematic of the PCCP program participation process and calculation of fees based on assessed effects on land cover, the stream system, and special habitats. These hypothetical scenarios consider a range of effects and apply the fees found in Table 9-6 (*Land Conversion Fee Schedule*) and Table 9-7 (*Special Habitats Fee Schedule*).

I.2 PCCP Development Fees Summary

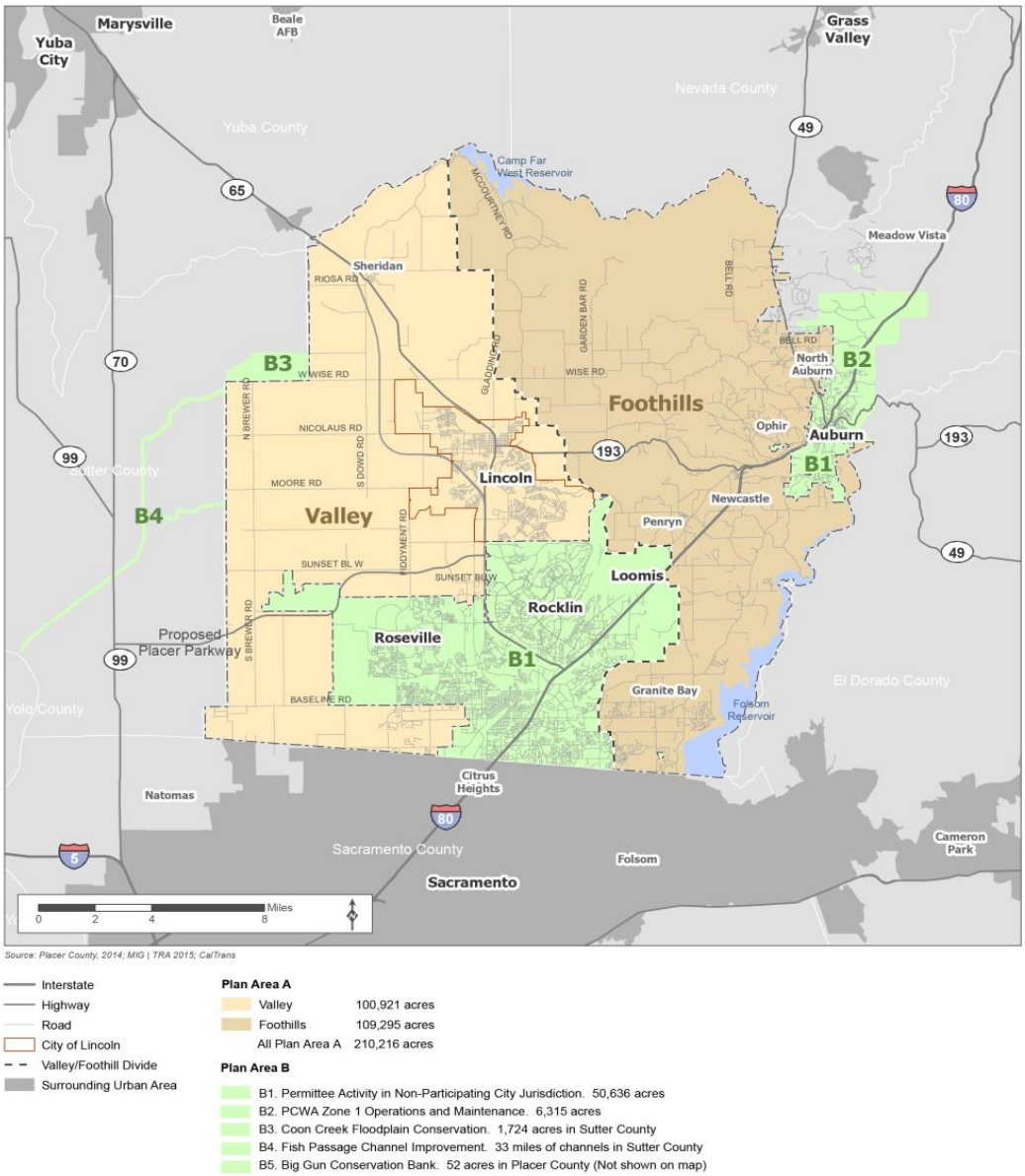
Chapter 9 of the HCP/NCCP describes the three types of Development Fees that will be paid as a result of effects from private and public Covered Activities to assist in meeting both Endangered Species Act (ESA) and NCCP Act requirements. Fees will generate sufficient funding to offset a proportionate share of HCP/NCCP costs including endowment contributions to fund all post-permit activities in perpetuity (see Section 9.3.8, *Costs in Perpetuity*) and reimbursement of the local share of plan preparation costs (see Section 9.3.9, *Plan Preparation Costs*). This proportionate share is based on the cost of mitigation that will offset losses of land-cover types, Covered Species' habitat, and other biological values, as well as benefits related to open space and fuels management. These one-time fees pay for the full cost of mitigating project effects on the Covered Species and natural communities.

Fees are based on the maximum allowable permanent loss of land-cover types presented in Chapter 4, *Effects of Covered Activities*. Land-cover effects are used because land cover and the associated presence of species is the best predictor of potential species habitat and is applicable to all of the Covered Species (see Appendix A, *Implementing Ordinance Template,* and Appendix D, *Species Accounts*). Effects on land cover are also used, in part, as the basis of the conservation strategy (see Chapter 5, *Conservation Strategy*, for details that determine Plan costs). The following HCP/NCCP Development Fees will apply in the Plan Area.

- Land Conversion Fee
- Special Habitat Fees
- Temporary Effect Fee

Figure I-1 depicts the geographic boundary between the Foothills and Valley for purposes of fee calculations. The Foothills fee also applies to the higher elevation portion of the City of Lincoln planning area roughly eastward of a line dropped due south from the intersection of Virginiatown Road and Hungry Hollow Road, and pulled west to follow the 200' elevation line which runs roughly along the Nevada Irrigation District canal north of State Route 193 and Oak Tree Lane.

Figure I-1 Western Placer County and the Plan Area



In addition to the Development Fees, there are Open Space and Fire Hazard Management Fees that are applied to projects that are not otherwise subject to the Development Fees. These fees only apply to the Foothills Area depicted on Figure I-1.

Tables 9-6 and 9-7 are incorporated into this Appendix for ease of use. The temporary effects fee is equal to 2 percent of the Land Cover Fee (See Section 9.4.1.5 *Temporary Effects*). For additional information on the most recent fee schedule, interested parties should contact the Placer Conservation Authority (PCA) or the Permittee (County/City) with land use authority over a project.

Table I-1
Table 9-6 from Chapter 9 of the HCP/NCCP

Land Conversion Fee Schedule

Plan Area A - Valley (Components A1 and A2)			
	Any Existing Parcel up to 20,000 square feet	No fee (not a Covered Activity)	
1a	Covered Activity on Existing Parcel greater than 20,000 square feet up to 1.0 acre	$5,197	per acre
1b	Single family residential on Existing Parcel greater than 1.0 acre or any parcel created by subdivision of an Existing Parcel into four or fewer total parcels	$3,897 plus $1,299 $12,990	per parcel per acre up to maximum[a]
1c	All other Covered Activities	$26,473	per acre
Plan Area A - Foothills (Components A3 and A4)			
	Any Existing Parcel up to 20,000 square feet	No fee (not a Covered Activity)	
2a	Residential project on Existing Parcel greater than 20,000 square feet up to 1.0 acre	$2,279	per dwelling unit
2b	Non-residential project on Existing Parcel greater than 20,000 square feet up to 1.0 acre	$2,757	per acre
2c	Single family residential on Existing Parcel greater than 1.0 acre or on any parcel created by subdivision of an Existing Parcel into four or fewer total parcels	$2,27 plus $1,332 $13,320	per parcel per acre up to maximum[a]
2d	Single family residential on any parcel created by subdivision of Existing Parcel into five or more total parcels and all multi-family residential	$2,279 plus $7,560	per dwelling unit per acre
2e	Non-residential project on Existing Parcel greater than 1.0 acre or on any parcel created by subdivision	$10,317	per acre
Plan Area B			
Valley (Component B1: Roseville / Rocklin / Loomis area)			
3a	All Covered Activities	$26,473	per acre
Foothills (Component B1: Auburn area and Component B2)			
3b	Covered Activity on Existing Parcel up to 1.0 acre	$2,757	per acre
3c	Covered Activity on Existing Parcel greater than 1.0 acre	$10,317	per acre

Notes:
All amounts in 2019 dollars
Fee schedule applies to permanent effects. See PCCP, Chapter 9, Section 9.4.1.5, *Temporary Effect Fee,* for application of fee to projects with temporary effects.
Non-covered activities are not subject to PCCP Development Fees but may be subject to other local fees for impacts to other resources such as open space and native trees.
Per acre fees apply to the entire parcel area excluding improved areas and where avoidance occurs pursuant to Section 6.3.1.3, General Condition 3, Land Conversion, including land approved by the PCA set aside as habitat. Per acre fees apply only to the disturbed area footprint of Covered Activities on low density rural development limited to structures or activities that are appurtenant to rural residential uses and activities or structures that support rural nonresidential land uses (See Section 6.3.1.3.2, *Permanent Effect Avoidance for Low Density Rural Development*).
"Existing Parcel" refers to a parcel at time of Plan adoption.
For mixed use projects with multi-family residential, the project pays the higher fee of either category 2d or category 2e.
Plan Area A - Foothills includes that portion of Plan Area A - Valley that is the higher elevation portion of the City of Lincoln planning area roughly eastward of a line dropped due south from the intersection of Virginiatown Road and Hungry Hollow Road and pulled west to follow the 200' elevation line which runs roughly along the NID irrigation ditch north of Hwy. 193 and Oak Tree Lane.
[a] Maximum amount per parcel applies to per acre fee only. Per dwelling unit fee is in addition to per acre fee.

Table I-2
Table 9-7 from Chapter 9 of the HCP/NCCP

Special Habitats Fee Schedule

	Name	Amount	Temporary Effect Fee Applicable?
4a	Vernal Pool Direct Effects	$171,167 per acre	Yes
4b	Vernal Pool Immediate Watershed Effects[a]	$28,586 per acre	No
4c	Aquatic/Wetland	$121,025 per acre	Yes
4d	Riverine/Riparian	$107,637 per acre	Yes
4e	Riverine/Riparian Buffer[b]	$53,819 per acre	No
4f	Stream System Encroachment[c]	$107,637 per acre	No
4g	Salmonid Stream Channel[d]	$654 per linear foot	No

Note: All special habitat fees are paid in addition to the land conversion fee.
All amounts in 2019 dollars
All special habitat fees are paid in addition to the land conversion fee.
Fee schedule applies to permanent effects. See PCCP, Chapter 9, Section 9.4.1.5, Temporary Effect Fee, for application of fee to projects with temporary effects.
[a]Vernal pool constituent habitat delineated wetland on a project site not altered by ground disturbance within an immediate watershed that is altered by ground disturbance. See Section 6.3.2.1.1 *Community Condition 1.1, Avoidance for Vernal pool-Type Wetlands.*
[b]Ground disturbance not in the Stream System but within 50 feet of riverine/riparian constituent habitat.
[c]Area subject to Stream System encroachment excludes any area already subject to a constituent habitat fee (such as a Riverine/Riparian Fee).
[d]Salmonid stream channel fee paid in addition to any other applicable special habitat fees.

The fee scenarios described in this Appendix will account for impacts to covered species and their habitat as well as impacts to Aquatic Resources of Placer County. For additional information on the cost of implementing the HCP/NCCP during the permit term and post-permit costs, see Chapter 9 (*Costs and Funding*) of the HCP/NCCP. For additional information on impacts to Aquatic Resources of Placer County, see the County Aquatic Resources Program.

I.3 HCP/NCCP Permit Processing

This section of Appendix I provides several examples of how the HCP/NCCP would apply to a hypothetical 100-acre tentative map in the Valley. The presentation here is a schematic of the HCP/NCCP program participation process and calculation of fees based on assessed effects on land cover, the Stream System, and special habitats. This hypothetical example considers two candidate projects: Project "A" which maximizes development of the site and Project "B" which substantially avoids impact on vernal pools and the Stream System. This example also provides specific details on how to determine indirect effects on vernal pool constituent habitats which is not included in the fee scenarios described above.

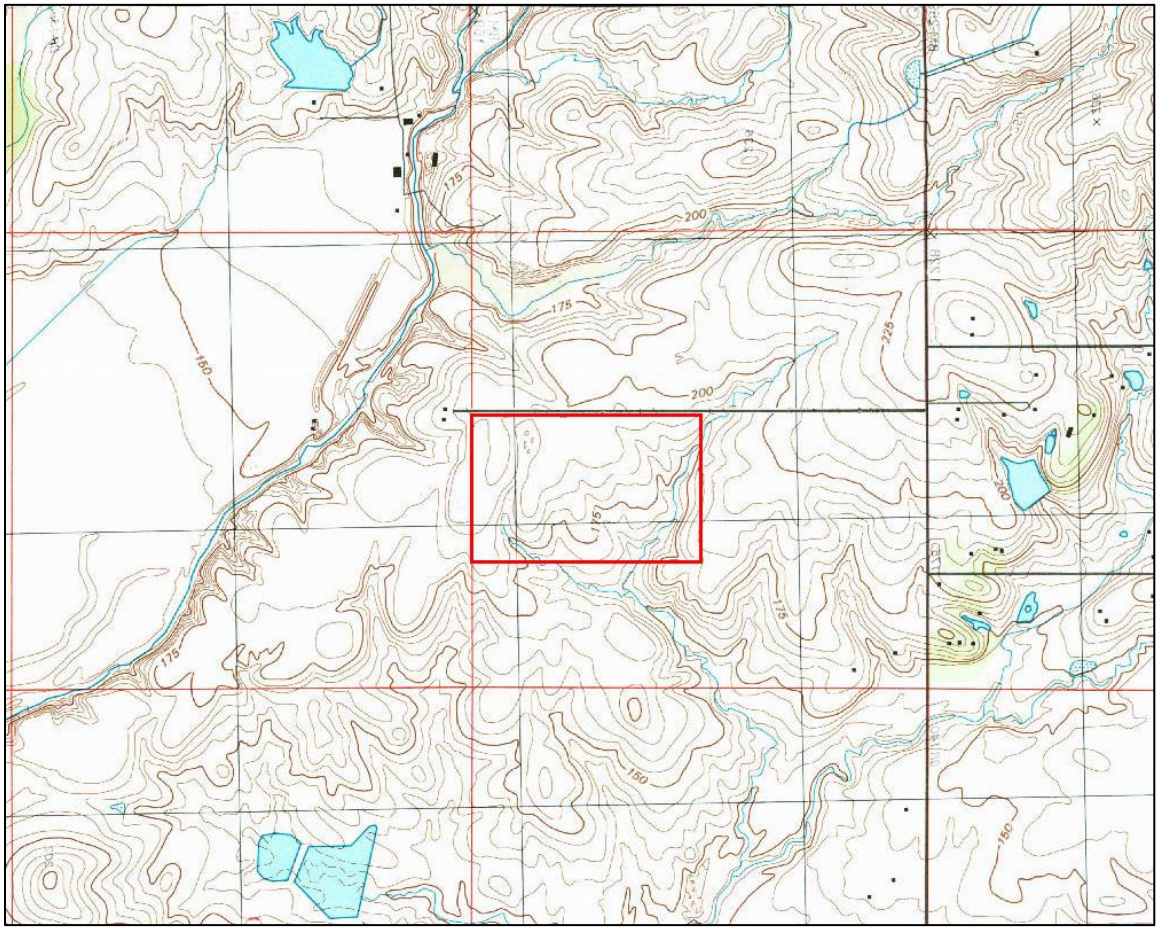
I.3.1 Step 1: Preliminary Site Analysis

The biological resources effects assessment begins with the preparation of a series of maps identifying the site, the resources noted there on vegetative base maps and other supporting documentation required by the Plan. This package of information is known collectively as the

HCP/NCCP participation package (See Section 6.2.4 *HCP/NCCP Participation Package*). Private applicants who seek coverage under the Plan will initiate the review of their project by applying to the County or the City of Lincoln by submitting a complete HCP/NCCP participation package. This information will typically be submitted concurrent with other application materials required by the County or City for project entitlements. The process of initiating participation in the Plan will be integrated into the local jurisdictions' normal CEQA procedures for discretionary permits or, for ministerial projects, the normal land development review process.

In addition to the mapping requirements, the HCP/NCCP participation package includes a biological resources effects assessment to determine the effects of the project with the land cover types present on the project site. The review of the HCP/NCCP participation package will also include species survey requirements and survey data results (See Section 6.3.5.1 *Surveys for Select Covered Wildlife Species*), and the application of conditions to avoid and minimize effects on covered species and their habitat (See Section 6.3. *Conditions on Covered Activities*).

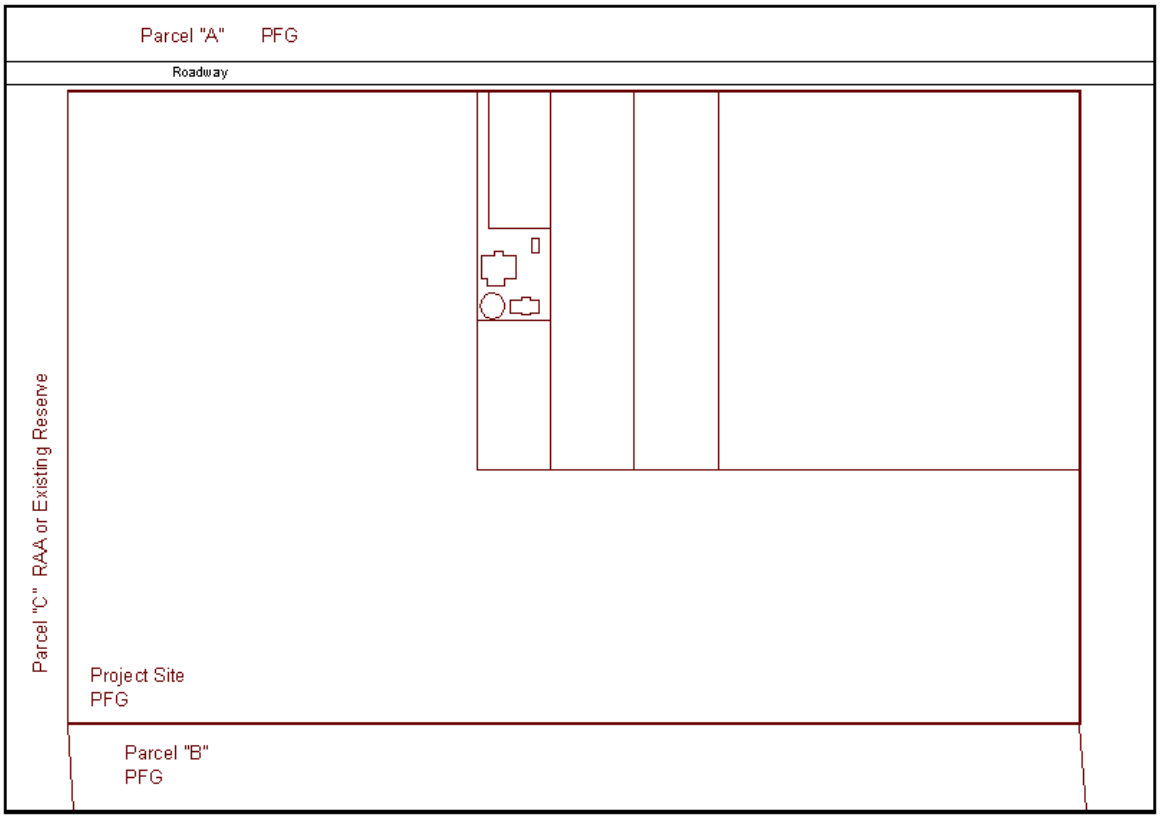
Figure I-2 Project location on USGS map



The project location (Figure I-2) is depicted on a USGS map and includes the project site boundary and 1-mile of the surrounding area based on the National Hydrology Database (See Section 6.2.4.2 *Item 2: Project Description and Site Map* for additional information on submittal requirements). This

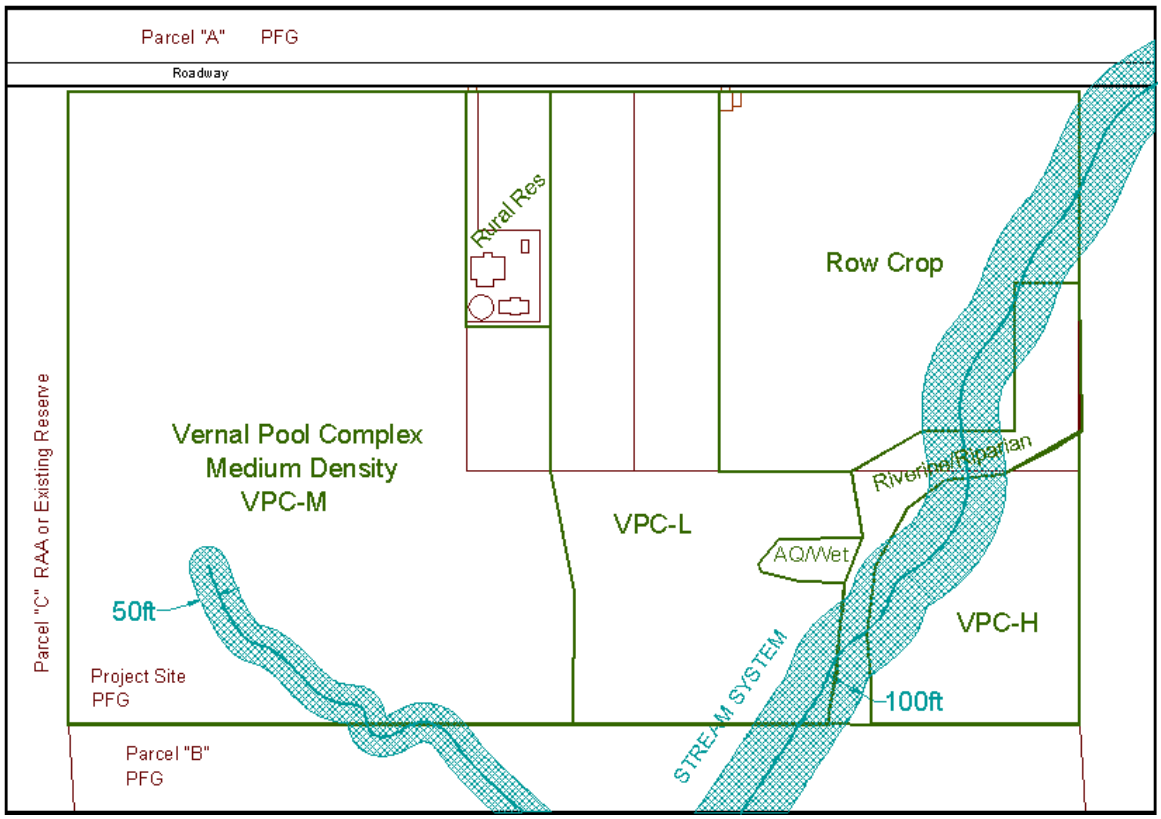
provides site location, vicinity conditions, and indicates the presence of "blue line streams" that will establish the Stream System defined by the HCP/NCCP (See Section 6.2.4.5 *Item 5: Mapping the Stream System and Salmonid Streams*). In this fictitious example, the 100-acre site includes a few segments of blue line stream and shows a road running along the north side of the site.

Figure I-3 Parcels comprising project site



A site plan will be needed which depicts the project's existing conditions (Figure I-3). In this example a map has been prepared that shows the site's parcels as they were constituted at the time of Plan adoption and will determine which fee categories may apply. In this hypothetical 100-acre Valley example, the project site comprises five separately saleable parcels including one 5-acre parcel within a rural residential setting. The project site is designated in the HCP/NCCP as "Potential Future Growth" (PFG) meaning that development entitlements were anticipated in this area providing that mitigation for covered species take complies with the HCP/NCCP. The project site is bounded on the north by Parcel "A" across a public road, on the south by Parcel "B" across a fence line, and on the west by Parcel "C" which is in the Reserve Acquisition Area (RAA) and is already in the reserve system.

Figure I-4 Land Cover base map applied to site



Land cover data is applied to the base map utilizing the HCP/NCCP's biological resources inventory as supplied by the local jurisdiction to the project proponent in a format that is consistent with County/City requirements (e.g. biological resource inventory map, AutoCAD or ESRI GIS). The HCP/NCCP's biological resources inventory shows the baseline land cover map, the location of existing reserves, and updates of covered species occurrences (Figure I-4). (See Section 6.2.4.3.1 *Community Mapping*).

The Stream System map maintained by the Placer Conservation Authority (PCA) shows the HCP/NCCP defined Stream System Boundary applied to the USGS blue line streams. The land cover map maintained by the PCA for the Permittees shows the rural residential parcel, row crops, and vernal pool complex (VPC). The land cover map also identifies the eastern stream reach as salmonid fish habitat.

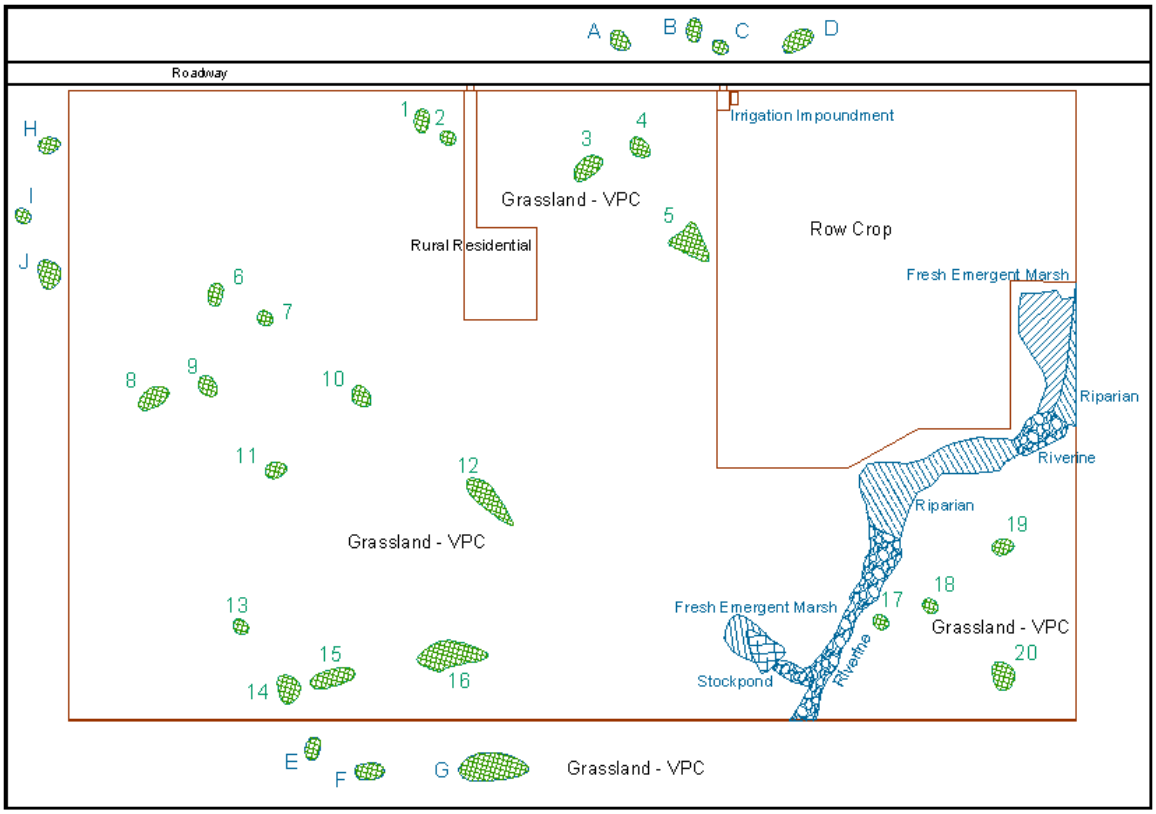
The main blue line stream also was originally mapped during the Plan preparation phase as Riverine/Riparian and Aquatic/Wetland although these do not seem to line up clearly with the Stream System as mapped around the blue line stream. Improving the accuracy of the mapping that was prepared during the Plan preparation phase will be a common occurrence when site specific mapping is prepared based upon actual field surveys.

Based on the review of the land cover map, the project is required to have a qualified biologist more precisely delineate the wetlands and riverine/riparian habitat, and more precisely identify other vegetative communities present on site. The qualified biologist will also need to indicate the likely

presence of wetlands and vegetative communities on adjacent properties. Because adjoining properties are likely to have limited access, the assessment can be based on aerial photography and visual surveys at the property line (See Section 6.2.4.4 *Item 4: Mapping HCP/NCCP Aquatic Features*).

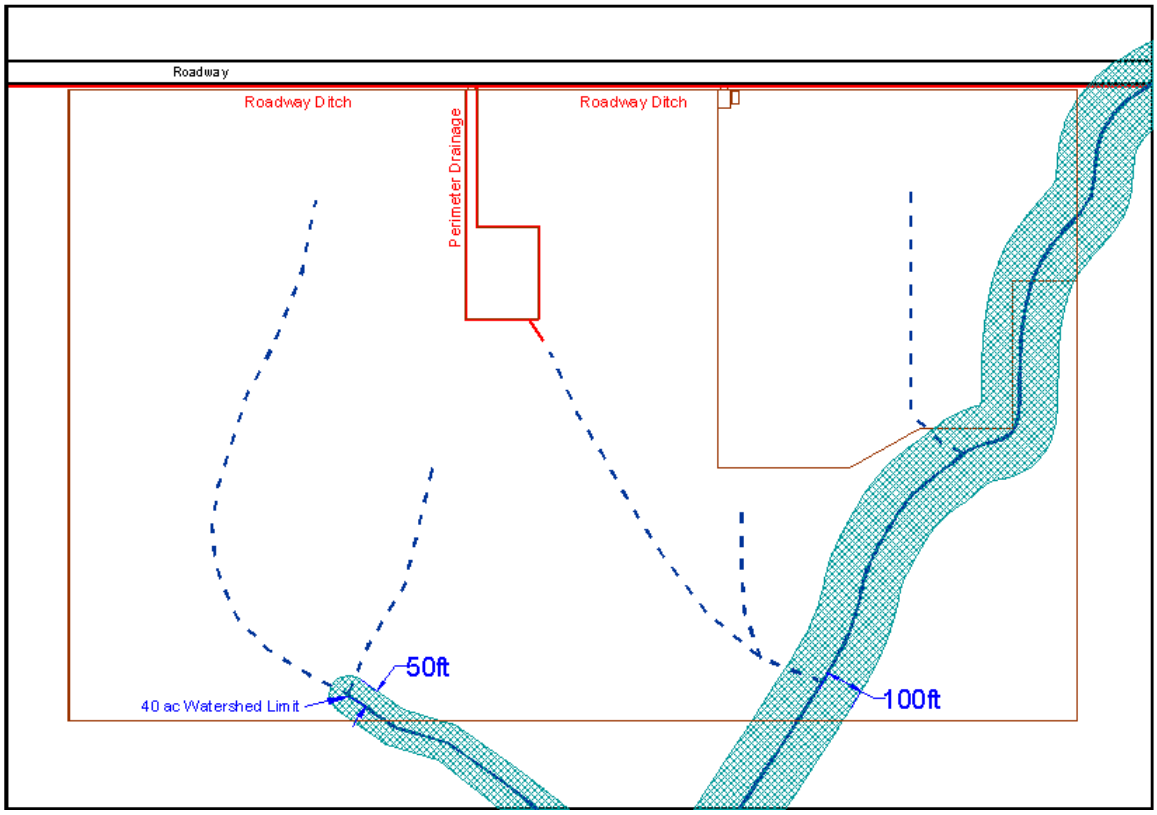
The aquatic features map (Figure I-5) includes a formal wetland delineation that shows the actual location of numerous vernal pool constituent habitats scattered throughout the property, non-vernal pool wetlands, and riverine/riparian and aquatic/wetland habitats along the stream. Several vernal pools are mapped off-site. (See Section 6.2.4.4 *Mapping HCP/NCCP Aquatic Features*).

Figure I-5 Mapping HCP/NCCP Aquatic Features



An additional map is prepared that (Figure I-6) identifies the actual position of the stream channels which define the precise location of the Stream System boundary on site (See Section 6.2.4.5 *Item 5: Mapping the Stream System and Salmonid Streams* and Figure 9-1 from Chapter 9). In this example, the stream channel locations did not align with the original USGS mapping. The new data will replace the land cover mapping prepared during the Plan preparation phase. Several existing features – the roadway ditch and elevated ground around the rural residence – define hydrological barriers. The western stream segment is truncated at the point where the watershed falls below 40 acres in extent. Any channels above the 40-acre watershed limit are considered upland drainage swales and are not part of the Stream System. This mapped Stream System Boundary will be used to determine the project's impacts and fees required.

Figure I-6 Mapping the Stream System

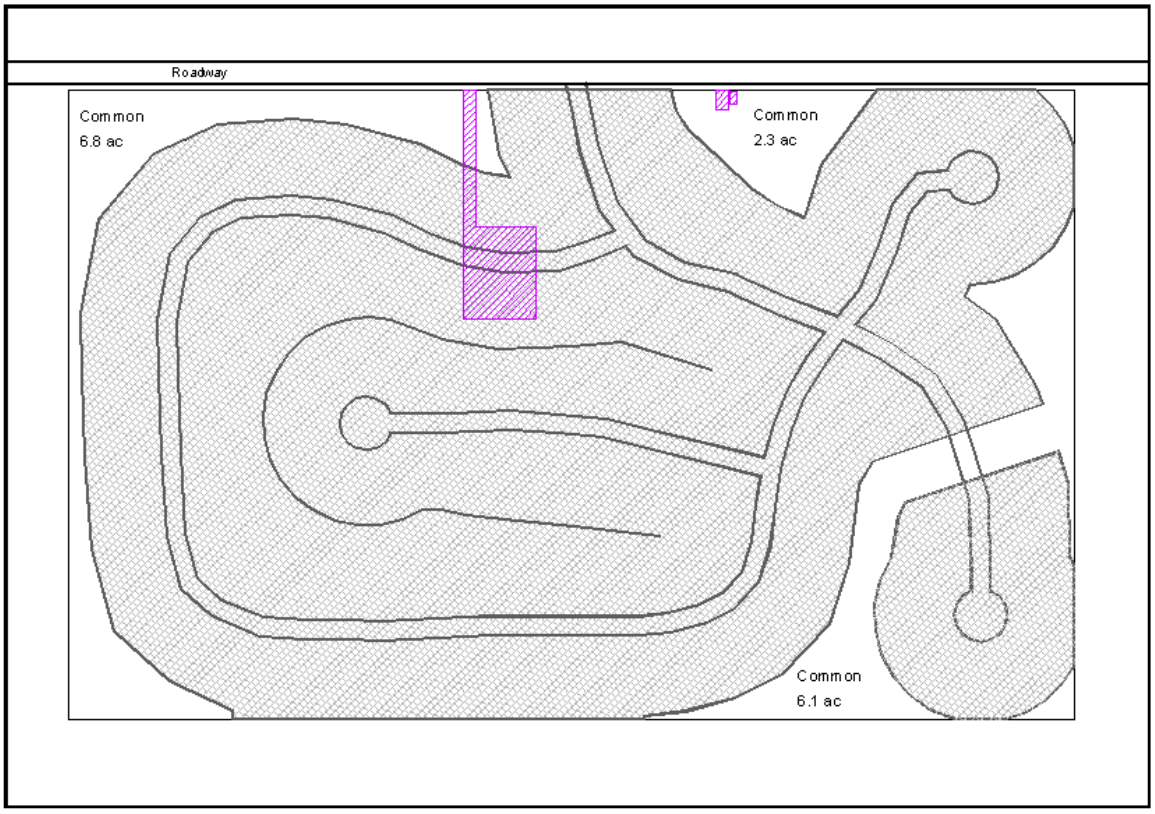


Once all of the biological resources are mapped consistent with the requirements for a complete HCP/NCCP participation package, it will be necessary for the County or City to evaluate the existing land cover types against baseline conditions (See Section 6.2.4.3.2 *Baseline Land-cover Map Consistency Finding*). If current site conditions reflect a substantial degradation of habitat conditions from baseline conditions (e.g., from a change or intensification of land uses), project effects and mitigation requirements will be calculated using the baseline conditions instead of the current, degraded site conditions.

I.3.2 Step 2 for Project Scenario "A": Project Assessment – Maximum Utilization of the Site

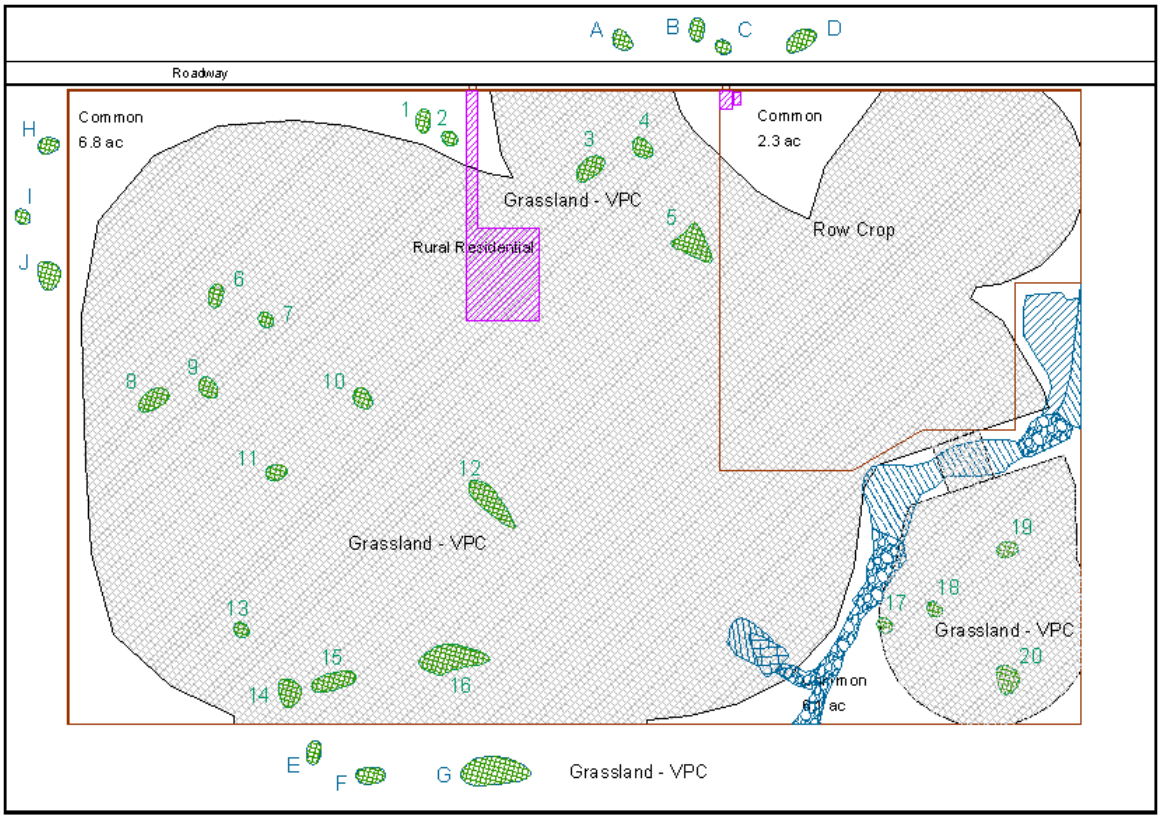
Hypothetical Project Scenario "A" is a schematic of a "lot and block" subdivision with homes surrounding an internal road network on an 85-acre development footprint (Figure I-7). In order to access the southeast corner of the site, one of the roads must cross the stream with a small bridge. Because of the project's design, there are residual areas of common area open space around the periphery and along most of the salmonid stream.

Figure I-7 Project Scenario "A" Footprint



Because none of these areas of open space meet the avoidance criteria (See Section 6.3.1.3.1 *Permanent Effect Avoidance in the PFG*), the project is considered to have a land conversion impact on the entire 100-acre site minus the areas of existing development. Taking into account the land cover mapping, the Land Conversion Fee (See Section 9.4.1.3 *Land Conversion Fees*) would apply to all natural, semi natural, and other agricultural land cover which includes the vernal pool complex and the row crops. The 1.3-acre area immediately occupied by the rural residence and several existing roads are considered existing development and are exempt from land conversion fees. The result is that there is a total of 3.1 exempt acres and 96.9 acres subject to the Valley Land Conversion fees.

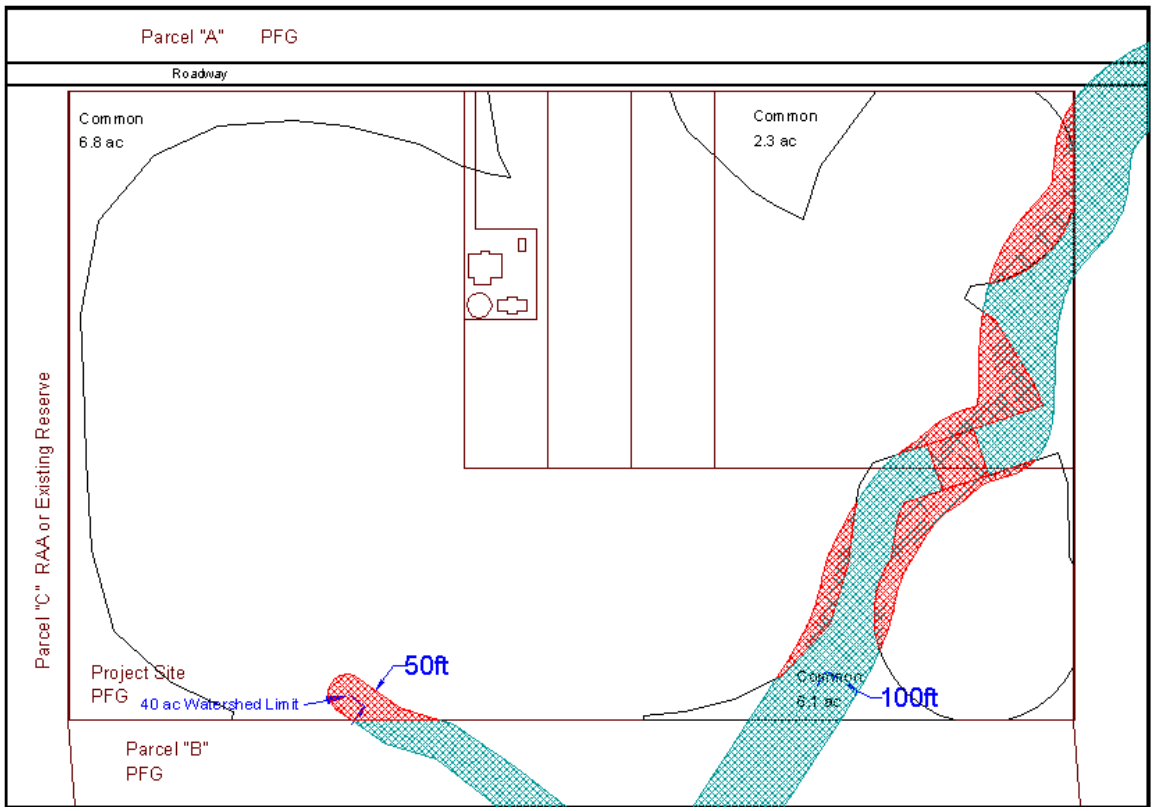
Figure I-8 Project Scenario "A" Effect on Special Habitats



The proposed project overlain on the special habitats map shows the extent of vernal pool constituent habitat, other wetlands, and riverine/riparian habitats that will be impacted by the project (Figure I-8). Although some of the vernal pools (VP 1 and VP 2) are in one of the areas of common open space, the project's development footprint comes within the immediate watershed (See Section 6.3.2.1.1 *Community Condition 1.1, Avoidance of Vernal Pool Complex Constituent* Habitat) of those pools and hence special habitat fees (See Section 9.4.1.4 *Special Habitat Fees*) will be owed as well as for the vernal pools under the project footprint. The stream crossing will directly remove riparian vegetation which will be subject to the Riverine/Riparian Special Habitat Fee. Because all of the riverine/riparian impacts are within the Stream System Boundary, the Riverine/Riparian Buffer Fee is not applicable. Construction of the bridge will result in a small amount of temporary disturbance that will be subject to the Temporary Effects Fee (See Section 9.4.1.5 *Temporary Effect Fee*).

The biological resources assessment identified vernal pool type wetlands on the three adjoining parcels. Some of these wetlands have an immediate watershed of potential impact that extends onto the project site. Off-site vernal pools to the north (vernal pools A-D) are hydrologically isolated from the project by the public roadway along the northern boundary; pools to the west are isolated by topography. Vernal pools to the south on Parcel "B" (vernal pools E-G) are subject to indirect effects from the project. Although no fee is paid on the area of these adjoining wetlands, the PCA must report their indirect take to the Wildlife Agencies in their annual reporting.

Figure I-9 Project Scenario "A" Encroachment on the Stream System



The project footprint encroaches into the Stream System Boundary (Figure I-9). Even though the land cover in the area of encroachment is not specifically riverine or riparian, it is subject to the Stream System Special Habitat Fee (See Section 9.4.1.5 *Calculating Fees for Wetland or Stream Effects*). The eastern stream reach was identified as salmonid fish habitat. Construction access and the bridge affect 80 lineal feet of stream bed which is subject to the Salmonid Stream Special Habitat Fee (See Section 9.4.1.4.1 *Calculating Fees for Wetland or Stream Effects*) in addition to the Stream System Special Habitat Fee.

I.3.3 Step 3 for Project Scenario "A": Fee Calculations

Project Scenario A maximizes the development potential of the site's holding capacity expressed through the general plan and zoning. As a result, the project has a limited amount of avoidance of the site's special habitats. Open space areas provide a number of common area functions for the project (e.g., passive recreation, stormwater quality improvements, buffers, and habitat avoidance) but do not provide a suitable level of avoidance to avoid effects and/or make a contribution to the reserve system.

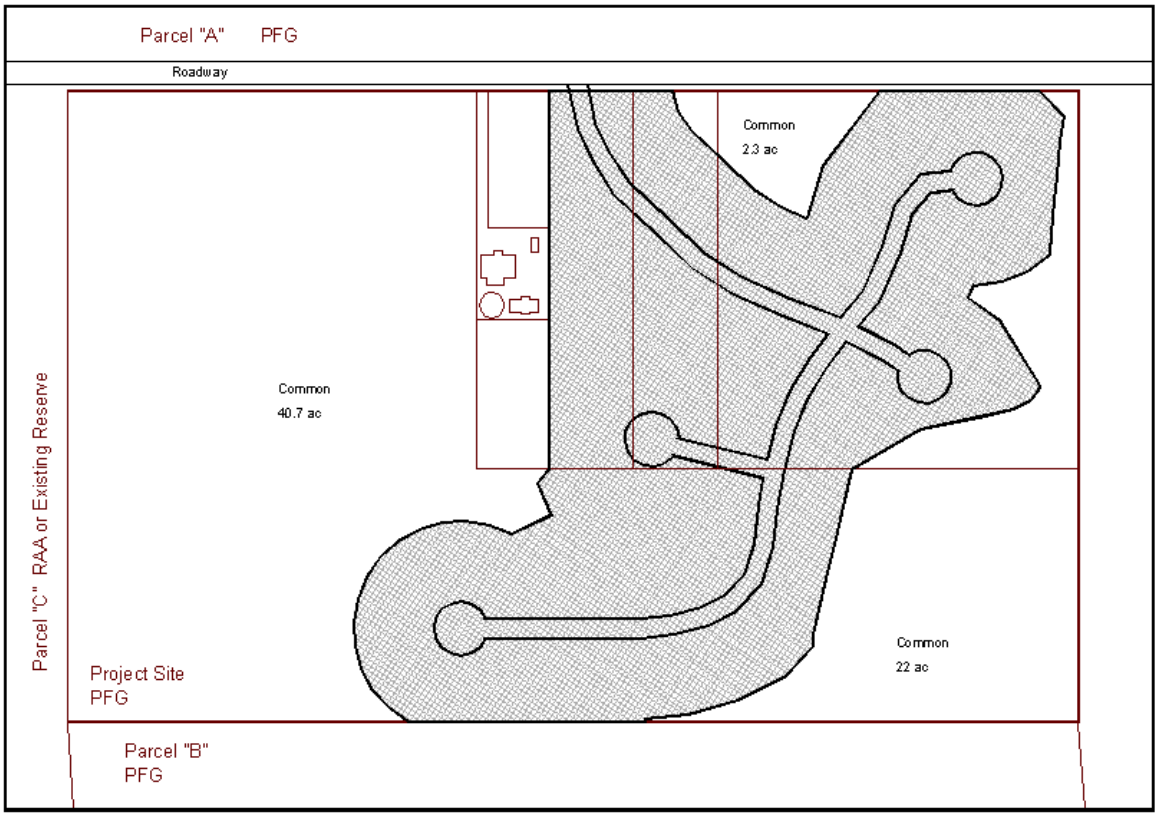
Applicable PCCP Development Fees (See Tables 9-5, 9-6 and 9-7)

Valley Land Conversion Fee Type:	1c
Land Conversion Fee Amount:	96.9 acres X $26,473/acre = $2,565,234
Special Habitat Fees:	
Vernal Pool Wetlands, Direct	1.3 acres X $171,167/acre = $222,517
Vernal Pool Wetlands, Indirect On-Site	0.07 acres X $28,586/acre = $2,001
Vernal Pool Wetlands, Indirect Offsite	0.34 acres – no applicable fee
Aquatic/Wetland	0.32 acres X $121,025 = $38,728
Riverine/Riparian	0.24 acres X 107,637/acre = $25,833
Stream System	3.31 acres X $107,637/acre = $356,278
Salmonid Channel Fee	80 linear feet X $654/linear feet = $52,320
Subtotal Special Habitat Fees:	$697,677
Temporary Effect Fee:	(0.15acres X $26,473) X 0.02 = $79
Total:	$3,261,990

I.3.4 Step 2 for Project Scenario "B": Project Assessment – Reduction of Impacts on Vernal Pools and the Stream System

In the second scenario on the same site, Project Scenario "B" reduces the subdivision development footprint to 36 acres, avoiding much of the vernal pool constituent habitat on the west and eliminating the requirement to cross the salmonid creek to reach the southeastern portion of the site (Figure I-10).

Figure I-10 Reduced Project Scenario "B" Footprint



The alternative design on the same site creates common area open space which may meet avoidance criteria for the PCCP. The 40.7-acre open space area on the west meets the criteria for adjacency to the RAA or an established reserve and for the presence of valuable biological resources, in this case vernal pool complex with wetlands. The 22-acre common open space surrounding the westerly stream and would meet the criteria for adjacency to the Stream System and presence of valuable biological resources, in this case the salmonid stream, riparian vegetation, fresh emergent marsh and a small portion of vernal pool complex. The 2.3-acre common open space on the north surrounded by the existing public roads and the proposed subdivision would not meet avoidance criteria (See Section 6.3.1.3.1 *Permanent Effect Avoidance in the Valley PFG*). The resulting development footprint of 37.3 acres is substantially smaller than the 96.9 acres of footprint in Project Scenario "A" and would yield a smaller number of dwelling units if approved (unless local zoning requirements allowed for a density transfer within the project boundary such as a planned development).

The avoidance of the western portion of the parcel spares several vernal pool wetlands from direct effects, but raises the issue of indirect effect. In Section I.3.6, the Project Scenario "B" is used to explore the process of calculating indirect effects on vernal pools by evaluating the project's potential effects in the area known as the "immediate watershed".

I.3.5 Step 3 for Project Scenario "B": Fee Calculations

The Project Scenario "B" will pay fewer fees than Project Scenario "A" because it is able to partially avoid land conversion, special habitats, and the Stream System encroachment and it completely avoids impacts on the salmonid stream channel. Land conversion fees will be based on a smaller development footprint and the 2.3-acre remnant open space fragment on the north which will pay the full land cover fee. The 40.7-acre remnant area on the west may be considered avoided (and not subject to fees) because it is adjacent to the RAA or an existing reserve, and the 22-acre area around the salmonid stream on the southeast may also be considered avoided depending on the condition of the stream and any aquatic and riverine/riparian habitat that is present.

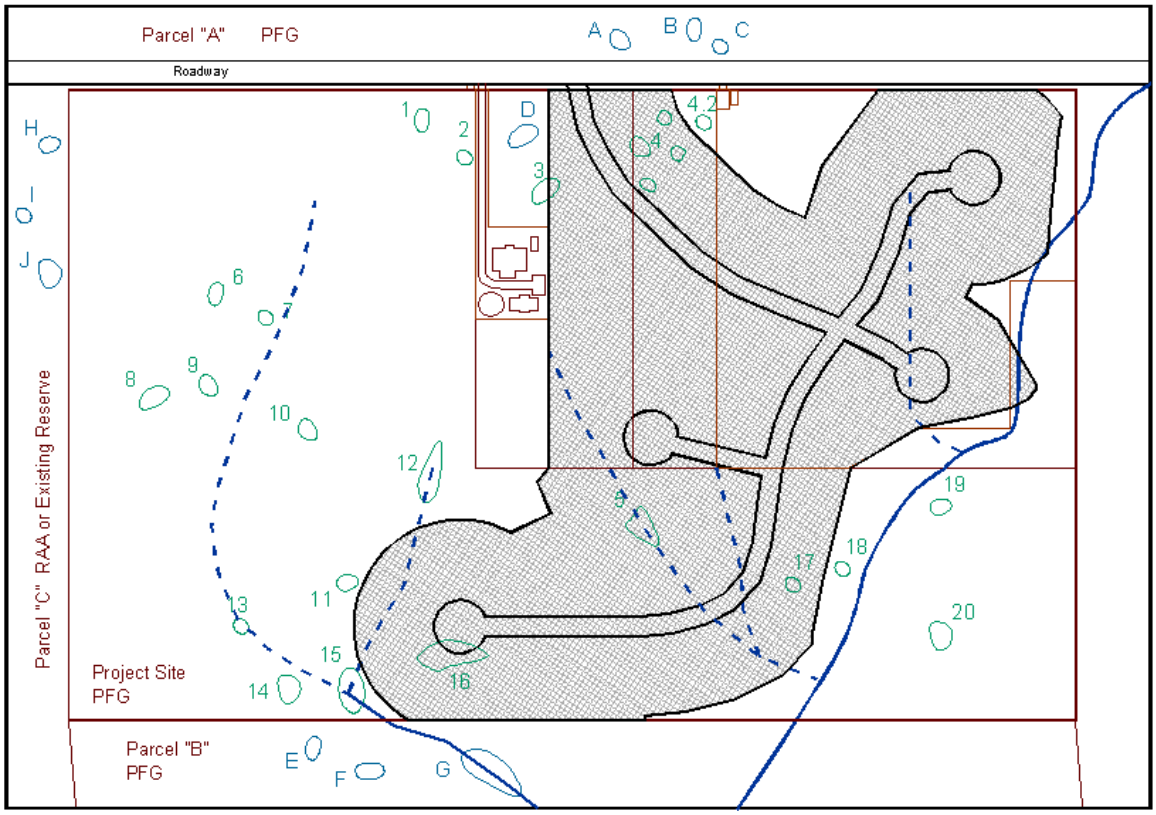
Applicable PCCP Development Fees

Valley Land Conversion Fee Type:	1c
Land Conversion Fee Amount:	37.3 acres X $26,473/acre = $987,443
Special Habitat Fees:	
Vernal Pool Wetlands, Direct	0.64 acres X $171,167/acre = $109,547
Vernal Pool Wetlands, Indirect On-Site	0.24 acres X $28,586/acre = $6,861
Vernal Pool Wetlands, Indirect Offsite	0.32 acres – no applicable fee
Aquatic/Wetland	0.12 acres X $121,025 = $14,523
Riverine/Riparian	0.09 acres X 107,637/acre = $9,687
Stream System Encroachment	0.41 acres X $107,637/acre = $44,131
Subtotal Special Habitat Fees:	$184,749
Total:	$1,172,192

I.3.6 Vernal Pool Wetland Indirect Take Example

The Project Scenario "B" would build on only a portion of the hypothetical 100-acre project site (Figure I-11). The site is bounded on the north by a public roadway with Parcel A on the far side, on the west by parcel C which would be RAA or an existing reserve, and on the south by parcel B designated in the PCCP as potential future growth area (PFG). The example shows an existing rural residential property in the center on the north and several pieces of remnant open space.

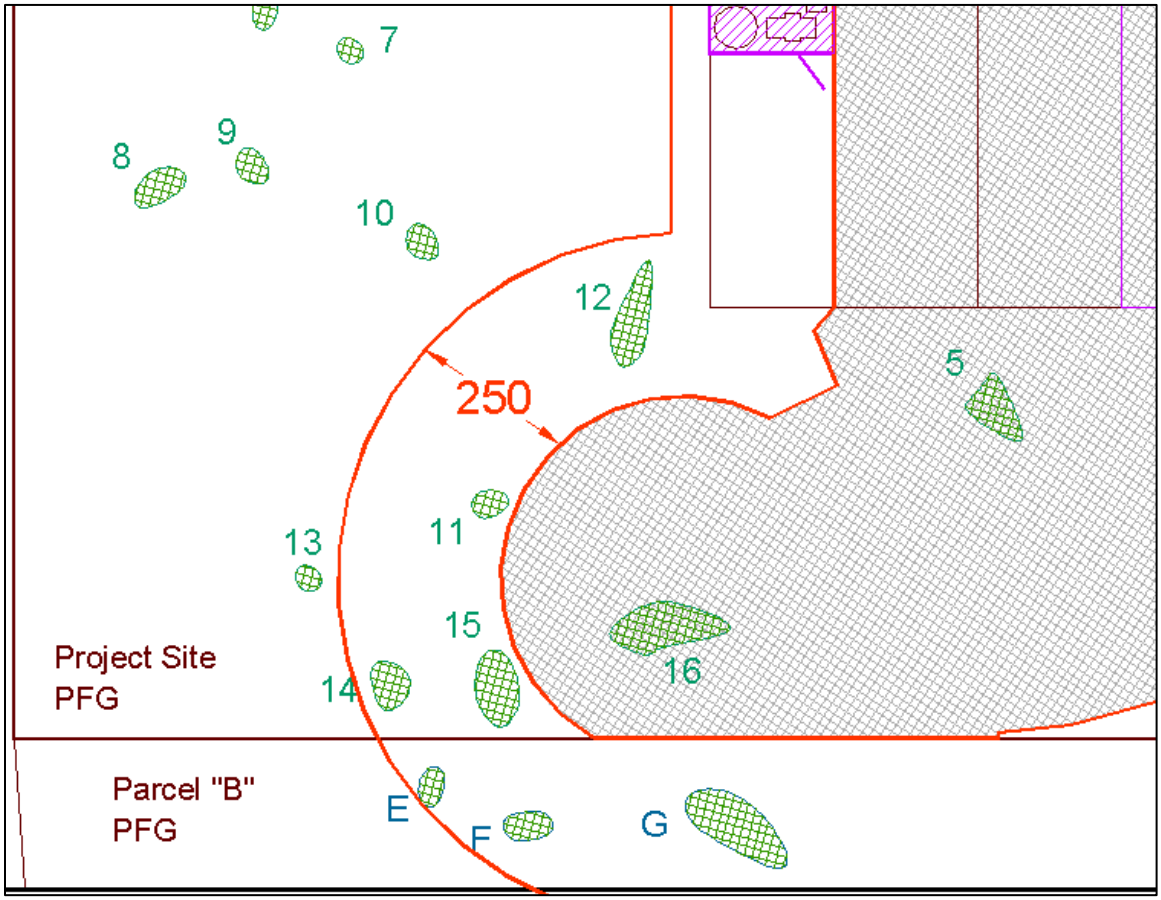
Figure I-11 Project Scenario "B" Footprint and Vernal Pool Type Wetlands.



Numbered wetlands (e.g. #1, #2, etc.) are located on the project site and have been located and characterized by the required wetland delineation. Lettered wetlands (e.g. A, B, etc.) are located off-site, and have been mapped using aerial photography or other remote sensing. The reader is urged to bear in mind that this is a schematic intended to illustrate application of the HCP/NCCP – it is not based on a real property or on an actual wetland delineation and hence is not intended to reflect ecological relationships that would commonly be found in the field.

Figure I-12 depicts the project footprint overlaid on the vernal pool type wetland delineations. From this point forward the scenario focuses on the southwest corner of the project site to see how wetlands are affected and how indirect effects are evaluated for vernal pool type wetlands.

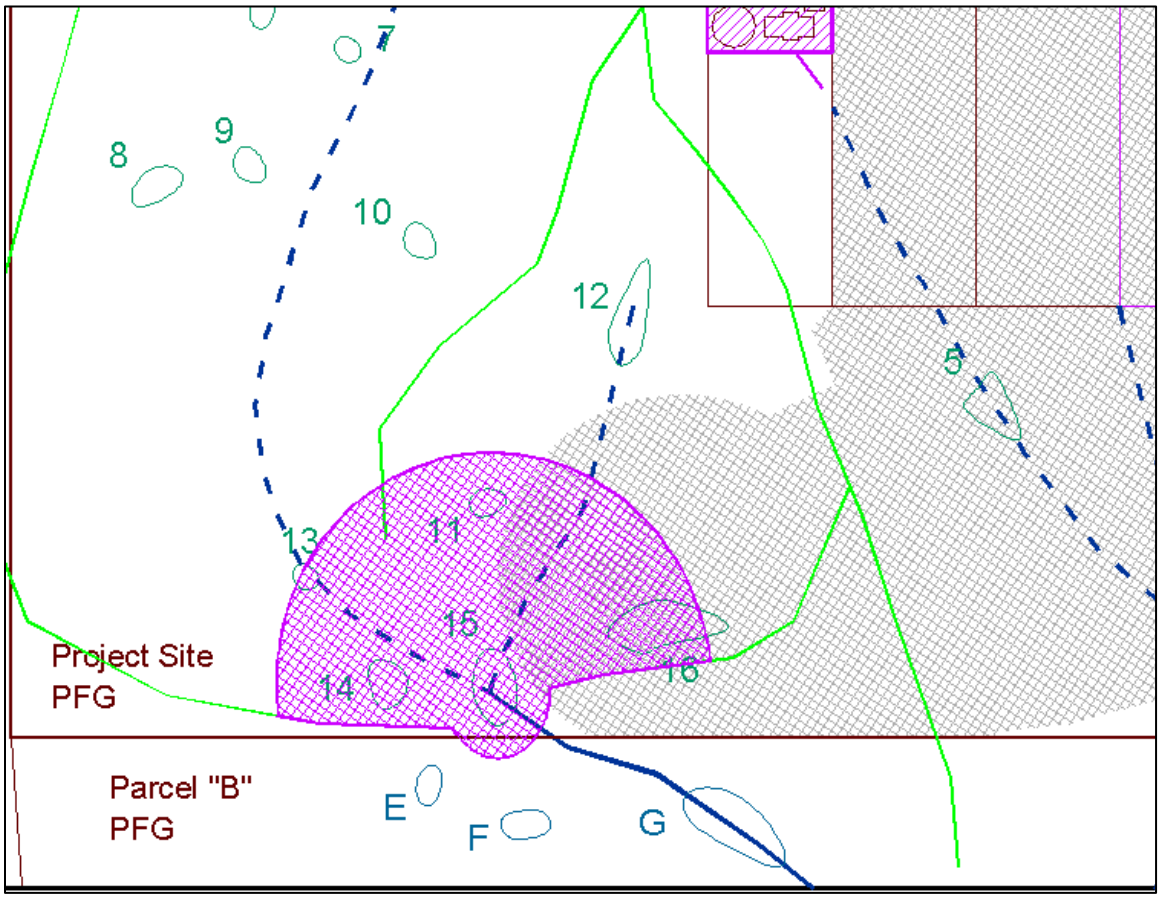
Figure I-12 Project Footprint Overlay on Vernal Pool Type Wetland Delineations



According to Community Condition 6.3.2.1.1 of the HCP/NCCP (*Avoidance for Vernal Pool Complex Constituent Habitat Wetlands*) Wetlands #5 and #16 clearly fall under the project footprint and are subject to permanent direct take. Because of the 250-foot default buffer, wetlands that need to be evaluated for indirect effect are all of those that fall within 250 feet of the outer edge of the project footprint. In this example that includes on-site Vernal Pool Wetlands 11, 12, 14, and 15 and off-site Vernal Pool Wetlands E, F, and G located on Parcel B which is under different ownership than the project site. No ground access is available to these vernal pools.

