Chapter 5
# Consultation and Coordination

# Introduction

This chapter describes the consultation and coordination associated with the Restoration Project. Public involvement, agency and PG&E[1] involvement, and environmental laws, regulations, and executive orders are discussed.

## Overview

Because of the federal and state actions associated with the Restoration Project, compliance with both NEPA (40 CFR 1500-1508) and CEQA (Public Resources Code §21000 *et seq*.) is required. As the federal lead agency, Reclamation is responsible for complying with all applicable environmental laws and regulations associated with the Restoration Project, including NEPA. FERC, a cooperating federal agency, is responsible for ensuring that the proposed modifications to the Hydroelectric Project associated with the Restoration Project comply with all applicable environmental laws and regulations, including NEPA, prior to issuing a license amendment for the Hydroelectric Project. Corps Individual and Nationwide Permits and FERC licensing actions in California, including new licenses, material license amendments, and relicensing, require CWA (33 USC 1251 *et seq*.) Section 401 water quality certification from the SWRCB. The SWRCB is the state lead agency for ensuring CEQA compliance. NEPA and CEQA compliance will be fulfilled through the preparation of a joint EIS/EIR.

# Public Involvement

## Public Scoping

Public involvement is a vital and required component of the NEPA and CEQA processes. Scoping is a process to gather input from the public, including their

[1] PG&E, the utility regulated by the California Public Utility Commission, owned the Battle Creek Hydroelectric Project (FERC Project No. 1121) at the time this document was prepared.

issues and concerns and, together with technical input and agency considerations, to define the significant issues to be addressed in the environmental document. NEPA regulations (40 CFR 1500 *et seq.*) define *scoping* as "an early and open process for determining the scope of issues to be addressed, and for identifying the significant issues related to the proposed action." The CEQA guidelines (Title 14 CCR §§15000 *et seq*.) require scoping meetings under limited circumstances and encourages scoping activities; however, it is encouraged.

The main objectives of the scoping process are to:

- provide the public and potentially affected agencies with adequate information and time to review and provide oral and/or written comments on a project,
- help ensure that issues related to the project are identified early and properly studied,
- ensure that the project alternatives are balanced and thorough, and
- prepare the appropriate environmental documentation.

Reclamation placed a Notice of Intent to prepare an EIS/EIR and notice of a public scoping meeting in the *Federal Register* on January 12, 2000. A brief description of the proposed Restoration Project, a request for written comments, and details on the public scoping meeting were included in the notice.

A joint federal and state public scoping meeting was held on January 31, 2000, at the Manton School Gymnasium in Manton, California. During this meeting, the public was presented with an overview of the Restoration Project, including the purpose and need for the project, a project description, and the current project alternatives. In addition, written and oral comments were received from the public at this meeting.

The SWRCB issued a Notice of Preparation of a draft EIS/EIR for the Restoration Project on April 12, 2000. The notice was circulated through the State Clearinghouse for agency review and comment on April 13, 2000.

The Scoping Report[2] provides an overview of the Restoration Project; describes the environmental compliance process associated with the Restoration Project, including the role of public scoping; discusses the public scoping meeting; describes Restoration Project alternatives; and contains comments received throughout the scoping process.

[2] The Scoping Report is available on Reclamation's web site at http://www.mp.usbr.gov/regional/battlecreek.

## Public Participation in Restoration Project Meetings

In addition to the public scoping process, public participation has been encouraged and has occurred at Restoration Project meetings. The public input received at Restoration Project meetings, including the Battle Creek Working Group, Environmental and Design Technical Team, and Project Management Team meetings, has been used throughout the development of the EIS/EIR.

## Public Review of the Draft Environmental Impact Statement/Environmental Impact Report

The release of the draft EIS/EIR is another opportunity for the public to provide input on the analysis of the environmental effects of the proposed project and the other alternatives examined in the EIS/EIR. Responses to the comments received during the review of the draft document will be included in the final EIS/EIR.

# Agency and PG&E Involvement

## U.S. Department of Interior, Bureau of Reclamation

Reclamation is participating in the Restoration Project pursuant to the CVPIA (Title 34, Public Law 102-575) and the California Bay-Delta Environmental Enhancement Act (Title 11, Public Law 104-333). As the federal agency that will carry out the Restoration Project, Reclamation will act as the federal lead agency. Reclamation is responsible for complying with all applicable environmental laws and regulations associated with the Restoration Project, including NEPA, Section 106 of the National Historic Preservation Act (16 USC 470), the Fish and Wildlife Coordination Act (FWCA) (16 USC 661-667e), the ESA (16 USC 1531-1544), and the CWA (33 USC 1251-1376).