To determine the immediate watershed applicable to Vernal Pool Wetland #15, the drainage (blue) and watershed lines (green) are depicted and buffers are drawn around the wetland perimeter of Vernal Pool Wetland#15 at the distance of the 50-foot down gradient minimum and the 250-foot maximum in the watershed above as shown in Figure I-13.

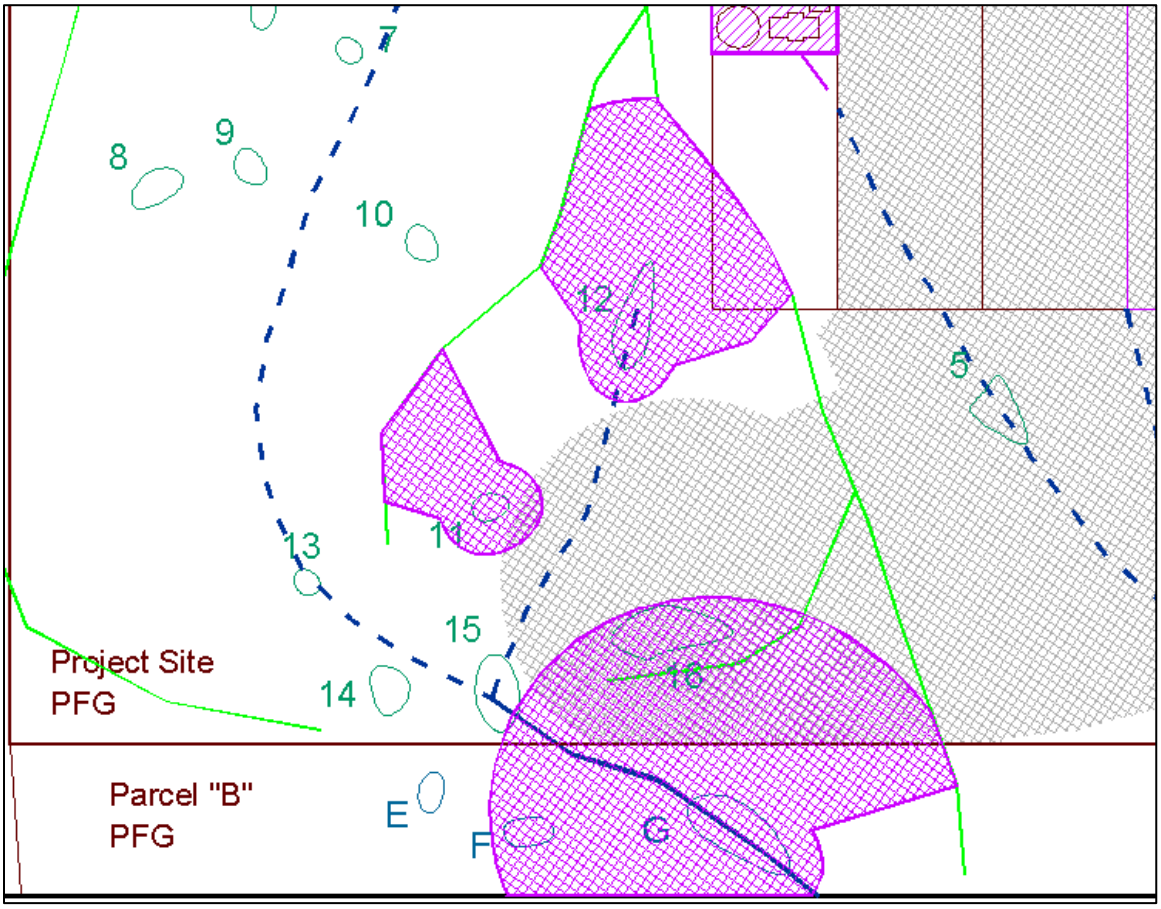
Figure I-13 Evaluate immediate watershed of Pond #15



The immediate watershed of Vernal Pool Wetland #15 is the wetland's micro-watershed subject to the 50/250-foot minimum/maximum defaults as depicted in purple above using the default minimum standards for effects. If the project footprint overlaps any portion of the wetland's immediate watershed, then the wetland fails to meet the avoidance criteria in Community Condition 6.3.2.1.1, (*Avoidance of Vernal Pool Complex Constituent Habitat*). In this case, Pond #15 is subject to indirect take and will be subject to the Vernal Pool Immediate Watershed Effects fee.

In Figure I-14 Vernal Pool Wetlands #11, #12 and off-site Vernal Pool Wetland G are evaluated.

Figure I-14 Determine the Immediate Watershed of Other Wetlands

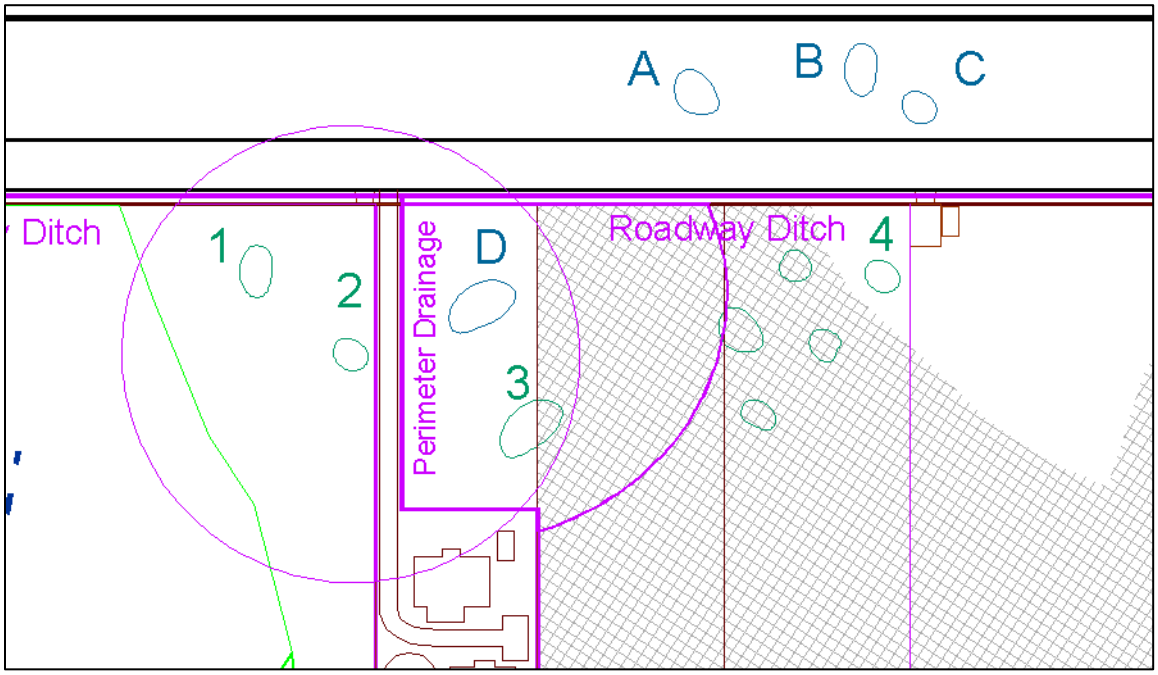


The project footprint overlaps the immediate watershed of Vernal Pool Wetland #11 and off-site Vernal Pool Wetland G. The project does not overlap the watershed of Vernal Pool Wetland #12 because the relatively steep swale containing Wetland #12 places it at sufficiently higher elevation so that the project won't affect its hydrology. From this analysis the following conclusions can be reached:

- The Vernal Pool Immediate Watershed Effects fee will not apply to Vernal Pool Wetland #12.
- The Vernal Pool Immediate Watershed Effects fee will apply to Vernal Pool Wetland #11 which is on-site.
- No fee will apply to off-site Vernal Pool Wetland G, but the PCA and the Permittees will be required to estimate the area of wetlands affected and to keep it in the summary of off-site indirect effects.

Figure I-15 evaluates the vernal pool wetlands to the North of the project that are located on an adjoining rural residential property.

Figure I- 15 Offsite Vernal Pool Wetlands



Project Scenario "B" has several vernal pool type wetlands on the north side of the project including offsite wetlands. In this case, the project footprint falls directly over the cluster of wetlands near Vernal Pool Wetland #4 and falls across a portion of Vernal Pool Wetland #3. The following conclusions can be reached about the wetlands depicted on Figure I-15:

- Because the project impacts a portion of the actual wetted area delineated for Vernal Pool Wetland #3, the entire wetland area of Wetland #3 is subject to the Vernal Pool Direct Effects fee and will be reported as take by the PCA.
- The immediate watershed analysis will show that on-site Vernal Pool Wetland #4 and off-site Vernal Pool Wetland D pools will be subject to indirect effects and the Vernal Pool Immediate Watershed Effects Fee.
- On-site Vernal Pool Wetland #2 has a 250-foot buffer that crosses over the intervening rural residential property in this example and touches on the project footprint. In this example, the perimeter drainage and driveway established around the pre-existing rural residential use isolates the project footprint from the hydrology of Wetland #2 and hence Wetland #2 is not subject to indirect effect.
- Off-site Vernal Pool Wetlands A, B, and C are within 250 feet of the project footprint and may have formerly been part of the watershed of a vernal pool complex associated with Vernal Pool Wetlands #1, 2, 3 and 4, but the existing road and roadway drainage ditch clearly isolate the project from any hydrology impact on those pools. They are not considered subject to indirect effect.

In summary, the final assessment of vernal pool direct and indirect effects is depicted in Figure I-16. Vernal pools subject to permanent direct effect are shown in red; vernal pools subject to permanent indirect effect on-site are shown in cyan, and vernal pools subject to indirect effects off-site are

shown in green. Table I-3 shows the area in acres associated with this hypothetical example and how fees would be applied to the different categories of effect.

Figure I-16 Vernal Pool – Final Disposition

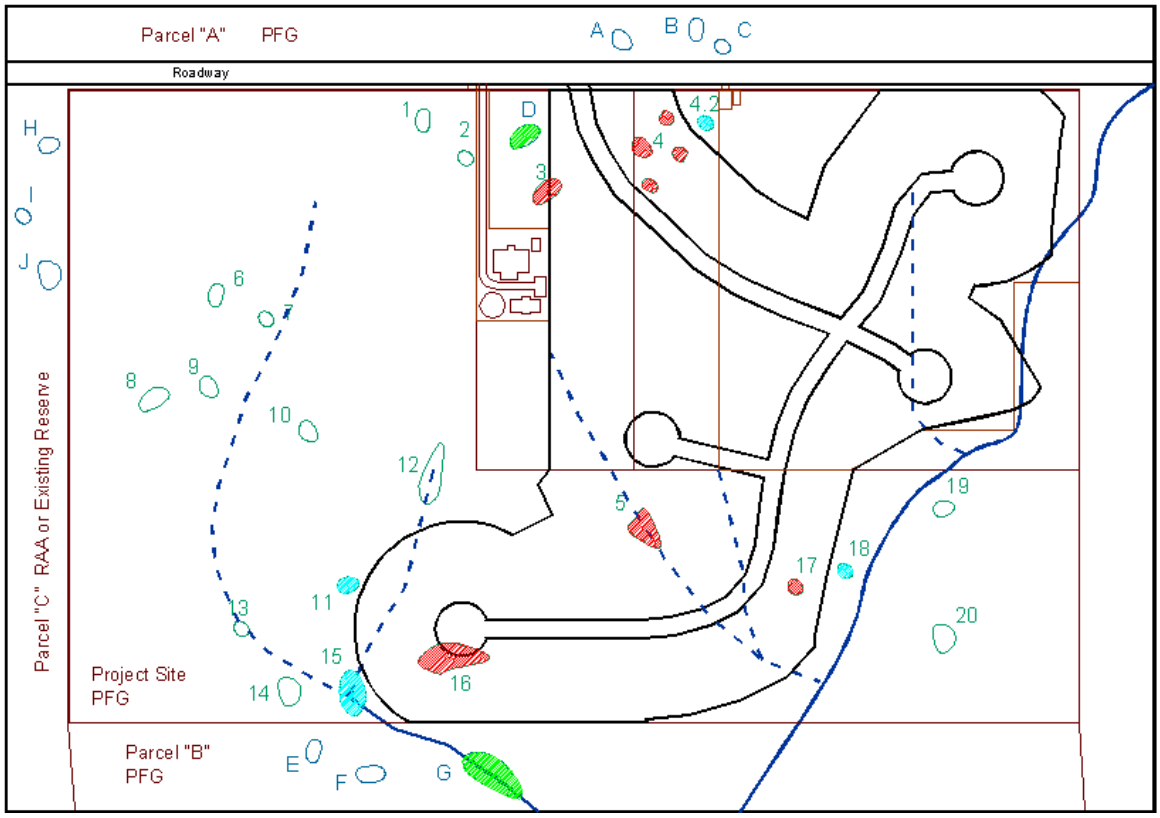


Table I-3 Project "B" Specific Vernal Pool Effect and Fees

Permanent Direct Effect		Permanent Indirect Effect, On-Site		Indirect Effect, Off-Site	
Pool ID#	Acres	Pool ID#	Acres	Pool ID	Acres
3	0.08	4.2	0.03	D	0.08
4	0.20	11	0.04	G	0.24
5	0.11	15	0.14		
16	0.22	18	0.03		
17	0.03				
Total	0.64		0.24		0.32
Fee $/acre	$171,167		$28,586		
Fee owed	$109,547		$6,861		$0

Appendix J

Reserve Unit Management Plan Template

PLACER COUNTY CONSERVATION PROGRAM

Reserve Unit Management Plan TEMPLATE

May 15, 2017

This management plan template is a companion document to the Placer County Conservation Program conservation or agriculture easement templates and are intended to provide a general outline to assist in the development of site-specific management plans for properties (i.e., Reserve Units) included in the Placer County Conservation Program Reserve System.

General Notes to Reviewers

Reserve Unit Management Plan; Relationship to Conservation/Agricultural Easement. This template anticipates the concurrent preparation of a conservation easement or agricultural easement (collectively, "easements"). The easements outline the primary prohibitions and restrictions that apply to the reserve unit; conversely, the reserve unit management plan (management plan) describes the primary activities that are planned to occur or are otherwise allowed to occur in the reserve unit in the future. As part of the implementation of the Placer County Conservation Program (PCCP), the Placer Conservation Authority (PCA) will develop management plans that prescribe management practices suitable for specific covered species and their associated habitat types and will be used by the PCA to inform management and allowed uses in each reserve unit. For reserve units not acquired by the PCA in fee, the PCA will work with each landowner to develop a management plan that is suitable to the specific conditions of the site and is mutually agreed upon by the landowner, the PCA, the California Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service.

The PCA recognizes that changes (e.g., in agricultural practices and technologies, weather cycles, natural resource management technologies, conservation practices) may dictate changes in the management of the reserve unit, consistent with the purposes of the easements and the PCCP. The management plan may be revised from time to time only with the written approval of both the Landowner (for lands not owned by the PCA in fee) and the PCA (and easement holder in situations where the PCA is not the easement holder), so long as the revisions are consistent with the PCCP. Any requested changes that are not consistent with the PCCP must receive approval from California Department of Fish and Wildlife and U.S. Fish and Wildlife Service. A full and complete copy of the current management plan, including any such revisions, shall be kept on file at the offices of the PCA.

For each reserve unit, the final easement and management plan ***will work together*** to specify (among other things) allowed, restricted, and prohibited uses and activities. The easement will generally include terms that will apply ***permanently*** to uses and activities on the reserve unit, while the management plan will contain terms relating to covered species management and monitoring, agricultural uses, and other uses that may—with the consent of the landowner (if applicable), PCA, and state and federal wildlife agencies—***vary over time*** due to changing conditions. Additionally, each reserve unit's management plan may contain terms relating to recreational uses, public access, and other uses and activities that are of interest to an individual landowner, or the PCA, at their request, as long as the uses are determined to be compatible with the reserve unit's conservation values and approved by the California Department of Fish and Wildlife and the U.S. Fish and Wildlife Service.

Text Color Code Legend:
(Blue Bracketed Text) includes general notes to the reader intended to provide additional explanation.

[*Green Bracketed Text*] notes where site-specific information needs to be included. The description of the type of information is written within the brackets.

Acceptable variations to the primary text will be provided in grey text surrounded by brackets, like this: [*replace "*PCA*" with the "*Easement Holder*" if the PCA is not the Easement Holder*]

{Purple Bracketed Text} provides references to associated sections of the PCCP that may contain additional explanation or detail.

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1: INTRODUCTION

1.1 Purpose of Establishment

The Placer Conservation Authority (PCA) is currently implementing a Habitat Conservation Plan/Natural Community Conservation Program (Placer County Conservation Program, PCCP) for western Placer County, California. The PCCP provides for the conservation of covered species[1] and protects regional biodiversity by protecting restoring, enhancing, and managing covered species habitat and important natural communities across western Placer County, including natural and agricultural landscapes that support covered species. As part of this program, the PCA may acquire conservation easements on lands within the PCCP plan area from willing landowners that include conservation and management requirements consistent with the biological goals and objectives of the PCCP.

An *[insert "agricultural" or "conservation" here, depending on the specific form of easement recorded against the Reserve Unit]* easement has been established on an [*insert acreage of easement*] acre portion of the [*insert name of site or sites*] property (Reserve Unit). The [*insert site name*] *[insert "agricultural" or "conservation"]* easement (Easement) was filed with the Placer County Recorder's Office on [*insert date*] and is identified as [*insert County Document code shown in top right corner of recorded easement document DOC-YEAR-restofcode-xx*]. This Management Plan was developed concurrently with the development of the Easement. Both the Easement and this Management Plan are intended to be consistent with the biological goals and objectives of the PCCP and to partially fulfill the PCCP conservation strategy.

The Conservation Values of the Reserve Unit are:

- *[Insert description of the Conservation Values as they are described in the Easement]*

The Reserve Unit contributes to the conservation strategy by:
{See Chapter 5 of the PCCP for the full description of the PCCP conservation strategy.}
[Insert a separate bullet here for each PCCP conservation strategy objective that is addressed {See Table 5-2 of the PCCP}*. An example format for describing a conservation strategy objective is provided below.]*

- Maintaining [*insert acreage*] acres of [*insert habitat type (e.g., nesting, foraging, upland, aquatic)*] *for* [*insert covered species* {a complete list of covered species is found in Table 1-1 of the PCCP}] and [*insert land cover type providing the abovementioned habitat* {this includes the land cover type(s) present on the site that

[1] For a complete description of status, range, life history, threats, and modeled habitat for each covered species associated with the PCCP, see Appendix D of the PCCP. Available: http://www.XXXX.XXX

provide habitat for the identified covered species and are included in Section 1.2.3 of the PCCP (e.g., rice, riparian woodland, vernal pool) along with the habitat function that the identified land cover type provides (e.g., foraging, nesting, aquatic, upland habitat)}].

1.2 Purpose of Management Plan

The purpose of this Management Plan is to ensure the Reserve Unit is managed, monitored, and maintained in perpetuity for the covered species. This document includes a description of biological resources identified for protection and establishes specific guidelines, roles, and responsibilities for the management and monitoring of the Reserve Unit. It was developed concurrently with the development of the Easement. This Management Plan is a binding and enforceable agreement implemented in accordance with the requirements of the PCCP and the terms of the Easement covering the property.

1.3 Land Ownership, Management, and Monitoring Entities

The parties responsible for ensuring that the Reserve Unit is maintained in a manner consistent with the Easement are listed below. The PCA is responsible for overseeing implementation of all management activities and site requirements of this Management Plan. *[If the PCA wishes to formally designate all or a portion of this responsibility to another entity such as a Land Manager, lessee or an entity that the PCA has willingly delegated the responsibility of all or portion of site management (crop management, habitat enhancement activities, etc.) then state so here and provide contact information below the PCA contact information]*.

Placer Conservation Authority (PCA)

The PCA is responsible for managing the Reserve Unit in a manner that is consistent with the Easement and this Management Plan. Contact information for the PCA is as follows:

Name: [*insert contact person and organization/entity where applicable*]

Contact Name: Delete if landowner is an individual

Address:

Phone number:

Email:

[*In cases where the PCA is not the Landowner, a separate contact entry will be added for the Landowner:*

Landowner

The landowner owns fee title to the Reserve Unit and is responsible for cooperating with the PCA to ensure that the Reserve Unit is managed and maintained in a manner that is consistent with the Easement and this Management Plan. Contact information for the landowner is as follows:

Name: *[insert contact person and organization/entity where applicable]*

Contact Name: Delete if landowner is an individual

Address:
Phone number:
Email:]

[*In cases where the PCA <u>is not</u> the Easement holder, a separate contact entry will be added for the*

<u>Easement Holder:</u>

The Easement holder is responsible for enforcing the terms of the Easement and for conducting, at minimum, annual compliance monitoring to ensure the Reserve Unit is managed and maintained in accordance with the PCCP, the Easement, and this Management Plan.

Name: [*Insert contact person and organization/entity*]
Contact Name:
Address:
Phone number:
Email:]

2: PROPERTY DESCRIPTION

2.1 Location and Setting

The property is located at [*insert address or other location description*], in Placer County, California. The Reserve Unit is shown on the general vicinity map (Figure 1), location map (Figure 2), and the site map (Figure 3). The general vicinity map shows the Reserve Unit in relation to cities, towns, or major roads, and other distinguishable landmarks. The location map shows the Reserve Unit and adjacent lands, and the site map shows the Reserve Unit and specific land management areas defined within the Easement.

Assessor's Parcel Number(s): [*insert APN(s)*]

U.S. Geological Survey 7.5-minute quadrangle: [*insert name of quad map*]

Township, Range, & Section: [*insert Township, Range, & Section*]

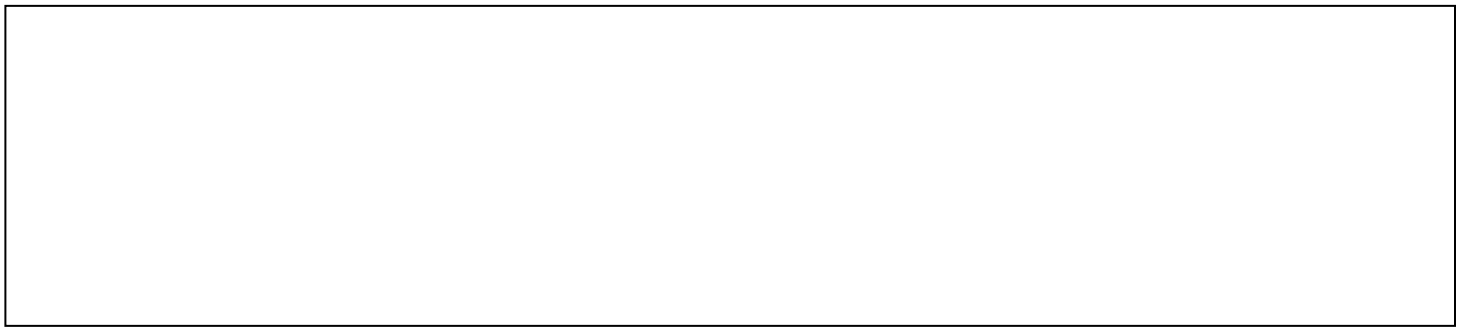

Figure 1: [*insert name of site*] vicinity map

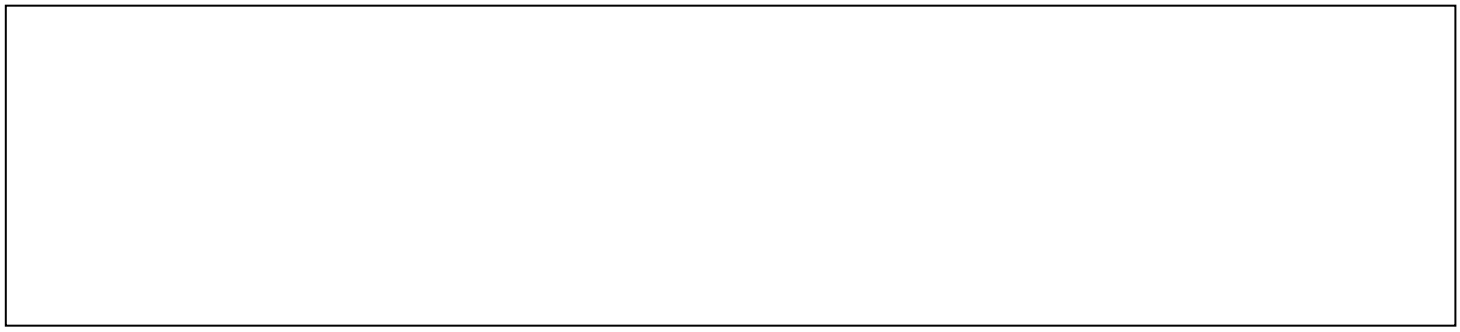

Figure 2: [*insert name of site*] location map showing adjacent land uses as captured in aerial photography taken [*insert date of aerial photography*]

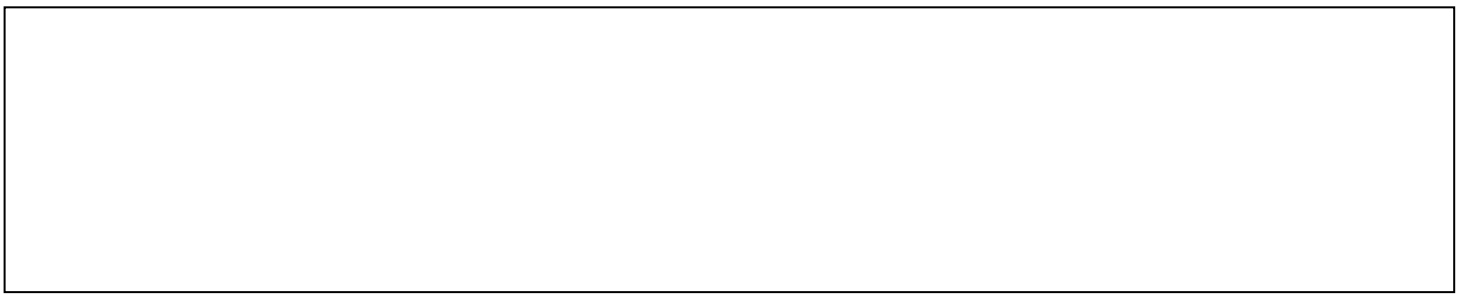

Figure 3: [*insert name of site*] site map showing specific land management areas as defined by the Conservation Easement

2.2 Historic and Current Land Use

[*Describe past and present land use including crop types, grazing practices and/or other significant land use activities as applicable. Describe all existing structures including roads, levees, fencing, and buildings, and whether they are located in the Reserve Unit or within a reserved development envelope, for sites that contain development envelopes severed from the Easement-protected portion of the Reserve Unit.*]

2.3 Site Soils, Topography, and Hydrology

[Note any significant topographic features, soil conditions, hydrologic conditions associated with the site. Identify any significant hydrologic natural community types or land cover types (e.g., fresh emergent wetland, riverine, etc.) {as further described in Section 1.2.3 of the PCCP}. *Show the location of any hydrologic land cover types in Figure 3 if applicable. If the site is a cultivated agricultural lands site and present soil conditions restrict crop types that may be of interest – note as such]*

2.4 Existing Easements

[*If there are existing encumbrances, include descriptions/locations of existing easements located on the property, their nature (buried pipeline, overhead power, ingress/egress, etc.), authorized users (if known), access procedures, etc. Depict easements, rights of way, ingress, and egress routes in a map. If there are no existing encumbrances on the site, state so here – DO NOT DELETE THIS SECTION.]*

2.5 Adjacent Land Uses

[*Provide a description of the adjacent land uses at the time in which the Reserve Unit was established. These land uses may change over time; however, the description of the baseline conditions will give the manager some idea of the conditions present when the management plan was first developed and can bring to light areas that may be of management concern or items outside of the Reserve Unit that may support or compromise the integrity of the*

Conservation Values over time. Note any known conservation easements existing within a 2-mile radius of the property at the time in which the Reserve Unit was established, identify if any are part of the PCCP Reserve System, and show them in Figure 2.]

3: HABITAT AND SPECIES DESCRIPTIONS

3.1 Conditions and Conservation Values of the Easement

[*Include a specific description of the Conservation Values of the site that includes a summary of their baseline condition. Include any applicable information about how the protection of this site fits in with protection of other adjacent sites or of specific natural community types that have been designated as important.]*

3.2 Summary of Enhancement Activities

[For sites where the PCA may implement habitat enhancements (e.g., sites that could provide additional, or improved, habitat for covered species, include a summary of the enhancement effort and the intended outcome of the effort. This would include items such as: planting hedgerows to increase prey habitat; planting nest trees to provide additional nest habitat; creation, restoration, or enhancement of vernal pools, other wetlands, or riparian habitat; modification of crop type from a low habitat value crop to a high habitat value crop to increase forage value; invasive species removal, etc. Include the estimated time in which enhancements will reach mature/final desired status and what benefits those enhancements will have for covered species, other species, and the natural community at-large. Identify who is responsible for implementing the enhancement activities and who will be responsible for management over time.]

3.3 PCCP Covered Species

[*Describe all covered species that occur or may occur on the site* {a complete list of covered species is found in Table 1-1 of the PCCP}.]

4: MANAGEMENT

(This section describes both allowed and restricted management practices. Descriptions are provided below for conditions that are likely to apply to most sites. Additional management provisions will be added as applicable for specific species and land cover types. Once developed, Reserve Unit Management Plans will provide the provisions applicable to specific species habitats and land cover types.)

4.1 General Site Activities and Management

(This section summarizes general site management measures that are not specific to a land type. Activities that would be included in this section include items such as public access, fencing and gates, trash, signage, etc. This section may be modified to fit the prohibitions contained in the actual Easement recorded for the Reserve Unit; the list below is included as an example only)

4.1.1 Vehicle Use: Use of vehicles on existing roads is allowed. *[Describe vehicle use and access on other portions of the site that are allowed and/or restricted as part of ongoing site management activities.]*

4.1.2 Site Improvements:

Construction, operation, or maintenance of buildings and facilities, not in existence at the time the conservation easement becomes effective, are prohibited except within any designated Development Envelope. This includes antennas, towers, and facilities for the generation and transmission of electrical power or telecommunications. The erection and maintenance of windmills, wind farms, wind generating facilities, or other facilities with exposed spinning blades are prohibited, including within the established Development Envelope (if applicable).

[*add this language for agricultural parcels:*
Electrical distribution and telecommunication facilities reasonably necessary in connection with agricultural and other authorized uses on the Reserve Unit shall be allowed. Solar power generation shall be allowed in quantities commensurate with agricultural power consumption on the Reserve Unit and electrical distribution and telecommunication facilities reasonably necessary in connection with agricultural uses on the Property. Solar power generation facilities are to be located within the established Development Envelope areas. Solar panels placed directly adjacent to water pumps or similar agricultural equipment used to maintain the agricultural function of the site are allowed, so long as the disturbance area does not exceed 25 square feet in total size, and no more than one such solar panel facility exists for every 10 acres of real property within the Reserve Unit (areas within Development Envelopes are not subject to this size restriction).]

Existing fencing may be repaired and new fences may be built anywhere on the property for purposes of reasonable and customary agricultural management or natural resource management, and for security in connection with authorized or reserved uses of the property. *[Describe any other site improvements (e.g., the construction, reconstruction, or relocation of signs, roads, temporary structures, etc.) that are allowed within the Reserve Unit.]*

Paving or covering with other impervious material of any area that is presently unpaved is prohibited, except (1) land within the established Development Envelope, or (2) to comply with a specific governmental directive (e.g., written requirement in connection with a binding permit) regarding air quality laws, fire safety regulations, or other governmental regulations applicable to the Reserve Unit. The use of gravel, crushed rock, or the lime treatment of soils is prohibited, except on (1) any roads that exist on the Reserve Unit as of the date of Easement recordation, so long as said use does not expand the currently existing roads, or (2) any roads located wholly within the Development Envelope, so long as Grantor obtains Grantee's and Third Party Beneficiaries' prior written consent for the location of the same. Notwithstanding the foregoing, however, the application of lime to soils on the Property for the purpose of adjusting levels of soil pH to achieve optimal agricultural production is permitted.

4.1.3 Dumping and Waste: The dumping or accumulation of any kind of refuse or hazardous waste, other than the temporary storage of farm-related trash and refuse produced on the property prior to offsite disposal is prohibited. This shall not prevent the storage of chemicals, fertilizers, soil amendments, products, byproducts, and other materials for agricultural use or for habitat management, restoration, creation, or enhancement on the Reserve Unit, so long as it is done in accordance with all applicable government laws and regulations, this Management Plan, and the Conservation Easement.

4.1.4 Mining:

Mining is prohibited as set forth in the Conservation Easement.

4.1.5 Tree Removal or Cutting:

The removal or cutting of trees on the site is prohibited except as required to implement this Management Plan or as reasonably necessary and/or prudent for: (1) construction of fire breaks, (2) prevention or treatment of disease, or (3) removal of vegetation and debris which pose a health and safety hazard or a threat to standard agricultural operations.

4.2 Agricultural Practices

(For applicable sites, this section will identify the specific locations in which agricultural activities occur and/or are allowed to occur, provide a general description of the agricultural practices within the defined areas, and any details regarding timing, duration, and/or quantity of practices. These items may include, but are not limited to,

methods and/or timing of crop harvest under conditions where species are present, management of irrigation canals, etc. Below are examples of some topics that are applicable to this section)

4.2.1 Crops and Crop Management:

[Describe types of crops typically planted on the site, typical rotation cycles, frequency of fallowing, etc., and identifies any crops that are prohibited based on the covered species associated with the site]

4.2.2 Herbicide, Pesticide, Biocide, and Other Chemical Use:

[Describe chemical applications allowed as applicable to site management for cultivated lands.]

4.2.3 Soil Amendments:

[If applicable, describe any applications of soil, compost, application of lime, or other soil amendments that are allowed as part of ongoing site management activities.]

4.2.4 Water Management:

[Describe water source(s) used for cultivated lands, application methods for irrigating crops (flood, drip, etc), canal management, etc.]

4.2.5 Pest Management:

[Describe any pest management approaches used or otherwise allowed on the site, if applicable. Note that rodenticides use is prohibited on all easement sites.]

4.2.6 Cover Strips and Hedgerows

[Describe typical management of cover strips and/or hedgerows, if applicable.]

4.3 Natural Lands Practices

(For applicable sites, this section would summarize natural lands management practices, locations in which natural lands activities occur and/or are allowed to occur and details regarding timing, duration, and/or quantity of practices. These items may include, but are not limited to, methods and timing of invasive species management, specific allowable livestock grazing practices, etc. Below are examples of some topics that may be applicable to this section; the topics included in each Reserve Unit Management Plan would be specific to that Reserve Unit and may vary.)

4.3.1 Vegetation Management:

[Describe general vegetation management practices including management for both native species and invasive species. If applicable, describe any efforts to maintain, enhance, or restore nest trees or other vegetative habitat features. Describe any herbicide applications allowed as applicable to invasive species

management here.]

4.3.2 Water Management:

[Describe water source(s) used for natural lands (e.g., for pasture, nest tree establishment, managed wetlands, livestock watering, etc.), application methods for distributing or applying water, canal management, etc.]

4.3.4 Grazing Management:

[If applicable, describe any grazing that occurs on the site or is otherwise allowed to occur on the site.]

4.3.5 Pest Management:

[Describe any pest management approaches used or otherwise allowed on the site, if applicable. Note that rodenticides use is prohibited on all easement sites.]

4.3.6 Non-native predator control:

[Describe any non-native predator control approaches used or otherwise allowed on the site.]

(Additional sub-section categories will vary based on site-specific conditions and uses. Some examples of additional sub-section categories include: Erosion Control, Pond Management, Installation and Management of Artificial Nest Burrows, Basking Habitat Enhancement and Management)

4.4 Avoidance and Minimization Measures

(This section will list all of the Avoidance and Minimization Measures applicable to the site including: general AMMs, natural community specific AMMs, and covered species specific AMM {see Table X-X of the PCCP})

5: MONITORING

(These sections would describe the specific techniques and protocols that will be used to monitor habitats and species in the PCCP reserve system. Because standard monitoring methods (e.g., accepted Wildlife Agency survey protocols for long-term monitoring) do not exist for all species or habitats, the methods described here will be based on, in this order of preference, methods prescribed by the PCCP in Chapter 7, Agency-accepted protocols, or methods commonly used to monitor these species and habitats in similar contexts (e.g., in mitigation or conservation banks and similar sites preserved as compensatory mitigation to satisfy Wildlife Agency permit requirements). The methods described in this section are intended to be starting points from which the approach to monitoring the PCCP Reserve system will evolve over time.)

5.1 General Biological Monitoring

The Reserve Unit will be visited once annually, at a minimum, by the PCA or its assigned representative. General biological monitoring is intended to document compliance with the site's Management Plan and Easement requirements. During these surveys, the PCA will document the extent to which invasive plants, inappropriate management (e.g., as evidenced by very high or very low amounts of residual dry matter, for Reserve Units with natural communities managed through livestock grazing), adjacent land uses, and similar factors are affecting the Reserve Unit's Conservation Values.

[*Insert any language regarding specific timing of monitoring based on species or habitat factors (e.g., timing of species presence or a particular life stage*].

5.2 Covered Species and Natural Community Monitoring

[Include any species or habitat monitoring that might not otherwise be incorporated into the site-specific annual monitoring. Things like covered species counts or invasive species monitoring that occurs across the Reserve Unit. Provide any details regarding timing, location, and methods. {see PCCP Chapters 7.4 and 7.5 for specific requirements for species and natural community monitoring, which will be incorporated into this section}. *Specific monitoring requirements will be included for Grassland, Oak Woodland, Riverine/Riparian Complex, Vernal Pool Complex, Aquatic/Wetland Complex, Swainson's Hawk, California Black Rail, Western Burrowing Owl, Tricolored Blackbird, Giant Garter Snake, Western Pond Turtle, Foothill Yellow-legged Frog, California Red-legged Frog, Salmonids: Central Valley Steelhead and Central Valley Fall-/Late Fall-run Chinook Salmon, Valley Elderberry Longhorn Beetle, and Vernal Pool Crustaceans, as applicable for each Reserve Unit.]*

5.3 Actions Based on Monitoring

Monitoring results will be used to ensure compliance with the Management Plan and to make recommendations with regard to:

- Habitat enhancement measures;
- Problems that need near-term or long-term attention (e.g., invasive species removal, fence repair); and
- Changes in the monitoring or management program to better maintain covered species populations and the natural communities that provide habitat for these species.

Noncompliance with Easement and/or Management Plan provisions will be addressed in accordance with the provisions of the Easement and the {adaptive management framework described in PCCP Chapter 7}.

6: AMENDMENTS, TRANSFERS, AND NOTICES

6.1 Amendments to Management

It is recognized that future unforeseen circumstances may arise that warrant the review and modification of the terms of the Management Plan to achieve the management goals. Any of the participating parties may request a modification to this Management Plan as long as the requested change meets or exceeds the existing ability of Management Plan activities to meet the management objectives and preserves the Conservation Values of the property. Any changes to the terms outlined in this Management Plan will require agreement of the PCA, the Landowner (if not the PCA), and the Easement Holder (if not the PCA). Parties that have been identified as third-party entities in the Easement shall also be provided with notification and an opportunity to review and provide comments on any proposed amendments.

All proposed amendments shall be formalized in writing with the agreement of all parties as an update to this Management Plan. All modifications must be consistent with the requirements of the PCCP and the terms of the Easement.

6.2 Transfer of Responsibilities

Any subsequent Landowner (if not the PCA) of the Reserve Unit assumes the responsibilities described in this Management Plan and as required in the Easement. The Easement holder [*and PCA– if the PCA is not the Easement holder*] shall be notified in writing of any transfer of land ownership or land management responsibilities under this Management Plan. Any transfer of responsibilities shall be incorporated into an updated version of this Management Plan and kept on file by all parties.

6.3 Notices

[This section is a place to insert contact information for Easement third-party entities or other entities that should receive notifications beyond those listed in Section 1.2. If this is not needed, this Section can be removed]
In addition to the entities named in Section 1.2, the following entities shall be provided with written notice of any proposed modifications to this Management Plan:

Appendix K

Conservation and Agriculture Easement Templates

RECORDING REQUESTED BY AND)
WHEN RECORDED MAIL TO:)
)
)
[Easement Holder])
[Easement Holder's Address])
Attention: _____)
)

Space Above Line for Recorder's Use Only

TEMPLATE NOTES:

- ***This template is prepared for use on privately-owned fee lands. Certain of the provisions below will likely require modification for conservation easements covering Permittee- or other public entity- owned properties (i.e. management plan, recreational uses, and condemnation provisions.)***
- ***Consistent with the PCCP, this template assumes the Placer Conservation Authority will hold the conservation easements over privately-owned fee lands. Italicized bracketed language is included below for insertion in conservation easements the Placer Conservation Authority determines, in consultation with the Wildlife Agencies and IRT Agencies, as applicable, will be held by another nonprofit organization, as allowed in the PCCP.***
- ***This template does not identify recreational/public access as allowable uses. Additional provisions (i.e. specific restrictions and allowed uses, as well as reference to "recreation plan" contemplated by PCCP) would need to be included if any recreational uses are contemplated for the Easement Area/Property [use Easement Area or Property, as applicable depending on whether part or all of a legal parcel is being committed to the reserve area, selection made in Recital A].***
- ***This template also assumes the PCA, and not the Landowner, will conduct the management and monitoring activities set forth in the Management Plan.***

CONSERVATION EASEMENT DEED

THIS CONSERVATION EASEMENT DEED ("**Conservation Easement**") is made as of the _____ day of _____, 20____, by [*insert full legal name(s) of Grantor*] ("**Grantor**"), in favor of [*Placer Conservation Authority, a California Joint Powers Authority*] ("**Grantee**"), with reference to the following facts:

RECITALS

A. Grantor is the sole owner in fee simple of certain real property containing approximately _____ acres, located in the County of Placer, State of California, more particularly described in **Exhibit A** attached hereto and incorporated herein by this reference (the

"**Property**") and depicted on the map attached hereto as **Exhibit B** and incorporated herein by reference.

OR

Grantor is the sole owner in fee simple of certain real property located in the County of Placer, State of California, more particularly known as Assessor's Parcel Number(s) *XXXXXX*. Grantor intends to grant this Conservation Easement over approximately *XXX* acres of the Property (the "**Easement Area**"), as described in **Exhibit A** attached hereto and incorporated herein by this reference and depicted on the map attached hereto as **Exhibit B** and incorporated herein by reference.

B. This Conservation Easement is granted to satisfy certain habitat conservation requirements set forth in the following documents (collectively the "**PCCP Instruments**"):

[*Include the following, as applicable*]

1. The Placer County Habitat Conservation Plan and Natural Community Conservation Plan ("**Plan**"), dated _____, prepared by County of Placer ("**County**"), City of Lincoln ("**City**"), and Placer County Water Agency ("**PCWA**"), and approved by the United States Fish and Wildlife Service ("**USFWS**") and the National Marine Fisheries Service ("**NMFS**") under Section 10 of the federal Endangered Species Act of 1973 (16 U.S.C. Section 1531 et seq., as it may be amended from time to time) ("**ESA**"), and by California Department of Fish and Wildlife ("**CDFW**") under the California Natural Community Conservation Planning Act (California Fish and Game Code Section 2800 et seq., as it may be amended from time to time) ("**NCCPA**"); and

2. Implementing Agreement for the Placer County Habitat Conservation Plan and Natural Community Conservation Plan (the "**Implementing Agreement**"), dated _____, by and among USFWS, NMFS and CDFW (collectively, the "**Wildlife Agencies**"), Placer Conservation Authority, a Joint Powers Authority ("**PCA**"), County, City, and PCWA (collectively, PCA, County, City, and PCWA, are referred to herein as "**Permittees**"); and

3. The federal incidental take permits issued by USFWS and NMFS to Permittees for the Plan pursuant to Section 10 of ESA; and

4. The state incidental take permit issued by CDFW to Permittees for the Plan pursuant to the NCCPA.

5. [*Remove/modify this recital as appropriate when conservation easement is not part of Placer County In-Lieu Fee Program.*] The Placer County In-Lieu Fee Program Enabling Instrument, dated _____, by and among the County, the U.S. Environmental Protection Agency ("**USEPA**") and U.S. Army Corps of Engineers

("**USACE**"), the Central Valley Regional Water Quality Control Board ("**CVRWQCB**") (the "**IRT Agencies**"), and the County of Placer.

C. CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants and the habitat necessary for biologically sustainable populations of these species pursuant to California Fish and Game Code Section 1802. CDFW is authorized to hold easements for these purposes pursuant to California Civil Code Section 815.3, Fish and Game Code Section 1348, and other provisions of California law.

D. The USFWS, an agency within the United States Department of the Interior, and the NMFS, an agency within the United States Department of Commerce, have jurisdiction over the conservation, protection, restoration and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of these species within the United States pursuant to the federal Endangered Species Act, 16 U.S.C. Section 1531, et seq., and other provisions of federal law.

E. [*Remove/modify this recital as appropriate when conservation easement is not part of Placer County In-Lieu Fee Program.*] The USACE and the USEPA have jurisdiction over waters of the United States pursuant to the federal Clean Water Act, 33 U.S.C. Section 1251, et seq.

F. Grantee is a California joint powers authority and is authorized to hold conservation easements pursuant to, among other provisions of law, California Civil Code Section 815.3.

G. In addition to serving as the holder of the conservation easement, the PCA is responsible for overseeing implementation of the PCCP Instruments, including carrying out planning and design, habitat and aquatic resource restoration, monitoring, adaptive management programs, and periodic coordination with USFWS, NMFS, and CDFW. *[Add reference to USACE, USEPA, and CVRWQCB if conservation easement is part of the Placer County In-Lieu Fee Program] The term "Grantee" is used herein specifically to refer to the PCA as the initial holder of the conservation easement, as well as any other qualified successor or assignee to which the conservation easement has been transferred in accordance with the terms and conditions set forth below.]* ***[TEMPLATE NOTE: The italicized language above will require revision if the PCA is not the Grantee.]***

H. The *Easement Area/Property* possesses wildlife, habitat value, and associated open space values of great importance to Grantee, the people of Placer County, and the people of the State of California and of the United States. The *Easement Area/Property* provides, or will provide high-quality natural, established, restored and/or enhanced habitat for [***specify listed and sensitive plant and/or animal species***] and contains, or will contain, [***list habitats; native and/or non-native***], [***include the following phrase only if there are jurisdictional wetlands:*** and restored, created, enhanced and/or preserved jurisdictional waters of the United States]. Individually and collectively, these wildlife and habitat values comprise the "**Conservation Values**" of the Property. The "**Initial Conservation Values**", described in **Exhibit C** attached hereto and incorporated herein by reference, are those Conservation Values that are identified in

the Plan and present on the *Easement Area/Property* at the time of the execution of the Conservation Easement.

I. Following recordation of this Conservation Easement, the *Easement Area/Property* will be incorporated into the PCCP Reserve System (as such term is defined in the Plan) ("**Reserve System**") and will count toward the land acquisition commitments set forth in the Plan.

J. The PCA [*has developed*] [*will develop*] a management plan, known as "_____," that applies to the Easement Area/Property (the "**Management Plan**"). The Management Plan [*has been*] [*will be*] developed in accordance with the applicable requirements of the PCCP Instruments [*and [identify any applicable reserve unit management plans]*].

K. The Management Plan [*is*] [*upon completion, will be*] incorporated herein by reference. Grantor and Grantee recognize that changes (e.g., in weather cycles, natural resource management technologies, conservation practices) may dictate an adaptation in the management of the *Easement Area/Property*, consistent with the purposes of this Conservation Easement and the PCCP Instruments. It may be revised from time to time with the written approval of the Grantor, Grantee, and the Wildlife Agencies [*add IRT Agencies if the conservation easement is part of the In-Lieu Fee Program*], so long as the revisions are consistent with the requirements of the PCCP Instruments [*and [identify applicable reserve unit management plans]*]. A full and complete copy of the current Management Plan, including any such revisions, shall be kept on file at the offices of the PCA. [*Include if the Management Plan has not been developed as of the effective date of the Conservation Easement, explain whether and how it will be incorporated in the Conservation Easement and add the following, if applicable: The Easement Area/Property will be managed in accordance with the applicable requirements of the Plan until the Management Plan is developed.*]

L. All section numbers referred to in this Conservation Easement are references to sections within this Conservation Easement, unless otherwise indicated.

COVENANTS, TERMS, CONDITIONS AND RESTRICTIONS

In consideration of the above and mutual covenants, terms, conditions and restrictions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and pursuant to the laws of the United States and the State of California, including California Civil Code Section 815, *et seq.*, Grantor hereby voluntarily grants and conveys to Grantee a conservation easement in perpetuity over the Easement Area/Property described in **Exhibit A** and depicted in **Exhibit B** (the "**Conservation Easement**"), subject to the terms and conditions set forth herein, restricting forever the uses which may be made of the Easement Area/Property.

1. Purpose.

The purpose of this Conservation Easement is to ensure that the *Easement Area/Property* will be retained forever in its [*insert the following as appropriate for the specific*

site: natural, restored, or enhanced] condition for the natural values and associated wildlife and habitat values as contemplated by the HCP/NCCP and Management Plan, preventing any use of the *Easement Area/Property* that would impair or interfere with the Conservation Values. Grantor intends that this Conservation Easement will confine the use of the *Easement Area/Property* to activities that are consistent with the purposes set forth herein, including, without limitation, those involving the preservation, restoration and enhancement of the *Easement Area/Property*'s natural communities.

2. Baseline Documentation Report.

A Baseline Documentation Report (the "**Report**") has been prepared for the *Easement Area/Property* and approved in writing by Grantor and Grantee. A copy of the Report is on file with Grantor and Grantee at their respective addresses for notices set forth below. The Report contains an accurate representation of the biological and physical condition of the *Easement Area/Property* at the time this Conservation Easement was recorded in the Official Records of Placer County ("**Official Records**"), including a full inventory of all of the *Easement Area/Property's* Covered Species and natural communities found thereon. Notwithstanding the foregoing, if a controversy arises with respect to the nature and extent of the physical or biological condition of the *Easement Area/Property* or the allowed uses of the *Easement Area/Property*, Grantor and Grantee shall not be foreclosed from utilizing any and all other relevant documents, surveys or other evidence or information to assist in the resolution of the controversy.

3. Rights of Grantee and Third Party Beneficiaries.

To accomplish the purposes of this Conservation Easement, Grantor hereby grants and conveys the following rights to Grantee:

(a) To preserve, protect, sustain, restore, and enhance the Conservation Values for the *Easement Area/Property* described in **Exhibit C** or which develop on the *Easement Area/Property* in accordance with the Management Plan and any applicable restoration plans prepared pursuant to Chapter 5.3 and Chapter 8.7 of the Plan, and the terms and conditions of this Conservation Easement;

(b) To enter upon the *Easement Area/Property* to monitor Grantor's compliance with, and to otherwise enforce the terms of, this Conservation Easement, and for scientific research necessary to support monitoring and in order to support adaptive management of the Conservation Values; provided, that Grantee shall not unreasonably interfere with Grantor's allowed uses and quiet enjoyment of the *Easement Area/Property*;

(c) To enter upon the *Easement Area/Property* to carry out, at Grantee's sole cost and expense, those restoration, management and monitoring requirements applicable to the *Easement Area/Property* that are set forth in the Management Plan or any applicable restoration plans prepared pursuant to Chapter 5.3 and Chapter 8.7 of the Plan, [*including, without limitation, habitat restoration, aquatic resource restoration, and installation and maintenance of fencing around the perimeter of the Easement Area/Property to the extent referenced in the Management Plan as necessary to protect the Conservation Values*;] provided, that Grantee shall use reasonable good faith efforts to conduct such restoration, management and monitoring

activities in a manner that does not unreasonably interfere with Grantor's allowed uses and quiet enjoyment of the *Easement Area/Property*;

(d) To prevent any activity on or use of the *Easement Area/Property* that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features of the *Easement Area/Property* that may be damaged by any act, failure to act, or any use or activity that is inconsistent with the purposes of this Conservation Easement;

(e) To require that all mineral, air and water rights held by Grantor that Grantee deems necessary to preserve and protect the biological resources and Conservation Values of the *Easement Area/Property* shall remain a part of and be put to beneficial use upon the *Easement Area/Property*, consistent with the purposes of this Conservation Easement; and

(f) All present and future development rights allocated, implied, reserved or inherent in the *Easement Area/Property*; such rights are hereby terminated and extinguished, and may not be used on or transferred to any portion of the *Easement Area/Property*, nor any other property adjacent or otherwise. Nothing in this Conservation Easement relieves Grantor of any obligation or restriction in relation to the development or use of the *Easement Area/Property* imposed by law, including but not limited to local land use restrictions.

Except where there is an imminent threat to the *Easement Area/Property* or its Conservation Values, Grantee and its employees, contractors or agents will only enter the *Easement Area/Property* at reasonable times and with at least forty-eight (48) hours advance notice to Grantor. Grantor may waive these requirements in whole or in part by written notice to Grantee.

4. Prohibited Uses.

Any activity on or use of the *Easement Area/Property* that adversely affects the purposes of this Conservation Easement is prohibited. Without limiting the generality of the foregoing, Grantor, Grantor's personal representatives, heirs, successors, assigns, employees, agents, lessees, licensees and invitees are expressly prohibited from doing or allowing any of the following uses and activities on the *Easement Area/Property*, unless, and then only to the extent that, a generally prohibited activity set forth below is: (i) an allowed use or practice (e.g., agricultural, rangeland or recreational uses) set forth on **Exhibit D** attached hereto and incorporated herein by reference; (ii) a management practice or restoration action set forth in the Management Plan or any applicable restoration plans prepared pursuant to Chapter 5.3 and Chapter 8.7 of the Plan; or (iii) otherwise necessary to maintain or enhance the Conservation Values as agreed to by the Grantee:

(a) Unseasonable watering;

(b) Use of fertilizers, pesticides, biocides, herbicides, rodenticides, fungicides, or other agents or chemicals;

(c) Use of off-road vehicles and use of any other motorized vehicles except on existing roadways, excepting off-road vehicle use required to conduct any allowed management

or monitoring practice set forth in the Management Plan;

(d) Agricultural uses, including, without limitation, vineyards, nurseries, or intensive livestock use (e.g., dairy, feedlot) except as may be provided for in the Management Plan (e.g., prescribed grazing);

(e) Depositing or accumulation of soil, trash, ashes, refuse, waste, bio-solids or any other materials;

(f) Planting, introduction, or dispersal of nonnative or exotic plant or animal species;

(g) Filling, dumping, excavating, draining, dredging, mining, drilling, removing, or exploring for or extraction of minerals, loam, soil, sands, gravel, rocks, or other material on or below the surface of the *Easement Area/Property*, and granting or authorizing any surface entry for any of these purposes;

(h) Removing, destroying, or cutting of trees, shrubs, or other vegetation; ; except as required by law for (i) fire breaks, (ii) maintenance of existing foot trails or roads, or (iii) prevention or treatment of disease;

(i) Manipulating, impounding, or altering any water course, body of water, or water circulation on the *Easement Area/Property*, and activities or uses detrimental to water quality, including but not limited to degradation or pollution of any surface or subsurface waters;

(j) Allowing public access, unless specifically provided for in the Management Plan;

(k) Commercial, industrial, residential, or institutional uses;

(l) Any legal or de facto division, subdivision or partitioning of the *Easement Area/Property*;

(m) Constructing, expanding, erecting or placing any building, billboard, or commercial sign, or any other structure or improvement of any kind; except as specifically provided in the Management Plan or any applicable restoration plans prepared pursuant to Chapter 5.3 and Chapter 8.7 of the Plan.

(n) Disturbing the surface or general topography of the *Easement Area/Property*, including but not limited to any harm to habitat, building roads or trails, paving or otherwise covering the *Easement Area/Property* with concrete, asphalt or any other impervious material except for those management activities specified in the Management Plan or any applicable restoration plans prepared pursuant to Chapter 5.3 and Chapter 8.7 of the Plan;

(o) Without the prior written consent of Grantee, which Grantee may reasonably withhold, transferring, encumbering, selling, leasing or otherwise separating the

mineral, air or water rights for the *Easement Area/Property* owned by Grantor; changing the place or purpose of use of the water rights owned by Grantor; abandoning or allowing the abandonment of, by action or inaction, any water or water rights, ditch or ditch rights, spring rights, reservoir or storage rights, wells, ground water rights or other rights in and to the use of water historically used on or otherwise appurtenant to the *Easement Area/Property* that are owned by Grantor, including but not limited to: (i) riparian water rights; (ii) appropriative water rights; (iii) rights to waters which are secured under contract with any irrigation or water district, to the extent such waters are customarily applied to the *Easement Area/Property*; and (iv) any water from wells that are in existence or may be constructed in the future on the *Easement Area/Property*;

(p) Any use or activity that may violate, or fail to comply with, relevant federal, state, or local laws, regulations, or policies applicable to Landowner, the Property, or the use or activity in question; and

(q) Any and all other activities and uses which would interfere with the purpose of this Conservation Easement.

[TEMPLATE NOTE: Section 4 "Prohibited Uses" for any Conservation Easement may include additional prohibited uses, or refinements of the above, to address specific site conditions, landowner preferences and operations, and species and habitat needs, as contemplated by Habitat Plan Chapter 8 and approved by the PCA and the Wildlife Agencies. Additionally, this prohibited uses section may require modification to address public access and recreation uses to the extent contemplated or required at the Easement Area/Property under the Management Plan.]

5. Unlawful Entry.

Grantor shall undertake all reasonable actions to prevent the unlawful entry and trespass on the *Easement Area/Property* by persons whose uses or activities may degrade or harm the Conservation Values or are otherwise inconsistent with the purposes of this Conservation Easement.

6. Grantor's Reserved Rights; Allowed Uses.

Grantor reserves to itself, and to its personal representatives, heirs, successors, and assigns, all rights accruing from its ownership of the *Easement Area/Property*, including without limitation, the following (collectively, the "**Allowed Uses**"):

(a) Those specific uses and activities identified in the Management Plan or any applicable restoration plans prepared pursuant to Chapter 5.3 and Chapter 8.7 of the Plan, or detailed in **Exhibit D** attached hereto, and

(b) All other uses of the *Easement Area/Property* that are not expressly prohibited or limited by this Conservation Easement, and are consistent with the purposes of this Conservation Easement as set forth in Section 1.

Grantor shall have the right to exercise any of the Allowed Uses directly or to

allow or invite others to engage in any of the Allowed Uses. While Grantor is not obligated under this Conservation Easement to perform the management and monitoring actions set forth in the Management Plan(s), Grantor's exercise of the Allowed Uses shall be conducted in a manner that is consistent with the Management Plan(s) and Conservation Values.

7. Grantee's Remedies.

If Grantee or any Third-Party Beneficiary (as defined in Section 7(d) below) determines there is a violation of the terms of this Conservation Easement or that such violation is threatened, written notice of such violation and a demand for corrective action sufficient to cure the violation shall be given to Grantor, with a copy provided to Grantee and each other Third-Party Beneficiary. The notice of violation shall specify the measures the Grantor must take to cure the violation. If Grantor fails to cure the violation within thirty (30) days after receipt of written notice and demand from Grantee or any Third-Party Beneficiary, as applicable; or if the cure reasonably requires more than thirty (30) days to complete and Grantor fails to begin the cure within such thirty (30) day period; or Grantor fails to continue diligently to complete the cure, Grantee or any Third-Party Beneficiary may bring an action at law or in equity in a court of competent jurisdiction to enforce the terms of this Conservation Easement, to recover any damages to which Grantee and the Third-Party Beneficiaries may be entitled for violation of the terms of this Conservation Easement or for any injury to the Conservation Values, to enjoin the violation, ex parte as necessary, by temporary or permanent injunction without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies, or for other legal or equitable relief, including, but not limited to, the restoration of the *Easement Area/Property* to the condition in which it existed prior to any such violation or injury. Without limiting Grantor's liability therefor, any damages recovered may be applied to the cost of undertaking any corrective action on the *Easement Area/Property* at the election of the party receiving such damages.

If Grantee or any Third-Party Beneficiary, each in its sole discretion, determines that circumstances require immediate action to prevent or mitigate damage to the Conservation Values, Grantee and/or any Third-Party Beneficiary may pursue its remedies under this section without prior notice to Grantor or without waiting for the period provided for cure to expire. The rights of Grantee and the Third-Party Beneficiaries under this section apply equally to actual or threatened violations of the terms of this Conservation Easement. Grantee shall notify the Grantor and Third-Party Beneficiaries within 30 days of such an occurrence. Grantor agrees that Grantee's and Third-Party Beneficiaries' remedies at law for any violation of the terms of this Conservation Easement are inadequate and that Grantee and/or any Third-Party Beneficiary shall be entitled to the injunctive relief described in this section, both prohibitive and mandatory, in addition to such other relief to which Grantee and the Third-Party Beneficiaries may be entitled, including specific performance of the terms of this Conservation Easement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies. Remedies described in this section shall be cumulative and shall be in addition to all remedies now or hereafter existing at law or in equity, including but not limited to, the remedies set forth in California Civil Code Section 815, et seq., or applicable federal law. The failure of Grantee or any Third-Party Beneficiary to discover a violation or to take immediate legal action in response to such action shall not bar such party from taking legal action at a later time.

[*Add if the PCA is not the conservation easement holder:* Pursuant to Government Code section 65967(e), if the PCA, after conferring with the Third-Party Beneficiaries, reasonably determines that this Conservation Easement is not being held, monitored, or stewarded for conservation purposes in the manner specified in this Conservation Easement, then the Conservation Easement shall revert to the PCA or to another public agency, governmental entity, special district, or nonprofit organization approved in advance in writing by the PCA and the Third-Party Beneficiaries. The PCA shall notify Grantee in writing of any such determination, and Grantee shall cooperate with the PCA as needed to effectuate such reversion.]

(a) Costs of Enforcement.

Any reasonable costs incurred by the Grantee or any Third Party Beneficiary, where it is the prevailing party, in enforcing the terms of this Conservation Easement against the Grantor, including, but not limited to, costs of suit and attorneys' and experts' fees, and any costs of restoration necessitated by Grantor's negligence or breach of this Conservation Easement shall be borne by Grantor. In any action where an agency of the United States is a party, the right to recover fees and costs shall be governed by federal law.

(b) Enforcement Discretion.

Enforcement of the terms of this Conservation Easement against Grantor shall be at the respective discretion of Grantee and each of the Third-Party Beneficiaries, and any forbearance by any such party to exercise its rights under this Conservation Easement in the event of any breach of any term of this Conservation Easement shall not be deemed or construed to be a waiver by such party of such term or of any subsequent breach of the same or any other term of this Conservation Easement or of any of such party's rights under this Conservation Easement. No delay or omission by Grantee or any Third-Party Beneficiary in the exercise of any right or remedy upon any breach shall impair such right or remedy or be construed as a waiver.

(c) Acts Beyond Grantor's Control.

Nothing contained in this Conservation Easement shall be construed to, or shall entitle, Grantee or any Third-Party Beneficiary to bring any action against Grantor for any injury to or change in the *Easement Area/Property* resulting from (i) any natural cause beyond Grantor's control, including, but not limited to, climate change, fire not caused by Grantor, flood, storm, and earth movement, or any prudent action taken by Grantor under emergency conditions to prevent, abate, or mitigate significant injury to the *Easement Area/Property* resulting from such causes; (ii) acts by Grantee or any Third-Party Beneficiary or any of their employees, contractors or agents; or (iii) acts by persons that entered the *Easement Area/Property* unlawfully or by Trespass whose activities degrade or harm the Conservation Values of the *Easement Area/Property* or whose activities are otherwise inconsistent with this Conservation Easement where Grantor has undertaken all reasonable actions to prevent such activities [*for public agencies only: or (iii) acts by persons that entered the Easement Area/Property lawfully or unlawfully whose activities degrade or harm the Conservation Values of the Easement Area/Property, or whose activities are otherwise inconsistent with this Conservation Easement, where Landowner has undertaken all reasonable actions to discourage or prevent such*

activities].

(d) Third Party Beneficiary Rights.

Each of PCA (during any such period, if any, that PCA does not also constitute Grantee), USFWS, NMFS *[for conservation easements under the CARP ILF Program: USACE, USEPA]* and CDFW (collectively, "Third-Party Beneficiaries") shall be a third-party beneficiary of this Conservation Easement. All rights and remedies conveyed to Grantee under this Conservation Easement shall extend to and are enforceable by each of the Third-Party Beneficiaries in accordance with the terms hereof. Grantor and Grantee acknowledge that the Third-Party Beneficiaries shall have the same rights of access to the *Easement Area/Property* granted to Grantee in Section 3 above, and with rights to enforce all of the provisions of this Conservation Easement. If at any time in the future Grantor uses, allows the use, or threatens to use or allow use of, the *Easement Area/Property* for any purpose that is inconsistent with or in violation of this Conservation Easement then, notwithstanding the provisions of California Civil Code Section 815.7, the California Attorney General and each Third-Party Beneficiary has standing as an interested party in any proceeding affecting the Conservation Easement. These rights are in addition to, and do not limit, the rights of enforcement under the PCCP Instruments. In addition, if a Third-Party Beneficiary reasonably determines in writing that the *Easement Area/Property* is, for a prolonged period, not being held, monitored, or stewarded for conservation purposes in the manner specified in this Conservation Easement, the Conservation Easement shall, subject to approval by all Third-Party Beneficiaries, revert to an entity, as described in California Government Code Section 65967, subdivisions (b) and (c).

8. Public Access.

Nothing contained in this Conservation Easement gives or grants to the public a right to enter upon or use the *Easement Area/Property* or any portion thereof. Nor shall this Conservation Easement extinguish any public right to enter upon or use the *Easement Area/Property*.

9. Costs and Liabilities.

Grantor shall retain all responsibilities and shall, except as specifically provided in Section 3, bear all costs and liabilities of any kind related to Grantor's ownership, operation, management, and maintenance activities on and relating to the *Easement Area/Property*. Grantor agrees that neither the Grantee nor Third Party Beneficiaries shall have any duty or responsibility for the operation or maintenance of the *Easement Area/Property*, the monitoring of hazardous conditions thereon, or the protection of Grantor, the public or any third parties from risks relating to conditions on the *Easement Area/Property*. Each of Grantor and Grantee shall remain responsible for obtaining any applicable governmental permits and approvals for its activity or use allowed on the *Easement Area/Property* under this Conservation Easement, and each of Grantor and Grantee shall undertake all allowed activities and uses of the *Easement Area/Property* in accordance with all applicable federal, state, local and administrative agency statutes, ordinances, rules, regulations, orders and requirements. Grantor shall pay before delinquency all taxes, assessments, fees, and charges of whatever description levied on or assessed against the *Easement Area/Property* by competent authority (collectively "taxes"), including any taxes imposed upon, or incurred as a result of, this Conservation Easement, and shall furnish Grantee with satisfactory evidence of payment upon request. Grantor and Grantee

shall keep the *Easement Area/Property* free from any liens, including those arising out of any obligations incurred by either for any labor or materials furnished or alleged to have been furnished to it or for its use on the *Easement Area/Property*.

10. Indemnification.

(a) Indemnification by Grantor.

Grantor shall hold harmless, protect and indemnify Grantee and the Third-Party Beneficiaries, and their respective members, directors, officers, employees, agents, contractors, and representatives and the heirs, personal representatives, successors and assigns of each of them (each a "Grantor Indemnified Party" and, collectively, the "Grantor Indemnified Parties") from and against any and all liabilities, penalties, costs, losses, damages, expenses (including, without limitation, reasonable attorneys' and experts' fees and costs), causes of action, claims, demands, orders, liens or judgments (each a "Claim" and, collectively, "Claims"), arising from or in any way connected with: (i) the activities of Grantor on the *Easement Area/Property*; (ii) the inaccuracy of any representation or warranty made by Grantor in this Conservation Easement; (iii) the breach by Grantor of any provision of this Conservation Easement; (iv) any injury to or the death of any person, or physical damage to any *Easement Area/Property* resulting from any act, omission, condition, or other matter related to or occurring on or about the *Easement Area/Property*, unless such injury or death or physical damage to any *Easement Area/Property* is solely due to an activity on, or use of, the *Easement Area/Property* by Grantee, including without limitation, those activities performed under the Management Plan, or is solely due to the negligent or willful misconduct of the Grantor Indemnified Party; or (v) any violation of, or failure to comply with, any state, federal or local law, regulation or requirement, by Grantor, or by any entity, other than one of the Grantor Indemnified Parties, acting at the time upon permission from Grantor, in any way affecting, involving or relating to the *Easement Area/Property*. If any action or proceeding is brought against any of the Grantor Indemnified Parties by reason of any such Claim, Grantor shall, at the election of and upon written notice from Grantee and the Third-Party Beneficiaries, defend such action or proceeding by counsel reasonably acceptable to the Grantor Indemnified Party.

(b) Indemnification by Grantee.

Grantee shall hold harmless, protect, and indemnify Grantor and the Third-Party Beneficiaries, and their respective members, directors, officers, employees, agents, contractors, and representatives and the heirs, personal representatives, successors and assigns of each of them (each, an "**Grantee Indemnified Party**," and collectively, the "**Grantee Indemnified Parties**") from and against any and all Claims arising from or in any way connected with: (a) the activities of Grantee on the *Easement Area/Property*, including without limitation the Grantee's performance of management and monitoring activities set forth in the Management Plan; (b) breach by Grantee of any provision of this Conservation Easement; (c) any injury to or the death of any person, or physical damage to any Easement Area/Property occurring on or about the *Easement Area/Property* resulting from any act, omission, condition, or other matter related to, an activity on, or use of, the *Easement Area/Property* by Grantee, including without limitation, those performed under the Management Plan, unless due solely to the negligence or willful misconduct of the Grantee Indemnified Party; and (d) any violation of, or failure to comply with, any state, federal or local law, regulation or requirement, by Grantee in any way affecting,

involving or relating to the *Easement Area/Property*. If any action or proceeding is brought against any of the Grantee Indemnified Parties by reason of any such Claim, Grantee shall, at the election of and upon written notice from Grantor, defend such action or proceeding by counsel reasonably acceptable to the Grantee Indemnified Party.

11. Extinguishment.

This Conservation Easement constitutes a property right, and the terms and conditions of this Conservation Easement shall be effective in perpetuity. Liberal construction is expressly required for purposes of effectuating the Conservation Easement in perpetuity, notwithstanding economic hardship or changed conditions of any kind. This Conservation Easement cannot be terminated or extinguished, in whole or in part, except by judicial proceedings in a court of competent jurisdiction. In addition, no such extinguishment shall affect the value of Grantee's interest in the *Easement Area/Property*, and if the *Easement Area/Property*, or any interest therein, is sold, exchanged or taken by power of eminent domain after such extinguishment, the proceeds from the sale or condemnation shall be used in compliance with Government Code section 65966(j). If such extinguishment occurs with respect to fewer than all acres of the *Easement Area/Property*, the amounts described above shall be calculated based on the actual number of acres subject to extinguishment.

12. Condemnation.

The purposes of this Conservation Easement are presumed to be the best and most necessary public use as defined in California Code of Civil Procedure Section 1240.680 notwithstanding Code of Civil Procedure Sections 1240.690 and 1240.700. [***TEMPLATE NOTE: If Easement Holder is CDFW or another state agency, substitute the preceding sentence with the following: This Conservation Easement is a "wildlife conservation easement" acquired by an agency of the State of California, the condemnation of which is prohibited except as provided in California Fish and Game Code Section 1348.3.***]

13. Transfer of Conservation Easement.

This Conservation Easement may be transferred by Grantee upon written approval of the Third-Party Beneficiaries, which approval shall not be unreasonably withheld or delayed; provided, that Grantee shall give Grantor and the Third-Party Beneficiaries at least sixty (60) calendar days prior written notice of the proposed assignment or transfer. Grantee may transfer its rights under this Conservation Easement only to an entity or organization: (a) authorized to acquire and hold conservation easements pursuant to California Civil Code Section 815.3 and California Government Code Section 65967(c) (and any successor or other provisions then applicable); and (b) otherwise reasonably acceptable to the Third-Party Beneficiaries. Grantee shall require the transferee to record the conveyance in the Official Records of the County where the *Easement Area/Property* is located. The failure of Grantee to perform any act provided in this section shall not impair the validity of this Conservation Easement or limit its enforcement in any way. Any transfer under this section shall be subject to the requirements of Section 17 below.

14. Transfer of Easement Area/Property.

Grantor agrees to incorporate the terms of this Conservation Easement by reference in any deed or other legal instrument by which Grantor divests itself of any interest in

all or any portion of the *Easement Area/Property*, including, without limitation, a leasehold interest. Grantor further agrees to give written notice to Grantee and the Third-Party Beneficiaries of the intent to transfer any interest at least sixty (60) calendar days prior to the date of such transfer. Grantee and the Third-Party Beneficiaries shall have the right to prevent subsequent transfers in which prospective subsequent claimants or transferees are not given notice of the covenants, terms, conditions and restrictions of this Conservation Easement. The failure of Grantor to perform any act provided in this section shall not impair the validity of this Conservation Easement or limit its enforceability in any way. Any transfer under this section is subject to the requirements of Section 17. Any successor in interest of Grantor, by acceptance of a deed, lease, or other document purporting to convey an interest in the *Easement Area/Property*, shall be deemed to have consented to, reaffirmed and agreed to be bound by all of the terms, covenants, restrictions, and conditions of this Conservation Easement.

15. Notices.

Any notice, demand, request, consent, approval, or other communication that Grantor, Grantee, or Third-Party Beneficiary desires or is required to give to the others shall be in writing and be served personally or sent by recognized overnight courier that guarantees next-day delivery or by first class United States mail, postage fully prepaid, addressed as follows:

To Grantor:	[Grantor name] [Grantor address] Attn:_____
To Grantee:	[Grantee name] [Grantee address] Attn:_____
To PCA:	[Placer Conservation Authority] [PCA address] Attn:_____
To CDFW:	[Department of Fish and Wildlife] North Central Region 1701 Nimbus Road Rancho Cordova, CA 95670 [Attn: Regional Manager]
With a copy to:	Department of Fish and Wildlife Office of General Counsel 1416 Ninth Street, 12th Floor Sacramento, CA 95814-2090 Attn: General Counsel
To USFWS:	United States Fish and Wildlife Service

Sacramento Field Office
2800 Cottage Way, Room W-2605,
Sacramento, CA 95825
Attn: Field Supervisor

[*Include NOAA Fisheries if the property contains streams that have the potential to bear salmon.*]

To NOAA: NOAA Fisheries
California Central Valley Area Office
650 Capitol Mall 5-100
Sacramento, CA 95814
Attn: Division Manager

[***Include USACE, USEPA, and the CVRWQCB for conservation easements that are part of the Placer County ILF Program.***]

To USACE: U.S. Army Corps of Engineers
Sacramento District
1325 J Street -- Room 1513
Sacramento, CA 95814
Attn: Chief, Regulatory Branch

To USEPA: U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105
Attn: Director, Water Division

To RWQCB: Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, 200
Rancho Cordova, CA 95670-6114
Attn: Supervisor

or to such other address a party shall designate by written notice to the others. Notice shall be deemed effective upon delivery in the case of personal delivery or delivery by overnight courier or, in the case of delivery by first class mail, five (5) days after deposit into the United States mail.

16. Amendment.

This Conservation Easement may not be amended, modified or otherwise changed in any manner, except by a written amendment executed by the parties hereto, or their successors in interest, it being understood that no Grantee or Grantor will ever be obligated to negotiate or enter into any such amendment; and no discretionary approval that this Conservation Easement may allow to be made from time to time by a party will operate to amend or modify any of the terms of this Conservation Easement to any extent or in any manner. Any such amendment shall be subject to the prior written consent of the Third-Party Beneficiaries; any amendment made

without such consent is void and without effect. Any such amendment shall be consistent with the purposes of the Conservation Easement and California law governing conservation easements and shall not affect the perpetual duration of the Conservation Easement. Any such amendment must refer to this Conservation Easement by reference to its recordation data, and must be recorded in the Official Records of the County where the *Easement Area/Property* is located. Grantee shall promptly provide a conformed copy of the recorded amendment to the Third-Party Beneficiaries.

17. Merger.

The doctrine of merger shall not operate to extinguish the Conservation Easement if the Conservation Easement and the *Easement Area/Property* become vested in the same party. If, despite this intent, the doctrine of merger applies to extinguish the Conservation Easement then, a replacement conservation easement, with a new Grantee identified by the PCA and approved by the Third-Party Beneficiaries, containing the same protections embodied in this Conservation Easement shall be recorded against the *Easement Area/Property*.

18. No Hazardous Materials Liability.

Grantor represents and warrants that, after reasonable review of Grantor's records as of the date of this Conservation Easement, Grantor has no knowledge or notice of any Hazardous Materials (as defined below) or underground storage tanks existing, generated, treated, stored, used, released, disposed of, deposited or abandoned in, on, under, or from the *Easement Area/Property*, or transported to or from or affecting the *Easement Area/Property* [*except as disclosed in the Report*]. [*Insert site-specific conditions, if applicable.*] Grantor further represents and warrants that Grantor shall comply with all Environmental Laws (as defined below) in using the *Easement Area/Property* and that Grantor shall keep the *Easement Area/Property* free of any material environmental defect, including, without limitation, contamination from Hazardous Materials (as defined below). Without limiting the obligations of Grantor under this Conservation Easement, Grantor hereby releases and agrees to indemnify, protect and hold harmless the Grantor Indemnified Parties (as defined in Section 10(a)) from and against any and all Claims (as defined in Section 10(a)) arising from or connected with any Hazardous Materials or underground storage tanks present, alleged to be present, or otherwise associated with the *Easement Area/Property* at any time, except any Hazardous Materials placed, disposed or released by Grantor Indemnified Parties, or their employees or agents. This release and indemnification includes, without limitation, Claims for (a) injury to or death of any person or physical damage to any *Easement Area/Property*; and (b) the violation or alleged violation of, or other failure to comply with, any Environmental Laws (as defined below). If any action or proceeding is brought against any of the Grantor Indemnified Parties by reason of any such Claim, Grantor shall, at the election of and upon written notice, defend such action or proceeding by counsel reasonably acceptable to the Grantor Indemnified Party.

Despite any contrary provision of this Conservation Easement, the parties do not intend this Conservation Easement to be, and this Conservation Easement shall not be, construed such that it creates in or gives to Grantee or the Third Party Beneficiaries any of the following:

(a) The obligations or liability of an "owner" or "operator," as those terms are defined and used in Environmental Laws (as defined below), including, without limitation, the

Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (42 U.S.C. Section 9601 et seq.; hereinafter, "**CERCLA**"); or

(b) The obligations or liabilities of a person described in 42 U.S.C. Section 9607(a)(3) or (4); or

(c) The obligations of a responsible person under any applicable Environmental Laws; or

(d) The right or duty to investigate and remediate any Hazardous Materials associated with the *Easement Area/Property*; or

(e) Any control over Grantor's ability to investigate, remove, remediate or otherwise clean up any Hazardous Materials associated with the *Easement Area/Property*.

The term "**Hazardous Materials**" includes, without limitation, (a) material that is flammable, explosive or radioactive; (b) petroleum products, including by-products and fractions thereof; and (c) hazardous materials, hazardous wastes, hazardous or toxic substances, or related materials defined in CERCLA, the Resource Conservation and Recovery Act of 1976 (42 U.S.C. Section 6901 et seq.; hereinafter "**RCRA**"); the Hazardous Materials Transportation Act (49 U.S.C. Section 6901 et seq.; hereinafter "**HTA**"); the Hazardous Waste Control Law (California Health & Safety Code Section 25100 et seq.; hereinafter "**HCL**"); the Carpenter-Presley-Tanner Hazardous Substance Account Act (California Health & Safety Code Section 25300 et seq.; hereinafter "**HAS**"), and in the regulations adopted and publications promulgated pursuant to them, or any other applicable Environmental Laws now in effect or enacted after the date of this Conservation Easement.

The term "**Environmental Laws**" includes, without limitation, CERCLA, RCRA,HTA, HCL, HSA, and any other federal, state, local or administrative agency statute, ordinance, rule, regulation, order or requirement relating to pollution, protection of human health or safety, the environment or Hazardous Materials. Grantor represents, warrants and covenants to Grantee and Third-Party Beneficiaries that all activities upon and use of the Property by Grantor, its agents, employees, invitees and contractors will comply with all Environmental Laws.

19. Representations and Warranties.

(a) Authority.

Grantor has good and sufficient title to the *Easement Area/Property* (including all appurtenances thereto, including, without limitation, [*all minerals and mineral rights and all water and water rights*], and Grantor has full right and authority to grant the Conservation Easement to Grantee. There are no monetary liens and encumbrances recorded against the *Easement Area/Property* except as expressly identified in **Exhibit E**. All deeds of trust and mortgages recorded against the *Easement Area/Property*, or any portion thereof, are and shall continue to be subordinated to this Conservation Easement; documentation of such subordinations are contained in **Exhibit E**.

(b) Compliance with Laws.

Grantor has not received notice of, and has no knowledge of, any material violation of any federal, state, county or other governmental or quasi-governmental statute, ordinance, regulation, law or administrative or judicial order with respect to the *Easement Area/Property* [*except as disclosed in the Report*]. [*Insert site-specific conditions, if applicable.*]

(c) No Litigation.

There is no action, suit or proceeding which is pending or threatened against the Easement Area/Property or any portion thereof relating to or arising out of the ownership or use of the Easement Area/Property, or any portion thereof, in any court or in any federal, state, county, or municipal department, commission, board, bureau, agency or other governmental instrumentality.

20. General Provisions.

(a) Controlling Law.

The interpretation and performance of this Conservation Easement shall be governed by the laws of the State of California, disregarding the conflicts of law principles of such state, and by applicable federal law.

(b) Liberal Construction.

It is the intent of this Conservation Easement to preserve the condition of the *Easement Area/Property* and each of the Conservation Values protected thereon, notwithstanding economic or other hardship or changes in circumstances or conditions. The provisions of this Conservation Easement shall be liberally construed to effectuate the purposes of the Conservation Easement, the policy and purpose of Civil Code section 815, *et seq*., and to allow Grantor's use and enjoyment of the *Easement Area/Property* to the extent consistent with such purposes. Liberal construction is expressly required for purposes of effectuating this Conservation Easement in perpetuity, notwithstanding changed conditions of any kind. The Conservation Easement created by this Conservation Easement is the intended best and most productive use of the *Easement Area/Property*. No remedy or election given by any provision in this Conservation Easement shall be deemed exclusive unless so indicated, but it shall, wherever possible, be cumulative with all other remedies at law or in equity. The parties acknowledge that each party and its counsel have had the opportunity to review and revise this Conservation Easement and that no rule of construction that ambiguities are to be resolved against the drafting party shall be employed in the interpretation of this Conservation Easement. In the event of any conflict between the provisions of this Conservation Easement and the provisions of any use and zoning restrictions of the State of California, the county in which the *Easement Area/Property* is located, or any other governmental entity with jurisdiction, the more restrictive provisions shall apply. If any provision in this instrument is found to be ambiguous, an interpretation consistent with the purposes of this Conservation Easement that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability.

If a court of competent jurisdiction voids or invalidates on its face any provision of this Conservation Easement, such action shall not affect the remainder of this Conservation Easement. If a court of competent jurisdiction voids or invalidates the application of any

provision of this Conservation Easement to a person or circumstance, such action shall not affect the application of the provision to any other persons or circumstances.

(d) Entire Agreement.

This instrument sets forth the entire agreement of the parties and the Third Party Beneficiaries with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings, or agreements relating to the Conservation Easement. No alteration or variation of this Conservation Easement shall be valid or binding unless contained in an amendment in accordance with Section 16.

(e) No Forfeiture.

Nothing contained in this Conservation Easement will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Successors.

The covenants, terms, conditions, and restrictions of this Conservation Easement shall be binding upon, and inure to the benefit of, the parties and their respective personal representatives, heirs, successors, and assigns, and shall constitute a servitude running in perpetuity with the *Easement Area/Property*.

(g) Termination of Rights and Obligations.

A party's rights and obligations under this Conservation Easement terminate upon transfer of the party's interest in the Conservation Easement, except that liability for acts, omissions or breaches occurring prior to transfer shall survive transfer.

(h) Captions.

The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon its construction or interpretation.

(i) Additional Easements.

Grantor shall not grant any additional easements, rights of way or other interests in the Property (other than a security interest that is subordinate to this Conservation Easement), or grant or otherwise abandon or relinquish any mineral, air, or water right or agreement relating to the Property, without first obtaining the written consent of Grantee and the Third-Party Beneficiaries. Grantee and any of the Third-Party Beneficiaries may withhold such consent if it determines that the proposed interest or transfer is inconsistent with the purposes of this Conservation Easement or may harm the Conservation Values. This section shall not prohibit transfer of a fee or leasehold interest in the Property that is subordinate to this Conservation Easement and complies with Section 14. Grantor shall provide a copy of any grant or Transfer document to the Grantee and Third-Party Beneficiaries.

(j) Recording.

Grantee shall record this Conservation Easement in the Official Records of the County in which the *Easement Area/Property* is located, and may re-record it at any time as Grantee deems necessary to preserve its rights in this Conservation Easement. Grantee shall

provide a conformed copy of the recorded Conservation Easement to the Third Party Beneficiaries within thirty (30) calendar days of recordation.

(k) Counterparts.

The parties may execute this Conservation Easement in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

IN WITNESS WHEREOF Grantor and Grantee have executed this Conservation Easement the day and year first above written.

Grantor:

_____

Name:_____

Title:_____

Grantee:

[Placer Conservation Authority, a California Joint Powers Authority]

By: _____

Name:_____

Title:_____

EXHIBITS:

Exhibit A -- Legal Description of the *Easement Area/Property*

Exhibit B -- Map of the *Easement Area/Property*

Exhibit C -- Initial Conservation Values

Exhibit D -- Allowed Uses

Exhibit E -- Title Encumbrances

RECORDING REQUESTED BY AND)
WHEN RECORDED MAIL TO:)
)
)
[Easement Holder])
[Easement Holder's Address])
Attention: **_____**)
)

Space Above Line for Recorder's Use Only

TEMPLATE NOTES:

- ***This template is prepared for use on privately-owned fee lands.***
- ***Consistent with the PCCP, this template assumes the Placer Conservation Authority will hold the agricultural conservation easements over privately-owned fee lands. Italicized bracketed language is included below for insertion in agricultural conservation easements the Placer Conservation Authority determines will be held by another nonprofit organization, as allowed in the PCCP.***
- ***This template does not identify recreational/public access as allowable uses. Additional provisions (i.e. specific restrictions and allowed uses, as well as reference to "recreation plan" contemplated by PCCP) would need to be included if any recreational uses are contemplated for the Easement Area/Property [use Easement Area or Property, as applicable depending on whether part or all of a legal parcel is being committed to the reserve area, selection made in Recital A].***
- ***This template also assumes the Placer Conservation Authority, and not the Landowner, will conduct the management and monitoring activities set forth in the Management Plan.***

AGRICULTURAL CONSERVATION EASEMENT DEED

THIS AGRICULTURAL CONSERVATION EASEMENT DEED ("**Agriculture Easement**") is made as of the _____ day of _____, 20____, by [*insert full legal name(s) of Grantor*] ("**Grantor**"), in favor of [*Placer Conservation Authority, a California Joint Powers Authority*] ("**Grantee**"), with reference to the following facts:

RECITALS

A. Grantor is the [*insert description of ownership interest*] of certain real property containing approximately _____ acres, located in the County of Placer, State of California, more particularly described in **Exhibit A** attached hereto and incorporated herein by this reference (the "**Property**") and depicted on the map attached hereto as **Exhibit B** and incorporated herein by reference.

OR

Grantor is the [*insert description of ownership interest*] of certain real property located in the County of Placer, State of California, more particularly known as Assessor's Parcel Number(s) *XXXXXX*. Grantor intends to grant this Agriculture Easement over approximately *XXX* acres of the Property (the "**Easement Area**"), as described in **Exhibit A** attached hereto and incorporated herein by this reference and depicted on the map attached hereto as **Exhibit B** and incorporated herein by reference.

B. This Agriculture Easement is granted to satisfy certain conservation requirements set forth in the following documents (collectively the "**PCCP Instruments**"):

1. The Placer County Habitat Conservation Plan and Natural Community Conservation Plan ("**Plan**"), dated _____, prepared by County of Placer ("**County**"), City of Lincoln ("**City**"), and Placer County Water Agency ("**PCWA**"), and approved by the United States Fish and Wildlife Service ("**USFWS**") and the National Marine Fisheries Service ("**NMFS**") under Section 10 of the federal Endangered Species Act of 1973 (16 U.S.C. Section 1531 et seq., as it may be amended from time to time) ("**ESA**"), and by California Department of Fish and Wildlife ("**CDFW**") under the California Natural Community Conservation Planning Act (California Fish and Game Code Section 2800 et seq., as it may be amended from time to time) ("**NCCPA**"); and

2. Implementing Agreement for the Placer County Habitat Conservation Plan and Natural Community Conservation Plan (the "**Implementing Agreement**"), dated _____, by and among USFWS, NMFS and CDFW (collectively, the "**Wildlife Agencies**"), Placer Conservation Authority, a Joint Powers Authority ("**PCA**"), County, City, and PCWA (collectively, PCA, County, City, and PCWA, are referred to herein as "**Permittees**"); and

3. The federal incidental take permits issued by USFWS and NMFS to Permittees for the Plan pursuant to Section 10 of ESA; and

4. The state incidental take permit issued by CDFW to Permittees for the Plan pursuant to the NCCPA.

5. [*Remove/modify this recital as appropriate when Agriculture Easement is not part of Placer County In-Lieu Fee Program.*] The County Aquatic Resource Program In-Lieu Fee Program Enabling Instrument, dated _____, by and among the County, the U.S. Environmental Protection Agency ("**USEPA**") and U.S. Army Corps of Engineers ("**USACE**").

C. CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants and the habitat necessary for biologically sustainable populations of these species pursuant to California Fish and Game Code Section 1802. CDFW is authorized to hold easements for these purposes pursuant to California Civil Code Section 815.3, Fish and

Game Code Section 1348, and other provisions of California law.

D. The USFWS, an agency within the United States Department of the Interior, and the NMFS, an agency within the United States Department of Commerce, have jurisdiction over the conservation, protection, restoration and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of these species within the United States pursuant to the federal Endangered Species Act, 16 U.S.C. Section 1531, et seq., and other provisions of federal law.

E. [*Remove/modify this recital as appropriate when Agriculture Easement is not part of Placer County In-Lieu Fee Program.*] The USACE and the USEPA have jurisdiction over waters of the United States pursuant to the federal Clean Water Act, 33 U.S.C. Section 1251, et seq.

F. Grantee is a California joint powers authority and is authorized to hold conservation easements pursuant to, among other provisions of law, California Civil Code Section 815.3.

G. In addition to serving as the holder of the Agriculture Easement, the PCA is responsible for overseeing implementation of the PCCP Instruments, including carrying out planning and design, habitat restoration, monitoring, adaptive management programs, and periodic coordination with USFWS, NMFS and CDFW. *[The term "Grantee" is used herein specifically to refer to the PCA as the initial holder of the Agriculture Easement, as well as any other qualified successor or assignee to which the Agriculture Easement has been transferred in accordance with the terms and conditions set forth below.]* ***[TEMPLATE NOTE: The italicized language above will require revision if the PCA is not the Grantee.]***

The *Easement Area/Property* possesses agricultural productive capacity and open space character [*if areas of the Stream System are present add: "and aquatic resources"]* of great importance to Grantee, the people of Placer County, and the people of the State of California and of the United States (the "**Conservation Values**"). The "**Initial Conservation Values**", described in **Exhibit C** attached hereto and incorporated herein by reference, are those Conservation Values that are identified in the Plan and present on the *Easement Area/Property* at the time of the execution of the Agriculture Easement. The existing buildings and improvements on the *Easement Area/Property* as depicted in **Exhibit C** ("**Building Envelopes and Existing Features**") are included in this Agriculture Easement. *[If areas of the Stream System are present add: The stream system on the Easement Area/Property as depicted in* ***Exhibit C*** *("Stream System") is also included.]* Except as shown in **Exhibit C**, the *Easement Area/Property* is open farmland that has the soil quality, growing season, and water supply needed for sustained agricultural production.

H. Following recordation of this Agriculture Easement, the *Easement Area/Property* will be incorporated into the PCCP Reserve System (as such term is defined in the Plan) ("**Reserve System**") and will count toward the land acquisition commitments set forth in the Plan.

I. All section numbers referred to in this Agriculture Easement are references to sections within this Agriculture Easement, unless otherwise indicated.

COVENANTS, TERMS, CONDITIONS AND RESTRICTIONS

In consideration of the above and mutual covenants, terms, conditions and restrictions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and pursuant to the laws of the United States and the State of California, including California Civil Code Section 815, *et seq.*, Grantor hereby voluntarily grants and conveys to Grantee a conservation easement in perpetuity over the *Easement Area/Property* described in **Exhibit A** and depicted in **Exhibit B** (the "**Agriculture Easement**"), subject to the terms and conditions set forth herein, restricting in perpetuity the uses which may be made of the *Easement Area/Property*.

1. Purpose.

The purpose of this Conservation Easement is to enable the *Easement Area/Property* to remain in agricultural use and to protect its open space character *[if areas of the Stream System are present add: and existing and future aquatic resource values]* by preventing in perpetuity any use of the Easement Area/Property that would impair or interfere with the Conservation Values . Grantor intends that this Conservation Easement will confine the use of the *Easement Area/Property* to activities that are consistent with the purposes set forth herein, including, without limitation, those involving the preservation and protection of the *Easement Area/Property*'s soils, agricultural productive capacity, and agricultural viability, utility, character and values.

2. Baseline Documentation Report.

A Baseline Documentation Report (the "**Report**") has been prepared for the *Easement Area/Property* and approved in writing by Grantor and Grantee. A copy of the Report is on file with Grantor and Grantee at their respective addresses for notices set forth below. The Report contains an accurate representation of the physical condition of the *Easement Area/Property* at the time this Agriculture Easement was recorded in the Official Records of Placer County ("**Official Records**"), including a full description of the *Easement Area/Property's* Building Envelopes and Existing Features, agricultural productive capacity, agricultural soil quality, and open space characteristics *[if areas of the Stream System are present add: and aquatic resource features and values]*. Notwithstanding the foregoing, if a controversy arises with respect to the nature and extent of the physical condition of the *Easement Area/Property* or the allowed uses of the *Easement Area/Property*, Grantor and Grantee shall not be foreclosed from utilizing any and all other relevant documents, surveys or other evidence or information to assist in the resolution of the controversy.

3. Grantee's Rights.

To accomplish the purposes of this Agriculture Easement, Grantor hereby grants and conveys the following rights to Grantee:

(a) To preserve, protect, sustain, restore, and enhance the Conservation

Values for the *Easement Area/Property* described in **Exhibit C** or which develop on the *Easement Area/Property* in accordance with the terms and conditions of this Agriculture Easement;

(b) To enter upon the *Easement Area/Property* to monitor Grantor's compliance with, and to otherwise enforce the terms of, this Agriculture Easement; provided, that Grantee shall not unreasonably interfere with Grantor's allowed uses and quiet enjoyment of the *Easement Area/Property*;

(c) To prevent any activity on or use of the *Easement Area/Property* that is inconsistent with the purposes of this Agriculture Easement and to require the restoration of such areas or features of the *Easement Area/Property* that may be damaged by any act, failure to act, or any use or activity that is inconsistent with the purposes of this Agriculture Easement;

(d) To require that all mineral, air and water rights held by Grantor that Grantee deems necessary to preserve and protect the Conservation Values of the *Easement Area/Property* shall remain a part of and be put to beneficial use upon the *Easement Area/Property*, consistent with the purposes of this Agriculture Easement; and

(e) All present and future development rights allocated, implied, reserved or inherent in the *Easement Area/Property*, except as specifically provided in Section 4(c); such rights are hereby terminated and extinguished, and may not be used on or transferred to any portion of the *Easement Area/Property*, nor any other property adjacent or otherwise. Nothing in this Agriculture Easement relieves Grantor of any obligation or restriction in relation to the development or use of the *Easement Area/Property* imposed by law, including but not limited to local land use restrictions.

Except where there is an imminent threat to the *Easement Area/Property* or its Conservation Values, Grantee and its employees, contractors or agents will only enter the *Easement Area/Property* during daytime hours with at least forty-eight (48) hours advance notice to Grantor. Grantor may waive these requirements in whole or in part by written notice to Grantee.

4. Prohibited Uses.

Any activity on or use of the *Easement Area/Property* that adversely affects the purposes of this Agriculture Easement is prohibited. Without limiting the generality of the foregoing, Grantor, Grantor's personal representatives, heirs, successors, assigns, employees, agents, lessees, licensees and invitees are expressly prohibited from doing or allowing any of the following uses and activities on the *Easement Area/Property*, unless, and then only to the extent that, a generally prohibited activity set forth below is: (i) an allowed use or practice (e.g., agricult ural or rangeland uses) set forth on **Exhibit D** attached hereto and incorporated herein by reference; or (ii) is otherwise necessary to maintain or enhance the Conservation Values as agreed to by the Grantee:

(a) Filling, dumping, excavating, draining, dredging, mining, drilling,

removing, or exploring for or extraction of minerals, loam, soil, sands, gravel, rocks, or other material on or below the surface of the *Easement Area/Property*, and granting or authorizing any surface entry for any of these purposes;

(b) Activities or uses that substantially degrade water quality, including but not limited to degradation or pollution of any surface or subsurface waters, or that otherwise substantially affects water quality and thereby adversely affects the Conservation Values;

(c) Construction, erection, installation, or placement of buildings, structures, billboards, signs, roads, or other improvements outside the footprint of the Building Envelopes and Existing Features as depicted in **Exhibit C**; provided, however, that (i) planting crops, (ii) constructing, repairing and replacing fences, and (iii) installing and maintaining agricultural irrigation systems is not prohibited.

(d) Without the prior written consent of Grantee, which Grantee may reasonably withhold, transferring, encumbering, selling, leasing or otherwise separating the mineral, air or water rights for the *Easement Area/Property* owned by Grantor; changing the place or purpose of use of the water rights owned by Grantor; abandoning or allowing the abandonment of, by action or inaction, any water or water rights, ditch or ditch rights, spring rights, reservoir or storage rights, wells, ground water rights or other rights in and to the use of water historically used on or otherwise appurtenant to the *Easement Area/Property* that are owned by Grantor, including but not limited to: (i) riparian water rights; (ii) appropriative water rights; (iii) rights to waters which are secured under contract with any irrigation or water district, to the extent such waters are customarily applied to the *Easement Area/Property*; and (iv) any water from wells that are in existence or may be constructed in the future on the *Easement Area/Property*.

(e) *[If areas of the Stream System are present add: Removal of trees or other vegetation, deposition of trash or other material, or ground disturbance, within the Stream System as depicted in **Exhibit C**.]*

[TEMPLATE NOTE: Section 4 "Prohibited Uses" for any Agriculture Easement may include additional prohibited uses, or refinements of the above, to address specific site conditions or conservation values, or landowner preferences and operations, as approved by the PCA.]

5. Unlawful Entry.

Grantor shall undertake all reasonable actions to prevent the unlawful entry and trespass on the *Easement Area/Property* by persons whose uses or activities may degrade or harm the Conservation Values or are otherwise inconsistent with the purposes of this Agriculture Easement.

6. Grantor's Reserved Rights; Allowed Uses.

Grantor reserves to itself, and to its personal representatives, heirs, successors, and assigns, all rights accruing from its ownership of the *Easement Area/Property*, including without limitation, the following (collectively, the "**Allowed Uses**").

(a) The use of the *Easement Area/Property* for agricultural purposes ("**Agricultural Uses**") that are consistent with the purposes of this Agricultural Easement. Such Agricultural Uses shall be in accordance with generally accepted agricultural practices and applicable law and shall not result in significant soil degradation or significant pollution or otherwise adversely affect the Conservation Values. For the purposes of this Agriculture Easement "Agricultural Uses" means: breeding, raising, pasturing, and grazing livestock of every nature and description for the production of food and fiber; breeding and raising bees, fish, poultry, and other fowl; planting, raising, harvesting, and producing agricultural, aquacultural, horticultural, and forestry crops and products of every nature and description; and the processing, storage, and sale, including direct retail sale to the public, of crops and products harvested and produced principally on the Easement Area/Property, provided that the processing, storage, and sale of any such crops or products that are not food or fiber shall require the consent of Grantee.

(b) The use of agrichemicals, including, but not limited to, fertilizers and biocides, in those amounts and with that frequency of application necessary to accomplish reasonable grazing and agricultural purposes consistent with industry standards. Such use shall be minimized to the maximum extent practicable near surface water and during periods of high ground water.

(c) The control of predatory and problem animals by the use of selective control techniques in accordance with applicable local, State and Federal laws and regulations; provided, however, that no species listed as threatened or endangered under the California Endangered Species Act or the Federal Endangered Species Act shall be harmed.

(d) The development and maintenance of water resources as necessary or appropriate for Agricultural Uses, provided that the creation or enlargement of any water impoundment shall not damage, impair, or interfere with the Conservation Values in any way; and the distribution of water on the *Easement Area/Property* for Agricultural Uses.

(e) Those specific uses and activities identified in **Exhibit D** attached hereto.

(f) All other uses of the *Easement Area/Property* that are not expressly prohibited or limited by this Agriculture Easement, and are consistent with the purposes of this Agriculture Easement as set forth in Section 1.

Grantor shall have the right to exercise any of the Allowed Uses directly or to allow or invite others to engage in any of the Allowed Uses.

7. Grantee's Remedies.

If Grantee determines there is a violation of the terms of this Agriculture Easement or that such violation is threatened, written notice of such violation and a demand for corrective action sufficient to cure the violation shall be given to Grantor. The notice of violation shall specify the measures the Grantor must take to cure the violation. If Grantor fails to cure the

violation within thirty (30) days after receipt of written notice and demand from Grantee; or if the cure reasonably requires more than thirty (30) days to complete and Grantor fails to begin the cure within such thirty (30) day period; or Grantor fails to continue diligently to complete the cure, Grantee may bring an action at law or in equity in a court of competent jurisdiction to enforce the terms of this Agriculture Easement, to recover any damages to which Grantee may be entitled for violation of the terms of this Agriculture Easement or for any injury to the Conservation Values, to enjoin the violation, ex parte as necessary, by temporary or permanent injunction without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies, or for other legal or equitable relief, including, but not limited to, the restoration of the *Easement Area/Property* to the condition in which it existed prior to any such violation or injury. Without limiting Grantor's liability therefor, any damages recovered may be applied to the cost of undertaking any corrective action on the *Easement Area/Property* at Grantee's election.

If Grantee determines that circumstances require immediate action to prevent or mitigate damage to the Conservation Values, Grantee may pursue its remedies under this section without prior notice to Grantor or without waiting for the period provided for cure to expire. The rights of Grantee under this section apply equally to actual or threatened violations of the terms of this Agriculture Easement. Grantor agrees that Grantee's remedies at law for any violation of the terms of this Agriculture Easement are inadequate and that Grantee shall be entitled to the injunctive relief described in this section, both prohibitive and mandatory, in addition to such other relief to which Grantee may be entitled, including specific performance of the terms of this Agriculture Easement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies. Remedies described in this section shall be cumulative and shall be in addition to all remedies now or hereafter existing at law or in equity, including but not limited to, the remedies set forth in California Civil Code Section 815, et seq. The failure of Grantee to discover a violation or to take immediate legal action in response to such action shall not bar such party from taking legal action at a later time.

(a) Costs of Enforcement.

Any reasonable costs incurred by the Grantee, where it is the prevailing party, in enforcing the terms of this Agriculture Easement against the Grantor, including, but not limited to, costs of suit and attorneys' and experts' fees, and any costs of restoration necessitated by Grantor's negligence or breach of this Agriculture Easement shall be borne by Grantor.

(b) Enforcement Discretion.

Enforcement of the terms of this Agriculture Easement against Grantor shall be at the respective discretion of Grantee, and any forbearance to exercise its rights under this Agriculture Easement in the event of any breach of any term of this Agriculture Easement shall not be deemed or construed to be a waiver of such term or of any subsequent breach of the same or any other term of this Agriculture Easement. No delay or omission by Grantee in the exercise of any right or remedy upon any breach shall impair such right or remedy or be construed as a waiver.

(c) Acts Beyond Grantor's Control.

Nothing contained in this Agriculture Easement shall be construed to, or shall entitle, Grantee to bring any action against Grantor for any injury to or change in the *Easement Area/Property* resulting from (i) any natural cause beyond Grantor's control, including, but not limited to, climate change, fire not caused by Grantor, flood, storm, and earth movement, or any prudent action taken by Grantor under emergency conditions to prevent, abate, or mitigate significant injury to the *Easement Area/Property* resulting from such causes; (ii) acts by Grantee or its employees, contractors or agents; or (iii) acts by persons that entered the *Easement Area/Property* unlawfully or by Trespass whose activities degrade or harm the Conservation Values of the *Easement Area/Property* or whose activities are otherwise inconsistent with this Agriculture Easement where Grantor has undertaken all reasonable actions to prevent such activities *[for public agencies only: or (iii) acts by persons that entered the Easement Area/Property lawfully or unlawfully whose activities degrade or harm the Conservation Values of the Easement Area/Property, or whose activities are otherwise inconsistent with this Agriculture Easement, where Landowner has undertaken all reasonable actions to discourage or prevent such activities]*.

8. Public Access.

Nothing contained in this Agreement gives or grants to the public a right to enter upon or use the *Easement Area/Property* or any portion thereof.

9. Costs and Liabilities.

Grantor shall retain all responsibilities and shall, except as specifically provided in Section 3, bear all costs and liabilities of any kind related to Grantor's ownership, operation, management, and maintenance activities on and relating to the *Easement Area/Property*. Grantor agrees that the Grantee shall not have any duty or responsibility for the operation or maintenance of the *Easement Area/Property*, the monitoring of hazardous conditions thereon, or the protection of Grantor, the public or any third parties from risks relating to conditions on the *Easement Area/Property*. Each of Grantor and Grantee shall remain responsible for obtaining any applicable governmental permits and approvals for its activity or use allowed on the *Easement Area/Property* under this Agriculture Easement, and each of Grantor and Grantee shall undertake all allowed activities and uses of the *Easement Area/Property* in accordance with all applicable federal, state, local and administrative agency statutes, ordinances, rules, regulations, orders and requirements. Grantor shall pay before delinquency all taxes, assessments, fees, and charges of whatever description levied on or assessed against the *Easement Area/Property* by competent authority (collectively "taxes"), including any taxes imposed upon, or incurred as a result of, this Agriculture Easement, and shall furnish Grantee with satisfactory evidence of payment upon request. Grantor and Grantee shall keep the *Easement Area/Property* free from any liens, including those arising out of any obligations incurred by either for any labor or materials furnished or alleged to have been furnished to it or for its use on the *Easement Area/Property*.

10. Indemnification.

(a) Indemnification by Grantor.

Grantor shall hold harmless, protect and indemnify Grantee and its members, directors, officers, employees, agents, contractors, and representatives and the heirs, personal representatives, successors and assigns of each of them (each a "**Grantor Indemnified Party**" and, collectively, the "**Grantor Indemnified Parties**") from and against any and all liabilities, penalties, costs, losses, damages, expenses (including, without limitation, reasonable attorneys' and experts' fees and costs), causes of action, claims, demands, orders, liens or judgments (each a "**Claim**" and, collectively, "**Claims**"), arising from or in any way connected with: (i) the activities of Grantor on the *Easement Area/Property*; (ii) the inaccuracy of any representation or warranty made by Grantor in this Agriculture Easement; (iii) the breach by Grantor of any provision of this Agriculture Easement; (iv) any injury to or the death of any person, or physical damage to any *Easement Area/Property* resulting from any act, omission, condition, or other matter related to or occurring on or about the *Easement Area/Property*, unless such injury or death or physical damage to any *Easement Area/Property* is solely due to an activity on, or use of, the *Easement Area/Property* by Grantee, or is solely due to the negligent or willful misconduct of the Grantor Indemnified Party; or (v) any violation of, or failure to comply with, any state, federal or local law, regulation or requirement, by Grantor, or by any entity, other than one of the Grantor Indemnified Parties, acting at the time upon permission from Grantor, in any way affecting, involving or relating to the *Easement Area/Property*. If any action or proceeding is brought against any of the Grantor Indemnified Parties by reason of any such Claim, Grantor shall, at the election of and upon written notice from Grantee, defend such action or proceeding by counsel reasonably acceptable to the Grantor Indemnified Party.

(b) Indemnification by Grantee.

Grantee shall hold harmless, protect, and indemnify Grantor and its members, directors, officers, employees, agents, contractors, and representatives and the heirs, personal representatives, successors and assigns of each of them (each, an "**Grantee Indemnified Party**," and collectively, the "**Grantee Indemnified Parties**") from and against any and all Claims arising from or in any way connected with: (a) the activities of Grantee on the *Easement Area/Property*; (b) breach by Grantee of any provision of this Agriculture Easement; (c) any injury to or the death of any person, or physical damage to any *Easement Area/Property* occurring on or about the *Easement Area/Property* resulting from any act, omission, condition, or other matter related to, an activity on, or use of, the *Easement Area/Property* by Grantee, unless due solely to the negligence or willful misconduct of the Grantee Indemnified Party; and (d) any violation of, or failure to comply with, any state, federal or local law, regulation or requirement, by Grantee in any way affecting, involving or relating to the *Easement Area/Property*. If any action or proceeding is brought against any of the Grantee Indemnified Parties by reason of any such Claim, Grantee shall, at the election of and upon written notice from Grantor, defend such action or proceeding by counsel reasonably acceptable to the Grantee Indemnified Party.

11. Extinguishment.

This Agriculture Easement constitutes a property right, and the terms and conditions of this Agriculture Easement shall be effective in perpetuity. Liberal construction is expressly required for purposes of effectuating the Agriculture Easement in perpetuity, notwithstanding economic hardship or changed conditions of any kind. This Agriculture

Easement cannot be terminated or extinguished, in whole or in part, except by judicial proceedings in a court of competent jurisdiction. In addition, no such extinguishment shall affect the value of Grantee's interest in the *Easement Area/Property*, and if the *Easement Area/Property*, or any interest therein, is sold, exchanged or taken by power of eminent domain after such extinguishment, the proceeds from the sale or condemnation shall be used in compliance with Government Code section 65966(j). If such extinguishment occurs with respect to fewer than all acres of the *Easement Area/Property*, the amounts described above shall be calculated based on the actual number of acres subject to extinguishment.

12. Condemnation.

The purposes of this Agriculture Easement are presumed to be the best and most necessary public use as defined in California Code of Civil Procedure Section 1240.680 notwithstanding Code of Civil Procedure Sections 1240.690 and 1240.700.

13. Transfer of Agriculture Easement.

This Agriculture Easement may be transferred by Grantee. Grantee may transfer its rights under this Agriculture Easement only to an entity or organization authorized to acquire and hold Agriculture Easements pursuant to California Civil Code Section 815.3 and California Government Code Section 65967(c) (and any successor or other provisions then applicable). Grantee shall require the transferee to record the conveyance in the Official Records of the County where the *Easement Area/Property* is located. The failure of Grantee to perform any act provided in this section shall not impair the validity of this Agriculture Easement or limit its enforcement in any way. Any transfer under this section shall be subject to the requirements of Section 17 below.

14. Transfer of Easement Area/Property.

Grantor agrees to incorporate the terms of this Agriculture Easement by reference in any deed or other legal instrument by which Grantor divests itself of any interest in all or any portion of the *Easement Area/Property*, including, without limitation, a leasehold interest. Grantor further agrees to give written notice to Grantee of the intent to transfer any interest at least thirty (30) calendar days prior to the date of such transfer. Grantee shall have the right to prevent subsequent transfers in which prospective subsequent claimants or transferees are not given notice of the covenants, terms, conditions and restrictions of this Agriculture Easement. The failure of Grantor to perform any act provided in this section shall not impair the validity of this Agriculture Easement or limit its enforceability in any way. Any successor in interest of Grantor, by acceptance of a deed, lease, or other document purporting to convey an interest in the *Easement Area/Property*, shall be deemed to have consented to, reaffirmed and agreed to be bound by all of the terms, covenants, restrictions, and conditions of this Agriculture Easement.

15. Notices.

Any notice, demand, request, consent, approval, or other communication that Grantor or Grantee desires or is required to give to the others shall be in writing and be served personally or sent by recognized overnight courier that guarantees next-day delivery or by first class United States mail, postage fully prepaid, addressed as follows:

To Grantor:	[Grantor name] [Grantor address] Attn:_____
To Grantee:	[Grantee name] [Grantee address] Attn:_____
To PCA:	[Placer Conservation Authority] [PCA address] Attn:_____

or to such other address a party shall designate by written notice to the others. Notice shall be deemed effective upon delivery in the case of personal delivery or delivery by overnight courier or, in the case of delivery by first class mail, five (5) days after deposit into the United States mail.

16. Amendment.

This Agriculture Easement may not be amended, modified or otherwise changed in any manner, except by a written amendment executed by Grantor and Grantee, or their successors in interest, it being understood that no Grantee or Grantor will ever be obligated to negotiate or enter into any such amendment; and no discretionary approval that this Agriculture Easement may allow to be made from time to time will operate to amend or modify any of the terms of this Agriculture Easement to any extent or in any manner. Any amendment shall be consistent with the purposes of the Agriculture Easement and shall not affect the perpetual duration of the Agriculture Easement. Any such amendment must refer to this Agriculture Easement by reference to its recordation data, and must be recorded in the Official Records of the County where the *Easement Area/Property* is located.

17. Merger.

The doctrine of merger shall not operate to extinguish the Agriculture Easement if the Agriculture Easement and the *Easement Area/Property* become vested in the same party. If, despite this intent, the doctrine of merger applies to extinguish the Agriculture Easement then, a replacement Agriculture Easement, with a new Grantee identified by the PCA, containing the same protections embodied in this Agriculture Easement shall be recorded against the *Easement Area/Property*.

18. No Hazardous Materials Liability.

Grantor represents and warrants that, after reasonable review of Grantor's records as of the date of this Agriculture Easement, Grantor has no knowledge or notice of any

Hazardous Materials (as defined below) or underground storage tanks existing, generated, treated, stored, used, released, disposed of, deposited or abandoned in, on, under, or from the *Easement Area/Property*, or transported to or from or affecting the *Easement Area/Property* [*except as disclosed in the Report*]. [*Insert site-specific conditions, if applicable.*] Grantor further represents and warrants that Grantor shall comply with all Environmental Laws (as defined below) in using the *Easement Area/Property* and that Grantor shall keep the *Easement Area/Property* free of any material environmental defect, including, without limitation, contamination from Hazardous Materials (as defined below). Without limiting the obligations of Grantor under this Agriculture Easement, Grantor hereby releases and agrees to indemnify, protect and hold harmless the Grantor Indemnified Parties (as defined in Section 10(a)) from and against any and all Claims (as defined in Section 10(a)) arising from or connected with any Hazardous Materials or underground storage tanks present, alleged to be present, or otherwise associated with the *Easement Area/Property* at any time, except any Hazardous Materials placed, disposed or released by Grantor Indemnified Parties, or their employees or agents. This release and indemnification includes, without limitation, Claims for (a) injury to or death of any person or physical damage to any *Easement Area/Property*; and (b) the violation or alleged violation of, or other failure to comply with, any Environmental Laws (as defined below). If any action or proceeding is brought against any of the Grantor Indemnified Parties by reason of any such Claim, Grantor shall, at the election of and upon written notice, defend such action or proceeding by counsel reasonably acceptable to the Grantor Indemnified Party.

Despite any contrary provision of this Agriculture Easement, Grantor and Grantee do not intend this Agriculture Easement to be, and this Agriculture Easement shall not be, construed such that it creates in or gives to Grantee any of the following:

(a) The obligations or liability of a "landowner" or "operator," as those terms are defined and used in Environmental Laws (as defined below), including, without limitation, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (42 U.S.C. Section 9601 et seq.; hereinafter, "**CERCLA**"); or

(b) The obligations or liabilities of a person described in 42 U.S.C. Section 9607(a)(3) or (4); or

(c) The obligations of a responsible person under any applicable Environmental Laws; or

(d) The right or duty to investigate and remediate any Hazardous Materials associated with the *Easement Area/Property*; or

(e) Any control over Grantor's ability to investigate, remove, remediate or otherwise clean up any Hazardous Materials associated with the *Easement Area/Property*.

The term "**Hazardous Materials**" includes, without limitation, (a) material that is flammable, explosive or radioactive; (b) petroleum products, including by-products and fractions thereof; and (c) hazardous materials, hazardous wastes, hazardous or toxic substances, or related

materials defined in CERCLA, the Resource Conservation and Recovery Act of 1976 (42 U.S.C. Section 6901 et seq.; hereinafter "**RCRA**"); the Hazardous Materials Transportation Act (49 U.S.C. Section 6901 et seq.; hereinafter "**HTA**"); the Hazardous Waste Control Law (California Health & Safety Code Section 25100 et seq.; hereinafter "**HCL**"); the Carpenter-Presley-Tanner Hazardous Substance Account Act (California Health & Safety Code Section 25300 et seq.; hereinafter "**HAS**"), and in the regulations adopted and publications promulgated pursuant to them, or any other applicable Environmental Laws now in effect or enacted after the date of this Agriculture Easement.

The term "**Environmental Laws**" includes, without limitation, CERCLA, RCRA, HTA, HCL, HSA, and any other federal, state, local or administrative agency statute, ordinance, rule, regulation, order or requirement relating to pollution, protection of human health or safety, the environment or Hazardous Materials.

19. Representations and Warranties.

(a) Authority.

Grantor has good and sufficient title to the *Easement Area/Property* (including all appurtenances thereto, including, without limitation, [*all minerals and mineral rights and all water and water rights*], and Grantor has full right and authority to grant the Agriculture Easement to Grantee. There are no monetary liens and encumbrances recorded against the *Easement Area/Property* except as expressly identified in **Exhibit E**. All deeds of trust and mortgages recorded against the *Easement Area/Property*, or any portion thereof, are and shall continue to be subordinated to this Agriculture Easement; documentation of such subordinations are contained in **Exhibit E**.

(b) Compliance with Laws.

Grantor has not received notice of, and has no knowledge of, any material violation of any federal, state, county or other governmental or quasi-governmental statute, ordinance, regulation, law or administrative or judicial order with respect to the *Easement Area/Property* [*except as disclosed in the Report*]. [*Insert site-specific conditions, if applicable.*]

(c) No Litigation.

There is no action, suit or proceeding which is pending or threatened against the *Easement Area/Property* or any portion thereof relating to or arising out of the ownership or use of the *Easement Area/Property*, or any portion thereof, in any court or in any federal, state, county, or municipal department, commission, board, bureau, agency or other governmental instrumentality.

20. General Provisions.

(a) Controlling Law.

The interpretation and performance of this Agriculture Easement shall be governed by the laws of the State of California, disregarding the conflicts of law principles of such state, and by applicable federal law.

(b) Liberal Construction.

It is the intent of this Agriculture Easement to preserve the condition of the *Easement Area/Property* and each of the Conservation Values protected thereon, notwithstanding economic or other hardship or changes in circumstances or conditions. The provisions of this Agriculture Easement shall be liberally construed to effectuate the purposes of the Agriculture Easement, the policy and purpose of Civil Code section 815, *et seq*., and to allow Grantor's use and enjoyment of the *Easement Area/Property* to the extent consistent with such purposes. Liberal construction is expressly required for purposes of effectuating this Agriculture Easement in perpetuity, notwithstanding changed conditions of any kind. The Agriculture Easement created by this Agriculture Easement is the intended best and most productive use of the *Easement Area/Property*. No remedy or election given by any provision in this Agriculture Easement shall be deemed exclusive unless so indicated, but it shall, wherever possible, be cumulative with all other remedies at law or in equity. Grantor and Grantee acknowledge that each and its counsel have had the opportunity to review and revise this Agriculture Easement and that no rule of construction that ambiguities are to be resolved against the drafting party shall be employed in the interpretation of this Agriculture Easement. In the event of any conflict between the provisions of this Agriculture Easement and the provisions of any use and zoning restrictions of the State of California, the county in which the *Easement Area/Property* is located, or any other governmental entity with jurisdiction, the more restrictive provisions shall apply. If any provision in this instrument is found to be ambiguous, an interpretation consistent with the purposes of this Agriculture Easement that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability.

If a court of competent jurisdiction voids or invalidates on its face any provision of this Agriculture Easement, such action shall not affect the remainder of this Agriculture Easement. If a court of competent jurisdiction voids or invalidates the application of any provision of this Agriculture Easement to a person or circumstance, such action shall not affect the application of the provision to any other persons or circumstances.

(d) Entire Agreement.

This instrument sets forth the entire agreement of Grantor and Grantee with respect to the Agriculture Easement and supersedes all prior discussions, negotiations, understandings, or agreements relating to the Agriculture Easement. No alteration or variation of this Agriculture Easement shall be valid or binding unless contained in an amendment in accordance with Section 16.

(e) No Forfeiture.

Nothing contained in this Agriculture Easement will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Successors.

The covenants, terms, conditions, and restrictions of this Agriculture Easement shall be binding upon, and inure to the benefit of, Grantor and Grantee and their respective

personal representatives, heirs, successors, and assigns, and shall constitute a servitude running in perpetuity with the *Easement Area/Property*.

(g) Termination of Rights and Obligations.

Each of Grantor and Grantee's rights and obligations under this Agriculture Easement terminate upon transfer of its interest in the Agriculture Easement, except that liability for acts, omissions or breaches occurring prior to transfer shall survive transfer.

(h) Captions.

The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon its construction or interpretation.

(i) Additional Easements.

Grantor shall not grant any additional easements, rights of way or other interests in the Property (other than a security interest that is subordinate to this Agriculture Easement), or grant or otherwise abandon or relinquish any water right or agreement relating to the Property, without first obtaining the written consent of Grantee. Grantee may withhold such consent if it determines that the proposed interest or transfer is inconsistent with the purposes of this Agriculture Easement or will impair or interfere with the Conservation Values. This section shall not prohibit transfer of a fee or leasehold interest in the Property that is subordinate to this Agriculture Easement and complies with Section 14.

(j) Recording.

Grantee shall record this Agriculture Easement in the Official Records of the County in which the Bank Property is located, and may re-record it at any time as Grantee deems necessary to preserve its rights in this Agriculture Easement.

(k) Counterparts.

Grantor and Grantee may execute this Agriculture Easement in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

IN WITNESS WHEREOF Grantor and Grantee have executed this Agriculture Easement the day and year first above written.

Grantor:

_____

Name:_____

Title:_____

Grantee:

[Placer Conservation Authority, a California Joint Powers Authority]

By: _____

Name:_____

Title:_____

EXHIBITS:

Exhibit A -- Legal Description of the *Easement Area/Property*

Exhibit B -- Map of the *Easement Area/Property*

Exhibit C -- Initial Conservation Values

Exhibit D -- Allowed Uses

Exhibit E -- Title Encumbrances

Appendix L
Public Review Draft Implementation Cost Estimates and Assumptions

Western Placer County HCP/NCCP

Final Plan Implementation Cost Estimates and Assumptions

January 2020

This cost model calculates one-time capital and on-going annual operating costs through the 50-year permit term for the Western Placer County HCP / NCCP (the Plan). Capital costs are expenses to acquire land and other fixed assets (site improvements, equipment, furniture, vehicles, technology) and to conduct restoration construction activity that changes the nature and characteristics of reserve land. Operating costs include all on-going annual costs for labor, material, supplies, and services to maintain, manage, and monitor reserve land and manage plan implementation.

The model takes input from a 50-year growth scenario and land development analysis for the Plan area (see **D_Input Schedules**) and from the Plan effects analysis (see **A_Plan Input Acquisition**, **B_Plan Input Restoration**, and **C_Plan Input Final Reserve**). Those sheets are linked to **K_Reserve Land by Time Period** and **L_SpecificHabitatRestoration.** Other input sheets include **E_Input Existing Reserve Credit** and **F_Input Grazing Urban_Suburban**. All other input is internal to this cost model.

The model uses cost factors developed based on analysis from Bender Rosenthal, Inc. (land value analysis), ICF/Jones & Stokes Associates, Richard Harris, TRA Environmental Sciences, Placer County, the Placer Land Trust, and the members of the PCCP Finance Committee. In 2015, the cost model was the subject of a peer review commissioned by the Placer County Landowners Group. Supporting documentation dating from 2011/2012 through 2017 is included at the end of *Appendix L Final Plan Implementation Cost Estimates and Assumptions*.

Cost factor variables are highlighted in the model and can be changed by the user.

Cost factor variables are found on annotated sheets labeled 2- 10. **Changing the highlighted cells with bold red text will change the cost calculations.**

Six summary sheets at the beginning of the model (1a - 1f) present summary costs from various perspectives:
1a and 1b: Total cost, total capital cost, total operating cost by time period and cost category; unrounded (1a) and rounded (1b)
1c and 1d: The same cost tables as 1a and 1b for each of the Plan subareas: Valley (1c) and Foothills (1d)
1e: Capital costs by time period and cost category for the Valley and the Foothills subareas
1f: Operating costs by time period and cost category for the Valley and the Foothills subareas
Note that for the Reserve Acquisition cost category, the cost detail by subarea is only calculated and presented in the above-described summary tables.