## Federal Energy Regulatory Commission

FERC is participating in the Restoration Project as the licensor of the Hydroelectric Project. As a cooperating federal agency, FERC is required to ensure that proposed changes in the Hydroelectric Project comply with NEPA, Section 7 of the ESA, Section 106 of the National Historic Preservation Act, the FWCA, and Section 401 of the CWA before issuing the license amendment.

### FERC Authority and Responsibilities for Hydroelectric Project License Amendment Approval or Denial

The proposed federal action for FERC with regard to the Restoration Project is its decision whether to issue a license amendment for the Hydroelectric Project, and if so, what conditions should be placed in the amended license.

After receiving the license amendment application from PG&E, FERC will issue a public notice requesting any comments, protests, or motions to intervene concerning the proposed application. FERC intends to use this EIS/EIR and the biological opinion for the Restoration Project to fulfill NEPA and ESA compliance requirements when deciding whether to approve the license amendment request.

Subject to the comments received in response to the public notice, and CWA, NEPA, and ESA compliance, FERC may decide to amend the license and incorporate any terms and conditions that were required as part of NEPA mitigation, FWCA, CWA Section 401 water quality certification issued by the state, and any conditions resulting from the ESA consultation process.

## National Marine Fisheries Service

The National Oceanic and Atmospheric Administration, NOAA Fisheries, is participating in the Restoration Project pursuant to its jurisdiction over anadromous fish and its mandates under the ESA.

## U.S. Department of the Interior, U.S. Fish and Wildlife Service

(Per 1999 MOU, Section 1.10) The USFWS is participating in the Restoration Project pursuant to the CVPIA (Title 34, Public Law 102-575), the Endangered Species Act (16 USC 1531-1544, as amended), FWCA (16 USC 661-667e), and the Fishery Conservation and Management Act (16 USC Sections 1801-1882). A Draft Fish and Wildlife Coordination Act Report is provided in Appendix Q of this document, and can also be accessed on the web site of the Fish and Wildlife Service's Sacramento office (http://sacramento.fws.gov), under the section titled "Of Special Interest."

## State Water Resources Control Board

The SWRCB is responsible for administering surface water rights throughout California (Water Code §§1000–5976). Among other things, the SWRCB issues permits and licenses to appropriate water users; acts on petitions to change the

point of diversion, place of use, or purpose of use authorized under a permit or license; and investigates complaints against water users.

In addition, the SWRCB is charged with the prevention of the waste or unreasonable use of water, the conservation of beneficial uses of water, including instream beneficial uses, and the protection of the public interest (Cal. Const., Article X, §2; Water Code §§100, 275). The public trust doctrine imposes upon the SWRCB the affirmative duty to supervise the protection of public trust interests, including interests in commerce, fishery, recreation, and ecology in navigable water bodies (National Audubon Society v. Superior Court [1983] 33 Cal. 3d 419 [658 P.2d 709, 189 Cal. Rptr. 346]).

The federal CWA (33 USC 1251 *et seq*.) was enacted "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC 1251[a]). Section 101(g) of the CWA (33 USC. 1251[g]) requires federal agencies to "cooperate with state and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources." Section 401 of the CWA (33 USC 1341) requires every applicant for a federal license or permit to provide the responsible federal agency with certification that the project will be in compliance with specified provisions of the CWA, including Section 303 (Water Quality Standards and Implementation Plans, 33 USC §1313); directs the state agency responsible for certification to prescribe effluent limitations and other limitations necessary to ensure compliance with the CWA and with any other appropriate requirement of state law; and provides that state certification conditions shall become conditions of any federal license or permit for the project.

The SWRCB is the agency responsible for water quality certification in California (Water Code §13160); and has delegated this function to the Executive Director by regulation (Title 23 CCR §3838, subd. [a]).

The California RWQCBs have adopted and the SWRCB has approved Water Quality Control Plans for each watershed basin in accordance with provisions of Section 303 of the CWA related to the establishment of water quality standards and planning (33 USC 1313). These plans identify beneficial uses of the waters within each region.

The California CVRWQCB, in its Water Quality Control Plan for the Central Valley Region, Sacramento River and San Joaquin River Basins, has identified the beneficial uses of Battle Creek as irrigation, stock watering, hydropower generation, contact and noncontact recreation, canoeing and rafting, cold freshwater habitat, warm freshwater habitat, salmon and steelhead migration, warm and cold spawning, and wildlife habitat.

Protection of the chemical, physical, and biological integrity of waters of the state for instream beneficial uses identified in the Basin Plans requires the maintenance of adequate streamflows as well as effluent limitations and other limitations on discharges of pollutants from point and nonpoint sources to navigable waters and their tributaries.