Overview of the various means of cost allocation by subarea (cell comments in the detailed worksheets provide guidance on these allocations):
Reserve Acquisition:
Sheets J Acquisition Schedule, K Reserve Land by Time Period, M FeeTitle vs Easement, and N AcquisitionCostbyPeriodType take the reserve acquisition input from A Plan Input Acquisition and D Input Schedules and apply various other factors to set a schedule of acquisition by land cover, subarea, and time period to which reserve acquisition cost factors are applied.
Restoration:
Sheet L SpecificHabitatRestoration takes the restoration input from B Plan Input Restoration and D Input Schedules to set a schedule of constituent habitat restoration activity by land cover, time period, and subarea to which restoration cost factors are applied.
Reserve Management:
Costs for most management activities are based on per-acre cost factors applied to acres by subarea and community type. The costs for in-channel enhancement activities are allocated by subarea proportional to the increment of riverine/riparian complex acres added to the reserve system by subarea during each period, including restoration. The capital cost of field facilities is allocated by subarea proportional to the final distribution of reserve acres by subarea. Other capital costs for management are allocated by subarea proportional to the distribution of acres under management by subarea at each time period. Responsive measures for changed circumstances, field and technical staff and overhead, advisory services, and costs for reserve management supplies and equipment are allocated by subarea proportional to the distribution of other reserve management costs by subarea at each time period.
Monitoring:
For all monitoring cost line items except Species Monitoring, costs are allocated by subarea proportional to the acres under management by subarea at each time period. Species Monitoring costs are allocated by subarea proportional to the costs of natural community monitoring by subarea at each time period.
Environmental Compliance:
Costs are allocated by subarea proportional to the acres under management by subarea at each time period.
Plan Administration:
Costs are allocated by subarea proportional to the acres under management by subarea at each time period**.**
Start-up costs except for the cost of reserve acquisition credits in the Foothills subarea are allocated 50% to the Valley subarea and 50% to the Foothills

Title Page	
Notes to User	model overview; sources and coding for cost factor assumptions
Road Map	list of worksheet tabs and contents
Legend	key to source material indicators used in cost model
1a Cost Summary	50-year permit term costs by major cost category, by 5 year period and for the complete permit term
1b Cost Summary (rounded)	
1c Cost Summary VALLEY	50-year permit term costs allocated to the Valley subarea, by major cost category, by 5 year period and for the complete permit term
1d Cost Summary FOOTHILLS	50-year permit term costs allocated to the Foothills subarea, by major cost category, by 5 year period and for the complete permit term
1e Capital Cost Detail Vly FH	more detailed line item costs; 50-year permit term costs by 5 year period and for the complete permit term
1f Operating Cost Detail Vly FH	more detailed line item costs; 50-year permit term costs by 5 year period and for the complete permit term
Tabs A – N	background source data and information; interim analysis tables
A Plan Input Acquisition	source table from Plan Document / TRA
B Plan Input Restoration	source table from Plan Document / TRA
C Plan Input Final Reserve	source table from Plan Document / TRA
D Input Schedules	source table for alternative development scenarios to apply in cost modelling
E Input Existing Reserve Credit	source Table from Chapter 8, Table 8-1, Jump Start Lands to be Credited toward Plan Land Acquisition Commitments
F Input Grazing Urban_Suburban	source table and analysis for assumptions about reserve land that requires more intensive grazing for invasives and fuel-load management
G Cost escalation factors	CPI factor to generate "current" cost factors for all but land acquisition; land cost adjustment factor
H.1 Credit Valley Reserve	dollar value of credits against Valley reserve assembly costs for mitigation
H.2 Credit Foothills Reserve	dollar value of credits against Foothills reserve assembly costs for mitigation
I.1 ConservationCreditValley	dollar value of credits against Valley reserve assembly costs for conservation
I.2 ConservationCreditFoothills	dollar value of credits against Foothills reserve assembly costs for conservation
J Acquisition Schedule	reserve acquisition acres input by 5-year time period, by natural community, Valley cost share and Foothills cost share
K Reserve Land by Time Period	acres acquired, restored, and under management by 5-year time period and cumulative total, by natural community, Valley cost share and Foothills cost share
L SpecificHabitatRestoration	source input from TRA allocated by 5-year time period with cumulative total changes including natural community detail on "restored from" and "restored to"
M Fee Title vs Easement	reserve acquisition acres input allocated by 5-year time period and by acquisition assumptions
N AcquisitionCostbyPeriodType	land purchase cost by 5-year period, by natural community, Valley cost share and Foothills cost share
2 Establish Reserve	cost to acquire protected lands and lands for restoration, including transaction costs, pre-acquisition surveys, and site improvements
3 RestoreNaturalCommunities	cost of restoration and cost to manage and monitor the restored land, including cost of remedial measures to respond to changed circumstances
3a Community_Restore	detailed assumptions to develop costs for natural community biological monitoring on restored habitat
3b Species_Restore	detailed assumptions to develop costs for species biological monitoring on restored habitat
4 Manage Enhance	cost to manage protected habitat that is not restored, including management oversight, management plans, enhancements, and costs for remedial measures to respond to changed circumstances
4a Agricultural Lease Revenue	estimates of lease revenue on agricultural land owned in fee title by the PCA and leased to farmers
5 Monitoring_Research	costs for natural community and species monitoring on newly protected and pre-permit reserve lands (all but restored lands), costs for YHC staff oversight of monitoring contractors, costs for targeted studies and Science Adviso
5a Community_Protect	detailed assumptions to develop costs for natural community biological monitoring on protected habitat, not including restored acres
5b Species_Protect	detailed assumptions to develop costs for species biological monitoring on protected habitat, not including restored acres
6 Environmental Compliance	costs for reporting and permitting triggerer by restoration projects and some land management activities
7 Plan Administration	costs for adminstrative staff and overhead including costs for public safety services on reserve lands and state and federal agency staff support
8 Contingency	additional cost allowance for these planning level estimates
9 Post Permit Costs Annual	estimated annual average post permit costs for relevant cost categories
9a Management Post Permit	analysis and assumptions for relevant cost categories
9b Monitoring Post Permit	analysis and assumptions for relevant cost categories
9c Administration Post Permit	analysis and assumptions for relevant cost categories
10a Staffing Plan	detailed FTE assumptions by 5-year period
10b Shared Staff and Overhead	salary, benefit, and overhead assumptions by position for Field and Technical staff, by 5-year period
10c Staff and Overhead per FTE	salary, benefit, and overhead assumptions by position for all staff, by 5-year period

Western Placer County HCP/NCCP January 2020	Enter new case here to indicate Plan Status for cost model
MIG/TRA Plan Tables 2/11/2016	Indicates link to or input from Plan tables
12/2014_7/2015_2/2016	Enter date for Plan input
10/1/2014 UPDATE 4/2015	Enter date for HEG land development scenario here
2019 dollars	Enter year for constant dollar values

Legend

	HEG/ICF 2012 - 2019
	HEG/ICF earlier
	Richard Harris
	Placer Land Trust
	Placer County/Placer County Water Agency
	Guesstimate
	Other Plans - East Contra Costa County Habitat Conservancy/ Natomas Basin Conservancy

plan input	
cost factor	Changing these cells will change the cost model output.
link to other cell in workbook	

TABLE 1a

Summary of Capital and Total Cumulative Operating Costs through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS												Annual
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**	**Average**
TOTAL BUDGET													
Establish Reserve System	360,000	27,722,873	33,020,284	43,617,696	43,617,696	56,871,876	67,990,249	62,232,193	59,591,549	51,138,004	46,361,554	**$492,523,975**	$9,850,480
Restore, Manage & Monitor Natural Communities	126,609	15,883,092	19,500,619	25,039,071	25,729,600	32,537,373	38,127,339	35,851,271	35,245,098	32,044,602	30,400,186	**$290,484,860**	$5,809,697
Reserve Management and Enhancement	115,429	4,255,326	5,078,683	7,006,431	7,634,860	9,343,467	11,590,423	12,044,527	13,898,359	14,367,216	15,243,323	**$100,578,042**	$2,011,561
Monitoring, Research, and Scientific Review	115,429	2,553,633	3,766,532	4,544,997	5,250,914	6,051,803	6,584,405	6,907,471	7,452,844	8,048,333	8,560,494	**$59,836,855**	$1,196,737
Environmental Compliance	-	2,278,441	2,989,377	2,988,861	2,988,516	2,989,111	2,988,601	2,988,534	2,988,516	2,277,154	2,276,753	**$27,753,865**	$555,077
Plan Administration	2,481,464	8,736,556	8,933,392	9,149,424	9,219,403	8,705,564	8,838,126	9,112,903	9,233,588	8,878,516	8,941,571	**$92,230,506**	$1,844,610
Contingency Fund	85,168	1,965,848	2,351,983	2,984,460	3,047,295	3,785,019	4,437,353	4,194,878	4,157,933	3,759,790	3,583,311	**$34,353,038**	$687,061
Total	**$3,284,100**	**$63,395,769**	**$75,640,870**	**$95,330,940**	**$97,488,284**	**$120,284,213**	**$140,556,496**	**$133,331,778**	**$132,567,886**	**$120,513,615**	**$115,367,191**	**$1,097,761,141**	**$21,955,223**
CAPITAL BUDGET													
Establish Reserve System	360,000	26,645,484	31,742,392	41,938,701	41,938,701	54,691,219	65,388,770	59,848,653	57,307,955	49,174,371	44,578,705	**$473,614,950**	$9,472,299
Restore Natural Communities (incl. contingency)	14,810	13,869,590	16,306,576	21,140,271	21,183,564	27,241,645	32,251,930	29,671,129	28,501,833	24,761,235	22,595,269	**$237,537,852**	$4,750,757
Reserve Management and Enhancement	3,630	915,995	964,990	1,674,627	1,284,705	1,514,454	2,229,049	1,823,486	2,510,120	2,123,868	2,198,396	**$17,243,320**	$344,866
Monitoring, Research, and Scientific Review	3,630	49,849	8,664	27,996	19,328	56,562	22,682	28,091	16,729	56,063	15,862	**$305,454**	$6,109
Environmental Compliance	-	852	638	420	330	1,040	530	348	330	534	132	**$5,154**	$103
Plan Administration	27,500	83,083	18,353	87,064	9,482	102,300	13,917	84,137	8,658	100,345	6,274	**$541,113**	$10,822
Contingency, Land Acquisition and Site Improvement:	-	1,332,274	1,587,120	2,096,935	2,096,935	2,734,561	3,269,438	2,992,433	2,865,398	2,458,719	2,228,935	**$23,662,748**	$473,255
Total	**$409,570**	**$42,897,127**	**$50,628,734**	**$66,966,013**	**$66,533,045**	**$86,341,781**	**$103,176,317**	**$94,448,276**	**$91,211,022**	**$78,675,134**	**$71,623,573**	**$752,910,591**	**$15,058,212**
OPERATING BUDGET													
Establish Reserve System	-	1,077,389	1,277,892	1,678,996	1,678,996	2,180,657	2,601,479	2,383,541	2,283,594	1,963,634	1,782,849	**$18,909,025**	$378,181
Restore, Manage & Monitor Natural Communities	111,799	2,013,502	3,194,043	3,898,800	4,546,036	5,295,728	5,875,409	6,180,142	6,743,265	7,283,367	7,804,917	**$52,947,008**	$1,058,940
Reserve Management and Enhancement	111,799	3,339,332	4,113,693	5,331,804	6,350,154	7,829,013	9,361,374	10,221,041	11,388,239	12,243,347	13,044,927	**$83,334,722**	$1,666,694
Monitoring, Research, and Scientific Review	111,799	2,503,784	3,757,868	4,517,001	5,231,587	5,995,241	6,561,723	6,879,380	7,436,115	7,992,270	8,544,632	**$59,531,401**	$1,190,628
Environmental Compliance	-	2,277,589	2,988,739	2,988,442	2,988,186	2,988,071	2,988,071	2,988,186	2,988,186	2,276,621	2,276,621	**$27,748,711**	$554,974
Plan Administration	2,453,964	8,653,472	8,915,039	9,062,360	9,209,920	8,603,264	8,824,209	9,028,766	9,224,930	8,778,171	8,935,297	**$91,689,392**	$1,833,788
Operating Contingency Fund	85,168	633,573	764,864	887,525	950,360	1,050,459	1,167,914	1,202,446	1,292,535	1,301,071	1,354,375	**$10,690,290**	$213,806
Total	**$2,874,530**	**$20,498,641**	**$25,012,137**	**$28,364,927**	**$30,955,239**	**$33,942,432**	**$37,380,179**	**$38,883,502**	**$41,356,864**	**$41,838,481**	**$43,743,618**	**$344,850,550**	**$6,897,011**
Average annual operating cost per acre managed:		$1,405	$796	$538	$418	$336	$282	$241	$218	$195	$185		

TABLE 9-1

Summary of Capital and Total Cumulative Operating Costs through 50-Year Permit Term (rounded) [a]

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS												Annual Average
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**	
TOTAL BUDGET													
Establish Reserve System	360,000	27,722,000	33,020,000	43,618,000	43,618,000	56,872,000	67,990,000	62,233,000	59,592,000	51,138,000	46,362,000	**$492,525,000**	$9,850,500
Restore, Manage & Monitor Natural Communities	127,000	15,884,000	19,501,000	25,039,000	25,730,000	32,538,000	38,127,000	35,851,000	35,245,000	32,044,000	30,400,000	**$290,486,000**	$5,809,720
Reserve Management and Enhancement	116,000	4,255,000	5,079,000	7,007,000	7,635,000	9,343,000	11,590,000	12,044,000	13,898,000	14,367,000	15,243,000	**$100,577,000**	$2,011,540
Monitoring, Research, and Scientific Review	116,000	2,554,000	3,767,000	4,545,000	5,251,000	6,052,000	6,585,000	6,907,000	7,453,000	8,048,000	8,561,000	**$59,839,000**	$1,196,780
Environmental Compliance	-	2,279,000	2,990,000	2,988,000	2,988,000	2,989,000	2,989,000	2,988,000	2,988,000	2,278,000	2,277,000	**$27,754,000**	$555,080
Plan Administration	2,482,000	8,736,000	8,933,000	9,149,000	9,219,000	8,705,000	8,838,000	9,113,000	9,234,000	8,878,000	8,941,000	**$92,228,000**	$1,844,560
Contingency Fund	85,000	1,966,000	2,352,000	2,985,000	3,047,000	3,785,000	4,437,000	4,194,000	4,158,000	3,760,000	3,583,000	**$34,352,000**	$687,040
Total	**$3,286,000**	**$63,396,000**	**$75,642,000**	**$95,331,000**	**$97,488,000**	**$120,284,000**	**$140,556,000**	**$133,330,000**	**$132,568,000**	**$120,513,000**	**$115,367,000**	**$1,097,761,000**	**$21,955,220**
CAPITAL BUDGET													
Establish Reserve System	360,000	26,645,000	31,742,000	41,939,000	41,939,000	54,691,000	65,389,000	59,849,000	57,308,000	49,174,000	44,579,000	**$473,615,000**	$9,472,300
Restore Natural Communities (incl. contingency)	15,000	13,870,000	16,307,000	21,140,000	21,184,000	27,242,000	32,252,000	29,671,000	28,502,000	24,761,000	22,595,000	**$237,539,000**	$4,750,780
Reserve Management and Enhancement	4,000	916,000	965,000	1,675,000	1,285,000	1,514,000	2,229,000	1,823,000	2,510,000	2,124,000	2,198,000	**$17,243,000**	$344,860
Monitoring, Research, and Scientific Review	4,000	50,000	9,000	28,000	19,000	57,000	23,000	28,000	17,000	56,000	16,000	**$307,000**	$6,140
Environmental Compliance	-	1,000	1,000	-	-	1,000	1,000	-	-	1,000	-	**$5,000**	$100
Plan Administration	28,000	83,000	18,000	87,000	9,000	102,000	14,000	84,000	9,000	100,000	6,000	**$540,000**	$10,800
Contingency, Land Acquisition and Site Improvements	-	1,332,000	1,587,000	2,097,000	2,097,000	2,735,000	3,269,000	2,992,000	2,865,000	2,459,000	2,229,000	**$23,662,000**	$473,240
Total	**$411,000**	**$42,897,000**	**$50,629,000**	**$66,966,000**	**$66,533,000**	**$86,342,000**	**$103,177,000**	**$94,447,000**	**$91,211,000**	**$78,675,000**	**$71,623,000**	**$752,911,000**	**$15,058,220**
OPERATING BUDGET													
Establish Reserve System	-	1,077,000	1,278,000	1,679,000	1,679,000	2,181,000	2,601,000	2,384,000	2,284,000	1,964,000	1,783,000	**$18,910,000**	$378,200
Restore, Manage & Monitor Natural Communities [b]	112,000	2,014,000	3,194,000	3,899,000	4,546,000	5,296,000	5,875,000	6,180,000	6,743,000	7,283,000	7,805,000	**$52,947,000**	$1,058,940
Reserve Management and Enhancement	112,000	3,339,000	4,114,000	5,332,000	6,350,000	7,829,000	9,361,000	10,221,000	11,388,000	12,243,000	13,045,000	**$83,334,000**	$1,666,680
Monitoring, Research, and Scientific Review	112,000	2,504,000	3,758,000	4,517,000	5,232,000	5,995,000	6,562,000	6,879,000	7,436,000	7,992,000	8,545,000	**$59,532,000**	$1,190,640
Environmental Compliance	-	2,278,000	2,989,000	2,988,000	2,988,000	2,988,000	2,988,000	2,988,000	2,988,000	2,277,000	2,277,000	**$27,749,000**	$554,980
Plan Administration	2,454,000	8,653,000	8,915,000	9,062,000	9,210,000	8,603,000	8,824,000	9,029,000	9,225,000	8,778,000	8,935,000	**$91,688,000**	$1,833,760
Operating Contingency Fund	85,000	634,000	765,000	888,000	950,000	1,050,000	1,168,000	1,202,000	1,293,000	1,301,000	1,354,000	**$10,690,000**	$213,800
Total	**$2,875,000**	**$20,499,000**	**$25,013,000**	**$28,365,000**	**$30,955,000**	**$33,942,000**	**$37,379,000**	**$38,883,000**	**$41,357,000**	**$41,838,000**	**$43,744,000**	**$344,850,000**	**$6,897,000**

Notes:

2019 dollars; detail may not add to total due to independent rounding.

[a] Does not include plan preparation and post-permit costs. Plan preparation costs are reported in Section 9.3.9 *Plan Preparation Costs* and post-permit costs are reported in Section 9.3.8, *Costs in Perpetuity* .

[b] Includes cost of long term management and monitoring on restored lands.

TABLE 1c

VALLEY Capital and Total Cumulative Operating Cost Share through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
TOTAL BUDGET												
Establish Reserve System	-	17,967,920	23,360,655	34,148,763	34,148,763	47,641,445	58,959,888	53,098,219	50,410,058	41,804,395	36,941,995	**$398,482,100**
Restore, Manage & Monitor Natural Communities	63,305	9,308,718	12,617,693	18,185,535	18,713,415	25,570,547	31,202,370	28,808,601	28,060,839	24,593,338	22,732,316	**$219,856,676**
Reserve Management and Enhancement	57,715	2,475,676	3,441,988	5,239,368	5,949,788	7,634,449	9,737,141	10,312,165	11,945,267	12,473,353	13,256,704	**$82,523,614**
Monitoring, Research, and Scientific Review	57,715	1,439,484	2,230,428	2,892,335	3,439,651	4,139,042	4,686,532	5,007,940	5,459,212	5,904,903	6,271,031	**$41,528,273**
Environmental Compliance	-	1,197,072	1,677,885	1,826,111	1,888,943	1,988,197	2,081,713	2,125,276	2,150,125	1,640,843	1,636,567	**$18,212,730**
Plan Administration	1,240,732	4,590,108	5,014,156	5,590,042	5,827,283	5,790,475	6,156,204	6,480,579	6,643,219	6,397,568	6,427,345	**$60,157,709**
Contingency Fund	42,584	1,216,642	1,589,753	2,240,341	2,302,911	3,067,355	3,736,720	3,491,992	3,441,021	3,034,014	2,838,531	**$27,001,864**
Total	**$1,462,050**	**$38,195,620**	**$49,932,557**	**$70,122,495**	**$72,270,755**	**$95,831,510**	**$116,560,567**	**$109,324,771**	**$108,109,741**	**$95,848,414**	**$90,104,488**	**$847,762,966**
CAPITAL BUDGET												
Establish Reserve System	-	17,286,961	22,475,320	32,854,574	32,854,574	45,835,903	56,725,393	51,085,873	48,499,589	40,220,069	35,541,946	**$383,380,200**
Restore Natural Communities (incl. contingency)	7,405	8,067,705	10,499,130	15,336,907	15,368,316	21,429,419	26,454,234	23,863,798	22,686,578	18,914,742	16,739,948	**$179,368,181**
Reserve Management and Enhancement	1,815	553,125	630,654	1,183,895	928,583	1,146,248	1,720,813	1,448,549	1,980,053	1,728,522	1,789,211	**$13,111,468**
Monitoring, Research, and Scientific Review	1,815	26,190	4,863	17,105	12,216	37,622	15,799	19,976	12,036	40,397	11,402	**$199,421**
Environmental Compliance	-	448	358	256	208	692	369	248	237	384	95	**$3,296**
Plan Administration	13,750	43,651	10,301	53,194	5,994	68,044	9,694	59,833	6,229	72,306	4,510	**$347,506**
Contingency, Land Acquisition and Site Improvements	-	864,348	1,123,766	1,642,729	1,642,729	2,291,795	2,836,270	2,554,294	2,424,979	2,011,003	1,777,097	**$19,169,010**
Total	**$24,785**	**$26,842,428**	**$34,744,392**	**$51,088,660**	**$50,812,620**	**$70,809,724**	**$87,762,570**	**$79,032,570**	**$75,609,701**	**$62,987,423**	**$55,864,209**	**$595,579,082**
OPERATING BUDGET												
Establish Reserve System	-	680,958	885,335	1,294,189	1,294,189	1,805,542	2,234,495	2,012,346	1,910,469	1,584,327	1,400,049	**$15,101,900**
Restore, Manage & Monitor Natural Communities	55,900	1,241,014	2,118,563	2,848,628	3,345,099	4,141,128	4,748,136	4,944,803	5,374,261	5,678,596	5,992,368	**$40,488,495**
Reserve Management and Enhancement	55,900	1,922,551	2,811,334	4,055,473	5,021,206	6,488,201	8,016,328	8,863,616	9,965,214	10,744,831	11,467,492	**$69,412,146**
Monitoring, Research, and Scientific Review	55,900	1,413,294	2,225,565	2,875,230	3,427,435	4,101,420	4,670,733	4,987,963	5,447,177	5,864,507	6,259,630	**$41,328,852**
Environmental Compliance	-	1,196,625	1,677,527	1,825,854	1,888,735	1,987,505	2,081,343	2,125,028	2,149,887	1,640,458	1,636,472	**$18,209,434**
Plan Administration	1,226,982	4,546,456	5,003,855	5,536,849	5,821,289	5,722,430	6,146,510	6,420,746	6,636,990	6,325,262	6,422,835	**$59,810,204**
Operating Contingency Fund	42,584	352,294	465,987	597,612	660,183	775,560	900,450	937,698	1,016,042	1,023,010	1,061,434	**$7,832,854**
Total	**$1,437,265**	**$11,353,192**	**$15,188,165**	**$19,033,835**	**$21,458,135**	**$25,021,787**	**$28,797,996**	**$30,292,200**	**$32,500,040**	**$32,860,990**	**$34,240,279**	**$252,183,884**
Average annual operating cost per acre managed:		$1,481	$861	$591	$459	$373	$312	$264	$238	$213	$201	

TABLE 1d

FOOTHILLS Capital and Total Cumulative Operating Cost Share through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
TOTAL BUDGET												
Establish Reserve System	360,000	9,754,953	9,659,629	9,468,934	9,468,934	9,230,431	9,030,361	9,133,974	9,181,491	9,333,609	9,419,559	**$94,041,875**
Restore, Manage & Monitor Natural Communities	63,305	6,574,374	6,882,927	6,853,536	7,016,185	6,966,825	6,924,970	7,042,670	7,184,259	7,451,264	7,667,870	**$70,628,184**
Reserve Management and Enhancement	57,715	1,779,650	1,636,694	1,767,062	1,685,071	1,709,017	1,853,282	1,732,362	1,953,091	1,893,863	1,986,619	**$18,054,428**
Monitoring, Research, and Scientific Review	57,715	1,114,149	1,536,104	1,652,662	1,811,263	1,912,761	1,897,873	1,899,531	1,993,632	2,143,429	2,289,463	**$18,308,582**
Environmental Compliance	-	1,081,369	1,311,492	1,162,751	1,099,573	1,000,914	906,889	863,258	838,391	636,312	640,186	**$9,541,135**
Plan Administration	1,240,732	4,146,448	3,919,236	3,559,382	3,392,120	2,915,089	2,681,922	2,632,324	2,590,369	2,480,949	2,514,226	**$32,072,797**
Contingency Fund	42,584	749,206	762,231	744,119	744,384	717,664	700,633	702,886	716,911	725,776	744,780	**$7,351,174**
Total	**$1,822,050**	**$25,200,149**	**$25,708,313**	**$25,208,445**	**$25,217,530**	**$24,452,702**	**$23,995,929**	**$24,007,007**	**$24,458,145**	**$24,665,201**	**$25,262,703**	**$249,998,175**
CAPITAL BUDGET												
Establish Reserve System	360,000	9,358,523	9,267,073	9,084,127	9,084,127	8,855,317	8,663,377	8,762,780	8,808,366	8,954,302	9,036,759	**$90,234,750**
Restore Natural Communities (incl. contingency)	7,405	5,801,885	5,807,447	5,803,363	5,815,248	5,812,225	5,797,697	5,807,331	5,815,255	5,846,493	5,855,321	**$58,169,671**
Reserve Management and Enhancement	1,815	362,869	334,336	490,732	356,123	368,206	508,237	374,937	530,067	395,346	409,185	**$4,131,852**
Monitoring, Research, and Scientific Review	1,815	23,659	3,801	10,891	7,111	18,940	6,883	8,114	4,693	15,666	4,460	**$106,033**
Environmental Compliance	-	404	280	163	121	348	161	101	93	149	37	**$1,857**
Plan Administration	13,750	39,432	8,052	33,870	3,489	34,256	4,223	24,304	2,429	28,040	1,764	**$193,608**
Contingency, Land Acquisition and Site Improvements	-	467,926	463,354	454,206	454,206	442,766	433,169	438,139	440,418	447,715	451,838	**$4,493,738**
Total	**$384,785**	**$16,054,699**	**$15,884,342**	**$15,877,353**	**$15,720,426**	**$15,532,057**	**$15,413,746**	**$15,415,705**	**$15,601,321**	**$15,687,711**	**$15,759,364**	**$157,331,509**
OPERATING BUDGET												
Establish Reserve System	-	396,430	392,556	384,807	384,807	375,114	366,984	371,194	373,125	379,307	382,800	**$3,807,125**
Restore, Manage & Monitor Natural Communities	55,900	772,488	1,075,480	1,050,172	1,200,937	1,154,600	1,127,273	1,235,339	1,369,004	1,604,771	1,812,549	**$12,458,513**
Reserve Management and Enhancement	55,900	1,416,781	1,302,359	1,276,331	1,328,949	1,340,812	1,345,045	1,357,425	1,423,025	1,498,516	1,577,434	**$13,922,576**
Monitoring, Research, and Scientific Review	55,900	1,090,491	1,532,303	1,641,771	1,804,152	1,893,821	1,890,990	1,891,417	1,988,939	2,127,764	2,285,003	**$18,202,549**
Environmental Compliance	-	1,080,964	1,311,212	1,162,587	1,099,451	1,000,566	906,728	863,158	838,299	636,162	640,149	**$9,539,277**
Plan Administration	1,226,982	4,107,016	3,911,184	3,525,511	3,388,631	2,880,833	2,677,699	2,608,021	2,587,940	2,452,909	2,512,462	**$31,879,189**
Operating Contingency Fund	42,584	281,279	298,877	289,913	290,177	274,899	267,464	264,747	276,493	278,061	292,942	**$2,857,436**
Total	**$1,437,265**	**$9,145,450**	**$9,823,971**	**$9,331,092**	**$9,497,104**	**$8,920,645**	**$8,582,183**	**$8,591,302**	**$8,856,824**	**$8,977,490**	**$9,503,339**	**$92,666,666**
Average annual operating cost per acre managed:		$1,321	$713	$455	$349	$264	$214	$184	$167	$150	$143	

TABLE 1e

Capital Costs through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**CUMULATIVE TOTAL**
VALLEY COST SHARE												
Establish Reserve System												
Land acquisition	-	16,390,725	21,310,095	31,151,241	31,151,241	43,459,558	53,784,486	48,437,345	45,985,146	38,134,875	33,699,287	**$363,504,000**
Fencing improvements	-	616,519	801,556	1,171,719	1,171,719	1,634,683	2,023,044	1,821,917	1,729,680	1,434,401	1,267,561	**$13,672,800**
Other one-time site improvements	-	279,717	363,669	531,613	531,613	741,662	917,862	826,611	784,762	650,793	575,097	**$6,203,400**
Contingency	-	864,348	1,123,766	1,642,729	1,642,729	2,291,795	2,836,270	2,554,294	2,424,979	2,011,003	1,777,097	**$19,169,010**
Total	**-**	**18,151,309**	**23,599,085**	**34,497,303**	**34,497,303**	**48,127,698**	**59,561,662**	**53,640,166**	**50,924,568**	**42,231,072**	**37,319,043**	**$402,549,210**
Restore Natural Communities												
Restoration incl. contingency	-	7,948,886	10,334,595	15,107,181	15,107,181	21,076,252	26,083,455	23,490,292	22,301,068	18,493,981	16,342,888	**$176,285,780**
Other shared capital/remedial measures	7,405	118,819	164,534	229,726	261,135	353,167	370,779	373,506	385,510	420,761	397,060	**$3,082,401**
Total	**7,405**	**8,067,705**	**10,499,130**	**15,336,907**	**15,368,316**	**21,429,419**	**26,454,234**	**23,863,798**	**22,686,578**	**18,914,742**	**16,739,948**	**$179,368,181**
Reserve Management and Enhancement												
Field facilties	-	-	-	390,317	-	-	390,317	-	390,317	-	-	**$1,170,951**
Fish barrier removal/modification	-	287,700	287,700	287,700	287,700	287,700	287,700	287,700	287,700	287,700	287,700	**$2,877,000**
Water supply	-	43,190	56,153	82,085	125,276	170,671	223,810	252,910	291,845	324,297	341,710	**$1,911,948**
Responsive measures	-	196,045	281,938	406,688	503,391	650,255	803,186	887,962	998,155	1,076,128	1,148,400	**$6,952,147**
Other shared capital	1,815	26,190	4,863	17,105	12,216	37,622	15,799	19,976	12,036	40,397	11,402	**$199,421**
Total	1,815	**553,125**	**630,654**	**1,183,895**	**928,583**	**1,146,248**	**1,720,813**	**1,448,549**	**1,980,053**	**1,728,522**	**1,789,211**	**$13,111,468**
Monitoring and Research												
Other shared capital	1,815	26,190	4,863	17,105	12,216	37,622	15,799	19,976	12,036	40,397	11,402	**$199,421**
Total	**1,815**	**26,190**	**4,863**	**17,105**	**12,216**	**37,622**	**15,799**	**19,976**	**12,036**	**40,397**	**11,402**	**$199,421**
Environmental Compliance												
Furniture, equipment, technology	-	448	358	256	208	692	369	248	237	384	95	**$3,296**
Total	**-**	**448**	**358**	**256**	**208**	**692**	**369**	**248**	**237**	**384**	**95**	**$3,296**
Plan Administration												
Furniture, equipment, technology, vehicles	13,750	43,651	10,301	53,194	5,994	68,044	9,694	59,833	6,229	72,306	4,510	**$347,506**
Total	**13,750**	**43,651**	**10,301**	**53,194**	**5,994**	**68,044**	**9,694**	**59,833**	**6,229**	**72,306**	**4,510**	**$347,506**
Total Capital Cost Share for Valley	**24,785**	**$26,842,428**	**$34,744,392**	**$51,088,660**	**$50,812,620**	**$70,809,724**	**$87,762,570**	**$79,032,570**	**$75,609,701**	**$62,987,423**	**$55,864,209**	**$595,579,082**

TABLE 1e

Capital Costs through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**CUMULATIVE TOTAL**
FOOTHILLS COST SHARE												
Establish Reserve System												
Land acquisition	-	8,974,211	8,886,516	8,711,083	8,711,083	8,491,669	8,307,611	8,402,932	8,446,646	8,586,589	8,665,660	**$86,184,000**
Fencing improvements	-	282,521	279,761	274,238	274,238	267,330	261,536	264,537	265,913	270,319	272,808	**$2,713,200**
Other one-time site improvements	-	101,791	100,796	98,806	98,806	96,318	94,230	95,311	95,807	97,394	98,291	**$977,550**
Acquire Credits at Big Gun Conservation Banl	360,000	-	-	-	-	-	-	-	-	-	-	**$360,000**
Contingency	-	467,926	463,354	454,206	454,206	442,766	433,169	438,139	440,418	447,715	451,838	**$4,493,738**
Total	**360,000**	**9,826,449**	**9,730,426**	**9,538,333**	**9,538,333**	**9,298,082**	**9,096,546**	**9,200,919**	**9,248,784**	**9,402,017**	**9,488,597**	**$94,728,488**
Restore Natural Communities												
Restoration incl. contingency	-	5,716,437	5,716,437	5,716,437	5,716,437	5,716,437	5,716,437	5,716,437	5,716,437	5,716,437	5,716,437	**$57,164,370**
Other shared capital/remedial measures	7,405	85,448	91,010	86,926	98,811	95,788	81,260	90,894	98,818	130,056	138,884	**$1,005,301**
Total	**7,405**	**5,801,885**	**5,807,447**	**5,803,363**	**5,815,248**	**5,812,225**	**5,797,697**	**5,807,331**	**5,815,255**	**5,846,493**	**5,855,321**	**$58,169,671**
Reserve Management and Enhancement												
Field facilties	-	-	-	152,683	-	-	152,683	-	152,683	-	-	**$458,049**
Fish barrier removal/modification	-	184,600	184,600	184,600	184,600	184,600	184,600	184,600	184,600	184,600	184,600	**$1,846,000**
Water supply	-	16,722	16,503	16,065	32,787	32,019	31,120	48,081	47,422	46,874	64,032	**$351,625**
Responsive measures	-	137,888	129,431	126,493	131,624	132,647	132,951	134,142	140,669	148,207	156,093	**$1,370,145**
Other shared capital	1,815	23,659	3,801	10,891	7,111	18,940	6,883	8,114	4,693	15,666	4,460	**$106,033**
Total	1,815	**362,869**	**334,336**	**490,732**	**356,123**	**368,206**	**508,237**	**374,937**	**530,067**	**395,346**	**409,185**	**$4,131,852**
Monitoring and Research												
Other shared capital	1,815	23,659	3,801	10,891	7,111	18,940	6,883	8,114	4,693	15,666	4,460	**$106,033**
Total	**1,815**	**23,659**	**3,801**	**10,891**	**7,111**	**18,940**	**6,883**	**8,114**	**4,693**	**15,666**	**4,460**	**$106,033**
Environmental Compliance												
Furniture, equipment, technology	-	404	280	163	121	348	161	101	93	149	37	**$1,857**
Total	**-**	**404**	**280**	**163**	**121**	**348**	**161**	**101**	**93**	**149**	**37**	**$1,857**
Plan Administration												
Furniture, equipment, technology, vehicles	13,750	39,432	8,052	33,870	3,489	34,256	4,223	24,304	2,429	28,040	1,764	**$193,608**
Total	**13,750**	**39,432**	**8,052**	**33,870**	**3,489**	**34,256**	**4,223**	**24,304**	**2,429**	**28,040**	**1,764**	**$193,608**
Total Capital Cost Share for Foothills	**$384,785**	**$16,054,699**	**$15,884,342**	**$15,877,353**	**$15,720,426**	**$15,532,057**	**$15,413,746**	**$15,415,705**	**$15,601,321**	**$15,687,711**	**$15,759,364**	**$157,331,509**
Total VALLEY AND FOOTHILLS												
Establish Reserve System												
Land acquisition	-	25,364,936	30,196,611	39,862,324	39,862,324	51,951,226	62,092,098	56,840,277	54,431,793	46,721,464	42,364,947	**$449,688,000**
Fencing improvements	-	899,040	1,081,316	1,445,957	1,445,957	1,902,013	2,284,580	2,086,454	1,995,593	1,704,720	1,540,369	**$16,386,000**
Other one-time site improvements	-	381,508	464,465	630,420	630,420	837,979	1,012,092	921,922	880,569	748,187	673,388	**$7,180,950**
Acquire credits at Big Gun Mitigation Bank	360,000	-	-	-	-	-	-	-	-	-	-	**$360,000**
Contingency	-	1,332,274	1,587,120	2,096,935	2,096,935	2,734,561	3,269,438	2,992,433	2,865,398	2,458,719	2,228,935	**$23,662,748**
Total	**360,000**	**27,977,759**	**33,329,512**	**44,035,636**	**44,035,636**	**57,425,780**	**68,658,208**	**62,841,085**	**60,173,353**	**51,633,089**	**46,807,640**	**$497,277,698**
Restore Natural Communities	**14,810**	**13,869,590**	**16,306,576**	**21,140,271**	**21,183,564**	**27,241,645**	**32,251,930**	**29,671,129**	**28,501,833**	**24,761,235**	**22,595,269**	**$237,537,852**
Management/Enhancement capital costs	**3,630**	**915,995**	**964,990**	**1,674,627**	**1,284,705**	**1,514,454**	**2,229,049**	**1,823,486**	**2,510,120**	**2,123,868**	**2,198,396**	**$17,243,320**
Monitoring capital costs	**3,630**	**49,849**	**8,664**	**27,996**	**19,328**	**56,562**	**22,682**	**28,091**	**16,729**	**56,063**	**15,862**	**$305,454**
Environmental compliance capital costs	**-**	**852**	**638**	**420**	**330**	**1,040**	**530**	**348**	**330**	**534**	**132**	**$5,154**
Adminstration capital costs	**27,500**	**83,083**	**18,353**	**87,064**	**9,482**	**102,300**	**13,917**	**84,137**	**8,658**	**100,345**	**6,274**	**$541,113**

TABLE 1e

Capital Costs through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**CUMULATIVE TOTAL**
Total Plan Capital Costs	**$409,570**	**$42,897,127**	**$50,628,734**	**$66,966,013**	**$66,533,045**	**$86,341,781**	**$103,176,317**	**$94,448,276**	**$91,211,022**	**$78,675,134**	**$71,623,573**	**$752,910,591**

TABLE 1f

Operating Costs through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**CUMULATIVE TOTAL**
VALLEY COST SHARE												
Establish Reserve System												
Pre-acquisition planning surveys	-	66,306	86,207	126,018	126,018	175,809	217,577	195,946	186,026	154,269	136,325	**$1,470,500**
Due Diligence	-	614,652	799,129	1,168,172	1,168,172	1,629,733	2,016,918	1,816,400	1,724,443	1,430,058	1,263,723	**$13,631,400**
Total	**-**	**680,958**	**885,335**	**1,294,189**	**1,294,189**	**1,805,542**	**2,234,495**	**2,012,346**	**1,910,469**	**1,584,327**	**1,400,049**	**$15,101,900**
Restore, Manage & Monitor Natural Communities												
Field and Technical Staff and overhead	55,900	658,179	1,244,782	1,572,962	1,743,269	2,081,877	2,205,396	1,977,556	1,986,348	1,930,624	1,893,230	**$17,350,123**
Management on restored lands	-	100,467	162,713	251,542	343,839	464,706	616,530	761,634	897,051	1,012,650	1,112,841	**$5,723,972**
Monitoring on restored lands	-	403,550	667,447	974,973	1,257,990	1,594,545	1,926,210	2,205,613	2,490,862	2,735,322	2,986,297	**$17,242,809**
Monitoring research	-	78,818	43,621	49,151	-	-	-	-	-	-	-	**$171,591**
Total	**55,900**	**1,241,014**	**2,118,563**	**2,848,628**	**3,345,099**	**4,141,128**	**4,748,136**	**4,944,803**	**5,374,261**	**5,678,596**	**5,992,368**	**$40,488,495**
Reserve Management and Enhancement												
Field and Technical Staff and overhead	55,900	664,283	1,325,026	1,653,781	1,904,839	2,198,136	2,306,874	2,136,105	2,187,262	2,221,433	2,249,667	**$18,903,305**
Agricultural advisory services	-	319,957	186,076	207,089	215,224	225,500	232,941	235,868	237,964	238,635	239,013	**$2,338,268**
Maintenance, utilities, supplies	-	5,653	14,209	68,102	81,916	100,561	168,512	187,336	252,980	267,882	281,349	**$1,428,500**
Reserve management plan	-	217,600	21,700	21,700	21,700	21,700	21,700	21,700	21,700	21,700	21,700	**$412,900**
All other management actions	-	715,057	1,264,323	2,104,802	2,797,526	3,942,304	5,286,301	6,282,607	7,265,309	7,995,181	8,675,764	**$46,329,173**
Total	**55,900**	**1,922,551**	**2,811,334**	**4,055,473**	**5,021,206**	**6,488,201**	**8,016,328**	**8,863,616**	**9,965,214**	**10,744,831**	**11,467,492**	**$69,412,146**
Monitoring and Research												
Field and Technical Staff and overhead	55,900	594,484	1,085,136	1,324,684	1,518,800	1,760,335	1,872,837	1,748,559	1,795,425	1,821,143	1,836,896	**$15,414,199**
Monitoring Contractors	-	676,691	1,026,629	1,426,671	1,823,306	2,251,290	2,703,862	3,143,400	3,554,624	3,946,087	4,325,694	**$24,878,254**
Research and Adaptive Management	-	142,118	113,800	123,875	85,329	89,795	94,034	96,004	97,127	97,277	97,040	**$1,036,400**
Total	**55,900**	**1,413,294**	**2,225,565**	**2,875,230**	**3,427,435**	**4,101,420**	**4,670,733**	**4,987,963**	**5,447,177**	**5,864,507**	**6,259,630**	**$41,328,852**
Environmental Compliance												
Field and Technical Staff and overhead	-	374,493	799,232	869,805	899,676	946,684	991,381	1,012,231	1,024,073	512,915	511,668	**$7,942,157**
Permitting and reporting	-	822,132	878,295	956,049	989,059	1,040,821	1,089,963	1,112,797	1,125,815	1,127,544	1,124,803	**$10,267,277**
Total	**-**	**1,196,625**	**1,677,527**	**1,825,854**	**1,888,735**	**1,987,505**	**2,081,343**	**2,125,028**	**2,149,887**	**1,640,458**	**1,636,472**	**$18,209,434**
Plan Administration												
Staff	1,209,750	3,985,353	4,404,664	4,794,603	4,960,148	4,692,608	4,914,166	5,017,115	5,075,807	4,638,651	4,627,378	**$48,320,244**
Administrative Overhead	17,232	15,679	12,712	12,793	12,306	11,423	11,962	12,642	12,789	12,464	12,433	**$144,435**
Other Program Costs	-	545,424	586,479	729,452	848,835	1,018,399	1,220,381	1,390,989	1,548,394	1,674,147	1,783,023	**$11,345,524**
Total	**1,226,982**	**4,546,456**	**5,003,855**	**5,536,849**	**5,821,289**	**5,722,430**	**6,146,510**	**6,420,746**	**6,636,990**	**6,325,262**	**6,422,835**	**$59,810,204**
Operating Contingency	**42,584**	**352,294**	**465,987**	**597,612**	**660,183**	**775,560**	**900,450**	**937,698**	**1,016,042**	**1,023,010**	**1,061,434**	**$7,832,854**
Total Operating Cost Share, Valley	**$1,437,265**	**$11,353,192**	**$15,188,165**	**$19,033,835**	**$21,458,135**	**$25,021,787**	**$28,797,996**	**$30,292,200**	**$32,500,040**	**$32,860,990**	**$34,240,279**	**$252,183,884**

TABLE 1f

Operating Costs through 50-Year Permit Term (2019 dollars)

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**CUMULATIVE TOTAL**
FOOTHILLS COST SHARE												
Establish Reserve System												
Pre-acquisition planning surveys	-	59,897	59,312	58,141	58,141	56,677	55,448	56,084	56,376	57,310	57,838	**$575,225**
Due Diligence	-	336,533	333,244	326,666	326,666	318,438	311,535	315,110	316,749	321,997	324,962	**$3,231,900**
Total	**-**	**396,430**	**392,556**	**384,807**	**384,807**	**375,114**	**366,984**	**371,194**	**373,125**	**379,307**	**382,800**	**$3,807,125**
Restore, Manage & Monitor Natural Communities												
Field and Technical Staff and overhead	55,900	473,329	688,534	595,196	659,639	564,660	483,333	481,244	509,161	596,750	662,216	**$5,769,964**
Management on restored lands	-	147,230	171,125	191,870	219,466	244,321	269,644	298,860	329,515	361,811	394,756	**$2,628,598**
Monitoring on restored lands	-	95,247	191,692	244,508	321,832	345,619	374,296	455,235	530,328	646,209	755,576	**$3,960,542**
Monitoring research	-	56,682	24,129	18,599	-	-	-	-	-	-	-	**$99,409**
Total	**55,900**	**772,488**	**1,075,480**	**1,050,172**	**1,200,937**	**1,154,600**	**1,127,273**	**1,235,339**	**1,369,004**	**1,604,771**	**1,812,549**	**$12,458,513**
Reserve Management and Enhancement												
Field and Technical Staff and overhead	55,900	467,225	608,290	514,378	498,069	448,401	381,855	322,696	308,248	305,941	305,779	**$4,216,782**
Agricultural advisory services	-	225,043	85,424	64,411	56,276	46,000	38,559	35,632	33,536	32,865	32,487	**$650,232**
Maintenance, utilities, supplies	-	3,976	6,523	21,182	21,419	20,514	27,894	28,300	35,652	36,893	38,241	**$240,595**
Reserve management plan	-	217,600	21,700	21,700	21,700	21,700	21,700	21,700	21,700	21,700	21,700	**$412,900**
All other management actions	-	502,937	580,422	654,660	731,485	804,197	875,037	949,097	1,023,889	1,101,116	1,179,227	**$8,402,068**
Total	**55,900**	**1,416,781**	**1,302,359**	**1,276,331**	**1,328,949**	**1,340,812**	**1,345,045**	**1,357,425**	**1,423,025**	**1,498,516**	**1,577,434**	**$13,922,576**
Monitoring, Research, and Adaptive Mngmt.												
Field and Technical Staff and overhead	55,900	537,024	848,180	843,474	884,109	886,202	815,893	710,241	700,084	706,231	718,550	**$7,705,889**
Monitoring Contractors	-	425,085	595,173	719,421	870,372	962,414	1,034,132	1,142,180	1,250,982	1,383,809	1,528,492	**$9,912,060**
Research and Adaptive Management	-	128,382	88,950	78,875	49,671	45,205	40,966	38,996	37,873	37,723	37,960	**$584,600**
Total	**55,900**	**1,090,491**	**1,532,303**	**1,641,771**	**1,804,152**	**1,893,821**	**1,890,990**	**1,891,417**	**1,988,939**	**2,127,764**	**2,285,003**	**$18,202,549**
Environmental Compliance												
Field and Technical Staff and overhead	-	338,296	624,707	553,836	523,710	476,587	431,890	411,155	399,313	198,906	200,153	**$4,158,554**
Permitting and reporting	-	742,668	686,505	608,751	575,741	523,979	474,837	452,003	438,985	437,256	439,997	**$5,380,723**
Total	**-**	**1,080,964**	**1,311,212**	**1,162,587**	**1,099,451**	**1,000,566**	**906,728**	**863,158**	**838,299**	**636,162**	**640,149**	**$9,539,277**
Plan Administration												
Staff	1,209,750	3,600,147	3,442,836	3,052,897	2,887,352	2,362,392	2,140,834	2,037,885	1,979,193	1,798,849	1,810,122	**$26,322,256**
Administrative Overhead	17,232	14,164	9,936	8,146	7,163	5,751	5,211	5,135	4,987	4,833	4,864	**$87,422**
Other Program Costs	-	492,706	458,412	464,469	494,116	512,691	531,654	565,001	603,760	649,227	697,477	**$5,469,511**
Total	**1,226,982**	**4,107,016**	**3,911,184**	**3,525,511**	**3,388,631**	**2,880,833**	**2,677,699**	**2,608,021**	**2,587,940**	**2,452,909**	**2,512,462**	**$31,879,189**
Operating Contingency	**42,584**	**281,279**	**298,877**	**289,913**	**290,177**	**274,899**	**267,464**	**264,747**	**276,493**	**278,061**	**292,942**	**$2,857,436**
Total Operating Cost Share, Foothills	**$1,437,265**	**$9,145,450**	**$9,823,971**	**$9,331,092**	**$9,497,104**	**$8,920,645**	**$8,582,183**	**$8,591,302**	**$8,856,824**	**$8,977,490**	**$9,503,339**	**$92,666,666**
Average annual cost per acre managed (complete reserve):	NA	$1,405	$796	$538	$418	$336	$282	$241	$218	$195	$185	

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Detail may not add to total due to independent rounding

Links to Reserve land by time period sheet.

A. Plan Acquisition Commitments Cost Obligation - by Community and Subarea

PCCP data for cost model 20141212b

Community	Valley Cost Share	Foothills Cost Share	Total Plan Area	Valley Cost Share	Foothills Cost Share	Total Plan Area
Vernal Pool Complex[1]	17,000	-	17,000	100%	0%	100%
Grassland	3,750	3,400	7,150	52%	48%	100%
Aquatic/Wetland Complex[1]	400	200	600	67%	33%	100%
Riverine/Riparian Complex[1]	1,600	600	2,200	73%	27%	100%
Valley Oak Woodland	90	100	190	47%	53%	100%
Oak Woodland	110	10,000	10,110	1%	99%	100%
Oak Woodland shift for obligation[2]	1,000	(1,000)	-			
Rice[3]	10,000	-	10,000	100%	0%	100%
Field	50	-	50	100%	0%	100%
Total	**34,000**	**13,300**	**47,300**			

Source: Table 5-5 Summary of Plan Area Effects and Conservation Strategy Commitments (acres)

1. Land area defined as "complex" includes a mosaic of various delineated wetlands and surrounding upland.

2. Oak woodland community types will be acquired in the Foothills to mitigate impacts in the Valley.

3. Almost 80% of the existing agricultural land in the Plan Area is rice, so the cost model assumes rice acquisition to meet Plan objectives. Only 2,000 acres of land are required to remain in rice production. Some of the other land acquired would be restored to natural communities such as grassland and vernal pool complex (see B Plan Input Restoration). The remainder could be any type of agricultural land providing connectivity within the Reserve System.

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Links to Reserve land by time period sheet and Specific Habitat Restoration

Detail may not add to total due to independent rounding

B.1 Plan Restoration by Community and Subarea

PCCP data for cost model 20141212b

Community	Valley Reserve Area	Foothills Reserve Area	Total Plan Area	Valley Reserve Area	Foothills Reserve Area	Total Plan Area
Vernal Pool Complex[1]	3,000	-	3,000	100%	0%	100%
Grassland	1,000	-	1,000	100%	0%	100%
Aquatic/Wetland Complex[1]	205	205	410	50%	50%	100%
Riverine/Riparian Complex[1]	795	630	1,425	56%	44%	100%
Valley Oak Woodland	222	63	285	78%	22%	100%
Oak Woodland	-	100	100	0%	100%	100%
Total	**5,222**	**998**	**6,220**			

Source: Table 5-4 Natural Community Restoration Commitments (acres)

1. Land area defined as "complex" includes a mosaic of various delineated wetlands and surrounding upland.

B.2 Constituent Habitat Restoration by Type and Subarea

PCCP data for cost model 20141212b

Constituent Habitat	Valley Reserve Area	Foothills Reserve Area	Total Plan Area	Percent of total by type		Valley Reserve Area	Foothills Reserve Area	Total Plan Area
Vernal Pool	326	-	326	36%				
Seasonal Wetland in Vernal Pool Complex	330	-	330	37%				
Seasonal Swales	244	-	244	27%				
Vernal Pool Complex Type Total	**900**	**-**	900	**100%**	-	100%	0%	100%
Fresh Emergent Marsh	98	98	196	48%				
Lacustrine	71.5	71.5	143	35%				
Non-Vernal Pool Seasonal Wetland	35.5	35.5	71	17%				
Aquatic/Wetland Complex Total	**205**	**205**	410	**100%**	-	50%	50%	100%
Riverine	98	77	175	12%				
Riparian	697	553	1,250	88%				
Riverine/Riparian Complex Total	**795**	**630**	1,425	**100%**	-	56%	44%	100%
All Specific Habitats	**1,900**	**835**	2,735		-			

Source: Table 5-4 Natural Community Restoration Commitments (acres)

PCCP data for cost model 20141212b

B.3 Restoration Activity - Valley Reserve Area

	From:					From:			
To:	Grassland	Rice	Field	**Total**		Grassland	Rice	Field	**Total**
Vernal Pool Complex	2,700	250	50	3,000		90%	8%	2%	100%
Grassland	-	1,000	-	1,000		0%	100%	0%	100%
Aquatic/Wetland Complex	123	82	-	205		60%	40%	0%	100%
Riverine/Riparian Complex	475	320	-	795		60%	40%	0%	100%
Valley Oak Woodland	114	108	-	222		51.5%	48.5%	0%	100%
Oak Woodland	-	-	-	-					
Total	**3,412**	**1,760**	**50**	**5,222**	-				

PCCP data for cost model 20141212b

B.4 Restoration Activity - Foothills Reserve Area

	From:					From:			
To:	Grassland	Rice	Field	**Total**		Grassland	Rice	Field	**Total**
Vernal Pool Complex				-					
Grassland				-					
Aquatic/Wetland Complex	205	-	-	205		100%	0%	0%	100%
Riverine/Riparian Complex	630	-	-	630		100%	0%	0%	100%
Valley Oak Woodland	63	-	-	63		100%	0%	0%	100%
Oak Woodland	100	-	-	100		100%	0%	0%	100%
Total	**998**	**-**	**-**	**998**	-				

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Links to Reserve land by time period sheet.

Detail may not add to total due to independent rounding

C. Plan Reserve System Cost Obligation - by Community and Subarea

PCCP data for cost model 20141212b

Community	Valley Cost Share	Foothills Cost Share	Total Plan
Vernal Pool Complex[1]	20,000	-	20,000
Grassland	1,338	2,402	3,740
Aquatic/Wetland Complex[1]	605	405	1,010
Riverine/Riparian Complex[1]	2,395	1,230	3,625
Valley Oak Woodland	312	163	475
Oak Woodland	110	10,100	10,210
Oak Woodland shift for obligation[2]	1,000	(1,000)	-
Rice (Objective GGS 1.1)	2,000	-	2,000
Any Agriculture	6,240		6,240
Field	-	-	-
Total	**34,000**	**13,300**	**47,300**

Source: Table 5-5 Summary of Plan Area Effects and Conservation Strategy Commitments (acres)

1. Land area defined as "complex" includes a mosaic of various delineated wetlands and surrounding upland.

2. Oak woodland community types will be acquired in the Foothills to mitigate impacts in the Valley.

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10/1/2014 UPDATE 4/2015 HEG Case
Valley schedule varies by period

D. Plan Estimates of Land Requirements through 50-year Permit Term (acres by time period)

	Permit Period (years)											
	Start up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Land Acquisition - Valley												
Evenly per period over 50 years	-	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	**100%**
All Community Types, per effects scenario	-	5%	6%	9%	9%	12%	15%	13%	13%	10%	9%	**100%**
Habitat Restoration - Valley												
Evenly per period over 50 years	-	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	**100%**
All Community Types, per effects scenario	-	5%	6%	9%	9%	12%	15%	13%	13%	10%	9%	**100%**
Land Acquisition - Foothills												
Evenly per period over 50 years	-	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	**100%**
Habitat Restoration - Foothills												
Evenly per period over 50 years	-	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	**100%**

Note: See Appendix M Growth Scenario, especially Figure 8 and associated text for background on land development assumptions over time

E. Jump Start Lands Credit

Jump Start Land to be Counted towards PCA Land Acquisition Commitments by Community Type

County Only (County Open Space Trust Fund)

	Foothills[1]			Valley[2]			
Natural Communities	Harvego Bear River Preserve	Hidden Falls Regional Park	**Total Foothills**	Bradley Property	Markham Ravine	**Total Valley**	**Total Reserve Credit**
Vernal Pool Complex	-	-	-	383.106	278.12	**661.23**	**661.23**
Grassland	10.38	63	**73.38**	-	-	-	**73.38**
Aquatic/Wetland Complex	2	-	**2.00**	16.6	-	**16.60**	**18.60**
Riverine/Riparian Complex	1	26	**27.00**	-	19.1	**19.10**	**46.10**
Oak Woodland	732.2	738	**1,470.20**	-	-	-	**1,470.20**
Total	**745.58**	**827**	**1,572.58**	**399.71**	**297.22**	**696.93**	**2,269.51**

Other Non-Mitigation Funding Sources - to be counted towards Conservation Commitments

	Foothills[1]			Valley[2]			
Natural Communities	Harvego Bear River Preserve	Hidden Falls Regional Park	**Total Foothills**	Doty Ravine Preserve	Swainson's Preserve	**Total Valley**	**Total Reserve Credit**
Vernal Pool Complex	-	-	-	381.3	446.4	**827.70**	**827.70**
Grassland	11.6	27.1	**38.70**	-	-	-	**38.70**
Aquatic/Wetland Complex	2.2	-	**2.20**	-	5.63	**5.63**	**7.83**
Riverine/Riparian Complex	1.11	11.1	**12.21**	0.97	-	**0.97**	**13.18**
Oak Woodland	819	317.6	**1,136.60**	23.2	-	**23.20**	**1,159.80**
Total	**833.91**	**355.8**	**1,189.71**	**405.47**	**452.03**	**857.50**	**2,047.21**

Note: The input for acreage by natural community reflects the significant digits in the Placer County source table.

1. Acreage is based on land cover type estimates, is proportional to the acreage commitment, and requires field verification unless noted otherwise.

2. Numbers have been field verified.

Source: Placer County (10/17/2019) - -

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F. Input for Urban/Suburban Grazing Assumption

Some land within the PFG will be incorporated into the reserve to meet the Plan's biological objectives. Much of this land will be open space in stream system corridors that cannot be developed. This land will be subject to management under the plan and will require higher costs for grazing for vegetation management.

To estimate open space that would be grazed

Data on existing specific plans from County GIS Analysis	Total Area	Open Space	Residual	Open Space % of Total	Open Space % of Residual
12 Bridges and Del Webb	6,096.2	1,852.1	4,244.1	30%	44%
Regional University SP	1,156.1	248.5	907.6	21%	27%
Placer Vineyards SP (including SPA)	5,233.8	716.1	4,517.7	14%	16%
Placer Vineyards SP (excluding SPA)	4,261.8	716.1	3,545.7	17%	20%
Riolo Vineyard	506.0	123.8	382.2	24%	32%
	17,253.9	3,656.6	13,597.3	**21%**	**27%**

Open Space % of urban/suburban plans	25%	(assume somewhat less than 27% calculated above)
Increment of reserve open space that would be grazed	**5,000**	**cost model factor**

Land Conversion Estimate (does not include open space)

Valley - XPU and PFG, for estimating open space	19,545
PFG Valley and Lincoln	
XPU Lincoln, and West Valley	

Does not include XPU foothills since this area does not include urban/suburban areas that will be retained as natural open space areas subject to management under the Plan.

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G. Cost Escalation Factors

Consumer Price Index -- All Urban Consumers — data extracted October 17, 2019

U. S. Department of Labor, Bureau of Labor Statistics — https://data.bls.gov/cgi-bin/dsrv

Series Id: CUUR0400SA0
Not Seasonally Adjusted
Area: West Region
Item: All items
Base Period: 1982-84=100
Years: 2009 to 2019

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	HALF1	HALF2
2009	215.923	217.095	217.357	217.910	218.567	219.865	219.484	219.884	220.294	220.447	219.728	219.307	218.822	217.786	219.857
2010	219.989	220.179	220.809	221.202	221.417	221.147	221.331	221.523	221.384	221.708	221.671	222.081	221.203	220.790	221.616
2011	223.149	224.431	226.558	227.837	228.516	228.075	227.805	228.222	229.147	229.195	228.771	228.117	227.485	226.428	228.543
2012	228.980	229.995	232.039	232.561	233.053	232.701	231.893	233.001	234.083	234.966	233.206	232.029	232.376	231.555	233.196
2013	232.759	234.595	235.511	235.488	235.979	236.227	236.341	236.591	237.146	237.000	236.153	236.096	235.824	235.093	236.555
2014	236.707	237.614	239.092	239.808	241.350	241.616	241.850	241.660	241.920	241.650	240.220	239.095	240.215	239.365	241.066
2015	238.318	239.748	241.690	242.302	244.227	**244.332**	245.040	244.737	244.257	244.341	243.749	243.434	243.015	241.770	244.260
2016	244.600	244.821	245.404	246.589	247.855	248.228	248.375	248.498	249.234	249.897	249.448	**249.516**	247.705	246.250	249.161
2017	250.814	252.252	252.949	253.806	254.380	254.469	254.708	255.282	256.504	257.223	257.126	257.347	254.738	253.112	256.365
2018	258.638	259.986	260.994	262.037	263.240	263.732	263.971	264.395	265.105	266.195	265.658	**265.209**	263.263	261.438	265.089
2019	265.624	266.215	267.370	269.522	270.880	270.957	271.029	271.264	272.102					268.428	

To update all costs other than land acquisition costs:
The costs updated and reviewed with the Finance Committee in the summer/fall of 2013; ongoing adjustments in 2015

Factor to convert mid-2015 dollars to 12/2018 (called 2019) **1.085** **applied to all but land acquisition costs, unless cost factors derived more recently**
Factor to convert 2017 dollars to 12/2018 (called 2019) **1.063**
For costs estimates from 2018/2019, use => **1.00**

California Construction Cost Index (based on ENR Building Cost Index average SF + LA) california construction cost index

	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
January	6684	6596	6373	6106	6073	5898	5774	5683	5592	5260	5309	4983	4869
February	6700	6596	6373	6132	6077	5896	5782	5683	5624	5262	5295	4983	4868
March	6616	6596	6373	6248	6069	5953	5777	5738	5627	5268	5298	4999	4871
April	6841	6596	6461	6249	6062	5956	5786	5740	5636	5270	5296	5004	4872
May	6852	6596	6455	6240	6069	5957	5796	5755	5637	5378	5288	5023	4886
June		6598	6470	6238	6055	5961	5802	5754	5643	5394	5276	5065	4842
July		6643	6474	6245	6055	5959	5804	5750	5654	5401	5263	5135	4849
August		6613	6620	6244	6055	5959	5801	5778	5667	5401	5265	5142	4851
September		6674	6620	6267	6113	5959	5802	5777	5668	5381	5264	5194	4942
October		6679	6596	6343	6114	5969	5911	5780	5675	5591	5259	5393	4943
November		6679	6596	6344	6109	5981	5903	5779	5680	5599	5259	5375	4978
December		6684	6596	6373	6108	5977	5901	5768	5680	5596	5262	5322	4981
Annual % (December)		*1.3%*	*3.5%*	*4.3%*	*2.2%*	*1.3%*	*2.3%*	*1.5%*	*1.5%*	*6.3%*	*-1.1%*	*6.8%*	
Annual Average		6629	6501	6252	6080	5952	5820	5749	5649	5400	5278	5135	4896
Annual %		*2.0%*	*4.0%*	*2.8%*	*2.1%*	*2.3%*	*1.2%*	*1.8%*	*4.6%*	*2.3%*	*2.8%*	*4.9%*	

Restoration construction activity cost adjustments
Factor to convert mid-2015 dollars to 12/2018 (called 2019) **1.104** ENR Construction Cost Index SF + LA Average (California Construction Cost Index)
Unless 2019 specific update is used, in which case use => **1.00**

Land acquisition cost adjustments

Valley
Rice **$11,000** per acre; mid point of range, ASFMRA 2019
All other land covers **3%** **annual average increase over two year period 2015 - 2017** based on ASFMRA trends in rangeland values in the market area
For 2019 update: ASFMRA 2019 indicates values flat for rangeland, so **no change** in land cost factors

Foothills
No adjustment required based on Bender Rosenthal analysis of trends in rural residential property sales, February 22, 2017, and review of ASFMRA 2019 rangeland values

H.1_Credit Valley Reserve Acquired with County Open Space Trust Funds (non-mitigation source)

Value of Open Space Trust Fund Acquisitions Credited to Plan Reserve through 50-Year Permit Term (2019 dollars)

	Acres	Percent of Total Valley Acquisition
existing vernal pool complex habitat	661	3.9%
existing grassland habitat	-	0.0%
acres of existing aquatic/wetland complex habitat	17	4.2%
existing riverine/riparian complex habitat	19	1.2%
existing oak woodland habitat	-	0.0%
Total Existing Reserve Credit - VALLEY	697	2.0%

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
TOTAL BUDGET												
Establish Reserve System	-	422,534	549,350	803,044	803,044	1,120,338	1,386,503	1,248,660	1,185,445	983,074	868,729	**$9,370,722**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency Fund	-	20,848	27,105	39,622	39,622	55,277	68,409	61,608	58,489	48,504	42,863	**$462,345**
Total	**$0**	**$443,382**	**$576,455**	**$842,665**	**$842,665**	**$1,175,615**	**$1,454,912**	**$1,310,268**	**$1,243,934**	**$1,031,578**	**$911,592**	**$9,833,067**
CAPITAL BUDGET												
Establish Reserve System	-	408,576	531,203	776,516	776,516	1,083,329	1,340,701	1,207,411	1,146,285	950,599	840,032	**$9,061,166**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency, Land Acquisition and Site Improvements	-	20,429	26,560	38,826	38,826	54,166	67,035	60,371	57,314	47,530	42,002	**$453,058**
Total	**$0**	**$429,005**	**$557,763**	**$815,341**	**$815,341**	**$1,137,495**	**$1,407,736**	**$1,267,782**	**$1,203,599**	**$998,129**	**$882,033**	**$9,514,224**
OPERATING BUDGET												
Establish Reserve System	-	13,958	18,147	26,528	26,528	37,010	45,802	41,249	39,160	32,475	28,698	**$309,556**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Operating Contingency Fund	-	419	544	796	796	1,110	1,374	1,237	1,175	974	861	**$9,287**
Total	**$0**	**$14,377**	**$18,692**	**$27,324**	**$27,324**	**$38,120**	**$47,176**	**$42,486**	**$40,335**	**$33,450**	**$29,559**	**$318,843**

H.2_Credit Foothills Reserve Acquired with County Open Space Trust Funds (non-mitigation source)

Value of Open Space Trust Fund Acquisitions Credited to Plan Reserve through 50-Year Permit Term (2019 dollars)

	Acres	Percent of Total Foothills Acquisition	
acres of existing grassland habitat	73.38	2%	
acres of existing aquatic/wetland complex habitat	2.00	1%	
acres of existing riverine/riparian complex habitat	27.00	5%	
acres of existing Oak Woodland habitat	1,470.20	15%	
Total Conservation Credit - FOOTHILLS	1,572.58	12%	
Additional Conservation Credit - Big Gun Mitigation Bank	$360,000	dollar value of credits purchased in October 2017, no contingency since costs are known	

TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS

	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
TOTAL BUDGET												
Establish Reserve System	360,000	1,111,346	1,110,444	1,108,639	1,108,639	1,106,382	1,104,489	1,105,470	1,105,919	1,107,359	1,108,172	**$11,436,860**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency Fund	-	54,630	54,594	54,522	54,522	54,432	54,357	54,396	54,414	54,471	54,503	**$544,840**
Total	**$360,000**	**$1,165,976**	**$1,165,038**	**$1,163,161**	**$1,163,161**	**$1,160,814**	**$1,158,846**	**$1,159,865**	**$1,160,333**	**$1,161,830**	**$1,162,676**	**$11,981,700**
CAPITAL BUDGET												
Establish Reserve System	360,000	1,064,473	1,064,029	1,063,140	1,063,140	1,062,029	1,061,097	1,061,580	1,061,801	1,062,510	1,062,910	**$10,986,709**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency, Land Acquisition and Site Improvemen	-	53,224	53,201	53,157	53,157	53,101	53,055	53,079	53,090	53,125	53,146	**$531,335**
Total	**$360,000**	**$1,117,696**	**$1,117,230**	**$1,116,297**	**$1,116,297**	**$1,115,131**	**$1,114,152**	**$1,114,659**	**$1,114,891**	**$1,115,635**	**$1,116,056**	**$11,518,045**
OPERATING BUDGET												
Establish Reserve System	-	46,874	46,416	45,499	45,499	44,353	43,392	43,890	44,118	44,849	45,262	**$450,151**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Operating Contingency Fund	-	1,406	1,392	1,365	1,365	1,331	1,302	1,317	1,324	1,345	1,358	**$13,505**
Total	**$0**	**$48,280**	**$47,808**	**$46,864**	**$46,864**	**$45,684**	**$44,694**	**$45,206**	**$45,442**	**$46,194**	**$46,620**	**$463,656**

I.1_Credit Valley Reserve Acquired with State and other non-mitigation sources

Value of Acquisitions Credited to Plan Conservation Commitments through 50-Year Permit Term (2019 dollars)

	Acres	Percent of Total Valley Acquisition
existing vernal pool complex habitat	827.70	4.9%
existing grassland habitat	-	0.0%
acres of existing aquatic/wetland complex habitat	5.63	1.4%
existing riverine/riparian complex habitat	0.97	0.1%
existing oak woodland habitat	23.20	21.1%
Total Existing Reserve Conservation Credit - VALLEY	857.50	2.5%

TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS

	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
TOTAL BUDGET												
Establish Reserve System	-	525,326	682,992	998,403	998,403	1,392,887	1,723,802	1,552,426	1,473,832	1,222,230	1,080,068	**$11,650,368**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency Fund	-	25,923	33,703	49,267	49,267	68,734	85,063	76,606	72,728	60,312	53,297	**$574,901**
Total	**$0**	**$551,248**	**$716,695**	**$1,047,670**	**$1,047,670**	**$1,461,620**	**$1,808,865**	**$1,629,032**	**$1,546,560**	**$1,282,542**	**$1,133,365**	**$12,225,269**
CAPITAL BUDGET												
Establish Reserve System	-	508,152	660,664	965,763	965,763	1,347,350	1,667,447	1,501,673	1,425,649	1,182,272	1,044,758	**$11,269,489**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency, Land Acquisition and Site Improvements	-	25,408	33,033	48,288	48,288	67,367	83,372	75,084	71,282	59,114	52,238	**$563,474**
Total	**$0**	**$533,559**	**$693,697**	**$1,014,051**	**$1,014,051**	**$1,414,717**	**$1,750,819**	**$1,576,757**	**$1,496,931**	**$1,241,386**	**$1,096,996**	**$11,832,964**
OPERATING BUDGET												
Establish Reserve System	-	17,174	22,329	32,640	32,640	45,537	56,355	50,753	48,183	39,958	35,310	**$380,879**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Operating Contingency Fund	-	515	670	979	979	1,366	1,691	1,523	1,445	1,199	1,059	**$11,426**
Total	**$0**	**$17,689**	**$22,999**	**$33,619**	**$33,619**	**$46,903**	**$58,046**	**$52,275**	**$49,629**	**$41,156**	**$36,369**	**$392,305**

I.2_Credit Foothills Reserve Acquired with State and other non-mitigation funding sources

Value of Acquisitions Credited to Plan Conservation Commitments through 50-Year Permit Term (2019 dollars)

	Acres	Percent of Total Foothills Acquisition
acres of existing grassland habitat	38.70	1%
acres of existing aquatic/wetland complex habitat	2.20	1%
acres of existing riverine/riparian complex habitat	12.21	2%
acres of existing Oak Woodland habitat	1,136.60	11%
Total Existing Reserve Credit - FOOTHILLS	1,189.71	9%

	TOTAL COST PER PERIOD AND CUMULATIVE OVER 50 YEARS										
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
TOTAL BUDGET												
Establish Reserve System	-	840,771	840,089	838,723	838,723	837,016	835,583	836,325	836,665	837,754	838,370	**$8,380,020**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency Fund	-	41,329	41,302	41,248	41,248	41,180	41,123	41,152	41,166	41,209	41,234	**$412,190**
Total	**$0**	**$882,100**	**$881,391**	**$879,971**	**$879,971**	**$878,195**	**$876,706**	**$877,477**	**$877,831**	**$878,964**	**$879,603**	**$8,792,210**
CAPITAL BUDGET												
Establish Reserve System	-	805,310	804,974	804,302	804,302	803,461	802,756	803,121	803,289	803,825	804,128	**$8,039,465**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Contingency, Land Acquisition and Site Improvemen	-	40,265	40,249	40,215	40,215	40,173	40,138	40,156	40,164	40,191	40,206	**$401,973**
Total	**$0**	**$845,575**	**$845,222**	**$844,517**	**$844,517**	**$843,634**	**$842,894**	**$843,277**	**$843,453**	**$844,016**	**$844,334**	**$8,441,439**
OPERATING BUDGET												
Establish Reserve System	-	35,461	35,115	34,422	34,422	33,555	32,827	33,204	33,377	33,930	34,242	**$340,554**
Reserve Management/Enhancement	-	-	-	-	-	-	-	-	-	-	-	**$0**
Monitoring, Research, and Scientific Review	-	-	-	-	-	-	-	-	-	-	-	**$0**
Environmental Compliance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Plan Administration	-	-	-	-	-	-	-	-	-	-	-	**$0**
Operating Contingency Fund	-	1,064	1,053	1,033	1,033	1,007	985	996	1,001	1,018	1,027	**$10,217**
Total	**$0**	**$36,525**	**$36,168**	**$35,454**	**$35,454**	**$34,561**	**$33,812**	**$34,200**	**$34,378**	**$34,948**	**$35,269**	**$350,771**

J_ACQUISITION SCHEDULE BY PERIOD

Period and Community Type	Valley Cost Share	Foothills Cost Share	Plan Total
Start-up			
Acres Acquired by Community Type			
Vernal Pool Complex	-	-	-
Grassland	-	-	-
Aquatic/Wetland Complex	-	-	-
Riverine/Riparian Complex	-	-	-
Valley Oak Woodland	-	-	-
Oak Woodland	-	-	-
Oak Woodland shift for cost share	-	-	-
Rice	-	-	-
Field	-	-	-
Total All Community Types	**-**	**-**	**-**
Years 1 - 5			
Acres Acquired by Community Type			
Vernal Pool Complex	767	-	767
Grassland	169	340	509
Aquatic/Wetland Complex	18	20	38
Riverine/Riparian Complex	72	60	132
Valley Oak Woodland	4	10	14
Oak Woodland	5	1,000	1,005
Oak Woodland shift for cost share	45	(45)	-
Rice	451	-	451
Field	2	-	2
Total All Community Types	**1,533**	**1,385**	**2,918**
Years 6 - 10			
Acres Acquired by Community Type			
Vernal Pool Complex	997	-	997
Grassland	220	340	560
Aquatic/Wetland Complex	23	20	43
Riverine/Riparian Complex	94	60	154
Valley Oak Woodland	5	10	15
Oak Woodland	6	1,000	1,006
Oak Woodland shift for cost share	59	(59)	-
Rice	586	-	586
Field	3	-	3
Total All Community Types	**1,993**	**1,371**	**3,365**
Years 11 - 15			
Acres Acquired by Community Type			
Vernal Pool Complex	1,457	-	1,457
Grassland	321	340	661
Aquatic/Wetland Complex	34	20	54
Riverine/Riparian Complex	137	60	197
Valley Oak Woodland	8	10	18
Oak Woodland	9	1,000	1,009
Oak Woodland shift for cost share	86	(86)	-
Rice	857	-	857
Field	4	-	4
Total All Community Types	**2,914**	**1,344**	**4,258**

J_ACQUISITION SCHEDULE BY PERIOD

Period and Community Type	Valley Cost Share	Foothills Cost Share	Plan Total
Years 16 - 20			
Acres Acquired by Community Type			
Vernal Pool Complex	1,457	-	1,457
Grassland	321	340	661
Aquatic/Wetland Complex	34	20	54
Riverine/Riparian Complex	137	60	197
Valley Oak Woodland	8	10	18
Oak Woodland	9	1,000	1,009
Oak Woodland shift for cost share	86	(86)	-
Rice	857	-	857
Field	4	-	4
Total All Community Types	**2,914**	**1,344**	**4,258**
Years 21 - 25			
Acres Acquired by Community Type			
Vernal Pool Complex	2,032	-	2,032
Grassland	448	340	788
Aquatic/Wetland Complex	48	20	68
Riverine/Riparian Complex	191	60	251
Valley Oak Woodland	11	10	21
Oak Woodland	13	1,000	1,013
Oak Woodland shift for cost share	120	(120)	-
Rice	1,196	-	1,196
Field	6	-	6
Total All Community Types	**4,065**	**1,310**	**5,375**
Years 26 - 30			
Acres Acquired by Community Type			
Vernal Pool Complex	2,515	-	2,515
Grassland	555	340	895
Aquatic/Wetland Complex	59	20	79
Riverine/Riparian Complex	237	60	297
Valley Oak Woodland	13	10	23
Oak Woodland	16	1,000	1,016
Oak Woodland shift for cost share	148	(148)	-
Rice	1,480	-	1,480
Field	7	-	7
Total All Community Types	**5,031**	**1,282**	**6,313**
Years 31 - 35			
Acres Acquired by Community Type			
Vernal Pool Complex	2,265	-	2,265
Grassland	500	340	840
Aquatic/Wetland Complex	53	20	73
Riverine/Riparian Complex	213	60	273
Valley Oak Woodland	12	10	22
Oak Woodland	15	1,000	1,015
Oak Woodland shift for cost share	133	(133)	-
Rice	1,333	-	1,333
Field	7	-	7
Total All Community Types	**4,531**	**1,297**	**5,827**

J_ACQUISITION SCHEDULE BY PERIOD

Period and Community Type	Valley Cost Share	Foothills Cost Share	Plan Total
Years 36 - 40			
Acres Acquired by Community Type			
Vernal Pool Complex	2,151	-	2,151
Grassland	474	340	814
Aquatic/Wetland Complex	51	20	71
Riverine/Riparian Complex	202	60	262
Valley Oak Woodland	11	10	21
Oak Woodland	14	1,000	1,014
Oak Woodland shift for cost share	127	(127)	-
Rice	1,265	-	1,265
Field	6	-	6
Total All Community Types	**4,301**	**1,303**	**5,605**
Years 41 - 45			
Acres Acquired by Community Type			
Vernal Pool Complex	1,783	-	1,783
Grassland	393	340	733
Aquatic/Wetland Complex	42	20	62
Riverine/Riparian Complex	168	60	228
Valley Oak Woodland	9	10	19
Oak Woodland	12	1,000	1,012
Oak Woodland shift for cost share	105	(105)	-
Rice	1,049	-	1,049
Field	5	-	5
Total All Community Types	**3,567**	**1,325**	**4,892**
Years 46 - 50			
Acres Acquired by Community Type			
Vernal Pool Complex	1,576	-	1,576
Grassland	348	340	688
Aquatic/Wetland Complex	37	20	57
Riverine/Riparian Complex	148	60	208
Valley Oak Woodland	8	10	18
Oak Woodland	10	1,000	1,010
Oak Woodland shift for cost share	93	(93)	-
Rice	927	-	927
Field	5	-	5
Total All Community Types	**3,152**	**1,337**	**4,489**
Total All Community Types	**34,000**	**13,300**	**47,300**

K_Reserve System Acres through 50-year Permit Term (acres by time period)

	Permit Period (years)											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
VALLEY COST SHARE												
Land Acquisition												
Vernal Pool Complex	-	767	997	1,457	1,457	2,032	2,515	2,265	2,151	1,783	1,576	**17,000**
Grassland	-	169	220	321	321	448	555	500	474	393	348	**3,750**
Aquatic/Wetland Complex	-	18	23	34	34	48	59	53	51	42	37	**400**
Riverine/Riparian Complex	-	72	94	137	137	191	237	213	202	168	148	**1,600**
Valley Oak Woodland	-	4	5	8	8	11	13	12	11	9	8	**90**
Oak Woodland	-	5	6	9	9	13	16	15	14	12	10	**110**
Oak Woodland shift for cost obligation	-	45	59	86	86	120	148	133	127	105	93	**1,000**
Rice	-	451	586	857	857	1,196	1,480	1,333	1,265	1,049	927	**10,000**
Field	-	2	3	4	4	6	7	7	6	5	5	**50**
Total All Community Types	**-**	**1,533**	**1,993**	**2,914**	**2,914**	**4,065**	**5,031**	**4,531**	**4,301**	**3,567**	**3,152**	**34,000**
Restoration - Natural Community												
Vernal Pool Complex in Grassland	-	122	158	231	231	323	399	360	342	283	250	**2,700**
Vernal Pool Complex from Rice	-	11	15	21	21	30	37	33	32	26	23	**250**
Vernal Pool Complex from Field Crops	-	2	3	4	4	6	7	7	6	5	5	**50**
Grassland from Rice	-	45	59	86	86	120	148	133	127	105	93	**1,000**
Aquatic/Wetland Complex in Grassland	-	6	7	11	11	15	18	16	16	13	11	**123**
Aquatic/Wetland Complex from Rice	-	4	5	7	7	10	12	11	10	9	8	**82**
Riverine/Riparian Complex in Grassland	-	21	28	41	41	57	70	63	60	50	44	**475**
Riverine/Riparian Complex from Rice	-	14	19	27	27	38	47	43	40	34	30	**320**
Valley Oak Woodland in Grassland	-	5	7	10	10	14	17	15	14	12	11	**114**
Valley Oak Woodland from Rice	-	5	6	9	9	13	16	14	14	11	10	**108**
Total	**-**	**235**	**306**	**448**	**448**	**624**	**773**	**696**	**661**	**548**	**484**	**5,222**
Cumulative total restored acres	**-**	**235**	**542**	**989**	**1,437**	**2,061**	**2,834**	**3,529**	**4,190**	**4,738**	**5,222**	**5,222**
Under Management (cumulative total acres)	**Start up**	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	
Vernal Pool Complex		902	2,074	3,788	5,502	7,893	10,853	13,518	16,048	18,146	20,000	**20,000**
Grassland	-	60	139	253	368	528	726	904	1,074	1,214	1,338	**1,338**
Aquatic/Wetland Complex	-	27	63	115	166	239	328	409	485	549	605	**605**
Riverine/Riparian Complex	-	108	248	454	659	945	1,300	1,619	1,922	2,173	2,395	**2,395**
Valley Oak Woodland	-	14	32	59	86	123	169	211	250	283	312	**312**
Oak Woodland	-	50	115	210	305	438	602	750	891	1,007	1,110	**1,110**
Rice for GGS/Field/Any Other Agriculture	-	372	855	1,561	2,267	3,252	4,471	5,569	6,612	7,476	8,240	**8,240**
Field	-	-	-	-	-	-	-	-	-	-	-	**-**
Total All Community Types	**-**	**1,533**	**3,526**	**6,440**	**9,354**	**13,419**	**18,449**	**22,980**	**27,281**	**30,848**	**34,000**	**34,000**

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K_Reserve System Acres through 50-year Permit Term (acres by time period)

	Permit Period (years)											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
FOOTHILLS COST SHARE												
Land Acquisition												
Vernal Pool Complex	-	-	-	-	-	-	-	-	-	-	-	-
Grassland	-	340	340	340	340	340	340	340	340	340	340	**3,400**
Aquatic/Wetland Complex	-	20	20	20	20	20	20	20	20	20	20	**200**
Riverine/Riparian Complex	-	60	60	60	60	60	60	60	60	60	60	**600**
Valley Oak Woodland	-	10	10	10	10	10	10	10	10	10	10	**100**
Oak Woodland	-	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	**10,000**
Oak Woodland shift for cost obligation	-	(45)	(59)	(86)	(86)	(120)	(148)	(133)	(127)	(105)	(93)	**(1,000)**
Rice	-	-	-	-	-	-	-	-	-	-	-	-
Field	-	-	-	-	-	-	-	-	-	-	-	-
Total All Community Types	**-**	**1,385**	**1,371**	**1,344**	**1,344**	**1,310**	**1,282**	**1,297**	**1,303**	**1,325**	**1,337**	**13,300**
Restoration - Natural Community												
Vernal Pool Complex	-	-	-	-	-	-	-	-	-	-	-	-
Grassland	-	-	-	-	-	-	-	-	-	-	-	-
Aquatic/Wetland Complex in Grassland	-	21	21	21	21	21	21	21	21	21	21	**205**
Riverine/Riparian Complex in Grassland	-	63	63	63	63	63	63	63	63	63	63	**630**
Valley Oak Woodland in Grassland	-	6	6	6	6	6	6	6	6	6	6	**63**
Oak Woodland in Grassland	-	10	10	10	10	10	10	10	10	10	10	**100**
Total	**-**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**998**
Cumulative total restored acres	**-**	**100**	**200**	**299**	**399**	**499**	**599**	**699**	**798**	**898**	**998**	**998**
Under Management (cumulative total acres)	**Start up**	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	
Vernal Pool Complex	-	-	-	-	-	-	-	-	-	-	-	-
Grassland	-	240	480	721	961	1,201	1,441	1,681	1,922	2,162	2,402	**2,402**
Aquatic/Wetland Complex	-	41	81	122	162	203	243	284	324	365	405	**405**
Riverine/Riparian Complex	-	123	246	369	492	615	738	861	984	1,107	1,230	**1,230**
Valley Oak Woodland	-	16	33	49	65	82	98	114	130	147	163	**163**
Oak Woodland	-	965	1,916	2,841	3,765	4,655	5,517	6,394	7,278	8,183	9,100	**9,100**
Rice	-	-	-	-	-	-	-	-	-	-	-	-
Field	-	-	-	-	-	-	-	-	-	-	-	-
Total All Community Types	**-**	**1,385**	**2,756**	**4,101**	**5,445**	**6,755**	**8,037**	**9,334**	**10,638**	**11,963**	**13,300**	**13,300**

K_Reserve System Acres through 50-year Permit Term (acres by time period)

	Permit Period (years)										
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Total VALLEY AND FOOTHILLS												
Land Acquisition												
Vernal Pool Complex	-	767	997	1,457	1,457	2,032	2,515	2,265	2,151	1,783	1,576	**17,000**
Grassland	-	509	560	661	661	788	895	840	814	733	688	**7,150**
Aquatic/Wetland Complex	-	38	43	54	54	68	79	73	71	62	57	**600**
Riverine/Riparian Complex	-	132	154	197	197	251	297	273	262	228	208	**2,200**
Valley Oak Woodland	-	14	15	18	18	21	23	22	21	19	18	**190**
Oak Woodland	-	1,005	1,006	1,009	1,009	1,013	1,016	1,015	1,014	1,012	1,010	**10,110**
Rice	-	451	586	857	857	1,196	1,480	1,333	1,265	1,049	927	**10,000**
Field	-	2	3	4	4	6	7	7	6	5	5	**50**
Total All Community Types	**-**	**2,918**	**3,365**	**4,258**	**4,258**	**5,375**	**6,313**	**5,827**	**5,605**	**4,892**	**4,489**	**47,300**
Restoration - Natural Community												
Vernal Pool Complex in Grassland	-	122	158	231	231	323	399	360	342	283	250	**2,700**
Vernal Pool Complex from Rice	-	11	15	21	21	30	37	33	32	26	23	**250**
Vernal Pool Complex from Field Crops	-	2	3	4	4	6	7	7	6	5	5	**50**
Grassland from Rice	-	45	59	86	86	120	148	133	127	105	93	**1,000**
Aquatic/Wetland Complex in Grassland	-	26	28	31	31	35	39	37	36	33	32	**328**
Aquatic/Wetland Complex in Rice	-	4	5	7	7	10	12	11	10	9	8	**82**
Riverine/Riparian Complex in Grassland	-	84	91	104	104	120	133	126	123	113	107	**1,105**
Riverine/Riparian Complex from Rice	-	14	19	27	27	38	47	43	40	34	30	**320**
Valley Oak Woodland in Grassland	-	11	13	16	16	20	23	21	21	18	17	**177**
Valley Oak Woodland from Rice	-	5	6	9	9	13	16	14	14	11	10	**108**
Oak Woodland in Grassland	-	10	10	10	10	10	10	10	10	10	10	**100**
Total	**-**	**335**	**406**	**547**	**547**	**724**	**872**	**796**	**760**	**648**	**584**	**6,220**
Cumulative total restored acres	**-**	**335**	**741**	**1,289**	**1,836**	**2,560**	**3,432**	**4,228**	**4,988**	**5,636**	**6,220**	**6,220**
Under Management (cumulative total acres)												
Vernal Pool Complex	-	902	2,074	3,788	5,502	7,893	10,853	13,518	16,048	18,146	20,000	**20,000**
Grassland	-	301	619	974	1,329	1,729	2,167	2,586	2,995	3,376	3,740	**3,740**
Aquatic/Wetland Complex	-	68	144	236	328	441	571	692	809	913	1,010	**1,010**
Riverine/Riparian Complex	-	231	494	823	1,151	1,560	2,038	2,480	2,906	3,280	3,625	**3,625**
Valley Oak Woodland	-	30	65	108	151	205	267	325	381	430	475	**475**
Oak Woodland	-	1,015	2,031	3,051	4,070	5,093	6,120	7,144	8,168	9,190	10,210	**10,210**
Rice for GGS/Field/Any Other Agriculture	-	372	855	1,561	2,267	3,252	4,471	5,569	6,612	7,476	8,240	**8,240**
Field	-	-	-	-	-	-	-	-	-	-	-	**-**
Total All Community Types	**-**	**2,918**	**6,283**	**10,541**	**14,799**	**20,174**	**26,487**	**32,314**	**37,919**	**42,811**	**47,300**	**47,300**

Note: See Appendix M Growth Scenario, especially Figure 8 and associated text for background on land conversion assumptions over time

L_Constituent Habitat Restoration Acres through 50-year Permit Term (acres by time period)

	Permit Period (years)											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
VALLEY COST SHARE												
Restoration - Specific Habitat												
Vernal Pool Type	-	41	53	77	77	108	133	120	114	94	83	**900**
Aquatic/Wetland Type	-	9	12	18	18	25	30	27	26	22	19	**205**
Riverine/Riparian Type	-	36	47	68	68	95	118	106	101	83	74	**795**
Total	**-**	**86**	**111**	**163**	**163**	**227**	**281**	**253**	**240**	**199**	**176**	**1,900**
Cumulative total restored acres	**-**	**86**	**197**	**360**	**523**	**750**	**1,031**	**1,284**	**1,525**	**1,724**	**1,900**	**1,900**
FOOTHILLS COST SHARE												
Restoration - Specific Habitat												
Vernal Pool Type	-	-	-	-	-	-	-	-	-	-	-	**-**
Aquatic/Wetland Type	-	21	21	21	21	21	21	21	21	21	21	**205**
Riverine/Riparian Type	-	63	63	63	63	63	63	63	63	63	63	**630**
Total	**-**	**84**	**84**	**84**	**84**	**84**	**84**	**84**	**84**	**84**	**84**	**835**
Cumulative total restored acres	**-**	**84**	**167**	**251**	**334**	**418**	**501**	**585**	**668**	**752**	**835**	**835**
Total VALLEY AND FOOTHILLS												
Restoration - Specific Habitat												
Vernal Pool Type	-	41	53	77	77	108	133	120	114	94	83	**900**
Aquatic/Wetland Type	-	30	33	38	38	45	51	48	46	42	40	**410**
Riverine/Riparian Type	-	99	110	131	131	158	181	169	164	146	137	**1,425**
Total	**-**	**169**	**195**	**246**	**246**	**311**	**365**	**337**	**324**	**283**	**260**	**2,735**
Cumulative total restored acres of Specific Habitat	**-**	**169**	**364**	**610**	**857**	**1,167**	**1,532**	**1,869**	**2,193**	**2,475**	**2,735**	**2,735**

Note: See Appendix M Growth Scenario, especially Figure 8 and associated text for background on land conversion assumptions over time

M. Fee Title and Easement Land Acquisition (acres by time period)

	Permit Period (years)												
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL	
VALLEY COST SHARE													
Land Acquisition by Fee Title													
Vernal Pool Complex	-	690	897	1,311	1,311	1,829	2,264	2,039	1,936	1,605	1,418	15,300	
Grassland	-	169	220	321	321	448	555	500	474	393	348	3,750	
Aquatic/Wetland Complex	-	16	21	31	31	43	53	48	46	38	33	360	
Riverine/Riparian Complex	-	65	84	123	123	172	213	192	182	151	133	1,440	
Valley Oak Woodland	-	2	3	5	5	6	8	7	7	6	5	54	
Oak Woodland	-	3	4	6	6	8	10	9	8	7	6	66	
Oak Woodland shift for obligation	-	14	18	26	26	36	44	40	38	31	28	300	
Rice	-	180	234	343	343	478	592	533	506	420	371	4,000	
Field	-	2	3	4	4	6	7	7	6	5	5	50	
Total All Community Types	**-**	**1,142**	**1,484**	**2,170**	**2,170**	**3,027**	**3,746**	**3,374**	**3,203**	**2,656**	**2,347**	**25,320**	**74%**
Land Acquisition by Easement													
Vernal Pool Complex	-	77	100	146	146	203	252	227	215	178	158	1,700	
Grassland	-	-	-	-	-	-	-	-	-	-	-	-	
Aquatic/Wetland Complex	-	2	2	3	3	5	6	5	5	4	4	40	
Riverine/Riparian Complex	-	7	9	14	14	19	24	21	20	17	15	160	
Valley Oak Woodland	-	2	2	3	3	4	5	5	5	4	3	36	
Oak Woodland	-	2	3	4	4	5	7	6	6	5	4	44	-
Oak Woodland shift for obligation	-	32	41	60	60	84	104	93	89	73	65	700	
Rice	-	271	352	514	514	717	888	800	759	629	556	6,000	
Field	-	-	-	-	-	-	-	-	-	-	-	-	
Total All Community Types	**-**	**391**	**509**	**744**	**744**	**1,038**	**1,284**	**1,157**	**1,098**	**911**	**805**	**8,680**	**26%**
FOOTHILLS COST SHARE													
Land Acquisition by Fee Title													
Vernal Pool Complex	-	-	-	-	-	-	-	-	-	-	-	-	
Grassland	-	102	102	102	102	102	102	102	102	102	102	1,020	
Aquatic/Wetland Complex	-	6	6	6	6	6	6	6	6	6	6	60	
Riverine/Riparian Complex	-	18	18	18	18	18	18	18	18	18	18	180	
Valley Oak Woodland	-	3	3	3	3	3	3	3	3	3	3	30	
Oak Woodland	-	300	300	300	300	300	300	300	300	300	300	3,000	
Oak Woodland shift for obligation	-	(14)	(18)	(26)	(26)	(36)	(44)	(40)	(38)	(31)	(28)	(300)	
Rice	-	-	-	-	-	-	-	-	-	-	-	-	
Field	-	-	-	-	-	-	-	-	-	-	-	-	
Total All Community Types	**-**	**415**	**411**	**403**	**403**	**393**	**385**	**389**	**391**	**398**	**401**	**3,990**	**30%**
Land Acquisition by Easement													
Vernal Pool Complex	-	-	-	-	-	-	-	-	-	-	-	-	
Grassland	-	238	238	238	238	238	238	238	238	238	238	2,380	
Aquatic/Wetland Complex	-	14	14	14	14	14	14	14	14	14	14	140	
Riverine/Riparian Complex	-	42	42	42	42	42	42	42	42	42	42	420	
Valley Oak Woodland	-	7	7	7	7	7	7	7	7	7	7	70	
Oak Woodland	-	700	700	700	700	700	700	700	700	700	700	7,000	-
Oak Woodland shift for obligation	-	(32)	(41)	(60)	(60)	(84)	(104)	(93)	(89)	(73)	(65)	(700)	
Rice	-	-	-	-	-	-	-	-	-	-	-	-	
Field	-	-	-	-	-	-	-	-	-	-	-	-	
Total All Community Types	**-**	**969**	**960**	**941**	**941**	**917**	**897**	**908**	**912**	**928**	**936**	**9,310**	**70%**
Fee title acquisitions, cumulative	-	1,557	3,453	6,026	8,599	12,020	16,151	19,913	23,508	26,561	29,310	29,310	62%

N. LAND ACQUISITION COST BY PERIOD, before pre-acquisition surveys, transaction costs, site improvements and contingency (2019 dollars)

Period and Community Type	Valley Cost Share	Foothills Cost Share	Plan Total
Start Up			
Cost of Acres Acquired by CommunityType			
Vernal Pool Complex	-	-	-
Grassland	-	-	-
Aquatic/Wetland Complex	-	-	-
Riverine/Riparian Complex	-	-	-
Valley Oak Woodland	-	-	-
Oak Woodland	-	-	-
Oak Woodland shift for cost share	-	-	-
Rice	-	-	-
Field	-	-	-
Total All Community Types	**-**	**-**	**-**
Years 1 - 5			
Cost of Acres Acquired by CommunityType			
Vernal Pool Complex	9,750,458	-	9,750,458
Grassland	1,352,727	2,203,200	3,555,927
Aquatic/Wetland Complex	229,423	129,600	359,023
Riverine/Riparian Complex	917,690	388,800	1,306,490
Valley Oak Woodland	27,271	64,800	92,071
Oak Woodland	33,331	6,480,000	6,513,331
Oak Woodland shift for cost share	292,189	(292,189)	-
Rice	3,769,600	-	3,769,600
Field	18,036	-	18,036
Total All Community Types	**16,390,725**	**8,974,211**	**25,364,936**
Years 6 - 10			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	12,676,876	-	12,676,876
Grassland	1,758,723	2,203,200	3,961,923
Aquatic/Wetland Complex	298,279	129,600	427,879
Riverine/Riparian Complex	1,193,118	388,800	1,581,918
Valley Oak Woodland	35,456	64,800	100,256
Oak Woodland	43,335	6,480,000	6,523,335
Oak Woodland shift for cost share	379,884	(379,884)	-
Rice	4,900,975	-	4,900,975
Field	23,450	-	23,450
Total All Community Types	**21,310,095**	**8,886,516**	**30,196,611**
Years 11 - 15			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	18,531,142	-	18,531,142
Grassland	2,570,913	2,203,200	4,774,113
Aquatic/Wetland Complex	436,027	129,600	565,627
Riverine/Riparian Complex	1,744,108	388,800	2,132,908
Valley Oak Woodland	51,830	64,800	116,630
Oak Woodland	63,347	6,480,000	6,543,347
Oak Woodland shift for cost share	555,317	(555,317)	-
Rice	7,164,278	-	7,164,278
Field	34,279	-	34,279
Total All Community Types	**31,151,241**	**8,711,083**	**39,862,324**

N. LAND ACQUISITION COST BY PERIOD, before pre-acquisition surveys, transaction costs, site improvements and contingency (2019 dollars)

Period and Community Type	Valley Cost Share	Foothills Cost Share	Plan Total
Years 16 - 20			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	18,531,142	-	18,531,142
Grassland	2,570,913	2,203,200	4,774,113
Aquatic/Wetland Complex	436,027	129,600	565,627
Riverine/Riparian Complex	1,744,108	388,800	2,132,908
Valley Oak Woodland	51,830	64,800	116,630
Oak Woodland	63,347	6,480,000	6,543,347
Oak Woodland shift for cost share	555,317	(555,317)	
Rice	7,164,278	-	7,164,278
Field	34,279	-	34,279
Total All Community Types	**31,151,241**	**8,711,083**	**39,862,324**
Years 21 - 25			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	25,853,071	-	25,853,071
Grassland	3,586,719	2,203,200	5,789,919
Aquatic/Wetland Complex	608,308	129,600	737,908
Riverine/Riparian Complex	2,433,230	388,800	2,822,030
Valley Oak Woodland	72,308	64,800	137,108
Oak Woodland	88,377	6,480,000	6,568,377
Oak Woodland shift for cost share	774,731	(774,731)	-
Rice	9,994,991	-	9,994,991
Field	47,823	-	47,823
Total All Community Types	**43,459,558**	**8,491,669**	**51,951,226**
Years 26 - 30			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	31,995,129	-	31,995,129
Grassland	4,438,836	2,203,200	6,642,036
Aquatic/Wetland Complex	752,827	129,600	882,427
Riverine/Riparian Complex	3,011,306	388,800	3,400,106
Valley Oak Woodland	89,487	64,800	154,287
Oak Woodland	109,373	6,480,000	6,589,373
Oak Woodland shift for cost share	958,789	(958,789)	-
Rice	12,369,556	-	12,369,556
Field	59,184	-	59,184
Total All Community Types	**53,784,486**	**8,307,611**	**62,092,098**
Years 31 - 35			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	28,814,240	-	28,814,240
Grassland	3,997,536	2,203,200	6,200,736
Aquatic/Wetland Complex	677,982	129,600	807,582
Riverine/Riparian Complex	2,711,928	388,800	3,100,728
Valley Oak Woodland	80,590	64,800	145,390
Oak Woodland	98,499	6,480,000	6,578,499
Oak Woodland shift for cost share	863,468	(863,468)	-
Rice	11,139,801	-	11,139,801
Field	53,300	-	53,300
Total All Community Types	**48,437,345**	**8,402,932**	**56,840,277**

N. LAND ACQUISITION COST BY PERIOD, before pre-acquisition surveys, transaction costs, site improvements and contingency (2019 dollars)

Period and Community Type	Valley Cost Share	Foothills Cost Share	Plan Total
Years 36 - 40			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	27,355,484	-	27,355,484
Grassland	3,795,156	2,203,200	5,998,356
Aquatic/Wetland Complex	643,658	129,600	773,258
Riverine/Riparian Complex	2,574,634	388,800	2,963,434
Valley Oak Woodland	76,510	64,800	141,310
Oak Woodland	93,513	6,480,000	6,573,513
Oak Woodland shift for cost share	819,754	(819,754)	-
Rice	10,575,835	-	10,575,835
Field	50,602	-	50,602
Total All Community Types	**45,985,146**	**8,446,646**	**54,431,793**
Years 41 - 45			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	22,685,542	-	22,685,542
Grassland	3,147,273	2,203,200	5,350,473
Aquatic/Wetland Complex	533,777	129,600	663,377
Riverine/Riparian Complex	2,135,110	388,800	2,523,910
Valley Oak Woodland	63,449	64,800	128,249
Oak Woodland	77,549	6,480,000	6,557,549
Oak Woodland shift for cost share	679,811	(679,811)	-
Rice	8,770,400	-	8,770,400
Field	41,964	-	41,964
Total All Community Types	**38,134,875**	**8,586,589**	**46,721,464**
Years 46 - 50			
Cost of Acres Acquired by Community Type			
Vernal Pool Complex	20,046,915	-	20,046,915
Grassland	2,781,204	2,203,200	4,984,404
Aquatic/Wetland Complex	471,692	129,600	601,292
Riverine/Riparian Complex	1,886,769	388,800	2,275,569
Valley Oak Woodland	56,069	64,800	120,869
Oak Woodland	68,529	6,480,000	6,548,529
Oak Woodland shift for cost share	600,740	(600,740)	-
Rice	7,750,287	-	7,750,287
Field	37,083	-	37,083
Total All Community Types	**33,699,287**	**8,665,660**	**42,364,947**
Total All Community Types	**$363,504,000**	**$86,184,000**	**$449,688,000**
Cumulative Cost by Community Type			
Vernal Pool Complex	216,240,000	-	216,240,000
Grassland	30,000,000	22,032,000	52,032,000
Aquatic/Wetland Complex	5,088,000	1,296,000	6,384,000
Riverine/Riparian Complex	20,352,000	3,888,000	24,240,000
Valley Oak Woodland	604,800	648,000	1,252,800
Oak Woodland (combined)	7,219,200	58,320,000	65,539,200
Rice	83,600,000	-	83,600,000
Field	400,000	-	400,000
Total All Community Types	**$363,504,000**	**$86,184,000**	**$449,688,000**
Percent Distribution by Community Type			
Vernal Pool Complex	59%	0%	48%
Grassland	8%	26%	12%
Aquatic/Wetland Complex	1%	2%	1%
Riverine/Riparian Complex	6%	5%	5%
Valley Oak Woodland	0%	1%	0%
Oak Woodland	2%	68%	15%
Rice	23%	0%	19%
Field	0%	0%	0%
Total All Community Types	**100%**	**100%**	**100%**

Table 2: Establish Reserve System

Valley schedule varies by period

2019 dollars — cost variable

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Capital budget (before contingency)												
Land Acquisition	-	25,364,936	30,196,611	39,862,324	39,862,324	51,951,226	62,092,098	56,840,277	54,431,793	46,721,464	42,364,947	**$449,688,000**
Fencing Improvements	-	899,040	1,081,316	1,445,957	1,445,957	1,902,013	2,284,580	2,086,454	1,995,593	1,704,720	1,540,369	**$16,386,000**
Other One-time Site Improvements		381,508	464,465	630,420	630,420	837,979	1,012,092	921,922	880,569	748,187	673,388	**$7,180,950**
Acquire Credits at Big Gun Conservation Bank - Foothills	360,000	-	-	-	-	-	-	-	-	-	-	**$360,000**
Capital subtotal	**360,000**	**$26,645,484**	**$31,742,392**	**$41,938,701**	**$41,938,701**	**$54,691,219**	**$65,388,770**	**$59,848,653**	**$57,307,955**	**$49,174,371**	**$44,578,705**	**$473,614,950**
Operating budget (before contingency)												
Pre-acquisition planning surveys	-	126,203	145,519	184,159	184,159	232,486	273,025	252,030	242,402	211,579	194,163	**$2,045,725**
Due diligence and transaction costs	-	951,185	1,132,373	1,494,837	1,494,837	1,948,171	2,328,454	2,131,510	2,041,192	1,752,055	1,588,686	**$16,863,300**
Operations subtotal	**$0**	**$1,077,389**	**$1,277,892**	**$1,678,996**	**$1,678,996**	**$2,180,657**	**$2,601,479**	**$2,383,541**	**$2,283,594**	**$1,963,634**	**$1,782,849**	**$18,909,025**
TOTAL	**$360,000**	**$27,722,873**	**$33,020,284**	**$43,617,696**	**$43,617,696**	**$56,871,876**	**$67,990,249**	**$62,232,193**	**$59,591,549**	**$51,138,004**	**$46,361,554**	**$492,523,975**

Acquisition Assumptions	VALLEY RESERVE AREA			FOOTHILLS RESERVE AREA		
Community Type	**Fee Title**	**Easement**		**Fee Title**	**Easement**	
Vernal Pool Complex	90%	**10%**	100%			
Grassland	100%	**0%**	100%	**30%**	70%	100%
Aquatic/Wetland Complex	90%	**10%**	100%	30%	**70%**	100%
Riverine/Riparian Complex	90%	**10%**	100%	30%	**70%**	100%
Valley Oak Woodland	60%	**40%**	100%	30%	**70%**	100%
Oak Woodland	60%	**40%**	100%	30%	**70%**	100%
Rice	**40%**	60%	100%			
Field Agriculture, other natural/semi-natural	100%	**0%**	100%			
Easement Acquisition Cost % of fee title cost per acre		**60%**			**60%**	

Land cost factors for the Plan, by subarea and parcel size and generalized land cover

	Per Acre Land Cost (gross acres)	
	Valley	**Foothills**
Weighted average price assuming some smaller parcels **(all types except wetlands and rice in VALLEY)**	**$8,000**	**$9,000**
Percent smaller parcels (40 - 80 acres)	**20%**	**32%**
All land covers except wetlands and rice in Valley		
Smaller parcels: 40 - 80 acre parcels	**$8,745**	**$11,500**
Larger parcels: 100-acre parcels or larger	**$7,685**	**$6,600**
Wetland community types: vernal pool grasslands, riparian, aquatic/wetland	**$13,250**	
Rice	**$11,000**	

In Foothills, these community types are included within the parcels and don't represent a separate land cover type transaction.

Assumptions/Notes:

The cost factors for all but rice land reflect analysis of land sales transactions in Placer County valley and foothills areas occurring from 2007 through 2011. See *Report on Property Value Ranges Placer County Conservation Plan,* by Bender Rosenthal, Inc., as of April 2011 and memorandum from Sally Nielsen, Hausrath Economics Group to Loren Clark, Placer County Planning Department, dated July 30, 2012, "Land acquisition cost factors for the Placer County Conservation Plan: 2012 Assumptions - DRAFT FOR REVIEW AND COMMENT" in Appendix L. The rice land cost factor was derived from California Chapter of the American Society of Farm Managers and Rural Appraisers, *Trends in Agricultural Land and Lease Values* , published annually.

The Finance Committee reviewed and commented on all land cost factors in July - August 2013. Cost factors were adjusted in March 2017 and in October 2019 based on analysis of trends in agricultural and rural residential land values. See Bender Rosenthal, Inc. memorandum "Land Value Trends, Placer County Conservation Plan" February 22, 2017 in Appendix L.

To factors derived from the analysis of land sales transactions, a 25 percent premium is added in the Valley subarea and a 10 percent premium is added in the Foothill subarea to capture the influence of scarcity on habitat land values over time. See memorandum from Sally Nielsen, Hausrath Economics Group to Loren Clark, Placer County Planning Department, dated July 30, 2012, "Land acquisition cost factors for the Placer County Conservation Plan: 2012 Assumptions - DRAFT FOR REVIEW AND COMMENT". A higher premium is assumed for wetland community types in the Valley due to the particular value of these land cover types to the reserve system.

Acquisition assumptions by parcel size based on TRA and Placer County parcel size analysis indicating land suitable for mitigation by parcel size.

Due Diligence and other Transaction Costs (% of acquisition cost)	**3.75%**

Covers appraisals, site assessments, boundary surveys, legal description, title insurance and other due diligence and closing costs. Includes a due diligence premium of 25% for for costs incurred on properties where the transaction is not consumated.

Legal assistance and program staff services are covered in program administration.

Table 2: Establish Reserve System

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

Pre-acquisition Survey and Assessment (contractor cost)

Assumptions:

Covers costs to verify biological resources in the field.
Includes evaluation of infrastructure and other site conditions and evaluation of restoration and enhancement potential.
Land cover type surveys include surveys for federal and state jurisdictional waters at a protocol level.
Covered plant and wildlife surveys include surveys at a protocol level.
Planning surveys for habitat restoration are covered under Restoration Planning and Implementation

2	Staff (wildlife biologist and botanist)

Hours for 200 acres

200	Assumed average parcel size
10	Total hours per 200 acres for wildlife biologist
10	Total hours per 200 acres for botanist

	Hours per Acre	Cost Per Acre	Cost per Acre with Due Diligence
Land cover type and habitat assessment surveys	**0.10**	$17	$22
Covered wildlife surveys	**0.05**	$9	$11
Covered plant surveys	**0.05**	$9	$11
Total per acre	**0.20**	**$35**	**$43**

$173	Hourly cost for biologist/botanist
Cost per acre	**$35**
1.25	Extra land that will not be acquired but is still surveyed and processed for due diligence/planning surveys.
Cost per acre with due diligence premium	**$43**

Biologist rate assumption		
Base cost per hour	**$165**	$ per hour
Direct expenses (meals) per day	**$20**	$ per day
Travel	**$58**	$ per day
assuming	**100**	miles
and	**$0.580**	$ per mile
Hours per day	**10**	hours per day
Total cost per hour including travel	**$173**	$ per hour

Assumptions:

Sr. Consultant II billing rate; assumes all work will be conducted from a local office (no per diem needed).

Site Improvements (One-Time)

Covers building demolition and stabilization, road removal and reconstruction, gate repair/replacement, signage, fence repair, and other security measures.
Includes labor and necessary materials, i.e., fencing.

Assumptions:

Percent of acquired land in VALLEY that requires one-time site improvements and maintenance	74%	fee title acres
Percent of acquired land in FOOTHILLS that requires one-time site improvements and maintenance	30%	fee title acres

Fencing improvement cost per gross acre VALLEY	**$540**	per gross acre acquired in fee title, from TRA analysis PCCP CS cost factors 20130128 as updated, using PLT fencing cost
Fencing improvement cost per gross acre FOOTHILLS	**$680**	per gross acre acquired in fee title, from TRA analysis PCCP CS cost factors 20130128 as updated, using PLT fencing cost
Cost per acre for other one-time site improvements	**$245**	per gross acre, based on detail below

Components of site improvement cost (200 acre parcel)		
Demolition/stabilization of old facilities	**$2,200**	
Road removal and reconstruction	**$38,000**	assume dirt ranch roads (PLT bruin ranch)
Gate repair replacement	**$5,400**	placer county parks
Signage	**$1,100**	placer land trust/placer county parks
Other security	**$2,200**	

Purchase Credits at Big Gun Conservation Bank - California Red-Legged Frog Habitat (Foothills Subarea) CM1 CRLF-1

The PCA will purchase credits at the Big Gun Conservation Bank to ensure habitat occupied by the California red-legged frog is protected by the Plan.
Credits acquired prior to Plan implementation in 2017 at a price of $90,000 per credit (four credits acquired).
The cost per credit includes all required management and monitoring in perpetuity. Compliance monitoring and review of Big Gun annual reports is included as a PCA staff cost.

Assumptions:

Cost per credit	**$90,000**	per Westervelt, bank manager (updated January 2017; confirmed October 2019)

Table 2: Establish Reserve System

Valley schedule varies by period

2019 dollars cost variable

Detail may not add to total due to rounding at various stages of the calculations.

4	number of credits acquired in 2017

Table 3: Restore Natural Communities, including Management and Monitoring on Restored Lands

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
Capital budget												
Restoration (including contingency) - VALLEY												
Vernal Pool Complex (vernal pool type wetland)	-	4,208,334	5,471,387	7,998,111	7,998,111	11,158,283	13,809,218	12,436,335	11,806,730	9,791,166	8,652,324	**$93,330,000**
Grassland	-	537,033	698,213	1,020,653	1,020,653	1,423,927	1,762,218	1,587,022	1,506,677	1,249,467	1,104,138	**$11,910,000**
Aquatic/Wetland Complex	-	675,710	878,511	1,284,214	1,284,214	1,791,626	2,217,272	1,996,836	1,895,744	1,572,115	1,389,258	**$14,985,500**
Riverine/Riparian Complex	-	2,300,678	2,991,183	4,372,532	4,372,532	6,100,184	7,549,439	6,798,889	6,454,687	5,352,787	4,730,188	**$51,023,100**
Valley Oak Woodland	-	227,131	295,300	431,672	431,672	602,232	745,307	671,210	637,229	528,446	466,981	**$5,037,180**
Subtotal - VALLEY RESTORATION	-	*$7,948,886*	*$10,334,595*	*$15,107,181*	*$15,107,181*	*$21,076,252*	*$26,083,455*	*$23,490,292*	*$22,301,068*	*$18,493,981*	*$16,342,888*	***$176,285,780***
Restoration (including contingency) - FOOTHILLS												
Vernal Pool Complex (vernal pool type wetland)	-	-	-	-	-	-	-	-	-	-	-	**$0**
Grassland	-	-	-	-	-	-	-	-	-	-	-	**$0**
Aquatic/Wetland Complex	-	1,498,550	1,498,550	1,498,550	1,498,550	1,498,550	1,498,550	1,498,550	1,498,550	1,498,550	1,498,550	**$14,985,500**
Riverine/Riparian Complex	-	4,043,340	4,043,340	4,043,340	4,043,340	4,043,340	4,043,340	4,043,340	4,043,340	4,043,340	4,043,340	**$40,433,400**
Valley Oak Woodland	-	142,947	142,947	142,947	142,947	142,947	142,947	142,947	142,947	142,947	142,947	**$1,429,470**
Oak Woodland	-	31,600	31,600	31,600	31,600	31,600	31,600	31,600	31,600	31,600	31,600	**$316,000**
Subtotal - FOOTHILLS RESTORATION	*$0*	*$5,716,437*	*$5,716,437*	*$5,716,437*	*$5,716,437*	*$5,716,437*	*$5,716,437*	*$5,716,437*	*$5,716,437*	*$5,716,437*	*$5,716,437*	***$57,164,370***
Shared capital purchases (vehicles, equipment, furniture)	3,630	49,849	8,664	27,996	19,328	56,562	22,682	28,091	16,729	56,063	15,862	**$305,454**
Water supply for grazing - VALLEY Cost Share	-	12,216	15,882	23,217	35,433	48,273	63,302	71,533	82,545	91,724	96,649	**$540,774**
Water supply for grazing - FOOTHILLS Cost Share	-	4,282	4,282	4,282	8,564	8,564	8,564	12,847	12,847	12,847	17,129	**$94,208**
Responsive measures for changed circumstances	11,180	137,920	226,715	261,157	296,621	335,556	357,490	351,929	372,208	390,184	406,304	**$3,147,266**
Capital subtotal	**$14,810**	**$13,869,590**	**$16,306,576**	**$21,140,271**	**$21,183,564**	**$27,241,645**	**$32,251,930**	**$29,671,129**	**$28,501,833**	**$24,761,235**	**$22,595,269**	**$237,537,852**
Operating budget												
Field and Technical Oversight (staff)	107,250	1,110,450	1,890,900	2,098,800	2,306,700	2,514,600	2,514,600	2,246,475	2,246,475	2,246,475	2,246,475	**$21,529,200**
Other Shared Operating Overhead	4,549	21,058	42,416	69,359	96,209	131,937	174,129	212,325	249,034	280,899	308,971	**$1,590,887**
Reserve management activities - VALLEY COST SHARE												
General reserve and site management	-	6,416	21,175	41,712	66,101	95,309	133,377	173,393	210,356	243,286	271,407	**$1,262,532**
Wetland and pond maintenance and protection	-	3,559	11,745	23,135	36,662	52,862	73,976	96,171	116,672	134,936	150,533	**$700,251**
Nonnative animal species control	-	648	2,137	4,209	6,671	9,618	13,460	17,498	21,229	24,552	27,390	**$127,411**
Vegetation and fuels management (initial and maintenance)	-	89,844	127,657	182,485	234,405	306,916	395,717	474,572	548,794	609,875	663,512	**$3,633,778**
Subtotal - VALLEY RESERVE COST SHARE	*$0*	*$100,467*	*$162,713*	*$251,542*	*$343,839*	*$464,706*	*$616,530*	*$761,634*	*$897,051*	*$1,012,650*	*$1,112,841*	***$5,723,972***
Reserve management activities - FOOTHILLS COST SHARE												
General reserve and site management	-	2,720	8,159	13,598	19,037	24,476	29,915	35,354	40,793	46,232	51,671	**$271,955**
Wetland and pond maintenance and protection	-	2,276	12,444	22,612	32,780	42,948	53,116	63,284	73,452	83,620	93,788	**$480,315**
Nonnative animal species control	-	274	823	1,372	1,921	2,470	3,019	3,568	4,117	4,666	5,215	**$27,445**
Vegetation and fuels management (initial and maintenance)	-	141,960	149,700	154,288	165,728	174,427	183,594	196,655	211,154	227,294	244,082	**$1,848,883**
Subtotal - FOOTHILLS RESERVE COST SHARE	*$0*	*$147,230*	*$171,125*	*$191,870*	*$219,466*	*$244,321*	*$269,644*	*$298,860*	*$329,515*	*$361,811*	*$394,756*	***$2,628,598***
Natural Community Monitoring - VALLEY	-	56,789	166,588	286,758	400,462	531,870	662,632	775,559	890,317	990,186	1,092,050	**$5,853,211**
Natural Community Monitoring - FOOTHILLS	-	13,403	47,844	71,914	102,450	115,283	128,761	160,074	189,557	233,928	276,304	**$1,339,520**
Species Monitoring - VALLEY	-	346,761	500,859	688,215	857,528	1,062,675	1,263,578	1,430,054	1,600,545	1,745,136	1,894,247	**$11,389,598**
Species Monitoring - FOOTHILLS	-	81,844	143,848	172,593	219,382	230,336	245,535	295,161	340,771	412,282	479,272	**$2,621,022**
Research	-	135,500	67,750	67,750	-	-	-	-	-	-	-	**$271,000**
Operations subtotal	**$111,799**	**$2,013,502**	**$3,194,043**	**$3,898,800**	**$4,546,036**	**$5,295,728**	**$5,875,409**	**$6,180,142**	**$6,743,265**	**$7,283,367**	**$7,804,917**	**$52,947,008**
TOTAL	**$126,609**	**$15,883,092**	**$19,500,619**	**$25,039,071**	**$25,729,600**	**$32,537,373**	**$38,127,339**	**$35,851,271**	**$35,245,098**	**$32,044,602**	**$30,400,186**	**$290,484,860**
Restoration allocation to Valley, based on cost after start-up; start up at 50/50	*50%*	*58%*	*64%*	*73%*	*73%*	*79%*	*82%*	*80%*	*80%*	*76%*	*74%*	*76%*
Restoration allocation to Foothills, based on cost after start-up; start up at 50/50	*50%*	*42%*	*36%*	*27%*	*27%*	*21%*	*18%*	*20%*	*20%*	*24%*	*26%*	*24%*

Assumptions: **$118,819** **$164,534**

Total cost for field and technical oversight staff and associated overhead allocated equally to restoration, reserve management, and monitoring.

33% Proportion of shared staff and overhead allocated to restoration

PCA staff prepare restoration management plans.

Restoration planning, design, and implementation accomplished through a combination of contractors with PCA staff oversight and management.

Table 3: Restore Natural Communities, including Management and Monitoring on Restored Lands

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

Habitat Restoration (cost per acre for surveys, planning, design and engineering, construction, monitoring and maintenance)

Cost per Acre

	VERNAL POOL TYPE			AQUATIC / WETLAND TYPE			RIVERINE / RIPARIAN TYPE		GRASSLAND	OAK WOODLANDS	
	Vernal Pool	Seasonal Wetland in Vernal Pool Complex	Seasonal Swales	Fresh Emergent Marsh	Lacustrine	Non-Vernal Pool Seasonal Wetland	Riverine (same as riparian)	Riparian	Grassland from Rice	Oak Woodland	Valley Oak Woodland
Pre-construction restoration planning surveys	$140	$140	$140	$140	$140	$140		$140	$40	$70	$70
Plans, specifications, and engineering	$15,800	$7,500	$12,300	$8,800	$6,300	$7,500		$5,000	$1,700	$280	$2,080
Bid assistance	$700	$500	$530	$530	$380	$500		$400	$100	$10	$80
Construction activity	**$46,900**	**$25,000**	**$35,000**	**$35,000**	**$25,000**	**$25,000**		**$20,000**	**$6,600**	**$1,100**	**$8,300**
Inoculum salvage, transportation, storage, and placement	**$7,100**										
Construction biological monitoring	$140	$140	$140	$140	$140	$140		$140	$140	$140	$140
Construction oversight	$18,000	$10,000	$14,000	$14,000	$10,000	$10,000		$10,000	$330	$60	$420
Post-construction restoration monitoring & maintenance	$56,300	$15,000	$21,000	$21,000	$15,000	$15,000		$24,000	$2,200	$1,300	$10,000
Total per acre, before contingency	**$145,080**	**$58,280**	**$83,110**	**$79,610**	**$56,960**	**$58,280**		**$59,680**	**$11,110**	**$2,960**	**$21,090**
Restoration contingency	$10,900	$4,400	$6,200	$6,000	$4,300	$4,400		$4,500	$800	$200	$1,600
Total per acre, including contingency	**$155,980**	**$62,680**	**$89,310**	**$85,610**	**$61,260**	**$62,680**		**$64,180**	**$11,910**	**$3,160**	**$22,690**
Weighted average cost per acre, Specific Habitats			**$103,700**			**$73,100**		**$64,180**			
Post-construction monitoring & maintenance, per restored acre monitored (model factor includes discount for land not requiring restoration monitoring)	$56,300	$18,800	$26,300	$26,300	$18,800	$18,800		$30,000	$2,800	$1,700	$12,500

Assumptions/Notes:

Calculations are rounded.

See memorandum from ICF International, "Documentation for PCCP restoration costs", October 16, 2015 in *Appendix L* for discussion of the approach to restoration costs factors and description of distinguishing features of the various types of restoration. Cost factors were updated in 2018 based on recent actual restoration project experiences in western Placer County.

Pre-construction planning surveys include, as needed: site selection, wetland delineation, detailed habitat mapping and species surveys, soil or geomorphological sampling and mapping. Planning surveys for restoration sites are more intensive and site-specific than planning surveys under Reserve Management.

Plan, specification, and engineering work, bid assistance, and restoration oversight will be conducted in the 5-year period in which restoration takes place. The estimate of restoration costs is a planning tool to assess the level of effort required to perform the work. Actual restoration costs will vary from the above estimates because of competitive bidding, negotiations with the client, or fluctuations in market prices.

Construction monitoring includes, as needed: on-site biologist conducting training for construction personnel regarding avoidance and minimization measures, verification during construction of implementation of avoidance/minimization measures, identification and translocation of covered species.

Construction oversight includes managing the overall construction of the restoration project to ensure that plans are constructed as designed.

Post-construction restoration monitoring and maintenance is a 5 year period of staff monitoring and contractor remediation (10 years for valley grassland/vernal pool restoration) following construction, to ensure successful implementation. Work includes including plant replacement, irrigation maintenance, weed control, erosion control, and repair of any substandard work.

The PCA will minimize the amount of more costly types of vernal pool restoration: steep sites and laser-leveled rice.

The vernal pool construction cost factors represent costs for the typically flat, undulating valley landscape, particularly west of Highway 65.

Riverine type restoration is the same cost as riparian, assuming the activity is planting riparian trees along the water course and no bank-modification or in-stream work.

Some land cover types have high restoration costs simply because a very small area of that land cover type will be restored/created.

Biologist rate per hour	$173		
Average parcel size for planning surveys and monitoring estimates	200		acres average parcel size
Pre-construction restoration planning surveys:			
Percent of Valley Oak Woodland, Oak Woodland restoration not from Rice	72%		
Hours per acre: Valley Oak Woodland, Oak woodland not from Rice	0.50	100	total hours per parcel for field work and reporting
cent of Vernal Pool Type, Aquatic/Wetland, Riverine/Riparian restoration not from Rice	87%		
Hours per acre: Vernal Pool Type, Aquatic/Wetland, Riverine/Riparian not from Rice	0.90	180	total hours per parcel for field work and reporting
Hours per acre: Rice to any other habitat type	0.25	50	total hours per parcel for field work and reporting
Plans, specifications, and engineering as percent of total construction costs :			
Vernal Pool, Seasonal Swales	35%		of construction cost
Seasonal Wetlands	30%		of construction cost
All other habitat types	25%		of construction cost
Bid assistance as percent of total construction costs :			
Valley Oak Woodland, Oak Woodland	1.0%		of construction cost
Vernal Pool, Seasonal Swale, Fresh Emergent Marsh, Lacustrine, Grassland	1.5%		of construction cost
Seasonal Wetland, Riverine/Riparian	2.0%		of construction cost
Percent of Vernal Pool restoration from rice:	8%		assume same as overall average percent for vernal pool type restoration
Cost premium for Vernal Pool restoration from rice	50%		Applies to construction cost; does not apply to other vernal pool type restoration costs
Vernal pool inoculum collection, transportation, storage, and application	$7,100		assumes collection of 531 cubic yards of material from each acre of impacted pool (4 inches from each basin) and application of 2 inches in each created pool for a total of 262 cy. Assumes a 6 mile distance between impact site and application site, double handling of material, and no charge for storage between collection and application; $35/cy x 262 cy

Table 3: Restore Natural Communities, including Management and Monitoring on Restored Lands

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

Construction biological monitoring: all habitat types:	0.80	160 total hours per parcel for construction monitoring, one month of oversight, 40 hours per week
Construction oversight as percent of total construction costs :		
Vernal Pool, Fresh Emergent Marsh, Lacustrine	40%	of construction cost
Seasonal Wetlands	40%	of construction cost
Seasonal Swales	40%	of construction cost
Riverine/Riparian	50%	of construction cost
Grassland, other non wetland	5%	of construction cost
Post-construction restoration monitoring & maintenance annual cost as percent of total construction costs:		
Valley Oak Woodland, Oak Woodland, and Riverine/Riparian	30%	of construction cost
Vernal Pool	25%	of construction cost; monitoring and reporting in years 1,3,5,7, and 10 after construction
Seasonal Wetland, Seasonal Swales, other Aquatic/Wetland	15%	of construction cost
Grassland	8.5%	of construction cost
Acreage discount for land not requiring restoration monitoring	20%	For all habitat types, except vernal pool
Years of post-construction monitoring & maintenance following installation of restoration project		
Vernal Pool from any land cover	5	monitoring years within a 10-year monitoring period after submission of as-built mapping after construction, Reference PCCP Section 7.4.3.1.2 Monitor the Success of Vernal Pool Complex Restoration/Creation
All other habitat types	5	coincides with 5-year period in which restoration occurs
Restoration contingency as percent of total restoration cost:	7.5%	assumed to be higher than standard contingency (revised 9/3/2013)

Reserve Management Activities

Assumptions/Notes:

The cost of reserve management on restored lands is estimated here. See 3_Manage_Enhance for details on cost assumptions.

Restored lands under management by community type Cumulative total by period: Restored to

	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
VALLEY COST SHARE											
Vernal Pool Complex under management	-	135	311	568	825	1,184	1,628	2,028	2,407	2,722	3,000
Grassland under management	-	45	104	189	275	395	543	676	802	907	1,000
Aquatic/Wetland Complex under management	-	9	21	39	56	81	111	139	164	186	205
Riverine/Riparian Complex under management	-	36	82	151	219	314	431	537	638	721	795
Valley Oak Woodland under management	-	10	23	42	61	88	120	150	178	201	222
Total Valley Cost Share Acres	**-**	**235**	**542**	**989**	**1,437**	**2,061**	**2,834**	**3,529**	**4,190**	**4,738**	**5,222**
FOOTHILLS COST SHARE											
Aquatic/Wetland Complex under management	-	21	41	62	82	103	123	144	164	185	205
Riverine/Riparian Complex under management	-	63	126	189	252	315	378	441	504	567	630
Valley Oak Woodland under management	-	6	13	19	25	32	38	44	50	57	63
Oak Woodland under management	-	10	20	30	40	50	60	70	80	90	100
Total Foothills Cost Share Acres	**-**	**100**	**200**	**299**	**399**	**499**	**599**	**699**	**798**	**898**	**998**
Suitable land used for commercial grazing (fee title only)											**6,220**
VALLEY COST SHARE (oak woodland, VPC, grassland, and pasture)											
Vernal Pool Complex	-	68	156	284	413	592	814	1,014	1,204	1,361	1,500
Grassland	-	23	52	95	138	197	271	338	401	454	500
Aquatic/Wetland Complex	-	-	-	-	-	-	-	-	-	-	-
Riverine/Riparian Complex	-	18	41	75	109	157	216	269	319	361	398
Valley Oak Woodland	-	5	12	21	31	44	60	75	89	101	111
Total Valley Cost Share	**-**	**113**	**260**	**475**	**690**	**990**	**1,361**	**1,695**	**2,013**	**2,276**	**2,509**
FOOTHILLS COST SHARE (oak woodland, VPC, grassland)											
Aquatic/Wetland Complex	-	-	-	-	-	-	-	-	-	-	-
Riverine/Riparian Complex	-	32	63	95	126	158	189	221	252	284	315
Valley Oak Woodland	-	3	6	9	13	16	19	22	25	28	32
Oak Woodland	-	5	10	15	20	25	30	35	40	45	50
Total Foothills Cost Share	**-**	**40**	**79**	**119**	**159**	**198**	**238**	**278**	**317**	**357**	**397**

Table 3: Restore Natural Communities, including Management and Monitoring on Restored Lands

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

Land Subject to Vegetation and Fuel-load Management (not grazed)	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
VALLEY COST SHARE											
VPC and Grassland, including rice mngd as grassland	-	90	207	379	550	789	1,085	1,352	1,605	1,815	2,000
Oak Woodland and Riparian Woodland	-	23	53	96	140	201	276	344	408	461	509
Aquatic/Wetland Complex	-	9	21	39	56	81	111	139	164	186	205
FOOTHILLS COST SHARE											
Oak Woodland and Riparian Woodland	-	40	79	119	159	198	238	278	317	357	397
Aquatic/Wetland Complex	-	21	41	62	82	103	123	144	164	185	205

Responsive Measures for Changed Circumstances

Establishes a reserve fund to covers costs associated with management activities on restored lands to respond to changed circumstances as outlined in Chapter 10 *Assurances.*

Assumptions:

Percentage of annual costs added to cover responsive measures. **10%** Applies to operational budget for management of restored reserve lands

Monitoring on Restored Land

Assumptions/Notes:

Costs to implement natural community and species monitoring on restored lands.

Costs to conduct biological monitoring to evaluate the effectiveness of the conservation strategy over time and to conduct targeted studies to inform adaptive management efforts.

PCA staff will conduct long-term landscape level monitoring, including updating GIS/aerials and analyzing status and trends at the landscape level at least every 5 years.

PCA staff will plan, coordinate, and report on the monitoring categories described below.

Contractors will conduct the field monitoring and data analysis.

Monitoring tasks consists of baseline ecological surveys, data analysis and reporting within 3 years of reserve site acquisition, followed by periodic status and trends surveys, data analysis, and reporting for the duration of the permit term.

Pre-construction surveys are assumed to occur prior to restoration projects on the reserve system, and costs are estimated as a component of those restoration costs.

Post-restoration success monitoring is also included in the restoration cost factors above.

Natural community monitoring on restored/created wetlands (Aquatic/Wetland Complex and Riverine/Riparian Complex) will continue in perpetuity.

Monitoring Survey and Reporting Team

Senior Staff	**1**	@ 8 hours per day
Junior Staff	**1**	@ 8 hours per day
Senior Staff Billing Rate	**$185**	per hour
Junior Staff Billing Rate	**$140**	per hour
	$2,600	monitoring contract cost per day

Natural Community Monitoring (see community restore)	Permit Period (years)											
Community Type	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Vernal Pool Complex	$0	$27,261	$85,098	$142,935	$200,772	$258,609	$316,446	$374,283	$432,120	$489,957	$547,794	$2,875,275
Grassland	$0	$18,096	$39,403	$60,710	$82,017	$103,324	$124,631	$145,938	$167,245	$188,552	$209,859	$1,139,775
Aquatic/Wetland Complex	*$0*	*$0*	*$10,026*	*$20,051*	*$30,077*	*$40,102*	*$50,128*	*$60,154*	*$70,179*	*$80,205*	*$90,230*	*$451,152*
Riverine/Riparian Complex	*$0*	*$0*	*$24,952*	*$49,904*	*$74,857*	*$99,809*	*$124,761*	*$149,713*	*$174,665*	*$199,618*	*$224,570*	*$1,122,849*
Valley Oak Woodland	$0	$18,626	$41,215	$63,804	$86,393	$108,982	$131,570	$154,159	$176,748	$199,337	$221,926	$1,202,760
Oak Woodland	$0	$6,209	$13,738	$21,268	$28,798	$36,327	$43,857	$51,386	$58,916	$66,446	$73,975	$400,920
TOTAL	**$0**	**$70,192**	**$214,432**	**$358,673**	**$502,913**	**$647,153**	**$791,393**	**$935,633**	**$1,079,874**	**$1,224,114**	**$1,368,354**	**$7,192,731**

Species Monitoring (see species restore)	Permit Period (years)											
Species	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Swainson's Hawk	$0	$6,198	$8,351	$10,504	$12,657	$14,810	$16,962	$19,115	$21,268	$23,421	$25,574	$158,860
California Black Rail	$0	$4,272	$5,717	$7,163	$8,609	$10,054	$11,500	$12,945	$14,391	$15,837	$17,282	$107,770
Western Burrowing Owl	$0	$33,540	$46,020	$58,500	$70,980	$83,460	$95,940	$108,420	$120,900	$133,380	$145,860	$897,000
Tricolored Blackbird	$0	$10,093	$14,368	$18,642	$22,916	$27,191	$31,465	$35,740	$40,014	$44,288	$48,563	$293,280
Giant Garter Snake	$0	$41,470	$130,260	$219,050	$307,840	$396,630	$485,420	$574,210	$663,000	$751,790	$840,580	$4,410,250
Western Pond Turtle	$0	$19,661	$26,627	$33,592	$40,557	$47,523	$54,488	$61,454	$68,419	$75,384	$82,350	$510,055
Foothill Yellow-legged Frog	$0	$3,877	$5,234	$6,591	$7,948	$9,305	$10,663	$12,020	$13,377	$14,734	$16,091	$99,840
California Red-legged Frog	$0	$90,610	$122,980	$155,350	$187,720	$220,090	$252,460	$284,830	$317,200	$349,570	$381,940	$2,362,750
Valley Elderberry Long Horned Beetle	$0	$101,587	$136,490	$171,392	$206,294	$241,197	$276,099	$311,002	$345,904	$380,806	$415,709	$2,586,480
Vernal Pool Invertebrates	$0	$90,979	$113,116	$135,252	$157,388	$179,525	$201,661	$223,798	$245,934	$268,070	$290,207	$1,905,930
Steelhead and Chinook Salmon	$0	$26,317	$35,545	$44,772	$53,999	$63,227	$72,454	$81,682	$90,909	$100,136	$109,364	$678,405
TOTAL	**$0**	**$428,605**	**$644,706**	**$860,808**	**$1,076,910**	**$1,293,011**	**$1,509,113**	**$1,725,214**	**$1,941,316**	**$2,157,418**	**$2,373,519**	**$14,010,620**

Research

Assumptions/Notes:

The PCA will conduct research as needed and as funding permits to reduce levels of uncertainties related to achieving biological goals on restored lands.

Because these studies can be expensive and resource-intensive, a limited budget is proposed. Many studies will be jointly funded by grants. Studies will be implemented on an as-needed basis, when resources permit.

Studies may be conducted in partnership with outside scientists from academic institutions, consulting firms, and non-profit organizations.

Research studies are implemented over the first 15 years of the permit period.

Estimated total cost for research studies for restored lands/species **$271,000**

TABLE 9-2

Habitat Restoration cost per acre by Natural Community Type

	VERNAL POOL TYPE HABITATS			AQUATIC / WETLAND TYPE HABITATS			RIVERINE / RIPARIAN TYPE	GRASSLAND	OAK WOODLANDS	
Restoration Cost Element	Vernal Pool	Seasonal Wetland in Vernal Pool Complex	Seasonal Swales	Fresh Emergent Marsh	Lacustrine	Non-Vernal Pool Seasonal Wetland	Riparian and Riverine Type	Grassland from Rice	Oak Woodland	Valley Oak Woodland
Pre-construction restoration planning surveys	$140	$140	$140	$140	$140	$140	$140	$40	$70	$70
Plans, specifications, and engineering	$15,800	$7,500	$12,300	$8,800	$6,300	$7,500	$5,000	$1,700	$280	$2,080
Bid assistance	$700	$500	$530	$530	$380	$500	$400	$100	$10	$80
Construction activity	$46,900	$25,000	$35,000	$35,000	$25,000	$25,000	$20,000	$6,600	$1,100	$8,300
Inoculum salvage, transportation, storage, and placement	$7,100									
Construction biological monitoring	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140
Construction oversight	$18,000	$10,000	$14,000	$14,000	$10,000	$10,000	$10,000	$330	$60	$420
Post-construction restoration monitoring & maintenance	$56,300	$15,000	$21,000	$21,000	$15,000	$15,000	$24,000	$2,200	$1,300	$10,000
Total per acre, before contingency	**$145,080**	**$58,280**	**$83,110**	**$79,610**	**$56,960**	**$58,280**	**$59,680**	**$11,110**	**$2,960**	**$21,090**
Restoration contingency	$10,900	$4,400	$6,200	$6,000	$4,300	$4,400	$4,500	$800	$200	$1,600
Total per acre, including contingency	**$155,980**	**$62,680**	**$89,310**	**$85,610**	**$61,260**	**$62,680**	**$64,180**	**$11,910**	**$3,160**	**$22,690**
Weighted average cost per acre, Constituent Habitats[a]			**$103,700**			**$73,100**	**$64,180**			

Notes:

2019 dollars

[a.] The cost factors for vernal pool type restoration and aquatic/wetland type restoration are weighted averages based on a mix of types of specific constituent habitats that might be restored.

Table 3a: Restoration cost detail for community types

Data source: Table 5-4 Natural Community Restoration Commitments (acres)

See comment

						ADJUSTMENT FACTORS	50%			50%		33%				
							Invasive Species/ Community Function/Post-Restoration Success Monitoring (included in restoration cost factor)					Data Synthesis, Analysis, and Annual Reporting	Days per Parcel			
Natural Community and Constituent Habitat	Restoration with All Effects	Assumptions	Average Parcel Size (acres)	Total Parcels Restored/ Surveyed	Number of parcels restored every 5 year period	Start Up Time[1] (Days)	Year 1 (Days)	Year 2 (Days)	Year 3 (Days)	Every Five Years (Days)	Grazing (Annual)	Days per Parcel (per survey year)	Year 1 (Grazing /Reporting Only)	Year 2 (Grazing /Reporting Only)	Year 3 (Grazing /Reporting Only)	Every Five Years Thereafter
Vernal Pool Complex	3,000	8% wetted acre density. Grazing management: One day early, one day late in the season. Surveys done every year. Intensive survey to map locations of invasive species in the first three years and then survey the whole property every five years thereafter. One survey day per 100 acres. Hydrologic function of restored pools will be monitored at the same time of branchiopod monitoring. One day to survey location of ground squirrel colonies and density of ground; survey the entire are the first year and then 50% of the site the following two years. Survey the entire site for ground squirrels every five years thereafter.	200	15	1.5	3	3.0	2.5	2.5	3.0	2.0	0.3	2.3	2.3	2.3	14.8
All Vernal Pool Type Wetlands	900															
Minimum as Delineated Vernal Pool	326															
Grassland	1,000	Intensive survey to map locations of invasive species, monitor restoration progress, and vegetation community composition and density in the first three years and then survey the whole property every five years thereafter. Four survey days per 200 acres for restoration success/invasive species monitoring. Grazing management: One day early, one day late in the season. Surveys done every year. One day to survey location of ground squirrel colonies and density of ground; survey the entire are the first year and then 50% of the site the following two years. Survey the entire site for ground squirrels every five years thereafter.	200	5	0.5	1.5	5.0	4.5	4.5	3.0	2.0	3	4.6	4.6	4.6	16.4
Aquatic/Wetland Complex																
All Aquatic/ Wetland	410	Intensive survey to map locations of invasive species in the first three years and then survey the whole property every five years thereafter. One survey day per 50 acres for invasive species monitoring. Two additional days per year for hydroperiod, vegetation percent cover, water quality, etc. monitoring associated with 1-2-3 assessment approach.	50	8	0.8	1	3	3	3	3	-	1	-	-	-	4.8
Minimum as Fresh Emergent Marsh	196															
Riverine/Riparian Complex																
All Riverine/ Riparian	1,425	14 days per 200 acres to survey the health of restored trees and to track invasive species infestations. Three additional days per year for monitoring of water quality, sediment quality, % runs, riffles, pools, percent canopy cover, etc. (possible to inform targeted studies/restoration siting).	200	7	0.7	2.5	17	17	17	8.5	-	4	-	-	-	13.7
Minimum as Riparian Woodland	1,250															
Valley Oak Woodland	285	4 days per 50 acres to survey the health of restored trees and to track invasive species infestations. Grazing management: One day early, one day late in the season. Surveys done every year. One survey per 50 acres.	50	6	0.6	1	4	4	4	2	2	2	4.0	4.0	4.0	14.5
Oak Woodland	100	4 days per 50 acres to survey the health of restored trees and to track invasive species infestations. Grazing management: One day early, one day late in the season. Surveys done every year. One survey per 200 acres.	50	2	0.2	1	4	4	4	2	2	2	4.0	4.0	4.0	14.5

1. Start up time includes time for survey methods design, GIS data acquisition and translation, site-specific history/research, data collection methods (datasheet, in-field GIS, etc.), database design and creation, coordinating access permission and with partner organizations, etc. Startup time presented here is assumed to be needed in the first year. Half this time is then needed for every five year survey.

Table 3b: Restoration cost detail for species

Data source: Table 5-6 Covered Species Protection and Restoration Commitments (acres)

See comment

				ADJUSTMENT FACTORS			50%	50%						33%				
								Invasive Species/ Community Function/Post-Restoration Success Monitoring						Data Synthesis, Analysis, and Annual Reporting	Days per Site, per year			
Species / Habitat Type		Habitat Restored	Natural Community and Constituent Habitat	Average Site Size (acres)	Number of Sites (TOTAL)	Sites Added per 5-year period	Start Up Time[1] (Days)	Year 1 (Days)	Year 2 (Days)	Year 3 (Days)	Year 4 (Days)*	Year 5 (Days)*	Every Five Years (Days)	Days per Site (per survey year)	Year 1	Year 2	Year 3	Every Five Years Thereafter
Swainson's Hawk																		
	Nesting Habitat	720	One nesting survey a year during optimal breeding time, assume four hours per site and four sites per day (assuming two people are at different sites). Average site size is 200 acres. Survey every year for three years, then every five years thereafter.	200	4	0.4	0.5	0.5	0.5	0.5			0.5	1	2.3	1.8	1.8	2.1
	Foraging	3,920	One hawk/TCBB nesting survey per year, four hours per 200 acres.; assume covered in community level monitoring.	200	-	-	0.5	0.5	0.5	0.5			0.5	1.0	2.0	1.5	1.5	1.7
California Black Rail																		
	Year-round Habitat	175	Three survey days per site, two weeks apart.	150	1	0.1	0.5	3	3	3			3	2	5.8	5.3	5.3	5.6
Western Burrowing Owl																		
	Overwintering Habitat	4,126	Two site surveys per day. All sites visited the first year then 50% of the sites in each of the following years; and then all sites surveyed every five years.	300	20	2.0	0.5	0.50	0.25	0.25			0.50	1.7	2.7	1.9	1.9	2.4
Tricolored Blackbird																		
	Nesting Habitat	87	Two survey days per site, two weeks apart.	25	3	0.3	1	2	2	2			3	2	5.0	4.0	4.0	5.5
	Foraging Habitat	4,000	Survey described under hawk; assume covered in community level monitoring.															
Giant Garter Snake																		
	Aquatic Habitat	529	Trapping surveys to detect presence; assume 2 trap lines per site, 8 active trap days per line and two days for deployment and retrieval, 2 trap lines surveyed per day. One year of trapping at each site; 50% in the second year, and 50% in the third year and then every five years thereafter.	100	5	0.5	2	10	5	5			64	3	15.3	8.3	8.3	68.3
	Upland Habitat	449	Surveys for snakes descrbed above.															
Western Pond Turtle																		
	Aquatic Habitat	1,850	Walking surveys at known/likely basking locations.Two sites surveyed per day.	100	19	1.9	0.5	0.5	0.5	0.5			0.5	1	1.7	1.2	1.2	1.4
	Upland Habitat	1,930	Surveys for turtle described above.															
Foothill Yellow-legged Frog																		
	Year-round Habitat	83	Adult, sub-adult, and egg mass walking surveys. One site per day.	25	3	0.3	0.5	0.5	0.5	0.5			0.5	1.0	2.0	1.5	1.5	1.7
California Red-legged Frog																		
	Aquatic Habitat	1,241	Visual daytime surveys and night surveys for eye shining and calling. So two days per site.	25	50	5.0	1	1	1	1			1	1.0	3.0	2.0	2.0	2.5
	Upland Habitat	160	Surveys on aquatic habitat only.															
Valley Elderberry Longhorn Beetle																		
	Year-round Habitat	1,553	Assume triple the effort of surveys on restored lands than on protected lands to allow for stem counts and increased density of shrubs on restoration site. Representative/rotating sample to assess health of shrub; survey for signs of beetle. Survey all shrubs the first three years. Every five years thereafter, randonmly sampled subset of 50%.	100	16	1.6	1.5	5	5	5			5	3	9.1	7.6	7.6	8.4
Vernal Pool Invertebrates																		
	Wetland Habitat	900	8% wetted acre density. For branchiopods, four surveys per season, each survey will take 2 days; survey everything the entirety of the site each year for three years and then a subset representing 50% every five years thereafter.	100	9	0.9	3	8	8	8	8	8	4	4	15.0	12.0	12.0	9.5
	Vernal Pool Complex	3,000	Assume this is primarily grassland habitat. Surveys for aquatic habitat described above.															
Steelhead and Chinook Salmon																		
		Spawning and juvenile rearing	Habitat quality monitoring described in natural community tab. Redd surveys, carcuss, and juvenile density baseline monitoring will be performed on protected and pre-restoration lands. All post-restoration/post-enhancement montioring is described is "targeted studied" columns. Assume: Three days per year for spawning/redd surveys; three days a year for snorkel/electrofishing surveys.	200		0.7	1.5	3	3	3	-	-	3	1	5.8	4.3	4.3	5.1

*Added survey years four and five for vernal pool crustacens per protocol described in Chapter 7.

Table 4: Reserve Management and Enhancement

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
Capital budget												
Shared capital purchases (vehicles, equipment, furniture)	3,630	49,849	8,664	27,996	19,328	56,562	22,682	28,091	16,729	56,063	15,862	**$305,454**
Field facilities	-	-	-	543,000	-	-	543,000	-	543,000	-	-	**$1,629,000**
Fish Barrier Removal/Modification - VALLEY	-	287,700	287,700	287,700	287,700	287,700	287,700	287,700	287,700	287,700	287,700	**$2,877,000**
Fish Barrier Removal/Modification - FOOTHILLS	-	184,600	184,600	184,600	184,600	184,600	184,600	184,600	184,600	184,600	184,600	**$1,846,000**
Water supply for grazing - VALLEY Cost Share	-	43,190	56,153	82,085	125,276	170,671	223,810	252,910	291,845	324,297	341,710	**$1,911,948**
Water supply for grazing - FOOTHILLS Cost Share	-	16,722	16,503	16,065	32,787	32,019	31,120	48,081	47,422	46,874	64,032	**$351,625**
Responsive measures for changed circumstances	-	333,933	411,369	533,180	635,015	782,901	936,137	1,022,104	1,138,824	1,224,335	1,304,493	**$8,322,292**
Capital subtotal	**$3,630**	**$915,995**	**$964,990**	**$1,674,627**	**$1,284,705**	**$1,514,454**	**$2,229,049**	**$1,823,486**	**$2,510,120**	**$2,123,868**	**$2,198,396**	**$17,243,320**
Operating budget												
Field and Technical Oversight (staff)	107,250	1,110,450	1,890,900	2,098,800	2,306,700	2,514,600	2,514,600	2,246,475	2,246,475	2,246,475	2,246,475	**$21,529,200**
Other shared operating overhead	4,549	21,058	42,416	69,359	96,209	131,937	174,129	212,325	249,034	280,899	308,971	**$1,590,887**
Agricultural advisory services	-	545,000	271,500	271,500	271,500	271,500	271,500	271,500	271,500	271,500	271,500	**$2,988,500**
Field facilities maintenance and utilities	-	-	-	54,500	54,500	54,500	109,000	109,000	163,500	163,500	163,500	**$872,000**
Management equipment/tools	-	9,629	20,733	34,784	48,835	66,574	87,406	106,636	125,132	141,275	156,090	**$797,095**
Reserve management plans	-	435,200	43,400	43,400	43,400	43,400	43,400	43,400	43,400	43,400	43,400	**$825,800**
Reserve management and enhancement activities - VALLEY COST SHARE												
Reserve enhancement activities, except in-channel	-	198,340	258,891	379,306	381,250	532,134	659,785	598,436	571,785	479,660	428,365	**$4,487,953**
In-channel enhancement activities	-	194,029	252,264	368,761	368,761	514,464	636,688	573,389	544,361	451,431	398,924	**$4,303,072**
General reserve and site management	-	24,695	81,497	160,537	254,405	366,816	513,328	667,340	809,601	936,340	1,044,568	**$4,859,127**
Wetland and pond maintenance and protection	-	6,250	20,625	40,627	64,383	92,831	129,909	168,885	204,887	236,961	264,351	**$1,229,708**
Nonnative animal species control	-	2,492	8,224	16,201	25,674	37,018	51,804	67,346	81,703	94,493	105,415	**$490,371**
Water supply for rice (share of water cost assigned to PCA)	-	24,800	81,843	161,220	255,487	368,377	515,512	670,179	813,045	940,323	1,049,011	**$4,879,796**
Vegetation and fuels management (initial and maintenance)	-	264,451	560,979	978,149	1,447,567	2,030,665	2,779,275	3,537,031	4,239,927	4,855,974	5,385,129	**$26,079,147**
Subtotal - VALLEY RESERVE COST SHARE	*$0*	*$715,057*	*$1,264,323*	*$2,104,802*	*$2,797,526*	*$3,942,304*	*$5,286,301*	*$6,282,607*	*$7,265,309*	*$7,995,181*	*$8,675,764*	***$46,329,173***
Reserve management and enhancement activities - FOOTHILLS COST SHARE												
Reserve enhancement activities, except in-channel	-	161,632	177,044	192,018	206,991	221,416	235,381	249,585	263,897	278,560	293,420	**$2,279,944**
In-channel enhancement activities	-	220,993	220,993	220,993	220,993	220,993	220,993	220,993	220,993	220,993	220,993	**$2,209,928**
General reserve and site management	-	8,602	25,696	42,457	58,997	75,261	91,015	106,658	122,476	138,525	154,851	**$824,538**
Wetland and pond maintenance and protection	-	666	3,642	6,618	9,594	12,570	15,546	18,522	21,498	24,474	27,450	**$140,580**
Nonnative animal species control	-	868	2,593	4,285	5,954	7,595	9,185	10,764	12,360	13,980	15,627	**$83,210**
Vegetation and fuels management (initial and maintenance)	-	110,176	150,455	188,290	228,955	266,362	302,917	342,576	382,665	424,585	466,886	**$2,863,867**
Subtotal - FOOTHILLS RESERVE COST SHARE	*$0*	*$502,937*	*$580,422*	*$654,660*	*$731,485*	*$804,197*	*$875,037*	*$949,097*	*$1,023,889*	*$1,101,116*	*$1,179,227*	***$8,402,068***
Operations subtotal	**$111,799**	**$3,339,332**	**$4,113,693**	**$5,331,804**	**$6,350,154**	**$7,829,013**	**$9,361,374**	**$10,221,041**	**$11,388,239**	**$12,243,347**	**$13,044,927**	**$83,334,722**
TOTAL	**$115,429**	**$4,255,326**	**$5,078,683**	**$7,006,431**	**$7,634,860**	**$9,343,467**	**$11,590,423**	**$12,044,527**	**$13,898,359**	**$14,367,216**	**$15,243,323**	**$100,578,042**

eserve allocation to Valley, based on cost after start up; start up at 50/50	*50%*	*59%*	*69%*	*76%*	*79%*	*83%*	*86%*	*87%*	*88%*	*88%*	*88%*	*85%*
rve allocation to Foothills, based on cost after start-up, start-up at 50/50	*50%*	*41%*	*31%*	*24%*	*21%*	*17%*	*14%*	*13%*	*12%*	*12%*	*12%*	*15%*

Table 4: Reserve Management and Enhancement

Valley schedule varies by period

2019 dollars **cost variable**

Assumptions/Notes:

Total cost for field and technical oversight staff and associated overhead allocated equally to restoration, reserve management, and monitoring.

In addition to oversight of restoration, management and monitoring contractors, these staff monitor conservation easements and manage/monitor activities on PCA land leased for grazing.

33%	Proportion of shared staff and overhead allocated to reserve management	

Reserve management plans (prepared/updated by contractors, except for system-wide plans which are updated by PCA staff) 5.3.2.2

Initial cost, per management unit	$109,000	One for each of 2 reserve management units (Valley and Foothills). Both completed initially in first 5-year period
Cost to update every 5 years	$21,700	
System-wide management plans (CM2 L-2, CM2 AO-2, CM2 TRBL-3)	$54,300	Initial cost for each of four plans during first 5-year period: fire management, vegetation/invasives management, water management, recreation management
		PCA staff updates plans as needed every 5 years

Source: Vollmar Consulting/AECOM , Small Vernal Pool Preserve Study, prepared for the Placer Land Trust, December 2009

Staffing - Agricultural advisory services

1/2 to full-time position	$109,000	annual cost, years 1- 5
1/3 to 1/2 time position	$54,300	annual cost, after year 5

Reserve Enhancement Activities

CM2 OW-1 Oak Woodland enhancement	$540	Cost per acre to plant, protect, and irrigate seedlings and saplings; labor provided by reserve maintenance staff
	10%	Percent of oak woodland acres enhanced; applied to cumulative total acres
CM2 VPCG-2 Vernal Pool Enhancement of Hydrologic Conditions	$10,400	Cost per acre assuming 10% of level of effort for restoration cost
	700	Acres of vernal pool wetlands protected (total commitment, Table 5-5) Note: All in Valley
	20%	Percent of vernal pool wetlands enhanced
CM2 AW-1 - 8; CM2 BLRA-1 Aquatic/Wetland Complex Enhancement	$14,600	Cost per acre assuming 20% of level of effort for restoration cost
	400	Acres of aquatic/wetland complex protected in Valley (total commitment, Table 5-5)
	200	Acres of aquatic/wetland complex protected in Foothills (total commitment, Table 5-5)
	50%	Percent of aquatic wetland complex enhanced
CM2 RAR-3 and RAR-4 Improvement of in-channel features	$6,513,000	placeholder budget to cover a range of types of enhancement activities as described in CM2 RAR-3 and RAR-4
CM2 RAR-2 Fish Barrier Removal/Modification		
VALLEY	Cost per project	
Hemphill Dam	$2,171,000	construct fish ladder and/or remove the dam and restore riparian zone
Nelson Lane Dam	$380,000	
Coon Creek at Waltz Road and Sutter County Line	$326,000	
	$2,877,000	
FOOTHILLS		
Cottonwood Dam	$1,520,000	remove dam and restore riparian habitat
Doty Ravine at Garden Bar Road	$326,000	
	$1,846,000	
Total Cost	$4,723,000	

Assumptions/Notes:

For planning purposes, cost in each subarea allocated equally across 10 periods: about $265,000 per period in the Valley and $170,000 per period in the Foothills.

Sources: Ed Sullivan email 2/19/2013 and "Anadromous Fish Screening and Passage Opportunities in Western Placer County and South Sutter County" (no date), and Placer County Planning Department, January 2015.

Reserve Management Activities

Assumptions/Notes:

The PCA actively manages land acquired in fee title. Management costs on land acquired by conservation easement are assumed to be the responsibility of the land-owner. The easement acquisition cost factors in these on-going responsibilities.

See 2_RestoreNaturalCommunities for management costs on restored lands.

Planning and permitting costs for reserve management tasks are included in field and technical oversight, reserve management plans, environmental compliance costs, and program administration costs.

Invasive plants and fuel loads on vernal pool complex lands, grasslands, riparian woodlands, and oak woodlands will be managed with a combination of grazing and hand and mechanical treatments, mastication, herbicide application, and prescribed burning as

Vegetation management on aquatic/wetland complex lands is a combination of hand and mechanical treatments, mastication, limited grazing, and prescribed burning as needed.

Vegetation and other fuel-load management activities other than grazing apply to the perimeter of grassland and woodland parcels and some portion of the interior parcel.

Cost per acre for vegetation management and fuel-load management (except grazing) include labor and materials. Costs are near the midpoint of a range where the high end assumes contractors do the work and public contracting rules and prevailing wages apply and the lower end of the range assumes use of California Conservation Corps or other subsidized labor. PCA reserve maintenance staff may also do some of the work.

The PCA assumes no grazing management cost on land leased for grazing. Grazing lease revenue is estimated in this model but is not included in the funding plan. See Table 4a. Agricultural Lease Revenue.

The PCA incurs a grazing cost for vegetation and fuel-load management on natural open space areas in the PFG that might be incorporated in the reserve.

Other invasive plant treatments include controlling Red Sesbania in creeks.

Rice land in the reserve is either acquired via conservation easement so there is no management cost except monitoring the easement, or the land is acquired in fee title and leased to a rice farmer. Most of the rice land acquired in fee title is managed to benefit the giant garter snake. The PCA assumes 50 percent of the water cost and the rice farmer is responsible for all other costs of rice production. This is the model of the Natomas Basin Conservancy, which has a 20-year track record acquiring rice land for management as giant garter snake habitat and leasing that land to rice farmers. Revenue from leases to rice farmers is assumed for all rice land leased (and estimated for the funding plan). See Table 4a Agricultural Lease Revenue.

No cost for recreation management assumed.

Table 4: Reserve Management and Enhancement

Valley schedule varies by period		
2019 dollars	**cost variable**	
		Note: Field facilities contain an area for equipment storage, a manager's office, a shared office, a locker room, and restrooms.
Field facilities (capital cost)	**$543,000**	cost assumes donated portable building with cost representing transportation, utilities, installation, permitting etc.
	15,000	Reserve acres per field facility; some field facility space would also be provided in existing buildings (barns, sheds) on lands added to reserve
Field facilities maintenance and utilities	**$10,900**	annual cost per facility, Placer County Parks and Recreation
Management equipment and materials	**$3,300**	cost per 1,000 acres per period for hand tools, landscaping equipment (Placer Land Trust information)
Annual cost per 1,000 acres for on-going site maintenance (CM2 L-3, CM2 AW-2, CM2 BLRA-2)	**$10,900**	fencing, gates, signage, water supply maintenance, trash and debris removal (Placer Land Trust and Placer County)
Annual cost per 1,000 acres for nonnative animal species control (CM2 AW-4,CM2 RAR-5, CM2 OW-2, CM2 TRBL-3)	**$1,100**	cost to control feral pigs, wild turkeys, beavers, bullfrogs, invasive fish (costs of traps, tags, etc.)
Annual cost to control Red Sesbania in creeks (CM2 RAR-1)	**$65,000**	annual contract cost, allocate to Valley and Foothills proportional to Riparian acres
Wetland and pond maintenance and protection (CM2 AW-1, CM2 AW-2, CM2 AW-7, CM2 AW-8)	**10%**	of Aquatic and Wetland acres require wetland and pond maintenance and protection
	$1,100	cost per acre per year for clearing debris in wetlands and ponds
	2%	of Aquatic and Wetland acres are ponds
Pond dredging, annual cost per acre (CM2 AW-3)	**$2,200**	assumes each pond dredged once every 5 years
Water points for grazing (capital cost initial and replacement)	**$5,400**	average cost per water point, Placer County (L Clark memo 1/25/2013, based on input from Roger Ingram)
Gross acres per water point	**50**	Placer County (L Clark memo 1/25/2013, based on input from Roger Ingram)
Replacement period (years)	**15**	TRA PCCP CS cost factors 20130128
Water rate per acre foot, PCWA General Irrigation Untreated	**$42.07**	based on miner's inch rate schedule for 2018, based on Water Cost of Service and Rate Study, , dated 9/14/2017
Water requirement for rice production	**4.5**	acre-feet per acre per year, based on U.S.D.A Census of Agriculture, California, 2012
PCWA loss factor charged to Zone 5 customers	**1.1625**	contractual loss factor of 16.25% represents need to deliver more than requested to account for losses along the way
Annual cost per acre for water for rice production	$220	rounded (includes loss factor premium)
Percent of annual water cost paid by PCA	**50%**	working assumption based on Natomas Basin Conservancy experience with rice farmers; rice farmer pays the balance
Proportion of fee title rice managed as grassland	**11%**	Placer County placeholder was 50%; now function of restoration requirements and GGS management
Proportion of suitable land utilized for commercial grazing	**50%**	Roger Ingram in L Clark memorandum, updated 7/10/2013; same for VALLEY and FOOTHILLS; applies to grassland and woodland
Proportion of Field Ag. in Valley that is irrigated pasture	**0%**	L Clark memorandum, updated 7/10/2013 (Note as of June 2015 all Field Ag used for restoration land base)
Cost per acre per year to graze urban/suburban grassland	**$270**	applies to 20% of the acres, cost for small isolated properties where transportation is a significant cost factor
Cost per acre per year to graze urban/suburban grassland	**$110**	applies to 80% of the acres, mid-range of Lee Hazeltine's operation in Lincoln/Rocklin area
Weighted average cost per acre per year for urban/suburban grazing	**$142**	Placer County (L Clark memo 1/25/2013 updated 7/10/2013; input from Patrick Shea/Wildlife Heritage Foundation: $70 - $130 per acre, depending on availability of grazing land and condition of the range; higher for small, isolated properties: $250 - 300 per acre. Applies in CARP/Stream System corridors in Valley and in plan area open spaces.

	Cost per parcel acre	Perimeter buffer % of Parcel	Cost per treated acre	
Vegetation and Fuel-load Management for land not grazed				TRA PCCP CS cost factors 20130128, based on R. Harris January 2013 White Paper; adjusted 9/2013 based on Finance Committee comments, reduced perimeter buffer % by assuming 50 ft buffer per parcel
Vegetation and Fuel-Load Management (initial cost, one time)				
Grassland including Vernal Pool Complex	$15	**7%**	**$220**	
Woodland, including Riparian/Riverine Complex (parcel perimeter)	$98	**5%**	**$1,950**	
Parcel level treatment, cost per treated acre	**$1,950**			
Woodland, including riparian woodland (rest of parcel)	**20%**			percent of parcel treated (R. Harris, January 2013 White Paper "...if 20 - 30% of an area is treated, there will be positive impacts beyond the area of treatment alone.")
Aquatic/Wetland Complex (parcel treatment)	**25%**			percent of parcel treated
Vegetation and Fuel-Load Management (maintenance cost per period)				
Grassland including Vernal Pool Complex	$39	**7%**	**$110**	
Woodland, including Riparian/Riverine Complex	$55	**5%**	**$1,090**	
Parcel level treatment, cost per treated acre	**$1,090**			
Woodland, including riparian woodland (rest of parcel)	**20%**			percent of parcel treated
Aquatic/Wetland Complex (parcel treatment)	**25%**			percent of parcel treated
Interval between treatments, Grassland	**1**			year
Interval between treatments, Woodland and Aquatic/Wetland Complex	**5**			year

Assumptions/Notes:

Fuel-load management cost applies to parcel perimeters and parcel area as estimated above

	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Cumulative total acres managed	-	2,918	6,283	10,541	14,799	20,174	26,487	32,314	37,919	42,811	47,300
Total field facilities	-	-	-	1.00	1.00	1.00	2.00	2.00	3.00	3.00	3.00
New field facilities	-	-	-	1.00	-	-	1.00	-	1.00	-	-

Note: in early years, existing buildings on land acquired for reserve could be used for field facilities.

Table 4: Reserve Management and Enhancement

Valley schedule varies by period

2019 dollars **cost variable**

Only Fee Title acres are under management Cumulative total by period: Start with fee title lands from fee title_easement sheet, subtract restored from (restored to counted in restoration tab)

VALLEY COST SHARE	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Vernal Pool Complex under management	-	690	1,587	2,898	4,209	6,038	8,302	10,341	12,276	13,882	15,300
Grassland under management	-	15	35	64	93	133	183	228	271	307	338
Aquatic/Wetland Complex under management	-	16	37	68	99	142	195	243	289	327	360
Riverine/Riparian Complex under management	-	65	149	273	396	568	781	973	1,155	1,307	1,440
Valley Oak Woodland under management	-	2	6	10	15	21	29	36	43	49	54
Oak Woodland under management	-	17	38	69	101	144	199	247	294	332	366
Rice under management	-	101	232	424	616	884	1,215	1,514	1,797	2,032	2,240
Field Agriculture under management	-	-	-	-	-	-	-	-	-	-	-
Total Valley Cost Share Acres	**-**	**906**	**2,084**	**3,807**	**5,529**	**7,932**	**10,906**	**13,584**	**16,126**	**18,235**	**20,098**
Rice managed as grassland	**-**	**11**	**25**	**45**	**66**	**95**	**130**	**162**	**193**	**218**	**240**
Rice managed for giant garter snake	**-**	**90**	**207**	**379**	**550**	**789**	**1,085**	**1,352**	**1,605**	**1,815**	**2,000**

FOOTHILLS COST SHARE	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Vernal Pool Complex under management	-	-	-	-	-	-	-	-	-	-	-
Grassland under management	-	2	4	7	9	11	13	15	18	20	22
Aquatic/Wetland Complex under management	-	6	12	18	24	30	36	42	48	54	60
Riverine/Riparian Complex under management	-	18	36	54	72	90	108	126	144	162	180
Valley Oak Woodland under management	-	3	6	9	12	15	18	21	24	27	30
Oak Woodland under management	-	286	569	843	1,117	1,382	1,637	1,897	2,159	2,428	2,700
Rice under management	-	-	-	-	-	-	-	-	-	-	-
Field Agriculture under management	-	-	-	-	-	-	-	-	-	-	-
Total Foothills Cost Share Acres	**-**	**316**	**627**	**931**	**1,234**	**1,528**	**1,812**	**2,102**	**2,393**	**2,691**	**2,992**
Suitable land used for commercial grazing (fee title only)											**23,090**

VALLEY COST SHARE (oak woodland, VPC, grassland, and pasture)											
Vernal Pool Complex	-	345	793	1,449	2,105	3,019	4,151	5,170	6,138	6,941	7,650
Grassland	-	8	18	32	46	67	92	114	136	153	169
Aquatic/Wetland Complex	-	-	-	-	-	-	-	-	-	-	-
Riverine/Riparian Complex	-	32	75	136	198	284	391	487	578	653	720
Valley Oak Woodland	-	1	3	5	7	11	15	18	22	24	27
Oak Woodland	-	8	19	35	50	72	99	124	147	166	183
Rice managed as Grassland	-	5	12	23	33	47	65	81	96	109	120
Irrigated Pasture in Field Agriculture	-	-	-	-	-	-	-	-	-	-	-
Total Valley Cost Share	**-**	**400**	**920**	**1,680**	**2,440**	**3,500**	**4,813**	**5,994**	**7,116**	**8,047**	**8,869**
FOOTHILLS COST SHARE (oak woodland, VPC, grassland)											
Vernal Pool Complex	-	-	-	-	-	-	-	-	-	-	-
Grassland	-	1	2	3	4	6	7	8	9	10	11
Aquatic/Wetland Complex	-	-	-	-	-	-	-	-	-	-	-
Riverine/Riparian Complex	-	9	18	27	36	45	54	63	72	81	90
Valley Oak Woodland	-	2	3	5	6	8	9	11	12	14	15
Oak Woodland	-	143	284	422	559	691	819	949	1,080	1,214	1,350
Irrigated Pasture in Agriculture or other Natural/Semi-natural	-	-	-	-	-	-	-	-	-	-	-
Total Foothills Cost Share	**-**	**155**	**308**	**456**	**605**	**749**	**888**	**1,030**	**1,172**	**1,318**	**1,466**
Urban/suburban grassland grazed											
Grassland in natural open space areas retained in PFG VALLEY	-	225	519	947	1,376	1,973	2,713	3,379	4,012	4,536	5,000
Land Subject to Vegetation and Fuel-load Management (not grazed)											
VALLEY COST SHARE											
VPC and Grassland, including rice mngd as grassland that is not grazed	-	358	823	1,504	2,184	3,133	4,308	5,366	6,370	7,203	7,939
Oak Woodland and Riparian Woodland	-	42	96	176	256	367	505	629	746	844	930
Aquatic/Wetland Complex	-	16	37	68	99	142	195	243	289	327	360
FOOTHILLS COST SHARE											
VPC, Grassland, and pasture	-	1	2	3	4	6	7	8	9	10	11
Oak Woodland and Riparian Woodland	-	154	305	453	601	743	882	1,022	1,164	1,308	1,455
Aquatic/Wetland Complex	-	6	12	18	24	30	36	42	48	54	60

Responsive Measures for Changed Circumstances

Establishes a reserve fund to covers costs associated with management activities on reserve lands to respond to changed circumstances as outlined in Chapter 10 *Assurances.*

Assumptions:

Table 4: Reserve Management and Enhancement

Valley schedule varies by period		
2019 dollars	**cost variable**	
Percentage of annual costs added to cover responsive measures.	**10%**	Applies to operational budget for management of reserve lands

Table 4a: Reserve Management - Grazing and Rice Lease Revenue

Valley schedule varies by period

2019 dollars cost variable

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Revenue from grazing and rice leases												
VALLEY SHARE												
Grazing Lease Revenue DO NOT ASSUME FOR FUNDING PLAN	-	19,446	66,771	132,388	211,240	304,694	426,950	556,749	676,446	783,533	874,799	**$4,053,016**
Rice Lease Revenue - ASSUMED IN FUNDING PLAN	-	40,582	133,925	263,814	418,069	602,798	843,565	1,096,656	1,330,437	1,538,710	1,716,564	**$7,985,120**
Subtotal Valley Lease Revenue	-	*$60,028*	*$200,697*	*$396,202*	*$629,309*	*$907,492*	*$1,270,515*	*$1,653,405*	*$2,006,883*	*$2,322,242*	*$2,591,363*	**$12,038,136**
FOOTHILLS SHARE												
Grazing Lease Revenue DO NOT ASSUME FOR FUNDING PLAN	-	6,193	18,499	30,561	42,461	54,157	65,480	76,721	88,090	99,630	111,372	**$593,166**
Subtotal Foothills Lease Revenue		*$6,193*	*$18,499*	*$30,561*	*$42,461*	*$54,157*	*$65,480*	*$76,721*	*$88,090*	*$99,630*	*$111,372*	**$593,166**
TOTAL PLAN AREA	-	**$66,221**	**$219,196**	**$426,764**	**$671,770**	**$961,649**	**$1,335,995**	**$1,730,125**	**$2,094,974**	**$2,421,872**	**$2,702,735**	**$12,631,302**

Assumptions:

Revenue from grazing and rice leases is estimated. Graziing lease revenue is not shown as a revenue source in the funding plan, but rice lease revenue is.

The model for costs and revenues associated with rice land managed for the giant garter snake is that of the Natomas Basin Conservancy, which has a 20-year track record acquiring rice land and leasing it to rice farmers who pay land rent and all costs of rice production including about 50% of water costs.

GRAZING LEASE REVENUE

Proportion of suitable land utilized for commercial grazing	50%	Roger Ingram in L Clark memorandum, updated 7/10/2013; same for VALLEY and FOOTHILLS; applies to grassland and woodland
Proportion of fee title rice managed as grassland	11%	Placer County placeholder was 50%; now function of restoration requirements and GGS management
Grazing lease revenue (annual per acre grazed)	Revenue per acre	L. Clark memorandum, updated 7/10/2013, based on input from Roger Ingram and Cork McIsaac of Ag Industries; averages from TRA worksheet PCCP cost factors TRA 20130128
Vernal Pool Complex	$20.00	weighted average across medium, low, and high density VP
Grassland	$16.00	
Irrigated pasture, Foothills only	$160.00	
Woodland	$16.00	weighted average across three canopy classes

	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Suitable land used for commercial grazing (fee title only)											
VALLEY COST SHARE											
Vernal Pool Complex	-	345	793	1,449	2,105	3,019	4,151	5,170	6,138	6,941	7,650
Grassland	-	8	18	32	46	67	92	114	136	153	169
Riverine/Riparian Complex	-	32	75	136	198	284	391	487	578	653	720
Valley Oak Woodland	-	1	3	5	7	11	15	18	22	24	27
Oak Woodland	-	8	19	35	50	72	99	124	147	166	183
Rice managed as Grassland	-	5	12	23	33	47	65	81	96	109	120
Irrigated Pasture in Field Agricultural	-	-	-	-	-	-	-	-	-	-	-
Total Valley	**-**	**400**	**920**	**1,680**	**2,440**	**3,500**	**4,813**	**5,994**	**7,116**	**8,047**	**8,869**
FOOTHILLS COST SHARE											
Vernal Pool Complex	-	-	-	-	-	-	-	-	-	-	-
Grassland	-	1	2	3	4	6	7	8	9	10	11
Riverine/Riparian Complex	-	9	18	27	36	45	54	63	72	81	90
Valley Oak Woodland	-	2	3	5	6	8	9	11	12	14	15
Oak Woodland	-	143	284	422	559	691	819	949	1,080	1,214	1,350
Irrigated Pasture in Field Agricultural	-	-	-	-	-	-	-	-	-	-	-
Total Foothills	**-**	**155**	**308**	**456**	**605**	**749**	**888**	**1,030**	**1,172**	**1,318**	**1,466**

RICE LEASE REVENUE

Proportion of fee title rice managed as grassland	11%	Placer County placeholder was 50%; now function of restoration requirements and GGS management
Rice managed for Giant Garter Snake	2,000	Plan Objective GGS-1.1
Proportion of suitable land contributing lease revenue	90%	
Rice lease revenue (annual per acre)	$200	Placer County Agriculture Department, January 2017. No rice ground renting for under $200 per acre; realistic range is $250 - 300 per acre, with range depending on availability and price of water. Lower rents result in long-term committed farmers who take better care of the land; less turnover. Lower range of $200 per acre reflects likely lower yields on land PCA will acquire in fee title.

	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Suitable land farmed for rice (fee title only)											
Rice under management (fee title)	-	101	232	424	616	884	1,215	1,514	1,797	2,032	2,240
Subtract: Rice managed as Grassland	-	11	25	45	66	95	130	162	193	218	240
Subtract: Rice managed for giant garter snake	-	90	207	379	550	789	1,085	1,352	1,605	1,815	2,000
Net rice under management with rice lease generating revenue	-	-	-	-	-	-	-	-	-	-	-

Table 5: Monitoring, Research, and Scientific Review

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
Capital budget												
Shared capital purchases (vehicles, equipment, furniture)	3,630	49,849	8,664	27,996	19,328	56,562	22,682	28,091	16,729	56,063	15,862	**$305,454**
Capital subtotal	**$3,630**	**$49,849**	**$8,664**	**$27,996**	**$19,328**	**$56,562**	**$22,682**	**$28,091**	**$16,729**	**$56,063**	**$15,862**	**$305,454**
Operating budget												
Field and Technical Oversight - PCA staff	107,250	1,110,450	1,890,900	2,098,800	2,306,700	2,514,600	2,514,600	2,246,475	2,246,475	2,246,475	2,246,475	**$21,529,200**
Other shared operating overhead	4,549	21,058	42,416	69,359	96,209	131,937	174,129	212,325	249,034	280,899	308,971	**$1,590,887**
Natural Community Monitoring - VALLEY	-	456,469	730,974	1,016,434	1,311,881	1,601,700	1,899,536	2,206,444	2,493,172	2,777,079	3,058,051	**$17,551,742**
Natural Community Monitoring - FOOTHILLS	-	168,389	252,229	329,378	419,836	488,362	553,135	632,132	703,749	782,451	864,088	**$5,193,747**
Species Monitoring - VALLEY	-	348,396	474,774	604,417	728,744	861,093	995,453	1,124,766	1,254,560	1,381,206	1,506,397	**$9,279,807**
Species Monitoring - FOOTHILLS	-	128,522	163,825	195,863	233,217	262,549	289,870	322,238	354,125	389,160	425,650	**$2,765,018**
Research	-	135,500	67,750	67,750	-	-	-	-	-	-	-	**$271,000**
Science Advisors	-	135,000	135,000	135,000	135,000	135,000	135,000	135,000	135,000	135,000	135,000	**$1,350,000**
Operations subtotal	**$111,799**	**$2,503,784**	**$3,757,868**	**$4,517,001**	**$5,231,587**	**$5,995,241**	**$6,561,723**	**$6,879,380**	**$7,436,115**	**$7,992,270**	**$8,544,632**	**$59,531,401**
TOTAL	**$115,429**	**$2,553,633**	**$3,766,532**	**$4,544,997**	**$5,250,914**	**$6,051,803**	**$6,584,405**	**$6,907,471**	**$7,452,844**	**$8,048,333**	**$8,560,494**	**$59,836,855**

Assumptions:

Total cost for field and technical oversight staff and associated overhead allocated equally to restoration, reserve management, and monitoring.

33% Proportion of shared staff and overhead allocated to monitoring

Monitoring Program

Assumptions/Notes:

Costs to conduct biological monitoring to evaluate the effectiveness of the conservation strategy over time and to conduct targeted studies to inform adaptive management efforts.

PCA staff will conduct long-term landscape level monitoring, including updating GIS/aerials and analyzing status and trends at the landscape level at least every 5 years.

PCA staff will plan, coordinate, and report on the monitoring categories described below.

Contractors will conduct the field monitoring and data analysis.

Monitoring tasks consists of baseline ecological surveys, data analysis and reporting within 3 years of reserve site acquisition, followed by periodic status and trends surveys, data analysis, and reporting for the duration of the permit te

Natural community and species monitoring on restored lands is included in 2_RestoreNaturalCommunities.

Compliance (implementation monitoring) will be conducted by PCA staff and is accounted for in the program administration cost category.

Pre-construction surveys are assumed to occur prior to construction of covered activites on the reserve system, and costs are estimated as a component of those restoration and management costs.

Construction monitoring is assumed to occur periodically during construction of covered activities and conservation measures, and costs are estimated as a component of those restoration and management costs.

Monitoring Survey and Reporting Team

Senior Staff	1	@ 8 hours per day
Junior Staff	1	@ 8 hours per day
Senior Staff Billing Rate	$185	per hour
Junior Staff Billing Rate	$140	per hour
	$2,600	monitoring contract cost per day

Table 5: Monitoring, Research, and Scientific Review

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

Natural Community Monitoring (see community protect)	**Permit Period (years)**											
Community Type	**Start Up**	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
Vernal Pool Complex	$0	$392,392	$642,096	$891,800	$1,141,504	$1,391,208	$1,640,912	$1,890,616	$2,140,320	$2,390,024	$2,639,728	$15,160,600
Grassland	$0	$63,554	$118,409	$173,264	$228,119	$282,974	$337,828	$392,683	$447,538	$502,393	$557,248	$3,104,010
Aquatic/Wetland Complex	$0	$40,435	$46,114	$51,792	$57,470	$63,149	$68,827	$74,506	$80,184	$85,862	$91,541	$659,880
Riverine/Riparian Complex	$0	$45,588	$53,396	$61,204	$69,012	$76,820	$84,627	$92,435	$100,243	$108,051	$115,859	$807,235
Valley Oak Woodland	$0	$23,296	$19,032	$19,032	$42,328	$38,064	$38,064	$61,360	$57,096	$57,096	$57,096	$412,464
Oak Woodland	$0	$59,592	$104,156	$148,720	$193,284	$237,848	$282,412	$326,976	$371,540	$416,104	$460,668	$2,601,300
Rice /Any Other Agriculture (compliance monitoring only)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL	**$0**	**$624,858**	**$983,203**	**$1,345,812**	**$1,731,717**	**$2,090,062**	**$2,452,671**	**$2,838,576**	**$3,196,921**	**$3,559,530**	**$3,922,139**	**$22,745,489**

Species Monitoring (see species protect)	**Permit Period (years)**											
Species	**Start Up**	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
Swainson's Hawk	$0	$7,753	$10,468	$13,182	$15,896	$18,611	$21,325	$24,040	$26,754	$29,468	$32,183	$199,680
California Black Rail	$0	$8,029	$10,748	$13,468	$16,188	$18,907	$21,627	$24,346	$27,066	$29,786	$32,505	$202,670
Western Burrowing Owl	$0	$66,245	$92,032	$117,819	$143,606	$169,393	$195,179	$220,966	$246,753	$272,540	$298,327	$1,822,860
Tricolored Blackbird	$0	$19,947	$28,720	$37,492	$46,264	$55,037	$63,809	$72,582	$81,354	$90,126	$98,899	$594,230
Giant Garter Snake	$0	$116,116	$149,968	$183,820	$217,672	$251,524	$285,376	$319,228	$353,080	$386,932	$420,784	$2,684,500
Western Pond Turtle	$0	$28,974	$39,239	$49,504	$59,769	$70,034	$80,298	$90,563	$100,828	$111,093	$121,358	$751,660
Foothill Yellow-legged Frog	$0	$3,104	$4,204	$5,304	$6,404	$7,504	$8,603	$9,703	$10,803	$11,903	$13,003	$80,535
California Red-legged Frog	$0	$109,736	$148,351	$186,966	$225,581	$264,196	$302,812	$341,427	$380,042	$418,657	$457,272	$2,835,040
Valley Elderberry Long Horned Beetle	$0	$47,661	$62,551	$77,441	$92,331	$107,221	$122,112	$137,002	$151,892	$166,782	$181,672	$1,146,665
Vernal Pool Invertebrates	$0	$27,997	$36,462	$44,928	$53,394	$61,859	$70,325	$78,790	$87,256	$95,722	$104,187	$660,920
Steelhead and Chinook Salmon	$0	$41,356	$55,856	$70,356	$84,856	$99,356	$113,857	$128,357	$142,857	$157,357	$171,857	$1,066,065
TOTAL	**$0**	**$476,918**	**$638,599**	**$800,280**	**$961,961**	**$1,123,642**	**$1,285,323**	**$1,447,004**	**$1,608,685**	**$1,770,366**	**$1,932,047**	**$12,044,825**

Research

Assumptions/Notes:

The PCA will conduct research as needed and as funding permits to reduce levels of uncertainties related to achieving biological goals and objectives and to refine conceptual models.

Because these studies can be expensive and resource-intensive, a limited budget is proposed. Many studies will be jointly funded by grants. Studies will be implemented on an as-needed basis, when resources permit.

Studies may be conducted in partnership with outside scientists from academic institutions, consulting firms, and non-profit organizations.

Research studies are implemented over the first 15 years of the permit period.

imated total cost for targeted studies for protected lands/species	**$271,000**

Adaptive Management/Scientific Review

Assumptions/Notes:

Resource management and science advisors will periodically evaluate the effectiveness of existing and proposed management actions and make recommendations to the PCA.

Average annual cost for science advisors	**$27,000**
Number of members	**10**
Stipend per member per year	**$2,700**

Table 5a: Monitoring cost detail for community types

Data source: Table 5-5. Summary of Plan Area Effects and Conservation Strategy Commitments (acres)

			See comment	ADJUSTMENT FACTORS		50%	apply to riparian and valley oak woodland									
						25%	apply to oak woodland					33%				
Natural Community							**Invasive Species / /Community Function Monitoring**				**Grazing (Annual)**	**Data Synthesis, Analysis, and Annual Reporting**	**Days per Parcel, per year**			
Constituent Habitat	**Total Protection Commitment**	**Assumptions**	**Average Parcel Size (acres)**	**Total Parcels Acquired/ Surveyed**	**Number of parcels acquired every 5 year period**	**Start Up Time[1]**	**Year 1 (Days)**	**Year 2 (Days)**	**Year 3 (Days)**	**Every Five Years (Days)**		**Days per Site (per survey year)**	**Year 1**	**Year 2**	**Year 3**	**Every Five Years Thereafter**
Vernal Pool Complex	17,000	15% wetted acre density. Grazing management: One day early, one day late in the season, 200 acres per day. Surveys done every year. Intensive survey to map locations of invasive species in the first year, and then 50% each year for the next two years. And then survey the whole property every five years thereafter. One survey day per 100 acres for invasive species surveying. Three days to survey location of ground squirrel colonies and density of burrows; survey the entire area the first year and then 50% of the site the following two years. Survey the entire site for ground squirrels every five years thereafter. Two additional days a year for 1-2-3 Approach to wetland assessment.	600	28	2.8	2	11.0	6.5	6.5	11.0	6.0	3.3	**22.3**	**15.8**	**15.8**	**34.3**
Vernal Pool Type Wetlands	790															
Minimum Delineated as Vernal Pool	250															
Grassland	2,740	Grazing management: One day early, one day late in the season; 200 acres per day. Surveys done every year. Intensive survey to map locations of invasive species in the first year, and then 50% each year for the next two years. And then survey the whole property every five years thereafter. One survey day per 100 acres for invasive species monitoring. One day to survey location of ground squirrel colonies and density of ground; survey the entire area the first year and then 50% of the site the following two years. Survey the entire site for ground squirrels every five years thereafter.	200	14	1.4	1.5	3.0	1.5	1.5	3.0	2.0	1.3	**7.8**	**4.82**	**4.82**	**15.07**
Aquatic/Wetland Complex	600	Intensive survey to map locations of invasive species in the first year, and then 50% each year for the next two years. And then survey the whole property every five years thereafter. One survey day per 50 acres for invasive species monitoring. Two additional days per year for hydroperiod, vegetation percent cover, water quality, etc. monitoring associated with 1-2-3 assessment approach.	50	12	1.2	1	3	2.5	2.5	3.0	-	1.3	**5.3**	**3.8**	**3.8**	**1.8**
Minimum as Fresh Emergent Marsh	256															
Riverine/Riparian Complex	2,200	Intensive survey to map locations of invasive species in the first year, and then 50% each year for the next two years. And then survey the whole property every five years thereafter. One day per 50 acres for invasive species surveying. Three additional days per year for monitoring of water quality, sediment quality, % runs, riffles, pools, percent canopy cover, etc. (possible to inform targeted studies/restoration siting).	200	11	1.1	1.5	3.5	2.5	2.5	3.5	-	2.0	**7.0**	**4.5**	**4.5**	**2.7**
Minimum as Riparian Woodland	1,410															
Valley Oak Woodland	190	Grazing management: One day early, one day late in the season; 200 acres per day. Surveys done every year. Intensive survey to map locations of invasive species in the first year, and then 50% each year for the next two years. And then survey the whole property every five years thereafter. One survey day per 100 acres for invasive species monitoring.	100	2	na	1	0.5	0.25	0.25	0.5	1.0	1.3	**3.8**	**2.57**	**2.57**	**7.32**
Oak Woodland	10,110	Grazing management: One day early, one day late in the season; 250 acres per day. Surveys done every year. Intensive survey to map locations of invasive species in the first year, and then 50% each year for the next two years. And then survey the whole property every five years thereafter. One survey day per 100 acres for invasive species monitoring.	500	20	2.0	2	1.25	0.63	0.63	1.25	1.0	1.3	**5.6**	**2.95**	**2.95**	**8.57**
Rice	2,000	Crop type confirmation done at the time of species-specific surveys. Crop type/rotation tracked through compliance monitoring. No additional surveys needed. Included in program administration cost.	300	27	2.7	-	-	-	-	-	-	1.0	-	-	-	-
Any Agriculture	6,240															

1. Start up time includes time for survey methods design, GIS data acquisition and translation, site-specific history/research, data collection methods (datasheet, in-field GIS, etc.), database design and creation, coordinating access permission and with partner organizations, etc. Startup time presented here is assumed to be needed in the first year. Half this time is then needed for every five year survey.

Table 5b: Monitoring cost detail for species

Data source: Table 5-6 Covered Species' Protection and Restoration Commitments (acres)

See comment

							ADJUSTMENT FACTORS	50%	50%						33%				
									Invasive Species/ Community Function Monitoring						Data Synthesis, Analysis, and Annual Reporting	Days per Site, per year			
Species / Habitat Type (1)		**Habitat Protected**	**Natural Community and Constituent Habitat**	**Average Site Size (acres)**	**Number of Sites (TOTAL)**	**Sites added per 5 year period**	**Start Up Time[1] (Days)**	**Year 1 (Days)**	**Year 2 (Days)**	**Year 3 (Days)**	**Year 4* (Days)**	**Year 5* (Days)**	**Every Five Years (Days)**	**Days per Site (per survey year)**	**Year 1**	**Year 2**	**Year 3**	**Every Five Years Thereafter**
Swainson's Hawk																			
	Nesting Habitat	1,268	One nesting survey a year during optimal breeding time, assume four hours per site and four sites per day (assuming two people are at different sites). Average site size is 200 acres. Survey every year for three years, then every five years thereafter.	200	6	1	0.5	0.5	0.5	0.5	-	-	0.5	1.0	2.0	1.5	1.49	1.7
	Foraging	17,003	Surveys described under TCBB. Assume monitored at community level.																
California Black Rail																			
	Year-round Habitat	256	Three survey days per site, two weeks apart.	150	2	0.2	0.5	3.0	3.0	3.0	-	-	3.0	2.0	5.5	5.0	4.98	5.2
Western Burrowing Owl																			
	Overwintering Habitat	17,129	Two site surveys per day. All sites visited the first year then 50% of the sites in each of the following years; and then all sites surveyed every five years.	300	57	5.7	0.5	0.5	0.3	0.3	-	-	0.5	1.0	2.0	1.2	1.24	1.7
Tricolored Blackbird																			
	Nesting Habitat	187	Two survey days per site, two weeks apart.	25	7	0.7	1.0	2	2	2	-	-	3.0	1.3	4.3	3.3	3.32	4.8
	Foraging Habitat	18,138	One nesting survey per site, four hours. Assume monitored at community level.	200	-	-	0.5	0.5	0.5	0.5	-	-	0.5	1.3	2.3	1.8	1.82	2.1
Giant Garter Snake																			
	Aquatic Habitat	2,702	Trapping surveys to detect presence; assume 2 trap lines per site, 8 active trap days per line and two days for deployment and retrieval, 2 trap lines surveyed per day. One year of trapping at each site; 50% in the second year, and 50% in the third year and then every five years thereafter.	200	14	1.4	2.0	10.0	5.0	5.0	-	-	5.0	3.3	15.3	8.3	8.30	9.3
	Upland Habitat	1,763	Surveys for snakes described above.																
Western Pond Turtle																			
	Aquatic Habitat	2,800	Walking surveys at known/likely basking locations. Two sites surveyed per day.	100	28	2.8	0.5	0.5	0.5	0.5	-	-	0.5	0.7	1.7	1.2	1.16	1.4
	Upland Habitat	3,859	Surveys for turtle described above.																
Foothill Yellow-legged Frog																			
	Year-round Habitat	83	Adult, sub-adult, and egg mass walking surveys. One site per day.	25	3	0.3	0.5	0.5	0.5	0.5	-	-	0.5	0.7	1.7	1.2	1.16	1.4
California Red-legged Frog																			
	Aquatic Habitat	1,168	Visual daytime surveys and night surveys for eye shining and calling. So two days per site.	25	47	4.7	1.0	2	2	2	-	-	2	0.7	3.7	2.7	2.66	3.2
	Upland Habitat	12,484	Surveys on aquatic habitat only.																
Valley Elderberry Longhorn Beetle																			
	Year-round Habitat	2,313	Representative/rotating sample to assess health of shrub; survey for signs of beetle. Survey all shrubs the first year. And then 50% of the shrubs for the next two years. Every five years thereafter, randomly sampled subset. Assume a 25-acre site has 25 shrubs. Half hour per shrub for survey, mostly walking time from shrub to shrub.	100	23	2.3	1.0	2	1	1	-	-	1	1.0	4.0	2.0	1.99	2.5
Vernal Pool Invertebrates																			
	Wetland Habitat	790	Two branchiopod surveys per 100-acre site, each requiring 2 days (4 days total); all pools sampled the first year, 50% second year and 50% third year and then a subset sampled every five years thereafter.	100	8	0.8	1.5	4.0	2.0	2.0	2.0	2.0	2.0	1.3	6.8	3.3	3.32	4.1
	Vernal Pool Complex	17,000	Assume this is primarily grassland habitat. Surveys for aquatic habitat described above.																
Steelhead and Chinook salmon																			
		Spawning and juvenile rearing	Habitat quality monitoring described in natural community tab. Redd surveys, carcuss, and juvenile density baseline monitoring will be performed on protected and pre-restoration lands. All post-restoration/post-enhancement monitoring is described is "targeted studied" columns. Assume: Three days per year for spawning/redd surveys; three days a year for snorkel/electrofishing surveys.	200		1.1	1.5	3	3	3	-	-	3	1.3	5.8	4.3	4.32	5.1

*Added survey years four and five for vernal pool crustaceans per protocol described in Chapter 7.

Table 6: Environmental Compliance - Permitting

Valley schedule varies by period

2019 dollars cost variable

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Capital budget												
Office furniture	-	650	353	155	84	803	293	102	84	402	-	**$2,926**
Other equipment and technology	-	202	286	264	246	237	237	246	246	132	132	**$2,228**
Capital subtotal	**$0**	**$852**	**$638**	**$420**	**$330**	**$1,040**	**$530**	**$348**	**$330**	**$534**	**$132**	**$5,154**
Operating budget												
Staff salaries and benefits	-	710,000	1,420,000	1,420,000	1,420,000	1,420,000	1,420,000	1,420,000	1,420,000	710,000	710,000	**$12,070,000**
Office space	-	-	-	-	-	-	-	-	-	-	-	**$0**
Office equipment, technology, maintenanc	-	2,789	3,939	3,642	3,386	3,271	3,271	3,386	3,386	1,821	1,821	**$30,711**
Other reporting and permit fees	-	1,564,800	1,564,800	1,564,800	1,564,800	1,564,800	1,564,800	1,564,800	1,564,800	1,564,800	1,564,800	**$15,648,000**
Operations subtotal	-	**$2,277,589**	**$2,988,739**	**$2,988,442**	**$2,988,186**	**$2,988,071**	**$2,988,071**	**$2,988,186**	**$2,988,186**	**$2,276,621**	**$2,276,621**	**$27,748,711**
TOTAL	**$0**	**$2,278,441**	**$2,989,377**	**$2,988,861**	**$2,988,516**	**$2,989,111**	**$2,988,601**	**$2,988,534**	**$2,988,516**	**$2,277,154**	**$2,276,753**	**$27,753,865**

Assumptions/Notes:

Environmental compliance costs include costs to prepare notifications and reports as well as all necessary application and permitting fees.

Compliance costs are triggered by restoration projects and some projects related to land management.

PCA staff would be responsible for some environmental compliance costs, including managing the permitting process.

PCA staff will conduct cultural resource and archeological surveys and prepare NHPA Section 106 cultural resource reports.

PCA staff will prepare CEQA Categorical Exemptions, NEPA Categorical Exclusions, and Mitigated Negative Declarations.

Program staff	*Annual Salary, Benefit Cost & OH per FTE*	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Cultural Resources Compliance Manager	$284,000	-	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5
	annual cost	$0	$142,000	$284,000	$284,000	$284,000	$284,000	$284,000	$284,000	$284,000	$142,000	$142,000
	cost per period	$0	$710,000	$1,420,000	$1,420,000	$1,420,000	$1,420,000	$1,420,000	$1,420,000	$1,420,000	$710,000	$710,000

Office overhead allocation

Environmental Compliance Staff	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Office space cost	-	-	-	-	-	-	-	-	-	-	-
Office furniture per employee - capital	-	650	353	155	84	803	293	102	84	402	-
Office furniture and equipment per employee - operating	-	-	-	-	-	-	-	-	-	-	-
Other equipment, technology - capital	-	202	286	264	246	237	237	246	246	132	132
Other equipment, technology, supplies - operating	-	558	788	728	677	654	654	677	677	364	364
Subtotal Environmental Compliance Overhead (annual cost)	**$0**	**$1,410**	**$1,426**	**$1,148**	**$1,007**	**$1,694**	**$1,184**	**$1,025**	**$1,007**	**$898**	**$496**
Subtotal Environmental Overhead (period cost)	**$0**	**$7,049**	**$7,131**	**$5,740**	**$5,035**	**$8,471**	**$5,922**	**$5,126**	**$5,035**	**$4,489**	**$2,481**

Other costs are estimated on a per-project basis. For the purposes of this cost estimate, projects assumed to occur throughout the permit period; 10 percent in each 5-year period.

	Projects over permit term	Projects per period	Percent of projects by size/complexity
Small/Simple	90	9	**60%**
Medium/More complex	30	3	**20%**
Large/Most complex	30	3	**20%**
Total over permit term	**150**	**15**	**100%**

Cost per project to prepare permit notifications and reports by project size/complexity

	USACE Pre-Construction Notification, CWA 401 Water Quality Certification, and CDFG Streambed Alteration Notification	NEPA/CEQA	Other, Including NHPA	Total
Small/Simple	$10,900	$38,000	$10,900	$59,800
Medium/More complex	$27,100	$70,600	$10,900	$108,600
Large/Most complex	$59,700	$163,000	$10,900	$233,600

Assumptions/Notes:

Activities qualify for authorization under one of the following US Army Corps of Engineers Nationwide Permits:

NWP 27: Aquatic Habitat Restoration, Establishment, and Enhancement Activities

NWP 14: LInear Transportation Project (bridges and culverts for road crossings)

NWP 12: Utility Line activiites (pipelines, transmission towers, and associated structures)

The cost of conducting wetland delineations is not included under CWA 404/401 compliance. Those costs are included in land acquisition and restoration costs.

Table 7: Plan Administration

Valley schedule varies by period
2019 dollars — cost variable

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	TOTAL
Capital budget												
Office furniture	15,000	34,760	10,139	4,470	2,421	21,071	7,688	2,689	2,211	19,072	-	**$119,520**
Other equipment and technology	12,500	10,824	8,214	7,594	7,061	6,229	6,229	6,447	6,447	6,274	6,274	**$84,093**
Vehicles purchased	-	37,500	-	75,000	-	75,000	-	75,000	-	75,000	-	**$337,500**
Capital subtotal	**$27,500**	**$83,083**	**$18,353**	**$87,064**	**$9,482**	**$102,300**	**$13,917**	**$84,137**	**$8,658**	**$100,345**	**$6,274**	**$541,113**
Operating budget												
Staff salaries and benefits	2,419,500	7,585,500	7,847,500	7,847,500	7,847,500	7,055,000	7,055,000	7,055,000	7,055,000	6,437,500	6,437,500	**$74,642,500**
Office space	-	-	-	-	-	-	-	-	-	-	-	**$0**
Office equipment, technology, maintenance & supplies	34,464	29,842	22,648	20,939	19,469	17,174	17,174	17,776	17,776	17,297	17,297	**$231,857**
Vehicles fuel and maintenance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Travel	-	-	-	-	-	-	-	-	-	-	-	**$0**
Legal and financial assistance, annual audit	-	-	-	-	-	-	-	-	-	-	-	**$0**
Insurance	-	-	-	-	-	-	-	-	-	-	-	**$0**
Public safety	-	102,130	219,891	368,921	517,951	706,090	927,035	1,130,990	1,327,154	1,498,374	1,655,500	**$8,454,035**
State and Federal agency staff support	-	936,000	825,000	825,000	825,000	825,000	825,000	825,000	825,000	825,000	825,000	**$8,361,000**
Operations subtotal	**2,453,964**	**$8,653,472**	**$8,915,039**	**$9,062,360**	**$9,209,920**	**$8,603,264**	**$8,824,209**	**$9,028,766**	**$9,224,930**	**$8,778,171**	**$8,935,297**	**$91,689,392**
TOTAL	**$2,481,464**	**$8,736,556**	**$8,933,392**	**$9,149,424**	**$9,219,403**	**$8,705,564**	**$8,838,126**	**$9,112,903**	**$9,233,588**	**$8,878,516**	**$8,941,571**	**$92,230,506**

Office overhead allocation

Administrative		Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Office space cost		-	-	-	-	-	-	-	-	-	-	-
Office furniture per employee - capital		15,000	6,952	2,028	894	484	4,214	1,538	538	442	3,814	-
Office furniture and equipment per employee - operating		-	-	-	-	-	-	-	-	-	-	-
Other equipment, technology - capital		12,500	2,165	1,643	1,519	1,412	1,246	1,246	1,289	1,289	1,255	1,255
Other equipment, technology, supplies - operating		34,464	5,968	4,530	4,188	3,894	3,435	3,435	3,555	3,555	3,459	3,459
Subtotal Administrative Overhead (annual cost)		**$61,964**	**$15,085**	**$8,200**	**$6,601**	**$5,790**	**$8,895**	**$6,218**	**$5,383**	**$5,287**	**$8,528**	**$4,714**
Subtotal Administrative Overhead (period cost)		**$61,964**	**$75,426**	**$41,001**	**$33,003**	**$28,952**	**$44,474**	**$31,091**	**$26,913**	**$26,434**	**$42,642**	**$23,571**

Salary and Benefits for Employees (FTE) $55,000

Administrative staff	*Annual Salary, Benefit Cost & OH per FTE*	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Placer County Conservation Program Administrator	$429,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IT- Database / GIS Management	$260,000	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Budget Analyst	$261,000	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Acquisition Specialist	$317,000	-	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5
Grant Specialist/Conservation Planner	$247,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5
Public Outreach / Advocacy	$220,000	-	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Admin – Secretary	$131,000	-	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total FTE		**2.50**	**5.35**	**5.75**	**5.75**	**5.75**	**5.25**	**5.25**	**5.25**	**5.25**	**4.75**	**4.75**
Total annual cost		**$ 806,500**	**$ 1,517,100**	**$ 1,569,500**	**$ 1,569,500**	**$ 1,569,500**	**$ 1,411,000**	**$ 1,411,000**	**$ 1,411,000**	**$ 1,411,000**	**$ 1,287,500**	**$ 1,287,500**
Total period cost		**$ 2,419,500**	**$ 7,585,500**	**$ 7,847,500**	**$ 7,847,500**	**$ 7,847,500**	**$ 7,055,000**	**$ 7,055,000**	**$ 7,055,000**	**$ 7,055,000**	**$ 6,437,500**	**$ 6,437,500**

Vehicles for Plan Administration

FOR CAPITAL BUDGET	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50
Passenger vehicle - purchased per period	-	1	-	2	-	2	-	2	-	2	-
Passenger vehicle - retired per period	-	-	-	1	-	2	-	2	-	2	-
Passenger vehicle - total per year per period	-	1	1	2	2	2	2	2	2	2	2
Acquisition cost, per period	**$0**	**$37,500**	**$0**	**$75,000**	**$0**	**$75,000**	**$0**	**$75,000**	**$0**	**$75,000**	**$0**
Maintenance and fuel, per year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance and fuel, per period	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Assumptions:

Vehicle insurance included in program administration insurance cost factor.

$37,500	Vehicles (Administrative); based on 4WD pick-up truck for Agricultural Commission in 2019-2020 budget
$0.00	Fuel, cost included in County overhead cost factor
8,000	Miles per year-vehicles and utility trucks (40 miles/day at 200 days travel within the 260 working days/year)
$0	maintenance, per passenger vehicle, included in County overhead cost factor

Table 7: Plan Administration

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

Travel - Costs included in County overhead cost factor

	Miles or Days	Cost per Year
Administrative staff (vehicle/mileage allowance)	-	**$0**
Days of overnight travel - Executive Director	-	**$0**
Total annual cost		**$0**

Assumptions:

$0.580	cost per mile
$206	per diem, 2019/20
3	per diem multiplier for executive director to cover additional costs such as air fare

Legal and Financial Analysis Assistance, Annual Financial Audit, per Govt Code	Period	0	1	2	3	4	5	6	7	8	9	10
	Cost per hour/period/year	**Start Up**	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**
Legal Assistance (hours per year)	$380	0	0	0	0	0	0	0	0	0	0	0
Legal Assistance cost per period		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Financial analysis assistance, per period	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual financial audit	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total cost per period		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Assumptions:

These costs are included in the County overhead cost factor.

Cost of outside legal counsel or cost of in-house counsel included in county overhead cost factor.

Legal assistance includes cost of legal services required under program administration and land acquisition cost categories.

Financial analyst's review will occur periodically over the course of the plan, at a minimum once every 5 years.

The financial analysis assistance category covers the periodic assistance of a financial analyst to review the program's cost/revenue balance and ensure that charges are adjusted in line with changing land costs and ensure compliance with state requirements on collection of development impact fees.

An annual financial audit of the PCA financial statements by an independent auditor is required by Government Code.

Program Insurance - Costs included in County overhead cost factor

	Cost per year
Directors and officers	**$0**
General liability, including automobile insurance	**$0**
Professional liability	**$0**
Total annual cost	**$0**

In-Lieu Funding for Law Enforcement and Fire Fighting

	Cost per acre per year
Total annual cost per acre	**$7.00**

Assumptions:

Law enforcement per reserve acre	**$4.30**
Fire fighting funding per reserve acre	**$2.70**

Based on Contra Costa Water District in lieu payments for law enforcement and fire fighting on 20,000 acres of land managed.

State and Federal Agency Staff Support

	Cost per year
Total annual cost, years 1 - 3	**$202,000**
Total annual cost, years 4 - 50	**$165,000**

Assumptions:

The PCA will fund staff positions at state and federal agencies to assist with implementation.

Annual cost to support CDFW staff position, years 1-3	$122,000	Annual cost for 0.5 FTE Senior Environmental Scientist Specialist, includes overhead and benefits
Annual cost to support CDFW staff position, years 4 - 50	$85,000	Annual cost for 0.5 FTE Environmental Scientist Specialist, including overhead and benefits
Annual cost to support ACOE staff position	$80,000	

Table 8: Contingency Fund (not including restoration construction contingency)

Valley schedule varies by period

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)											
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**
Land acquisition capital budget	$360,000	$26,645,484	$31,742,392	$41,938,701	$41,938,701	$54,691,219	$65,388,770	$59,848,653	$57,307,955	$49,174,371	$44,578,705	**$473,614,950**
Land acquisition contingency	$0	$1,332,274	$1,587,120	$2,096,935	$2,096,935	$2,734,561	$3,269,438	$2,992,433	$2,865,398	$2,458,719	$2,228,935	**$23,662,748**
Restoration capital budget (incl contingency)	$14,810	$13,869,590	$16,306,576	$21,140,271	$21,183,564	$27,241,645	$32,251,930	$29,671,129	$28,501,833	$24,761,235	$22,595,269	**$237,537,852**
All other program budget items	$2,838,932	$21,119,114	$25,495,462	$29,584,161	$31,678,670	$35,015,285	$38,930,481	$40,081,518	$43,084,493	$43,369,036	$45,145,850	**$356,343,003**
General operating contingency	$85,168	$633,573	$764,864	$887,525	$950,360	$1,050,459	$1,167,914	$1,202,446	$1,292,535	$1,301,071	$1,354,375	**$10,690,290**
Total contingency, except restoration	**$85,168**	**$1,965,848**	**$2,351,983**	**$2,984,460**	**$3,047,295**	**$3,785,019**	**$4,437,353**	**$4,194,878**	**$4,157,933**	**$3,759,790**	**$3,583,311**	**$34,353,038**

Assumptions/Notes

Land acquisition contingency	5%	percent of acquisition capital costs (land and site improvements) needed for acquisition contingency fund
Operating budget contingency	3%	percent of total program budget, exclusive of acquisition capital budget and restoration budget, needed for contingency fund

TABLE 9-3

Post-Permit Implementation Budget (2019 dollars)

Cost Category	Annual Costs	Assumptions
TOTAL BUDGET		
Establish Reserve System	**$0**	
Restore, Manage & Monitor Natural Communities	**$0**	
Reserve Management/Enhancement	**$2,153,835**	
Monitoring, Research, and Scientific Review	**$652,765**	
Environmental Compliance	**$0**	
Plan Administration	**$875,150**	
Contingency Fund	**$0**	
Total	**$3,681,751**	
CAPITAL BUDGET		
Establish Reserve System	**$0**	Acquisition complete during permit term
Restore Natural Communities	**$0**	Restoration projects constructed during permit term [a]
Reserve Management/Enhancement	**$77,256**	Replacement period doubled
Monitoring, Research, and Scientific Review	**$7,204**	Replacement period doubled
Environmental Compliance	**$0**	
Plan Administration	**$3,069**	Replacement period doubled
Contingency, Land Acquisition and Site Improvemer	**$0**	Not required, post permit
Total	**$87,530**	
OPERATING BUDGET		
Establish Reserve System	**$0**	Acquisition complete during permit term
Restore, Manage & Monitor Natural Communities	**$0**	Restoration complete during permit term
Reserve Management/Enhancement	**$2,076,579**	Reduced staffing; Reserve planning at 50% of annual cost in year 50; 75% of permit-term management assumed; see Cost Model for detail
Monitoring, Research, and Scientific Review	**$645,561**	One-third of long-term monitoring contractor cost in year 50; no change to long-term monitoring on restored wetlands; other obligations reduced
Environmental Compliance	**$0**	Not required, post permit
Plan Administration	**$872,081**	Reduced staffing plus 100% of per employee cost
Operating Contingency Fund	**$0**	Not required, post permit
Total	**$3,594,221**	

Average annual cost per reserve acre:	**$78**
Percent of average annual cost years 45 -50:	**16%**

Notes:

[a] Funds for remediation of restoration projects (construction completed by year 40) would be available after the permit term, if needed.

Table 9a: Post-Permit Reserve Management and Enhancement on protected and restored lands

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

	Post-Permit: Annual	Annual Average Cost Years 46 - 50
Capital budget		
Shared capital purchases (vehicles, equipment, furniture)	7,204	3,172
Field facilities	18,100	-
Fish Barrier Removal/Modification - VALLEY	-	57,540
Fish Barrier Removal/Modification - FOOTHILLS	-	36,920
Water supply for grazing - VALLEY	43,836	87,672
Water supply for grazing - FOOTHILLS	8,116	16,232
Remedial measures	-	342,159
Capital subtotal	**$77,256**	**$543,696**
Operating budget		
Field and Technical Oversight (staff)	275,000	449,295
Other shared operating overhead	92,323	61,794
Agricultural advisory services	-	54,300
Field facilities maintenance and utilities	24,525	32,700
Management equipment/tools	23,414	31,218
Reserve management plans	4,340	8,680
Reserve management activities - VALLEY		
Reserve enhancement activities, except in-channel	-	85,673
In-channel enhancement activities	-	79,785
General reserve and site management	197,396	263,195
Wetland and pond maintenance and protection	62,233	82,977
Nonnative animal species control	19,921	26,561
Water supply for rice (cost of water assigned to PCA)	209,802	209,802
Vegetation and fuels management (initial and maintenance)	907,296	1,209,728
Vegetation and fuels management contingency	90,730	na
Subtotal - VALLEY RESERVE MANAGEMENT	*$1,487,378*	*$1,957,721*
Reserve management activities - FOOTHILLS		
Reserve enhancement activities, except in-channel	-	58,684
In-channel enhancement activities	-	44,199
General reserve and site management	30,978	41,305
Wetland and pond maintenance and protection	18,186	24,248
Nonnative animal species control	3,126	4,168
Vegetation and fuels management (initial and maintenance)	106,645	142,194
Vegetation and fuels management contingency	10,665	na
Subtotal - FOOTHILLS RESERVE MANAGEMENT	*$169,600*	*$314,797*
Operations subtotal	**$2,076,579**	**$2,910,505**
TOTAL	**$2,153,835**	**$3,454,200**
Reserve management allocation to Valley, based on cost	*90%*	
Reserve management allocation to Foothills, based on cost	*10%*	

Assumptions:

Total cost for field and technical oversight staff and associated overhead allocated equally to management and monitoring, post-permit term

In addition to oversight of management and monitoring contractors, these staff monitor conservation easements and manage/monitor activities on PCA land leased for grazing.

50%	Proportion of shared staff and overhead allocated to reserve management, post permit term
$18,100	assume twice as long before replacement; i.e., every 30 years instead of every 15 years
0%	Percentage of annual costs for remedial measures, fish barrier removal, and other enhancements that continue post permit term
50%	Percentage of annual capital costs for water supply for grazing that continue post-permit term
0%	Percentage of annual costs for agricultural advisory services that continue post-permit term
50%	Percentage of annual costs for reserve planning that continue post-permit term
100%	Percentage of annual costs for water supply for rice production that continue post-permit term
75%	Percentage of annual costs for all other reserve management activities that continue post-permit term
10%	Post-permit contingency to cover potential incentive payments to ensure on-going grazing for vegetation management

Table 9b: Post-Permit Monitoring, Research, and Scientific Review on protected and restored lands

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

	Post-Permit: Annual	Annual Average Cost Years 46 - 50	
Capital budget			
Shared capital purchases (vehicles, equipment, furniture)	7,204	3,172	
Capital subtotal	**$7,204**	**$3,172**	
Operating budget			
Field and Technical Oversight - staff	275,000	449,295	
Other shared operating overhead	92,323	61,794	
Natural Community Monitoring - VALLEY Protected Lands	-	611,610	
Natural Community Monitoring - FOOTHILLS Protected Lands	-	172,818	
Natural Community Monitoring - Restored Wetlands	62,960	62,960	*Aquatic Wetland Complex and Riverine/Riparian Complex*
Natural Community Monitoring - All Other Restored Lands	-	210,711	
Species Monitoring - VALLEY Protected Lands	75,320	301,279	
Species Monitoring - FOOTHILLS Protected Lands	21,282	85,130	
Species Monitoring - VALLEY Restored Lands	94,712	378,849	
Species Monitoring - FOOTHILLS Restored Lands	23,964	95,854	
Targeted Studies	$0	-	
Science Advisors	$0	27,000	
Operations subtotal	**$645,561**	**$2,430,301**	
TOTAL	**$652,765**	**$2,433,473**	

Assumptions:

Total cost for field and technical oversight staff and associated overhead allocated equally to management and monitoring, post-permit

50%	Proportion of shared staff and overhead allocated to monitoring
100%	percentage of natural community monitoring cost on restored wetlands that continues post-permit
0%	percentage of other natural community monitoring cost that continues post-permit
25%	percentage of species monitoring cost that continues post-permit

Table 9c: Post-Permit Plan Administration

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

	Post-Permit: Annual
Capital budget	
Office furniture	261
Other equipment and technology	583
Vehicles purchased	2,225
Capital subtotal	**$3,069**
Operating budget	
Staff salaries and benefits	536,753
Office space	-
Office equipment, technology, maintenance & supplies	1,608
Vehicles fuel and maintenance	-
Travel	-
Insurance	-
Public safety	333,720
State and Federal agency staff support	-
Operations subtotal	**872,081**
TOTAL	**$875,150**

49% of annual average plan adminstration cost in years 45 - 50

Office overhead allocation

Administrative	Post Permit: Annual	Post-permit adjustment: percentage of annual costs in year 50 that continue in perpetuity
Office space cost	-	
Office furniture per employee - capital	261	assume twice as long before replacement
Office furniture and equipment per employee - operating	-	100%
Other equipment, technology - capital	583	50%
Other equipment, technology, supplies - operating	1,608	50%
Subtotal Administrative Overhead (annual cost)	**$2,453**	

Salary and Benefits for Employees (FTE)

Administrative staff	*Annual Salary, Benefit Cost & OH per FTE*	Post-Permit
Placer County Conservation Program Administrator	$465,656	1.0
IT- Database / GIS Management	$282,216	-
Budget Analyst	$283,301	-
Acquisition Specialist	$344,086	-
Conservation Planner/Grant Specialist	$268,105	-
Public Outreach / Advocacy	$238,798	-
Admin – Secretary	$142,193	0.5
Total FTE		**1.5**
Total annual cost		**$ 536,753**

Table 9c: Post-Permit Plan Administration

2019 dollars **cost variable**

Detail may not add to total due to rounding at various stages of the calculations.

Vehicles for Plan Administration

FOR CAPITAL BUDGET	Post Permit: Annual
Passenger vehicle - purchased every 10 years	1
Acquisition cost, annualized	$2,225
Maintenance and fuel, per year	$0

Assumptions:

Vehicle insurance included in program administration insurance cost factor.

Vehicle cost includes vehicles and utility trucks and fuel, insurance, and maintenance cost per year per vehicle

$22,252	Vehicles (Administrative)
$0.000	Fuel, cost included in County overhead cost factor
8,000	Miles per year-vehicles and utility trucks (40 miles/day at 200 days travel within the 260 working days/year)
$0	maintenance, per passenger vehicle, included in County overhead cost factor

Travel - Costs included in County overhead cost factor

	Miles or Days	Cost per Year
Administrative staff (vehicle/mileage allowance)	-	$0
Days of overnight travel - Executive Director	-	$0
Total annual cost		$0

Assumptions: 50% Post-permit adjustment: percentage of annual costs in year 50 that continue in perpetuity

$0.580	cost per mile
$182	per diem
3	per diem multiplier for executive director to cover additional costs such as air fare

Insurance - Costs included in County overhead cost factor

	Cost per year
Directors and officers	$0
General liability, including automobile insurance	$0
Professional liability	$0
Total annual cost	$0

100%	Post-permit adjustment for auto, general liability, and professional liability insurance: percentage of annual costs in year 50 that continue in perpetuity
0%	Post-permit adjustment for directors' and officers' insurance: percentage of annual costs in year 50 that continue in perpetuity

In-Lieu Funding for Law Enforcement and Fire Fighting

	Cost per acre per year
Total annual cost per acre	$7.06
	100% Post-permit adjustment: percentage of annual costs in year 50 that continue in perpetuity
Reserve Acres Managed at permit term	47,300

Assumptions:

Law enforcement per reserve acres	$4.34
Fire fighting funding per reserve acres	$2.71

Based on CCWD in lieu payments for law enforcement and fire fighting on 20,000 acres of land managed.

State and Federal Agency Staff Support

	Cost per year
Total annual cost, years 1 - 3	$124,826
Total annual cost, years 4 - 50	$65,000
	0% Post-permit adjustment: percentage of annual costs in year 50 that continue in perpetuity

Assumptions:

The PCA will fund staff positions at state and federal agencies to assist with implementation

Annual cost to support CDFW staff position, years 1-3	$124,826
Annual cost to support CDFW staff position, years 4 - 50	$65,000
Annual cost to support ACOE staff position	$81,408

Table 10a: Staffing Plan

Valley schedule varies by period

2019 dollars cost variable

Full-Time Equivalent (FTE) Staffing	Permit Period (years)											
Plan Administration	**Start Up**	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**POST PERMIT**
Placer County Conservation Program Administrator	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IT- Database / GIS Management (GIS Analyst II)	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
Budget Analyst (Senior ASO)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Acquisition Specialist (Property Manager)	-	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	-
Conservation Planner/Grant Specialist (Senior Planner)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	-
Public Outreach / Advocacy	-	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-
Admin – Secretary (Admin Secretary)	-	0.60	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.50
Total Plan Administration Staff (FTE)	**2.5**	**5.35**	**5.75**	**5.75**	**5.75**	**5.25**	**5.25**	**5.25**	**5.25**	**4.75**	**4.75**	**1.50**
Field and Technical												
Senior Scientist	-	0.30	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Reserve/Project Manager (Project Manager)	-	0.30	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5
Wetland Biologist (Senior Planner)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	-
Technical Staff (Senior Technician)	-	0.60	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
Reserve Maintenance Staff (Parks & Grounds Worker)	-	0.60	2.0	3.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	2.0
Total Field and Technical Staff (FTE)	**1.0**	**2.80**	**5.5**	**6.5**	**7.5**	**8.5**	**8.5**	**8.0**	**8.0**	**8.0**	**8.0**	**3.0**
Environmental Compliance												
Cultural Resources Compliance Manager (Environmental Coordinat	-	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	-
Total Environmental Compliance Staff (FTE)	**0.0**	**0.5**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**0.5**	**0.5**	**0.0**
GRAND TOTAL STAFF (FTE)	**3.5**	**8.65**	**12.25**	**13.25**	**14.25**	**14.75**	**14.75**	**14.25**	**14.25**	**13.25**	**13.25**	**4.50**

Assumptions/Notes:

Start-up staffing and phase-in of staff during years 1 - 5 provided by Gregg McKenzie, January 3, 2019. FTE value for years 1 - 5 reflects weighted average FTE staffing for the full five-year period. Some positions are only filled in years 3 - 5.

Field and Technical staff costs are allocated equally across three categories: Restoration, Reserve management, and Monitoring.

Cultural Resouces Compliance Manager staff allocated to the Environmental Compliance category.

All other staff allocated to Plan Administration.

Table 10b: Shared Field and Technical Staff and Overhead

Valley schedule varies by period
2019 dollars — cost variable
Detail may not add to total due to rounding at various stages of the calculations.

	Permit Period (years)												
	Start Up	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**TOTAL**	POST PERMIT: Annual
Capital budget													
Office furniture	6,000	18,192	9,698	5,053	3,158	34,115	12,447	4,098	3,368	32,121	-	**$128,251**	522
Other equipment and technology	5,000	5,665	7,857	8,585	9,211	10,085	10,085	9,825	9,825	10,566	10,566	**$97,268**	1,167
Vehicles purchased	-	127,200	8,700	71,200	46,200	127,200	46,200	71,200	37,500	127,200	37,500	**$700,100**	12,720
Capital subtotal	**$11,000**	**$151,057**	**$26,255**	**$84,838**	**$58,568**	**$171,400**	**$68,732**	**$85,123**	**$50,693**	**$169,887**	**$48,066**	**$925,619**	**$14,408**
Operating budget													
Staff salaries and benefits	325,000	3,365,000	5,730,000	6,360,000	6,990,000	7,620,000	7,620,000	6,807,500	6,807,500	6,807,500	6,807,500	**$65,240,000**	550,000
Office space	-	-	-	-	-	-	-	-	-	-	-	**$0**	-
Office equipment, technology, maintenance & suppli	13,786	15,618	21,663	23,670	25,395	27,805	27,805	27,088	27,088	29,132	29,132	**$268,182**	3,217
Vehicles fuel and maintenance	-	-	-	-	-	-	-	-	-	-	-	**$0**	-
Leased vehicles and equipment	-	48,195	106,869	186,508	266,146	372,005	499,859	616,323	727,562	822,078	907,145	**$4,552,688**	181,429
Travel	-	-	-	-	-	-	-	-	-	-	-	**$0**	-
Operations subtotal	**$338,786**	**$3,428,813**	**$5,858,532**	**$6,570,177**	**$7,281,541**	**$8,019,810**	**$8,147,664**	**$7,450,910**	**$7,562,150**	**$7,658,710**	**$7,743,777**	**$70,060,870**	**$734,646**
TOTAL	**$349,786**	**$3,579,870**	**$5,884,787**	**$6,655,015**	**$7,340,109**	**$8,191,210**	**$8,216,397**	**$7,536,033**	**$7,612,842**	**$7,828,597**	**$7,791,843**	**$70,986,489**	

Salary and Benefits for Full Time Equivalent (FTE) Staffing

Field and Technical	*Annual Salary, Benefit Cost & OH per FTE*	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	POST PERMIT: Annual
Senior Scientist	**$366,000**	-	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Reserve/Project Manager	**$230,000**	-	0.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5
Wetland Biologist	**$325,000**	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	-
Technical Staff	**$156,000**	-	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
Reserve Maintenance Staff	**$126,000**	-	0.6	2.0	3.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	2.0
Total staff (FTE)		**1.0**	**2.8**	**5.5**	**6.5**	**7.5**	**8.5**	**8.5**	**8.0**	**8.0**	**8.0**	**8.0**	**3.0**
Total annual cost		**$ 325,000**	**$ 673,000**	**$ 1,146,000**	**$ 1,272,000**	**$ 1,398,000**	**$ 1,524,000**	**$ 1,524,000**	**$ 1,361,500**	**$ 1,361,500**	**$ 1,361,500**	**$ 1,361,500**	**$ 550,000**
Total period cost		**$ 325,000**	**$ 3,365,000**	**$ 5,730,000**	**$ 6,360,000**	**$ 6,990,000**	**$ 7,620,000**	**$ 7,620,000**	**$ 6,807,500**	**$ 6,807,500**	**$ 6,807,500**	**$ 6,807,500**	

Office overhead allocation

Field and Technical	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	POST PERMIT: Annual
Office space cost	-	-	-	-	-	-	-	-	-	-	-	-
Office furniture per employee - capital	6,000	3,638	1,940	1,011	632	6,823	2,489	820	674	6,424	-	522
Office furniture and equipment per employee - operating	-	-	-	-	-	-	-	-	-	-	-	-
Other equipment, technology - capital	5,000	1,133	1,571	1,717	1,842	2,017	2,017	1,965	1,965	2,113	2,113	1,167
Other equipment, technology, supplies - operating	13,786	3,124	4,333	4,734	5,079	5,561	5,561	5,418	5,418	5,826	5,826	3,217
Subtotal Field & Technical Overhead (annual cost)	**$24,786**	**$7,895**	**$7,844**	**$7,462**	**$7,553**	**$14,401**	**$10,067**	**$8,202**	**$8,056**	**$14,364**	**$7,940**	**$4,905**
Subtotal Field & Technical Overhead (period cost)	**$24,786**	**$39,475**	**$39,218**	**$37,308**	**$37,763**	**$72,005**	**$50,337**	**$41,011**	**$40,281**	**$71,819**	**$39,698**	

Travel - Costs included in County overhead cost factor

	Miles or Days	Cost per Year
Days of overnight travel - Senior Scientist	-	**$0**
Days of overnight travel - Reserve Manager	-	**$0**

Assumptions:

$206 per diem

50% Post-permit adjustment: percentage of annual costs in year 50 that continue in perpetuity

Table 10b: Shared Field and Technical Staff and Overhead

Valley schedule varies by period

2019 dollars — cost variable

Detail may not add to total due to rounding at various stages of the calculations.

Vehicles and Equipment for Field and Technical Staff

		Permit Period (years)											
FOR CAPITAL BUDGET		Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	Post Permit, per 10 year period
Passenger vehicle - purchased per period		-	1	-	1	-	1	-	1	-	1	-	1
Passenger vehicle - retired per period		-	-	-	1	-	1	-	1	-	1	-	
Passenger vehicle - total per year per period		-	1	1	1	1	1	1	1	1	1	1	1
4WD pick up truck - purchased per period		-	1	-	1	1	1	1	1	1	1	1	1
4WD pick up truck - retired per period		-	-	-	1	-	1	1	1	1	1	1	
4WD pick up truck - total per year per period		-	1	1	1	2	2	2	2	2	2	2	1
ATVS and trailers - purchased per period		-	1	1	1	1	1	1	1	-	1	-	1
ATVS and trailers - retired per period		-	-		1	1	1	1	1	1	1	-	
ATVS and trailers - total per year per period		-	1	2	2	2	2	2	2	1	1	1	1
Portable generator - purchased per period		-	1	-	-	-	1	-	-	-	1	-	1
Portable generator - retired per period		-	-	-	-	-	1	-	-	-	1	-	
Portable generator - total per year per period		-	1	1	1	1	1	1	1	1	1	1	1
Acquisition cost, per period		$0	$127,200	$8,700	$71,200	$46,200	$127,200	$46,200	$71,200	$37,500	$127,200	$37,500	$12,720
Maintenance and fuel, per year		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance and fuel, per period		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Leased vehicles and equipment annual cost		$0	$9,639	$21,374	$37,302	$53,229	$74,401	$99,972	$123,265	$145,512	$164,416	$181,429	$181,429
Leased vehicles and equipment per period cost		$0	$48,195	$106,869	$186,508	$266,146	$372,005	$499,859	$616,323	$727,562	$822,078	$907,145	

Assumptions:

Vehicle insurance included in plan administration insurance cost factor.

Vehicle cost includes vehicles and fuel, insurance, and maintenance cost per year per vehicle

Cost of 4WD truck includes vehicle, fire pumper, chain saw, sprayer, and small tool set.

$25,000	Passenger vehicles (Field & Technical)
$37,500	4 WD Pickup Truck
$8,700	ATVs and trailers
$56,000	Portable generator
$0.00	Fuel, included in County overhead cost factor
8,000	Miles per year-vehicles and utility trucks (40 miles/day at 200 days travel within the 260 working days/year)
4,000	Miles per year - ATVs (20 miles/day at 200 days travel within the 260 working days/year)
$0	annual maintenance, per passenger vehicle, included in County overhead cost factor
$0	annual maintenance, per 4WD pickup, included in County overhead cost factor
$0	annual maintenance, per ATV/trailer, included in County overhead cost factor

Leased vehicles and equipment, used on land held in fee title for active management	Average days of use per 1,000 acres per year	Rental Cost per Day	Rental Cost per Year per 1,000 ac.
Tractor	8	$270	$2,160
Small Tractor	8	$160	$1,280
Dump Truck	5	$330	$1,650
Fire Truck	5	$220	$1,100
			$6,190
			100% Post-permit adjustment: percentage of cost that continues beyond permit term

Shared staff allocations	Permit Term	Post Permit
Restoration	33%	0%
Management	33%	50%
Monitoring	33%	50%

Table 10c: Overhead Costs Allocated per Staffing Plan (Full-Time Equivalent)

Valley schedule varies by period

2019 dollars

cost variable

Detail may not add to total due to rounding at various stages of the calculations.

		Permit Period (years)											
Office overhead allocation		**Start Up**	**1 - 5**	**6 - 10**	**11 -15**	**16 - 20**	**21 -25**	**26 - 30**	**31 -35**	**36 - 40**	**41 - 45**	**46 - 50**	**POST PERMIT: Annual**
Administrative													
Office space cost		-	-	-	-	-	-	-	-	-	-	-	-
Office furniture per employee - capital		15,000	6,952	2,028	894	484	4,214	1,538	538	442	3,814	-	261
Office furniture and equipment per employee - operating		-	-	-	-	-	-	-	-	-	-	-	-
Other equipment, technology - capital		12,500	2,165	1,643	1,519	1,412	1,246	1,246	1,289	1,289	1,255	1,255	583
Other equipment, technology, supplies - operating		34,464	5,968	4,530	4,188	3,894	3,435	3,435	3,555	3,555	3,459	3,459	1,608
Subtotal Administrative Overhead (annual cost)		**$61,964**	**$15,085**	**$8,200**	**$6,601**	**$5,790**	**$8,895**	**$6,218**	**$5,383**	**$5,287**	**$8,528**	**$4,714**	**$2,453**
Subtotal Administrative Overhead (period cost)		**$61,964**	**$75,426**	**$41,001**	**$33,003**	**$28,952**	**$44,474**	**$31,091**	**$26,913**	**$26,434**	**$42,642**	**$23,571**	
Field and Technical													
Office space cost		-	-	-	-	-	-	-	-	-	-	-	-
Office furniture per employee - capital		6,000	3,638	1,940	1,011	632	6,823	2,489	820	674	6,424	-	522
Office furniture and equipment per employee - operating		-	-	-	-	-	-	-	-	-	-	-	-
Other equipment, technology - capital		5,000	1,133	1,571	1,717	1,842	2,017	2,017	1,965	1,965	2,113	2,113	1,167
Other equipment, technology, supplies - operating		13,786	3,124	4,333	4,734	5,079	5,561	5,561	5,418	5,418	5,826	5,826	3,217
Subtotal Field & Technical Overhead (annual cost)		**$ 24,786**	**$ 7,895**	**$ 7,844**	**$ 7,462**	**$ 7,553**	**$ 14,401**	**$ 10,067**	**$ 8,202**	**$ 8,056**	**$ 14,364**	**$ 7,940**	**$ 4,905**
Subtotal Field & Technical Overhead (period cost)		**$24,786**	**$39,475**	**$39,218**	**$37,308**	**$37,763**	**$72,005**	**$50,337**	**$41,011**	**$40,281**	**$71,819**	**$39,698**	
Environmental Compliance													
Office space cost		-	-	-	-	-	-	-	-	-	-	-	-
Office furniture per employee - capital		-	650	353	155	84	803	293	102	84	402	-	-
Office furniture and equipment per employee - operating		-	-	-	-	-	-	-	-	-	-	-	-
Other equipment, technology - capital		-	202	286	264	246	237	237	246	246	132	132	-
Other equipment, technology, supplies - operating		-	558	788	728	677	654	654	677	677	364	364	-
Subtotal Environmental Compliance Overhead (annual cost)		**$ -**	**$ 1,410**	**$ 1,426**	**$ 1,148**	**$ 1,007**	**$ 1,694**	**$ 1,184**	**$ 1,025**	**$ 1,007**	**$ 898**	**$ 496**	**$ -**
Subtotal Environmental Compliance Overhead (period cost)		**$0**	**$7,049**	**$7,131**	**$5,740**	**$5,035**	**$8,471**	**$5,922**	**$5,126**	**$5,035**	**$4,489**	**$2,481**	

Assumptions/Notes:

Field and technical staff and overhead allocated equally to reserve management, restoration, and monitoring (1/3 to each cost category). **See Shared Staff and Overhead**

Salary and Benefits per Full-Time Equivalent (FTE) Staff

Plan Administration	*Annual Salary, Benefit and OH Cost per FTE*	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	POST PERMIT: Annual
Executive Director (Assistant Director CDRA)	$429,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IT- Database / GIS Management (GIS Analyst II)	$260,000	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
Budget Analyst (Senior ASO)	$261,000	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Acquisition Specialist (Property Manager)	$317,000	-	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	-
Conservation Planner/Grant Specialist (Senior Planner)	$247,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	-
Public Outreach / Advocacy	$220,000	-	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-
Admin – Secretary (Admin Secretary)	$131,000	-	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5
Total staff (FTE)		**2.50**	**5.35**	**5.75**	**5.75**	**5.75**	**5.25**	**5.25**	**5.25**	**5.25**	**4.75**	**4.75**	**1.50**
Total annual cost		**$806,500**	**$1,517,100**	**$1,569,500**	**$1,569,500**	**$1,569,500**	**$1,411,000**	**$1,411,000**	**$1,411,000**	**$1,411,000**	**$1,287,500**	**$1,287,500**	**$494,500**
Total period cost		**$806,500**	**$7,585,500**	**$7,847,500**	**$7,847,500**	**$7,847,500**	**$7,055,000**	**$7,055,000**	**$7,055,000**	**$7,055,000**	**$6,437,500**	**$6,437,500**	
Field and Technical	*Annual Salary, Benefit and OH Cost per FTE*												
Senior Scientist	$366,000	-	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Reserve/Project Manager (Project Manager)	$230,000	-	0.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5
Wetland Biologist (Senior Planner)	$325,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	-
Technical Staff (Senior Technician)	$156,000	-	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
Reserve Maintenance Staff (Parks & Grounds Worker)	$126,000	-	0.6	2.0	3.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	2.0
Total staff (FTE)		**1.0**	**2.8**	**5.5**	**6.5**	**7.5**	**8.5**	**8.5**	**8.0**	**8.0**	**8.0**	**8.0**	**3.0**
Total annual cost		**$325,000**	**$673,000**	**$1,146,000**	**$1,272,000**	**$1,398,000**	**$1,524,000**	**$1,524,000**	**$1,361,500**	**$1,361,500**	**$1,361,500**	**$1,361,500**	**$550,000**
Total period cost		**$325,000**	**$3,365,000**	**$5,730,000**	**$6,360,000**	**$6,990,000**	**$7,620,000**	**$7,620,000**	**$6,807,500**	**$6,807,500**	**$6,807,500**	**$6,807,500**	
Environmental Compliance	*Annual Salary, Benefit and OH Cost per FTE*												
Cultural Resources Compliance Manager (Environmental Coordina	$284,000	-	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	-
Total staff (FTE)		**0.0**	**0.5**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**0.5**	**0.5**	**0.0**
Total annual cost		**$0**	**$142,000**	**$284,000**	**$284,000**	**$284,000**	**$284,000**	**$284,000**	**$284,000**	**$284,000**	**$142,000**	**$142,000**	**$0**
Total period cost		**$0**	**$710,000**	**$1,420,000**	**$1,420,000**	**$1,420,000**	**$1,420,000**	**$1,420,000**	**$1,420,000**	**$1,420,000**	**$710,000**	**$710,000**	

Assumption:

FTE compensation includes benefits at 35% of total compensation, per BLS *Employer Costs for Employee Compensation, 2004 - 2012 (* state and local government)

Table 10c: Overhead Costs Allocated per Staffing Plan (Full-Time Equivalent)

Valley schedule varies by period
2019 dollars — cost variable
Detail may not add to total due to rounding at various stages of the calculations.

Office Space

	Cost psf/month	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	POST PERMIT: Annual	Post Permit Adjustment
			Permit Period (years)											
Lease space (square feet)	$0.00	-	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	-	0%
Total annual cost	**$0.00**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Total period cost		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Assumptions:
Covers office space for Plan Administration, Field and Technical, and Environmental Compliance staff. Included in Annual Salary, Benefit and Overhead Cost per FTE.
FOR CAPITAL BUDGET

Office Furniture and Equipment by Employee

	Cost per unit	Start Up	1 - 5	6 - 10	11 -15	16 - 20	21 -25	26 - 30	31 -35	36 - 40	41 - 45	46 - 50	POST PERMIT: Annual	Post Permit Adjustment
Total FTEs		**3.5**	**8.7**	**12.3**	**13.3**	**14.3**	**14.8**	**14.8**	**14.3**	**14.3**	**13.3**	**13.3**	**4.5**	
Common office furniture (replace every 20 years/40 yrs post perm	$4,300	$0	$4,300	$0	$4,300	$0	$4,300	$0	$4,300	$0	$4,300	$0	$108	assume twice as long before
Cubicle workstation (replace every 20 yrs/40 yrs post permit)	$6,000	$21,000	$51,900	$21,600	$6,000	$6,000	$54,900	$21,600	$3,000	$6,000	$48,900	$0	$675	replacement
Office supplies (replace every year)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	100%
Computers (replace every 3 years)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	100%
Cell phones (replace every 2 years)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	100%
Cell phone service per year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	100%
Total period cost		**$21,000**	**$56,200**	**$21,600**	**$10,300**	**$6,000**	**$59,200**	**$21,600**	**$7,300**	**$6,000**	**$53,200**	**$0**	**$783**	

Assumptions:
Office furniture for Plan Administration, Field and Technical, and Environmental Compliance staff. Allocate proportional to FTE. Cost for Equipment and supplies included in Annual Salary, Benefit, and Overhead Cost per FTE.

Office Equipment and Technology - Capital

	Cost per unit	Replacement period (years)	Cost per period
Color printer/copier/scanner (2 per period)	$0	5	$0
Fax machine (2 per period)	$0	5	$0
Digital cameras (4 per period)	$0	3	$0
Portable radios (2 per period)	$0	5	$0
Gimbal mounted HD camera (2 per period)	$1,300	5	$2,600
GIS/CAD database server	$5,400	5	$5,400
Tablet PC	$0	3	$0
Plotter	$15,200	8	$9,500
GPS units (2 per period)	$0	5	$0
		Total cost per period	**$17,500**

50% Post-permit adjustment: percentage of cost that continues beyond permit term

Unless otherwise noted, costs are included in Salary, Benefit, and Overhead Cost Factor per FTE. $3,500

Technology Equipment/Services, Supplies and Maintenance - Operating

	Cost per unit	Replacement period (years)	Cost per period
Office telephone system (annual lease)	$0		$ -
GIS/CAD software	$19,500	5	$19,500
Database and other software	$0	3	$0
Annual budget for public outreach materials	$5,400	1	$27,000
Publications, subscriptions, memberships, annual	$0		$ -
		Cost per period	**$ 46,500**
Maintenance for office equipment and technology (10% total cost)			**$1,750**
		Total cost per period	**$48,250**

50% Post-permit adjustment: percentage of cost that continues beyond permit term

Assumptions: $9,650
Unless otherwise noted, costs are included in Salary, Benefit, and Overhead Cost Factor per FTE.

Appendix M
Growth Scenario Memo

HAUSRATH ECONOMICS GROUP

FINAL MEMORANDUM

Date: August 31, 2015 (revised)

To: Loren Clark, Placer County Planning Department
Holly Heinzen and Bryan Hacker, Placer County Executive Office

From: Sally Nielsen

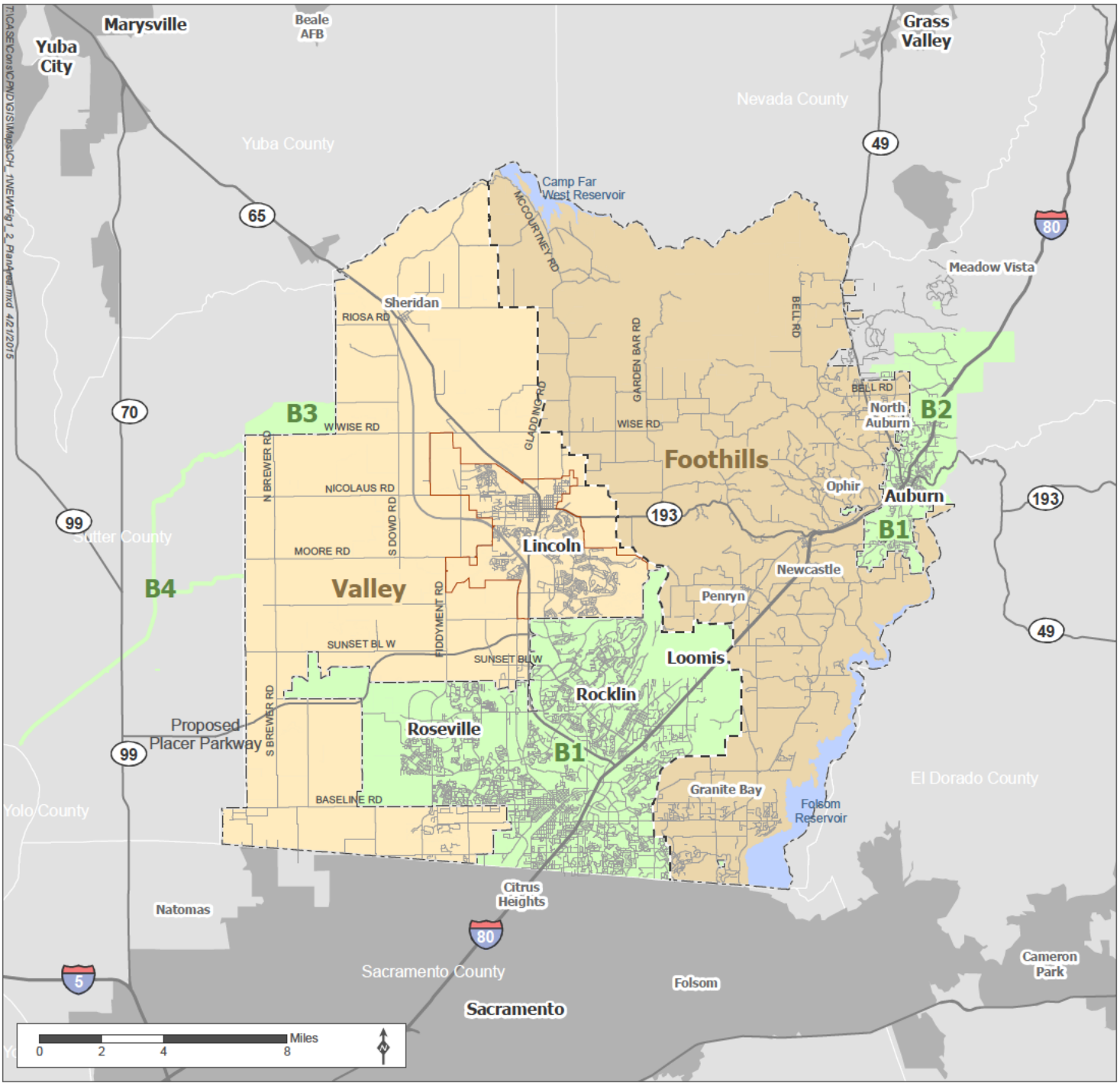
Subject: **Placer County Conservation Plan growth scenario and land development estimates, 2015**

This memorandum presents estimates of existing conditions for housing, population and employment in Plan Area A of the Placer County Conservation Plan and the larger West Placer area; a scenario of housing, population, and employment growth for these areas; and estimates of associated land development to accommodate urban/suburban and rural residential land uses. The estimates of land development are used to estimate the effects of covered activities during the 50-year permit term of the Placer County Conservation Plan (PCCP).

Geographic areas for analysis

The focus of this analysis is Plan Area A defined as unincorporated Placer County and the City of Lincoln within the boundaries delineated in **Figure 1**. In addition, a larger West Placer area is defined to include the non-participating city jurisdictions within or adjacent to the Plan Area A boundary. These jurisdictions are the cities of Auburn, Rocklin, and Roseville and the Town of Loomis. Plan Area A is divided into two subareas: the Valley—consisting of unincorporated Placer County and the City of Lincoln, and the Foothills / I-80 Corridor—consisting entirely of unincorporated Placer County areas. (See **Figure 1**.) For context, the analysis includes County totals for existing conditions and the 50-year planning horizon, with the latter based on generalized planning parameters.

2014 is the setting year for the estimates of existing conditions. The 2014 estimates incorporate the results of the 2010 Census, current (as of late 2014) demographic and economic information



Source: Placer County, 2014; MIG | TRA 2015; CalTrans

- Interstate
- Highway
- Road
- City of Lincoln
- Valley/Foothill Divide
- Surrounding Urban Area

Plan Area A

Valley	100,921
Foothills	109,295
All Plan Area A	210,216

Plan Area B

B1. Permittee Activity in Non-Participating City Jurisdic ion. 50,636 acres
B2. PCWA Zone 1 Operations and Maintenance. 6,315 acres
B3. Coon Creek Floodplain Conserva ion. 1,724 acres in Sutter County
B4. Fish Passage Channel Improvement. 33 miles of channels in Sutter County
B5. Big Gun Conservation Bank. 52 acres in Placer County (Not shown on map)

Figure 1 Western Placer County and the Plan Area

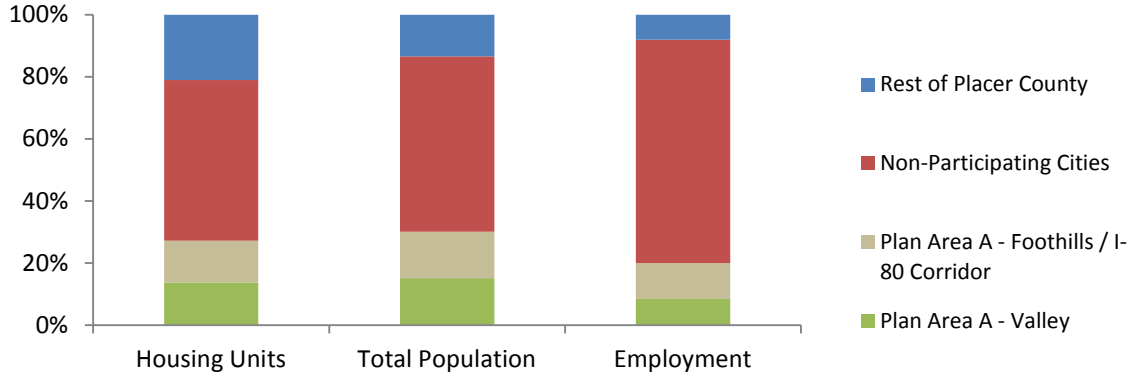
Placer County Conservation Program

available for Placer County and subareas of the county, the effects of the Great Recession, and recent indications of recovery from that downturn. The 50-year growth projection is based on analysis of development potential in Placer County and the cities in the county and assumptions about long-term trends for economic growth and housing demand. The totals for the end of the permit term are the sum of the 2014 existing conditions and the 50-year growth increment.

Existing Conditions—2014

Figure 2 and Table 1 present the existing conditions estimates for housing, population and employment. There are 109,000 people living in 40,000 households in Plan Area A in 2014. The Non-Participating Cities account for about two times as much housing and population. Combined, this West Placer area represents about 80 percent of the housing in Placer County and almost 90 percent of the resident population. There is proportionally more population than housing in West Placer because of the substantial proportion of housing units in the rest of the County (the East County/Tahoe Basin area) that do not house permanent residents. There are about 33,000 people working in Plan Area A and almost 120,000 working in the adjacent Non-Participating Cities. Just over 90 percent of all employment in Placer County is located in West Placer.[1]

Figure 2
2014 Existing Conditions: Distribution of Housing, Population and Employment by Placer County Areas



[1] The employment estimates presented throughout this memorandum include both wage and salary employment, those jobs measured in California Employment Development Department (EDD) employer statistics produced from employer reports, and self-employed workers, i.e., people who are employed but work for themselves and who are not counted in the employer statistics that are the basis for the wage and salary employment estimates. The self-employed are an important component of the workforce. Analysis of the ability of the local economy to employ area residents is incomplete without counting the self-employed. HEG's estimates of total employment including the self-employed are based on analysis of American Community Survey estimates that indicate that people who are self-employed in their own business are about 12 percent of Placer County employment (measured by place of work). Placer County's self-employed are in business as specialty trade contractors, real estate agents/brokers, accountants, lawyers, computer and other technical consultants, architects, doctors and other health practitioners, day care providers, and non-store retailers.

Table 1
2014 Existing Conditions in Plan Area A and the Rest of Placer County: Housing, Population, and Employment

	Housing Units	Households	Household Population	Total Population	Employment by Place of Work
Plan Area A	**42,700**	**40,300**	**109,000**	**110,200**	**33,000**
Valley	*21,500*	*20,300*	*55,000*	*55,300*	*14,000*
Foothills / I-80 Corridor	*21,200*	*20,000*	*54,000*	*54,900*	*19,000*
Non-Participating Cities	**81,400**	**76,900**	**205,300**	**207,000**	**119,000**
West Placer Total	**124,100**	**117,200**	**314,300**	**317,200**	**152,000**
Placer County Total	**157,100**	**136,700**	**362,200**	**366,100**	**165,300**

Note:
Estimates for subareas of the County detailed in this table are based on 2010 Census data and 2010 OnTheMap jobs by place of work estimates by Census geographies and GIS analysis prepared by the Placer County Planning Department for the detailed geography at the eastern boundary of the Plan Area. 2014 estimates are based on California Department of Finance estimates for 2014 for the unincorporated county and the cities in the county, California Employment Development Department March 2013 benchmark estimates of County wage and salary employment, and U.S. Census Bureau OnTheMap 2011 estimates of jobs by place of work for the unincorporated county and cities in the county. The 2014 estimates for housing and population for Plan Area A and its subareas assume that West Placer represents the same percentage of County totals as it does in 2010 and that the distribution among subareas also remains the same. The 2014 employment estimate is derived by applying the 2010 – 2013 annual growth rate to 2013 EDD estimates, assuming the same distribution among jurisdictions as in 2011 and the same distribution among Plan Area A subareas as in 2010.

Sources: State of California Department of Finance*, E-5 Population and Housing Estimates for Cities, Counties and the State, January 1, 2011 - 2014, with 2010 Benchmark,* May 2014; State of California Employment Development Department, *Annual Average Industry Employment, March 2013 benchmark,* September 19, 2014; U.S. Census Bureau, *American Community Survey 2008-2012 and 2010-2012;* U.S. Census Bureau, *OnTheMap application and LEHD Origin-Destination Employment Statistics*, 2010 and 2011 for Placer County areas; Placer County Planning Department; and Hausrath Economics Group.

New Development Potential in Plans and Projects

There is substantial development potential to accommodate population and employment growth in the West Placer area. Much of this development potential in plans and proposed or entitled projects is located in Plan Area A and represents land development covered activity under the HCP / NCCP. **Figure 3:** *West Placer Housing Units—2014 and Build Out Capacity by Jurisdiction* and **Figure 4:** *West Placer Employment—2014 and Build Out Capacity by Jurisdiction* illustrate the magnitude of the capacity for land use change in this area. In 2014, both housing and jobs are concentrated in the cities of Roseville and Rocklin in particular. The scenario shifts dramatically for the potential to accommodate future new development. Unincorporated West Placer represents 60 percent of the remaining build out development capacity for housing in the West Placer area and about 50 percent of the remaining build out capacity for employment. See Appendix **Table A.1** for details on development potential in the West Placer area by planning area and jurisdiction.

Figure 3
West Placer Housing Units - 2014 and Remaining Build Out Capacity, by Jurisdiction

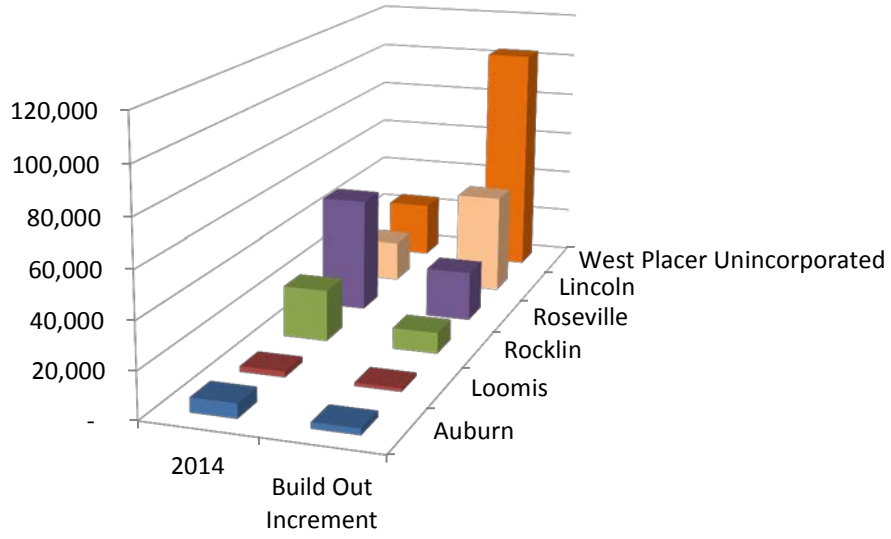
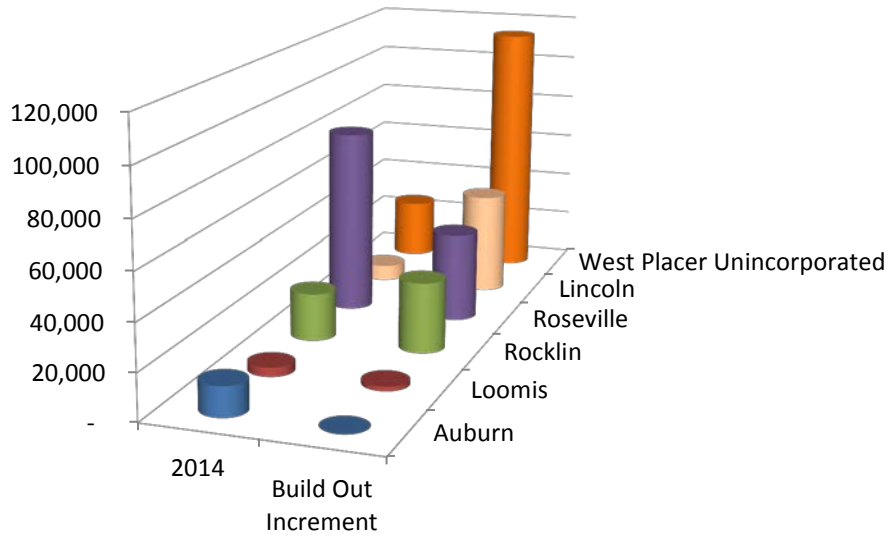


Figure 4
West Placer Employment - 2014 and Remaining Build Out Capacity, by Jurisdiction



- The incremental build out development capacity for West Placer overall beyond 2014 totals 183,000 housing units and about 231,000 jobs.
- The Unincorporated Areas within Plan Area A represent capacity for an additional 104,000 housing units and 114,000 jobs.
- The City of Lincoln within Plan Area A represents capacity for 44,000 more housing units and 45,000 more jobs.
- The remaining development potential within Non-Participating Cities is in the range of 35,000 housing units and 72,000 jobs.

These estimates are based on land use inventory updates conducted in 2013 and 2014 by the Sacramento Area Council of Governments (SACOG) as part of preparation for the 2016 update of the regional Metropolitan Transportation Plan / Sustainable Communities Strategy (2016 MTP/SCS update). SACOG staff and member agency planning and public works staff compiled an updated list of development potential in adopted and proposed land use plans. The list is published as "Attachment A – Table 2" in the *Inventory of Adopted and Proposed Land Use Plans* dated March 27, 2014 and revised April 2, 2014. This analysis for the Western Placer County HCP / NCCP includes technical refinements to the buildout estimates as presented in the tables for the 2016 MTP/SCS Update *Draft Preferred Scenario* – April 16, 2015 (Attachment C for the SACOG Board of Directors, April 9, 2015).For Placer County jurisdictions in the West Placer area, the inventory includes the following:

- Auburn: infill of Center, Corridor and Established Communities[2] (including Amtrak station and Highway 49) and the Baltimore Ravine Specific Plan Developing Community
- Lincoln: infill of Center, Corridor, and Established Communities (including Downtown Urban Design Plan), and Developing Communities including portion of Highway 65 in the sphere of influence (SOI), housing in Villages 1, 2, 3, 4, 5, 6, and 7; and SUD A and employment in Villages 5 and 7 and SUD's B and C.

[2] Center, Corridor and Established Communities are the Community Types defined by SACOG for the 2012 MTP/SCS 2035. They are described briefly as follows (see SACOG, Current MTP/SCS 2035, adopted April 2012, *Chapter 3 Summary of Growth and Land Use Forecast* (http://www.sacog.org/2035/files/MTP-SCS/3%20-%20Land%20Use%20Forecast%20Final.pdf):

- *Center and Corridor Communities* are "identified in local plans as historic downtowns, main streets, commercial corridors, rail station areas, central business districts, town centers, or other high density destinations;"
- *Established Communities* are "adjacent to, or surrounding, Center and Corridor Communities….made up of existing low- and medium-density residential neighborhoods, office and industrial parks, or commercial strip centers;"
- *Developing Communities* "are typically, but not always, situated on vacant land at the edge of existing urban or suburban development….identified in local plans as special plan areas, specific plans, or master plans;"
- *Rural Residential Communities* "are outside of urbanized areas and designated in local land use plans for rural residential development."

- Loomis: infill of Center, Corridor, and Established Communities (including Town Center Master Plan), and rural residential development
- Rocklin: infill of Center, Corridor, and Established Communities (including Rocklin Downtown Plan/Amtrak station), and Clover Valley, Highway 65 Corridor, I-80 Commercial, and Sunset Ranchos Developing Communities
- Roseville: infill of Center, Corridor, and Established Communities (including Downtown Master Plan and remaining Amtrak station, Douglas West, Sunrise), and Creekview, Sierra Vista, and West Roseville Developing Communities. The SACOG inventory lists (as part of the Roseville land use inventory) Amoruso Ranch (*aka* Brookfield) proposed for land area currently in unincorporated Placer County. This analysis for the PCCP attributes this development capacity to Unincorporated West Placer (see below).
- Unincorporated West Placer: infill of Established Communities and Sphere-of-Influence areas (including non-residential development potential in the Sunset Industrial Area, remaining development capacity in Granite Bay, Newcastle/Penryn, Ophir community plans), Auburn Sphere of Influence; Bickford Ranch, Placer Vineyards, Regional University, Riolo Vineyard, Placer Ranch (Community and University) Developing Communities; and rural residential development in the foothills. In addition, as noted above, the development capacity for the Brookfield (or Amoruso Ranch) Specific Plan Area is attributed to Unincorporated West Placer.

For the purposes of the PCCP analysis, plan areas in Lincoln and Unincorporated West Placer that are listed as "unknown" in the SACOG inventory are instead estimated using background information from other sources: the Lincoln General Plan update (2008) for additional capacity in Villages 3, 4, and 6 and Placer County background materials for Curry Creek. These estimates add about 1,800 jobs to Lincoln's development capacity and about 25,000 housing units and 3,400 jobs to Unincorporated West Placer development capacity, beyond that indicated in the SACOG inventory. In addition, the Placer Ranch University is represented (in unincorporated West Placer development potential) by 5,000 jobs based on faculty and staff estimates for the proposed specific plan. All of these amounts are included in the development capacity beyond 2014 illustrated in Figures 3 and 4.

50-Year Growth Scenario

The following 50-year growth scenario considers the planned and proposed development capacity described above in conjunction with analysis of factors supporting long-term demand for urban/suburban and rural residential land uses in Placer County based on analysis of demographic trends, economic factors, regional growth potential, and more localized development patterns. The scenario accounts for Placer County's increasing importance in the regional economy and housing market. The estimates represent a reasonable scenario for expected growth based on the assumption that a high quality of life continues to attract economic activity and new residents and that appropriate infrastructure and public facilities development

occurs to accommodate growth. Among other factors, transportation costs, climate change, and potential market responses to those changes could alter the 50-year growth scenario.

The 50-year growth scenario presented here was prepared for the purposes of the PCCP in 2015. The scenario incorporates significant updates to current employment estimates indicating recovery of essentially all of the jobs lost between 2007 and 2010 and incorporates the most recent development potential estimates.

Table 2, Figure 5, and Figure 6 present the future scenario for housing, population, and employment at the end of the 50-year permit term. The growth scenario for the PCCP shows a three-fold increase in the number of housing units in Plan Area A and a commensurate increase in population to a total of 358,000 residents. In 2014, Plan Area A encompasses 30 percent of the County's population; at the end of the permit term, the scenario shows 50 percent of the County's population living in the Plan Area A. Plan Area A has the potential to accommodate more housing than the four Non-Participating Cities at the end of the permit term. The growth scenario shows 114,000 housing units and just over 300,000 people in the four Non-Participating Cities at the end of the 50-year period. The scenario shows substantial employment growth in Plan Area A—almost four times as many jobs as are located there in 2014. The Non-Participating Cities continue to accommodate substantial job growth but the share of total County employment in these cities declines from 70 percent of the total in 2014 to just under 60 percent of the total at the end of the. The scenario shows the combined West Placer area growing at a somewhat faster pace than the rest of the county, representing roughly 90 percent of total county population and 95 percent to total county employment at the end of the 50-year permit term.

Table 3 and Figure 7 present the 50-year *growth increment* that is the basis for the estimates of land development by covered activities under the PCCP. The growth scenario for Plan Area A shows an increase of 93,000 housing units, almost three times as many as accommodated in the Non-Participating Cities, representing more than 60 percent of the housing added in the County. New housing in the Valley subarea is 85 percent of the total increase over the 50-year permit term. The 50-year scenario also shows an increase of 91,000 jobs in Plan Area A, almost all of that in the Valley subarea. The Non-Participating Cities see an increase of almost 70,000 jobs over the 50-year period.

Table 2
Conditions at End of 50-year Permit Term in Plan Area A and the Rest of Placer County: Housing, Population, and Employment

	Housing Units	Households	Household Population	Total Population	Employment by Place of Work
Plan Area A	**135,700**	**128,900**	**354,500**	**358,100**	**124,000**
Valley	*100,500*	*95,500*	*262,600*	*263,600*	*103,000*
Foothills / I-80 Corridor	*35,200*	*33,400*	*91,900*	*93,400*	*21,000*
Non-Participating Cities	**114,400**	**108,700**	**298,900**	**301,700**	**187,000**
West Placer Total	**250,100**	**237,600**	**653,400**	**659,800**	**311,000**
Placer County Total	**303,900**	**264,000**	**726,000**	**733,000**	**327,400**

Note:
These projections prepared for the purposes of the Placer County Conservation Plan represent one possible scenario for long-term growth in Placer County, assuming continuation of long-term regional growth trends and planned development patterns. The scenario reflects future economic and population growth potential for Placer County and the cities in the county and assessment of development plans and proposals under consideration in Placer County and the cities as of April 2015. Among other factors, transportation costs, climate change, and potential market responses to those changes with alter the 50-year growth scenario.

The conditions for the end of the permit term are derived as follows:

1. The 50-year growth increment (see **Table 3**) for housing units and employment by place of work for West Placer (Plan Area A subareas and the Non-Participating Cities) is derived from analysis of remaining development potential.
2. For each geographic area, the 50-year increment is added to 2014 existing conditions for housing units and employment by place of work.
3. The estimate of occupied housing units at the end of the permit term assumes a five percent housing vacancy rate for all of West Placer and West Placer subareas and.
4. The estimate of household population at the end of the permit term assumes 2.75 persons per household in all areas in the future.
5. The estimate of total population at the end of the permit term in each subarea assumes no change over time in the ratio of household population to total population.
6. County totals for population and employment are calculated from the West Placer estimates assuming that in 50 years West Placer represents 90 percent of total population and household population in the County (up from the 87 percent estimated in 2014) and 95 percent of total employment in the County (up from the 92 percent estimated for 2014). The Placer County household estimate assumes 2.75 persons per household; and the housing unit estimate assumes a 13 percent housing vacancy rate for Placer County overall (the same as indicated by 2010 data).

Sources: Hausrath Economics Group; Sacramento Area Council of Governments "Inventory of Adopted and Proposed Land Use Plans", Attachment A – Table 2 (revised April 2, 2014) and 2016 Metropolitan Transportation Plan/Sustainable Communities Strategy Update, *Draft Preferred Scenario*, April 16, 2015 (*Attachment C*, SACOG Board of Directors, April 9, 2015); and various planning and environmental review documents prepared in Placer County and the cities in the county.

Figure 5
50-Year Housing Unit Scenario: 2014 to the end of the Permit Term, by Placer County Areas

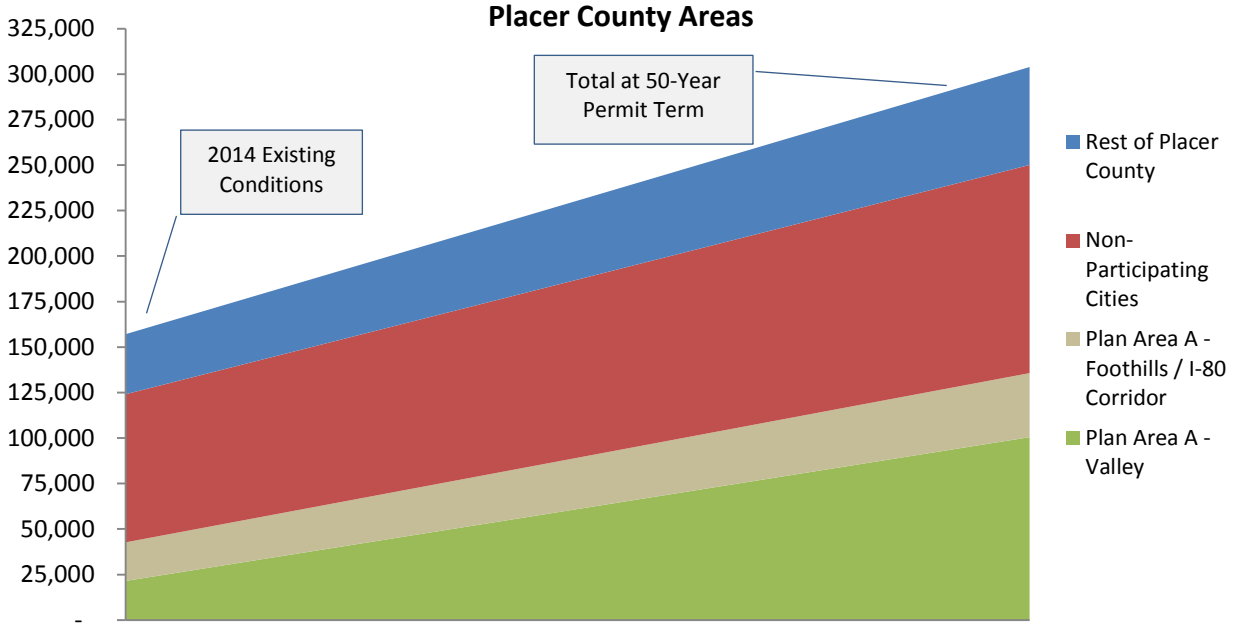


Figure 6
50-Year Employment Scenario: 2014 to the end of the Permit Term, by Placer County Areas

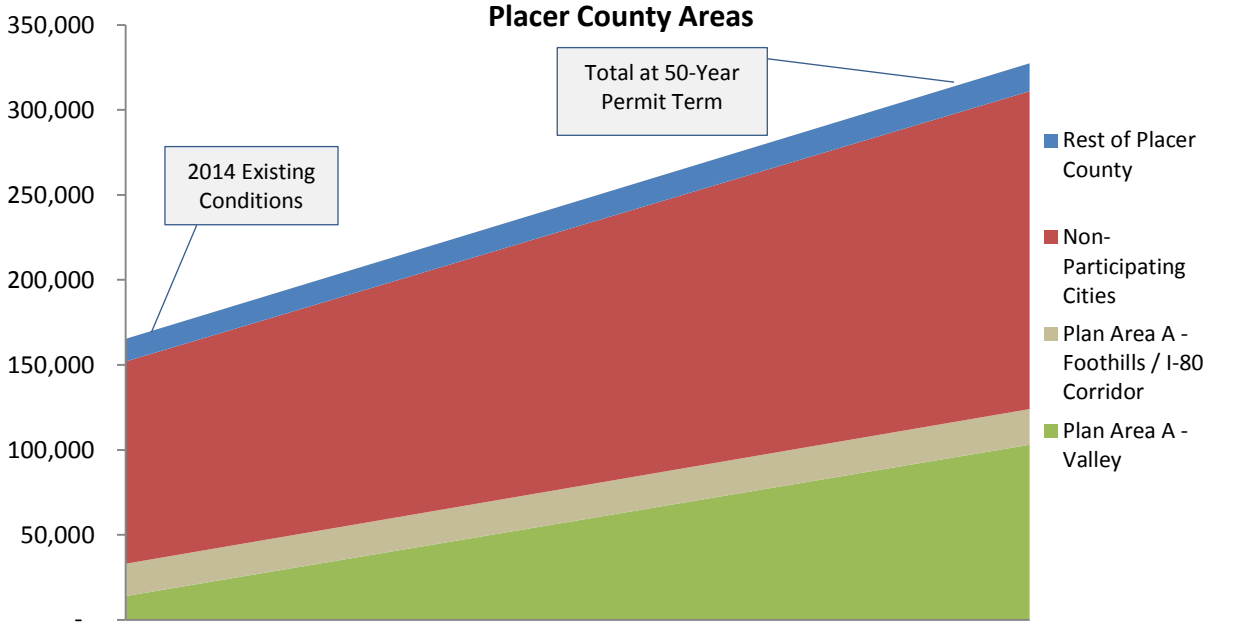


Table 3
Growth Increment for 50-year Permit Term in Plan Area A and the Rest of Placer County: Housing, Population, and Employment

	Housing Units	Households	Household Population	Total Population	Employment by Place of Work
Plan Area A	**93,000**	**88,600**	**245,500**	**246,800**	**91,000**
Valley	*79,000*	*75,200*	*207,600*	*208,300*	*89,000*
Foothills / I-80 Corridor	*14,000*	*13,400*	*37,900*	*38,500*	*2,000*
Non-Participating Cities	**33,000**	**31,800**	**93,600**	**94,700**	**68,000**
West Placer Total	**126,000**	**120,400**	**339,100**	**341,500**	**159,000**
Placer County Total	**146,800**	**127,300**	**363,800**	**366,900**	**162,100**

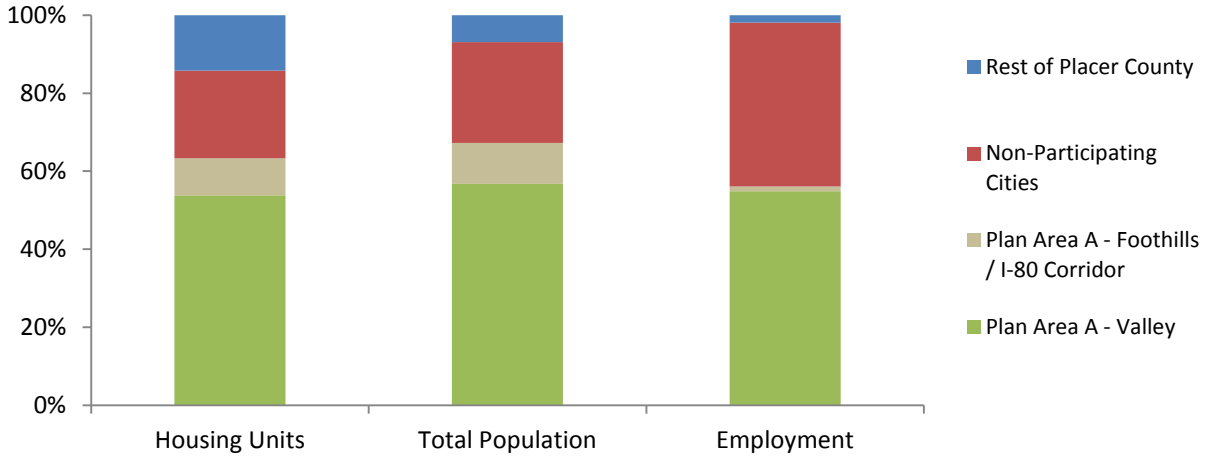
Note:
These projections prepared for the purposes of the Placer County Conservation Plan represent one possible scenario for long-term growth in Placer County, assuming continuation of long-term regional growth trends and planned development patterns. The scenario reflects future economic and population growth potential for Placer County and the cities in the county and assessment of development plans and proposals under consideration in Placer County and the cities as of April 2015. Among other factors, transportation costs, climate change, and potential market responses to those changes with alter the 50-year growth scenario.

The 50-year growth increment for housing units and employment by place of work for West Placer (Plan Area A subareas and the Non-Participating Cities) is derived from analysis of remaining development potential. The other growth increment indicators (households, household population, and total population) are derived by subtracting 2014 existing conditions from conditions at the end of the 50-year permit term estimated as described in **Table 2**.

For the County totals, the increment for all indicators is derived by subtracting 2014 existing conditions from conditions at the end of the 50-year permit term estimated as described in **Table 2**.

Sources: Hausrath Economics Group; Sacramento Area Council of Governments "Inventory of Adopted and Proposed Land Use Plans", Attachment A – Table 2 (revised April 2, 2014) and 2016 Metropolitan Transportation Plan/Sustainable Communities Strategy Update, *Draft Preferred Scenario*, April 16, 2015 (*Attachment C*, SACOG Board of Directors, April 9, 2015); and various planning and environmental review documents prepared in Placer County and the cities in the county.

Figure 7
50-year Permit Term: Distribution of Housing, Population and Employment Growth by Placer County Areas



Evaluation of the 50-Year Growth Scenario

The increase in housing and jobs in West Placer projected for the 50-year PCCP permit term does not represent build out of the development capacity in this area as measured by current land use plans and proposals. The 126,000 housing units are about 70 percent of the remaining residential development capacity overall for West Placer, and the 159,000 jobs fill about 70 percent of the remaining non-residential development capacity. Over this period, the Non-Participating Cities are expected to build out their development capacity, and redevelopment/reinvestment accommodates more population and employment in established developed areas. In Plan Area A, the City of Lincoln and Unincorporated West Placer would use about 60 percent of their remaining development capacity.

At about 2,500 housing units added per year on average, the West Placer 50-year growth scenario is in line with the most recent 30-year trend (1980 – 2010) for all West Placer cities, and represents a substantial slowing of the shorter-term annual growth rate of the 2000 – 2010 decade (3,800 units per year added in West Placer cities). The scenario's 50-year annual growth rate for housing is 1.4 percent per year; about the same as the rate indicated for the shorter 2012 – 2036 period covered by SACOG's 2016 MTP / SCS Update (*Draft Preferred Scenario*, April 16, 2015) for all of Placer County outside the Tahoe Basin. Both the Plan scenario and the SACOG scenario for housing and population growth are substantially faster in Placer County than the growth rate indicated in long-term population projections for California counties for the 2010 to 2060 period issued in 2013 by the California Department of Finance (DOF). For Placer County, the DOF 2013 projections indicate a 50-year population growth rate of about 1.0 percent

per year, a substantial slowing from the population growth rate indicated in prior DOF modelling.[3]

The 50-year job growth scenario for West Placer represents a growth rate of about 1.4 percent per year and an average annual increase of 3,200 jobs per year in the West Placer area. This is somewhat slower than rate of growth SACOG shows for the 2012 – 2036 period in the 2016 MTP / SCS Update (*Draft Preferred Scenario*, April 16, 2015)—a rate of 2.05 percent per year for all of Placer County outside the Tahoe Basin. (Note that the slower rate over a longer time period is a consistent growth scenario.) Caltrans most recent county-level employment forecasts for Placer County also indicate a similar long-term growth rate of 1.6 percent per year for the 2010 – 2040 period.

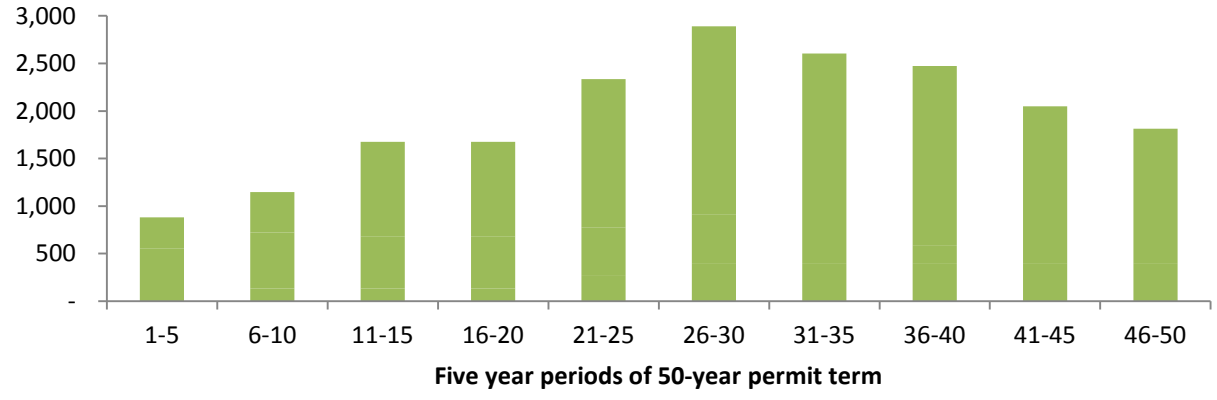
Development pattern over time

The distribution of West Placer development capacity by jurisdiction described above means that there is likely to be a near-term lag in the pace of development in those jurisdictions covered by the PCCP—the City of Lincoln and unincorporated Placer County. Over the next 5 – 15 years, most of the new development in West Placer is likely to occur in the non-participating cities of Roseville and Rocklin where development capacity is further along in the entitlement and implementation process. SACOG's 2015 MTP/SCS *Draft Preferred Scenario* illustrates this development pattern, showing Roseville and Rocklin in 2020 at 70 – 80 percent of residential buildout and 40 – 60 percent of non-residential buildout, while Lincoln and unincorporated Placer County in 2020 are at 45 – 50 percent of residential buildout and about 25 percent of non-residential buildout.

The pace of land development over time is one variable in the cost and funding analysis of the PCCP. The pace of development is assumed to be even over time in the Foothills subarea. Because of the conditions described above, this is not likely to be the case in the Valley subarea. **Figure 8** illustrates the scenario of land development over time in the Valley subarea that is used in the cost and funding analysis of the PCCP.

[3] The projections DOF projections based on fertility and mortality assumptions and 2000 – 2010 migration trends; projection model does not directly consider job growth. See Center for the Continuing Study of the California Economy, *A Review of the DOF and ABAG Population Projections to 2040*, March 2013, prepared for the Association of Bay Area Governments, for a discussion of the differences between DOF's methodology and integrated regional forecasting models such as those developed by ABAG and SACOG.

Figure 8
Pace of Land Development in the Valley Subarea over 50-year Permit Term
(acres of land development by 5-year period)



Land development scenario to accommodate growth

The estimates of land development to accommodate population and employment growth in Plan Area A through the 50-year permit-term are the basis for the PCCP effects analysis of land development covered activities. **Table 4** summarizes the land development estimates for the analysis zones that make up Plan Area A. The table presents estimates of the 50-year growth increment for housing and jobs (from **Table 3**) along with estimates of acres of land developed to accommodate that growth. Estimates are presented for PCCP analysis zones that fall within the Valley and Foothills / I-80 Corridor subareas shown on **Figure 9.**

Just over 30,000 acres of land would be developed for urban/suburban and rural residential uses and associated infrastructure and public facilities in Plan Area A over the 50-year permit term. The estimates of land development reflect development types and development intensities (dwelling units per acre and floor-area-ratios for non-residential development) that are currently envisioned in City of Lincoln and Placer County general and specific plans, planning studies, and planning proposals as documented in the SACOG land use inventory analysis for the 2016 MTP/SCS Update (*Draft Preferred Scenario)* and other City of Lincoln and Placer County sources cited above. Foothills / I-80 Corridor land development is also based on analysis rural residential development patterns.

Two-thirds of the land development occurs in the Valley where most of the population and employment growth is expected to occur. The Foothills and I-80 Corridor unincorporated areas accommodate a relatively small amount of growth but the low density development pattern means 33 percent of Plan Area A land development occurs there

Table 4
Land Development to Accommodate Growth in Plan Area A for 50-year Permit Term

Plan Area A Subareas / Analysis Zones	Land Area Developed(acres)	Housing Units	Employment by Place of Work
Valley Planned & Potential Future Growth – Lincoln [a]	6,325	25,000	25,000
Valley Planned & Potential Future Growth – Placer County [a]	13, 220	54,000	64,000
Valley Conservation and Rural Development [b]	570	-	-
Valley Subtotal	**20, 115**	**79,000**	**89,000**
Foothills / I-80 Corridor Planned & Potential Future Growth [b]	9,993	13,700	2,000
Foothills Conservation and Rural Development [c]	1,007	300	-
Foothills / I-80 Corridor Subtotal	**11,000**	**14,000**	**2,000**
Plan Area A Total	**31,115**	**93,000**	**91,000**

Notes:

a. Acres of land development reflecting City of Lincoln and Placer County General and Specific Plans (see Appendix **Table A.1**) and a generalized factor of 15 percent additional land development to account for infrastructure, right-of-ways, and public facilities.
b. Estimates developed by MIG|TRA Environmental Sciences and Hausrath Economics Group.
c. Estimates developed by MIG|TRA Environmental Sciences.

Sources: Hausrath Economics Group and MIG|TRA Environmental Sciences

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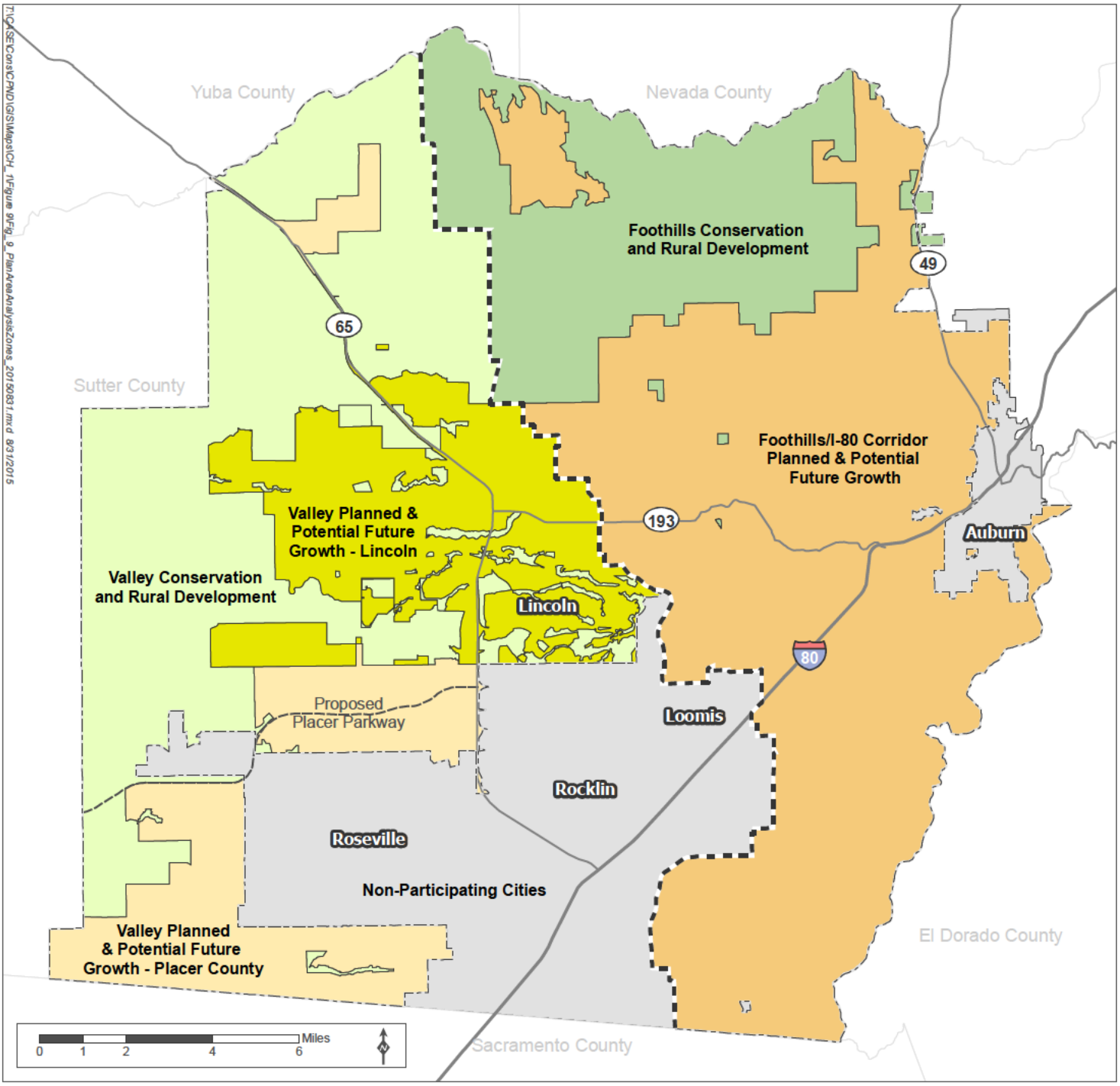

Source: Placer County, 2014

Plan Area A Boundary

Valley/Foothill Divide

Analysis Zones

- Valley Planned & Potential Future Growth - Lincoln
- Valley Planned & Potential Future Growth - Placer County
- Valley Conservation and Rural Development
- Foothill Conservation and Rural Development
- Foothills/I-80 Corridor Planned & Potential Future Growth
- Non-Participating Cities

Figure 9 Plan Area Analysis Zones

Placer County Conservation Program

Sources

HEG used the following source materials to prepare the growth scenario.

- Sacramento Area Council of Governments (SACOG), *Metropolitan Transportation Plan/Sustainable Communities Strategy 2035* (April 2012)
- SACOG, *Inventory of Adopted and Proposed Land Use Plans – Attachment A-Table 2* (March 27, 2014, revised April 2, 2014*)*
- SACOG, 2016 Metropolitan Transportation Plan/Sustainable Communities Strategy Update, *Draft Preferred Scenario,* April 16, 2015 (*Attachment C*, SACOG Board of Directors, April 9, 2015)
- State of California, California Department of Transportation, *California County-Level Economic Forecast 2014 – 2040*, prepared for California Department of Transportation Economic Analysis Branch, prepared by The California Economic Forecast (September 2014)
- State of California, Department of Finance, *E-5 Population and Housing Estimates for Cities, Counties, and the State, January 2011 – 2014, with 2010 Benchmark* (May 2014)
- State of California, Department of Finance, *Report P-1, State and County Total Population Projections, 2010 - 2060* (January 2013)
- State of California, Employment Development Department, Industry Employment and Labor Force data, *Annual Average Industry Employment, March 2013 benchmark* (September 19, 2014)
- U.S. Census Bureau, American Community Survey, 5-year estimates
- U.S. Census Bureau, *2010 Census*
- U.S. Census Bureau, Longitudinal Employer-Household Dynamics Program (LEHD), *OnTheMap Application*
- U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information Series
- Planning and environmental review documents describing general and specific plans in Placer County and Placer County cities.

Table A.1
Development Potential Detail for West Placer, by Planning Area and Jurisdiction
Housing Units, Employment, and Acres

	Housing Units			Employment			Remaining Development Acres[a]		
Jurisdiction and Planning Areas	**2014[b]**	**Total at Build Out**	**Build Out Increment beyond 2014**	**2014[b]**	**Total at Build Out**	**Build Out Increment beyond 2014**	**Residential**	**Non Residential[c]**	**University[d]**
HCP/NCCP Plan Area A									
City of Lincoln									
Established Communities, Center & Corridor Communities, Portion of Hwy 65 in SOI	18,076	22,768	4,692	6,700	37,532	30,832	not available	not available	
Developing Communities									
Village 1		5,640	5,640		677	677	840	20	
Village 2		3,874	3,874		351	351	850	10	
Village 7		3,285	3,285		397	397	380	5	
Other Capacity									
Village 3[e]		4,841	4,841		1,400	1,400	970	70	
Village 4[e]		5,421	5,421		200	200	1,050	10	
Village 5/SUD B		8,318	8,318		11,402	11,402	1,720	420	
Village 6[e]		5,082	5,082		200	200	790	10	
SUD A		2,967	2,967		unknown	unknown	140	1,310	
SUD C		-	-		123	123	-	480	
Remainder SOI		unknown	unknown		unknown	unknown	unknown	unknown	
Placer County Unincorporated Area - West Placer									
Established Communities, Auburn Sphere of Influence Area, and Rural Residential Communities[f,g]	24,624	73,180	48,556	26,300	98,531	72,231	not available	not available	
Developing Communities									
Bickford Ranch		1,890	1,890		312	312	764.7	9.7	
Placer Vineyards		14,132	14,132		9,037	9,037	3,361.0	309.0	
Regional University - Community		3,232	3,232		1,075	1,075	315.5	22.2	
Regional University - University		1,155	1,155		800	800	-	-	416.5
Riolo Vineyard		932	932		166	166	326.9	7.5	
Other Capacity									
Placer Ranch - Community		5,527	5,527		20,155	20,155	720.4	505.8	
Placer Ranch - University		-	-		5,000	5,000	-	-	300.0
Curry Creek Planning Area		25,200	25,200		3,425	3,425	1,993.0	153.0	
Brookfield/Amoruso Ranch		3,011	3,011		1,463	1,463	347.0	51.0	

Table A.1
Development Potential Detail for West Placer, by Planning Area and Jurisdiction
Housing Units, Employment, and Acres

	Housing Units			Employment			Remaining Development Acres[a]		
Jurisdiction and Planning Areas	2014[b]	Total at Build Out	Build Out Increment beyond 2014	2014[b]	Total at Build Out	Build Out Increment beyond 2014	Residential	Non Residential[c]	University[d]
Non Participating City Jurisdictions									
City of Auburn									
Established Communities, Center & Corridor Communities	6,239	8,208	1,969	13,000	12,925	-	not available	not available	
Developing Communities (Baltimore Ravine SP)		725	725		226	226	92	28	
Town of Loomis									
Established Communities, Center & Corridor Communities, Rural Residential	2,485	3,954	1,469	3,900	6,111	2,211	not available	not available	
City of Rocklin									
Established Communities, Center & Corridor Communities, Developing Communities	22,617	31,788	9,171	21,100	52,287	31,187	not available	not available	
City of Roseville									
Established Communities, Center & Corridor Communities, West Roseville	50,077	61,339	11,262	80,700	110,742	30,042	not available	not available	
Developing Communities									
Sierra Vista		8,679	8,679		9,003	9,003	1,068.2	258.6	
Creekview		2,011	2,011		418	418	237.2	19.3	

Notes:

a. Acres for developed land uses, not including open space, parks, public facilities, infrastructure, and right of ways.

b. 2014 estimates are for existing city limits and the unincorporated areas of West Placer. See **Table 1** for detail on methods and sources.

c. Non Residential acres includes commercial, office, business park, and industrial land use.

d. University acres do not include areas for open space use.

e. Employment capacity not provided in SACOG Inventory of Adopted and Proposed Land Use Plans. Estimated by Hausrath Economics Group based on an average jobs-per-acre factor for the rest of the Lincoln General Plan: 20 jobs per acre.

f. Includes the remaining development capacity in the Sunset Industrial Area after accounting for the land uses in Placer Ranch proposed for part of that plan area, including acres currently designated AG-80 (Agricultural Use with 80-acre minimum lot sizes). See note (g) following. Also includes development capacity in the Auburn/Bowman, Dry Creek/West Placer, Granite Bay, Horseshoe Bar / Penryn, Ophir, and Sheridan community plans, Does not include development capacity in the Colfax Sphere of Influence Area or the capacity represented by the Village at Squaw Valley Specific Plan. The estimate is somewhat inflated to the extent it accounts for development capacity in the parts of the Auburn Sphere of Influence area and surrounding unincorporated area (primarily rural residential) that are generally to the east and outside of the Plan Area A boundary yet within the boundary of the Placer County area inventoried by SACOG, i.e., all but the Tahoe Basin.

g. The remaining development capacity in the Sunset Industrial Area after accounting for the land uses in Placer Ranch is estimated to be about 1,800 acres of commercial, business park, and industrial land uses. Assuming standard development densities for these land use categories, that land could accommodate about 18 million square feet of building space. Assuming 750 square feet per employee, that space accommodates 24,000 workers.

Sources: Sacramento Area Council of Governments, "Inventory of Adopted and Proposed Land Use Plans", Attachment A - Table 2 (revised April 2, 2014) and 2016 Metropolitan Transportation Plan/Sustainable Communities Strategy Update, *Draft Preferred Scenario* , April 16, 2015 (*Attachment C* , Board of Directors, April 9, 2015); *City of Lincoln General Plan Update and EIR* (2008), *Bickford Ranch Specific Plan* (2004); *Placer Vineyards Specific Plan* (2007); *Regional University Specific Plan* (2008); *Riolo Vineyard Specific Plan* (2008); *Sunset Industrial Plan* (1997); *Sunset Industrial Area Services Assessment* , Goodwin Consulting Group, November 12, 2009; Willdan Financial Services, *Sunset Industrial Area Fire Services Cost Allocation Study* , October 6, 2010; Placer Ranch Land Use Plan (proposed specific plan), April 8, 2015; City of Roseville website description of Placer Ranch Specific Plan (accessed 7/1/2015); and Hausrath Economics Group.

HAUSRATH ECONOMICS GROUP

MEMORANDUM

Date: March 24, 2016 (revised)

To: Gregg McKenzie, Jen Byous, and Loren Clark, Placer County Planning Department
Holly Heinzen and Bryan Hacker, Placer County Executive Office

From: Sally Nielsen

Subject: **Implications of Bickford Ranch 2015 Approval for Placer County Conservation Plan growth scenario and land development estimates**

On December 8, 2015 the Placer County Board of Supervisors approved a revised Bickford Ranch Specific Plan. The revised project includes mitigation for impacts to species and habitat and is no longer a covered activity under the Placer County Conservation Plan (PCCP).

The growth scenario and land development estimates presented in the August 31, 2015 Hausrath Economics Group (HEG) memorandum "Placer County Conservation Plan growth scenario and land development estimates" (as revised) include Bickford Ranch as described in the adopted 2004 Specific Plan in the inventory of unincorporated area development potential in the Foothills subarea that would represent land development covered by the PCCP. (See Table A.1 Development Potential Detail for West Placer, by Planning Area and Jurisdiction: Housing Units, Employment and Acres.)

Since the December approval of the revised Bickford Ranch Specific Plan, *no change* is proposed for the amount of land development associated with PCCP covered activities. However, since Bickford Ranch is no longer considered part of that inventory, this means that, all other things equal, it will take more time for the land development associated with covered activities to occur. Absent any changes to the demographic and economic trends influencing market demand, it will simply take more years to absorb the total amount of land development in West Placer represented by PCCP covered activities *plus* the land development associated with Bickford Ranch—no longer a covered activity.

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The 2015 land use plan for Bickford Ranch (1,890 housing units and 1,144 acres of land development—not counting the 783.5 acres of open space preserve) represents 10 – 15 percent of the total growth increment for the Foothills subarea.

Any changes to PCCP chapter text, tables, footnotes and appendices will appear in the Public Review Draft PCCP document.

Appendix N
Placer Vineyards Specific Plan

Appendix N
Placer Vineyards Specific Plan

N.1 Background

As described in Chapter 8, all Placer Vineyards Specific Plan (PVSP) development is required to comply with the Placer Vineyards Mitigation Strategy (*Placer Vineyards Specific Plan Mitigation Monitoring & Reporting Program*, Revised August 2012, October 2014, and November 2016) (Mitigation Strategy), which itself was designed to be compatible with the Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) conservation strategy. Because the land plan (the distribution, location, and extent of the uses of land, including open space, within the area covered under the specific plan) for the PVSP area was finalized while the HCP/NCCP was still in development, some of the on-site avoidance and minimization measures set forth in the Mitigation Strategy, and the calculation of impacts and mitigation, differ somewhat from the general HCP/NCCP requirements, as described in this appendix. These measures were established by the U.S. Fish and Wildlife Service (USFWS) through the Programmatic Biological Opinion (Programmatic BO; USFWS 2016, 2018) described in Chapter 8. Additionally, the National Marine Fisheries Service (NMFS) concurred that the PVSP, as designed and described in a biological assessment prepared for NMFS, is not likely to adversely affect federally listed fish species, as stated in a May 31, 2016 concurrence letter from NMFS (Attachment 1).

The PVSP's on-site preserves will not be incorporated into the Reserve System, but rather will be managed and held by an accredited land trust, special district, or other public agency and managed in accordance with an open space preserve management plan (OSPMP) developed for Placer Vineyards in particular. It will not be necessary for these lands to be managed in a manner consistent with the HCP/NCCP monitoring and adaptive management strategy (Chapter 7) because they are not a component of the HCP/NCCP Reserve System. If, at a future date, the PCA wishes to enroll the OSPMP lands into the HCP/NCCP reserve system, the PCA would need to ensure that the lands are managed and monitored consistent with the HCP/NCCP.

Chapter 8 of the HCP/NCCP describes the requirements and actions that will be implemented to smoothly incorporate PVSP biological mitigation into the HCP/NCCP and to account for PVSP effects (Section 8.8.5, *Placer Vineyards Specific Plan*). All PVSP projects approved under the authority of this HCP/NCCP (i.e. projects that are not interim projects covered by the Programmatic BO) will be subject to the applicable fees described in Chapter 9 of the HCP/NCCP; provided, however, that fees relating to avoided lands (i.e., on-site open space preserves) and stream zone setbacks will be calculated as set forth below.

N.2 Covered Activities

The PVSP area encompasses approximately 5,232 acres in unincorporated southwestern Placer County, approximately 15 miles north of the City of Sacramento (Figure N-1). The PVSP establishes a coordinated and comprehensive approach towards land use development consisting of residential, employment, commercial, recreational and public/quasi-public land uses, and required infrastructure, as well as open space. Development activities associated with the PVSP that are

within the HCP/NCCP Plan Area are covered under the HCP/NCCP. These activities include both onsite development (i.e. development within the PVSP area), and onsite and offsite infrastructure (infrastructure development both inside and outside the PVSP area), such as improvements to existing roadways and intersections, proposed routes for new major roadways, portions of pedestrian/bicycle trails, water transmission lines, and sewer trunk lines, force mains, and lift stations within the HCP/NCCP Plan Area (see Chapter 2 for details on Covered Activities). Improvements that are located in Sutter or Sacramento Counties are not Covered Activities under the PCCP except to the extent portions of those improvements are located in the HCP/NCCP Plan Area.

N.3 Onsite Avoidance and Mitigation/Protection Commitments

N.3.1 Avoidance Requirements

The U.S. Army Corps of Engineers' (USACE) Programmatic Record of Decision for PVSP establishes an environmentally preferred alternative that identifies certain avoidance areas to be established within the PVSP (Figures N-1 and N-2). In addition, the Regional General Permit for PVSP backbone infrastructure (PVSP RGP) issued by the USACE includes a variety of on-site minimization and other measures. Because the on-site avoidance requirements for PVSP were established prior to adoption of the HCP/NCCP, the HCP/NCCP's on-site avoidance requirements and calculation of on-site impacts for PVSP differ from those described for other Covered Activities in the HCP/NCCP in the following sections: Section 6.3.2.1.1, *Community Condition 1.1, Avoidance of Vernal Pool Complex Constituent Habitat*; Section 6.3.2.1.2, *Community Condition 1.2, Avoidance of Aquatic/Wetland Complex Constituent Habitat*; Section 6.3.2.2.1, *Community Condition 2.1, Riverine and Riparian Avoidance*; Section 6.3.2.3.1, *Community Condition 3.1, Valley Oak Woodland Avoidance;* and Section 6.3.3.1, *Stream System Condition 1, Stream System Avoidance and Minimization*. Wherever there is a conflict between provisions of Appendix N and these or other provisions of the HCP/NCCP regarding on-site avoidance requirements, the provisions of Appendix N will control. Minor changes to Figures N-1 and N-2 may be approved as minor modifications to the HCP/NCCP in accordance with Section 10.5.2..

In particular, based on the site-specific biological and aquatic resource characteristics of the PVSP area, the PVSP includes a strategy for avoiding impacts to the Stream System that implements Stream System buffers that differ from the requirements of the HCP/NCCP. Accordingly, PVSP projects will not be subject to the Stream System Encroachment Fee. All other HCP/NCCP requirements and fees will apply to PVSP projects, except as provided in bulleted section below.

The Programmatic BO (pages 9-10, "Open Space within the PVSP") establishes specific criteria for determining whether on-site open space areas within PVSP (i.e., those reflected in the U.S. Army Corps of Engineers' environmentally preferred alternative) will be considered to be impacted and thus require mitigation even though they are undeveloped. These criteria are carried forward and hereby incorporated into the HCP/NCCP relative to PVSP projects, as set forth below. The following text also identifies which HCP/NCCP fees must be paid if any on-site open space areas are considered to be impacted under these criteria.

- Lands located within the PVSP on-site avoidance areas will be treated as avoided, and will not be subject to HCP/NCCPland conversion fees, if: 1) no land cover conversion occurs (e.g., examples of a land cover conversion include engineered detention basin(s) constructed of non-native materials or park and recreational improvements which include hardscape features, such as paved or compacted trails, parking lots, grass/turf areas such as ball fields/soccer fields and other similar amenities,); and 2) if these lands are protected through a restrictive covenant and managed and enhanced for their biological values. Any impacts occurring within the open space area affecting vernal pools, seasonal or perennial wetlands, valley oak woodlands, riverine/riparian will be mitigated pursuant to the requirements of the proposed conservation measures identified in the HCP/NCCP as set forth in the following bullets.
- Land conversion, as defined in the Programmatic BO, within the on-site avoidance areas will be subject to the Land Conversion fee.
- Direct affects to vernal pools, seasonal or perennial wetlands, in-stream, or riverine/riparian habitat within the on-site avoidance areas will be subject to the applicable HCP/NCCP Land Conversion and Special Habitat fees (Table 9-5 of the HCP/NCCP).
- Land conversion occurring outside of the on-site avoidance area will not be subject to the Vernal Pool Immediate Watershed Effects Special Habitat Fee for any indirect effects of such conversion that may occur to resources within the on-site avoidance area.
- Land conversion, as defined in the programmatic BO, within the on-site avoidance areas that directly affects the Immediate Watershed of vernal pool wetlands as defined in Section 6.3.2.1.1 Community Condition 1.1 Avoidance for Vernal Pool Constituent Habitat Wetlands will be subject to a Vernal Pool Immediate Watershed Effects fee (Table 9-7).
- Impacts associated with the construction of drainage features in the open space area (e.g., detention basins using natural systems with natural land cover and drainage canals, and channel improvements), including the modification of existing drainage features and their hydrology, that result in the restoration or enhancement of function for Covered Species or Covered Habitat as determined by the Wildlife Agencies will not be subject to any HCP/NCCP fees.
- Impacts in the open space areas that do <u>not</u> improve function for Covered Species or Covered Habitat as determined by the Wildlife Agencies will be subject to the HCP/NCCP temporary effect fee (Table 9-5 of the HCP/NCCP) if the effects persist for less than 1 year and the habitat is returned to pre-project conditions or ecological equivalent within 1 year from the time of groundbreaking. If the activity does not improve function and the effects persist for greater than one year from the time of ground breaking, then the PCCP Land Conversion Fee and/or applicable Special Habitat Fees will be required.
- For backbone infrastructure activities covered under the PVSP RGP, minimization will occur in accordance with the RGP so long as the PVSP RGP is in effect.

N.3.2 Onsite Mitigation/PCCP Protection Commitments

While Section N.3.1, *Onsite Avoidance Requirements*, describes onsite PVSP open space areas that would be treated as avoided and would not require mitigation or payment of HCP/NCCP fees, not all

these avoided areas would count toward PVSP project mitigation requirements or HCP/NCCP protection commitments; provided, however, that the following land cover within PVSP open space areas will count toward project mitigation under the HCP/NCCP (land in lieu of fees) and toward HCP/NCCP land protection commitments if they meet the criteria for Reserve System lands in Section 8.4.1 of the HCP/NCCP, *Criteria for Reserve System Lands*, and are approved by the PCA and the Wildlife Agencies. These land cover types comprise a portion of the overall PVSP open space areas and are shown on Figure N-2 of this appendix. If these specific open space areas are enrolled into the Reserve System, upon PCA and Wildlife Agency approval, they will be managed, adaptively managed, and funded consistent with the provisions of the HCP/NCCP.

1. Open Space A: Riverine/riparian along Dry Creek and Curry Creek (Approximately 40 acres).

2. Open Space B: The large aquatic/wetland complex in the southern portion of the PVSP area, south of Dyer Lane. (Approximately 22 acres).

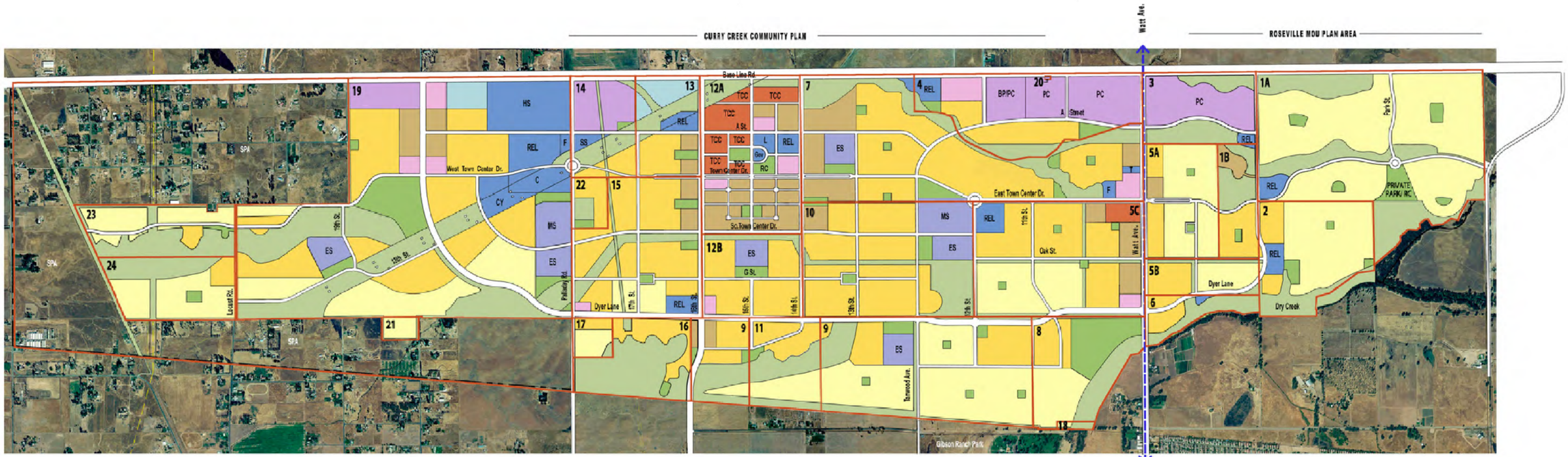
3. Open Space C: Oak woodlands associated with the Dry Creek corridor (Approximately 25 acres).

N.3.3 References

Placer County. 2015. Placer Vineyards Specific Plan. Placer County, CA. http://www.placer.ca.gov/departments/communitydevelopment/planning/pvineyards

USFWS. 2016. Draft Programmatic Biological Opinion for the Placer Vineyards Specific Plan Project, Placer County, California (Corps File Number SPK-1999-00737). USFWS reference number 81420-2008-F-0983-1

USFWS. 2017-19. Amendments and Appendages to the April 1, 2016 Programmatic Biological Opinion for the Placer Vineyards Specific Plan Project (Corps File Number: SPK-1999-00737). USFWS reference number 81420-2008-F-0983-(Various)



EDAW | AECOM

MacKay & Somps

NOTE: THIS EXHIBIT SHOWS THE APPROVED PLACER VINEYARDS SPECIFIC PLAN LAND USE PLAN WITH ALTERNATIVE LAND USE STUDY PLANS ON PROPERTIES 1B, 3, 16, 17, & 23.

LEGEND

C/MU	COMMERCIAL/ MIXED USE	SPA	SPECIAL PLANNING AREA	ES	ELEMENTARY SCHOOL		PUBLIC/ QUASI-PUBLIC USES			OS	OPEN SPACE
COM	COMMERCIAL	LDR	LOW DENSITY RESIDENTIAL	MS	MIDDLE SCHOOL	REL	RELIGIOUS FACILITY	CY	CORPORATE YARD	P	PARK
PC	POWER CENTER	MDR	MEDIUM DENSITY RESIDENTIAL	HS	HIGH SCHOOL	F	FIRE	SS	SUBSTATION	RC	RECREATION CENTER
BP	BUSINESS PARK	HDR	HIGH DENSITY RESIDENTIAL			Gov	GOVERNMENT	T	TRANSIT		
O	OFFICE					L	LIBRARY	C	CEMETERY	⟷	BRT LINE
						Po	POLICE				

NORTH

0 500 800 1000 2000 Feet

NOVEMBER 2011

Placer Vineyards Land Use Plan

Including Study Area Alternatives on Properties 1B, 3, 16, 17 & 23

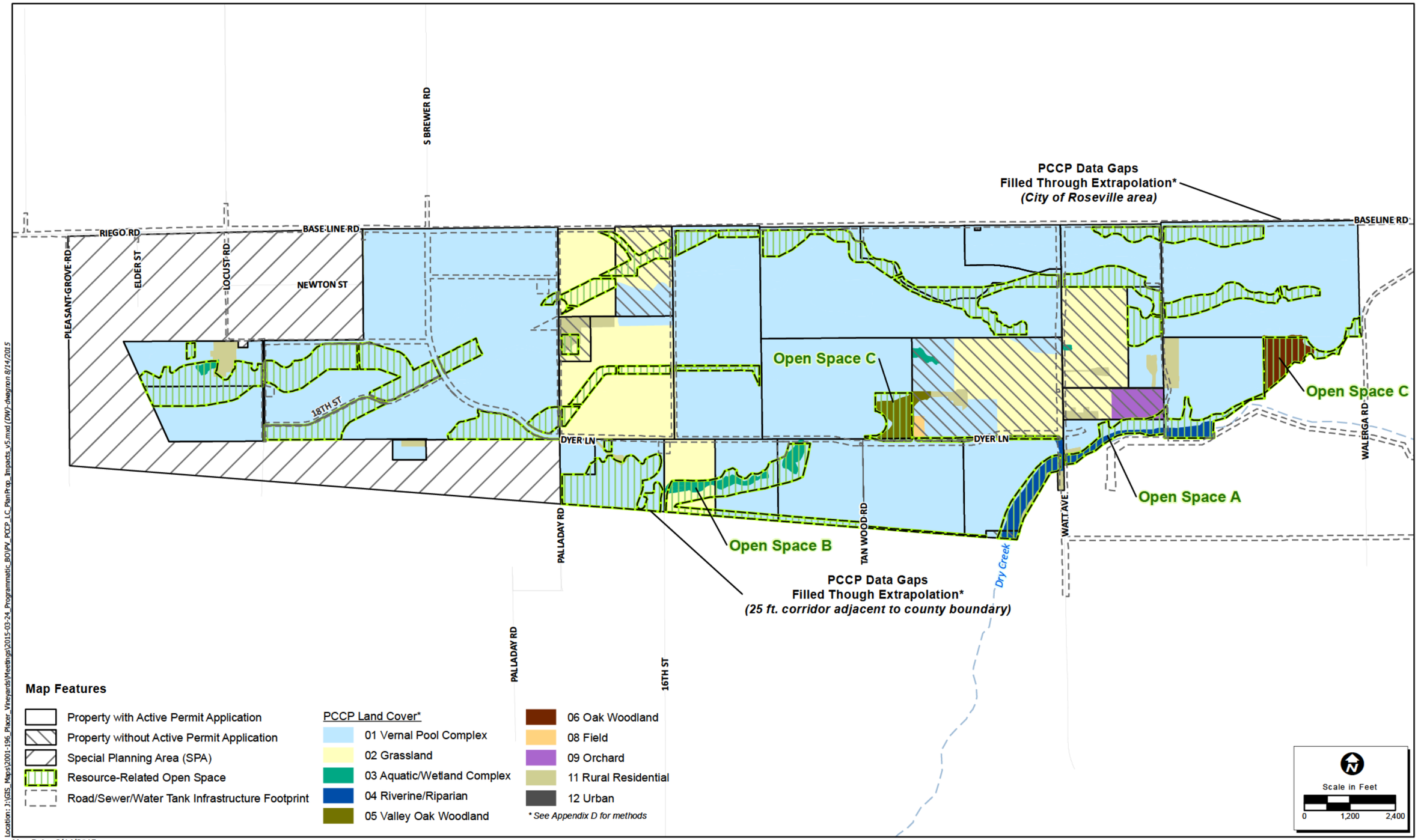
Location: J:\GIS_Maps\2001-196_Placer_Vineyards\Meetings\2015-03-24_Programmatic_BO\EDAW_LEDPA_Graphic.mxd (DW)-dwagnon 8/13/2015

Map Date: 8/13/2015
Base Source: MacKay and Somps, EDAW

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

Figure 1. Placer Vineyards Specific Plan - Approved Development Plan

2001-196 Placer Vineyards



Map Date: 8/14/2015
Data Source: PCCP 2015, MacKay and Somps

ECORP Consulting, Inc.
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Figure 2. PVSP Open Space and Land Cover Types

2001-196 Placer Vineyards