The SWRCB is participating as the state lead agency for CEQA compliance. It is responsible for approving or denying the issuance of certifications of compliance with Section 401 of the CWA for any federal permits or license amendments necessary to carryout the Restoration Project. In addition, the SWRCB may be petitioned pursuant to Water Code Section 1707 (a)(1) to change the purpose of use of PG&E water rights that may be transferred as a result of the adoption of the proposed alternative. Water Code Section 1707 (a)(1) authorizes any person entitled to the use of water, whether based upon an appropriative, riparian, or other right, to petition the SWRCB for a change in purpose of use for preserving or enhancing wetlands habitat, fish and wildlife resources, or recreation in or on the water.

# California Department of Fish and Game

The DFG participation in the Restoration Project is based on its responsibilities as trustee agency for the fish and wildlife resources of California and its jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (Fish and Game Code §§1801-1802), the CESA (Fish & Game Code §§2050-2068) and other applicable state and federal laws.

# Pacific Gas and Electric Company

PG&E is participating in the Restoration Project as the owner and operator of the Hydroelectric Project. As PG&E, it is responsible for submitting a license amendment application to FERC for the modifications to the Hydroelectric Project associated with the Restoration Project.

## Hydroelectric Project License Amendment Application

To implement changes to the Hydroelectric Project, PG&E is required by the Federal Power Act (FPA) (16 USC 791-828c) to submit a license amendment application to FERC and obtain its concurrence. PG&E proposes to use a hybrid of the consultation requirements specified in 18 CFR 4.38 for its license amendment application for the Hydroelectric Project. In addition to the requirements in 18 CFR 4.38, PG&E proposes to use a hybrid process that incorporates elements of the alternative licensing and amendment procedures described in FERC Order 596, including public outreach and participation.[3]

[3] The alternative process is voluntary. Applicants may use the standard seven-step process.

## Process Protocol

As part of its use of a hybrid process, PG&E has prepared a communications protocol entitled, "Communications Protocol for Preparing NEPA/CEQA Documents, the FERC License Amendment Application, and Other Related Documents for the Battle Creek Salmon and Steelhead Restoration Project, Battle Creek Hydroelectric Project, FERC Project No. 1121" (PG&E 1999) (Communications Protocol). The Communications Protocol reviews general distribution methods for documenting communication and consultation among parties during the preparation of environmental compliance documents and the license amendment application. It also includes relevant background information regarding ongoing cooperation between PG&E and federal and state regulatory agencies interested in fishery restoration in Battle Creek, participants in the compliance documents process, public reference files for the Restoration Project, and specific information regarding written communications, telephone conversations, and public meetings and notices consistent with the Communications Protocol.

## Consultation on Restoration Project and License Amendment

In the summer of 1999, several technical teams studied and reviewed the construction and environmental impacts of the project alternatives and developed a draft Adaptive Management Plan (Appendix D) for the Proposed Action Alternative. Members of the teams included Reclamation, USFWS, NOAA Fisheries, FERC, DFG, SWRCB, California Department of Water Resources, PG&E, Battle Creek Working Group, Battle Creek Watershed Conservancy, Friends of the River, and others. The teams were:

- **Project Management Team**: The Project Management Team assessed progress and addressed issues that arose in the broad range of concurrent efforts associated with the implementation of the Restoration Project.
- **Adaptive Management Policy and Technical Teams**: The Adaptive Management Policy and Technical Teams developed a draft Adaptive Management Plan for the Proposed Action Alternative.
- **Design Technical Team**: The Design Technical Team met with the Fish Passage Technical Team as design work evolved for various proposed Restoration Project features.
- **Environmental Technical Team**: The Environmental Technical Team has worked to identify the environmental compliance requirements for the Restoration Project and supported the development of documentation to meet these requirements.
- **Fish Passage Technical Team**: The Fish Passage Technical Team evaluated options to improve or restore fish passage as part of the Restoration Project.

- **Real Estate Team**: The Real Estate Team has met with property owners and has prepared surveys of lands within the Restoration Project.

Most of the teams met monthly; meetings were open to the public. The meetings were announced on Reclamation's web page for the Restoration Project (Reclamation n.d.) for the Restoration Project. In addition, email notices of meetings were distributed to the team participants. Anyone could request to be included on the email list.

# Laws, Regulations, and Executive Orders

The following sections briefly describe each law, regulation, and executive order as they are understood and interpreted by the applicable regulating agency. Federal, state, and local environmental laws, regulations, and executive orders that may be applicable to the Restoration Project are reviewed briefly below:

## National Environmental Policy Act

Funding and implementation of the Restoration Project qualifies as a major federal action under NEPA (42 USC 4321-4347). NEPA regulations (40 CFR 1508.18) define a *major federal action* to include actions that may be major and that are potentially subject to federal control and responsibility. Such actions include new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies (40 CFR 1508.18[a]). The Restoration Project also qualifies as a federal action because it involves federal approval of specific projects, such as construction or management activities located in a defined geographic area, and includes actions approved by permit or other regulatory decision as well as federal and federally assisted activities (40 CFR 1508.18[b][4]).

The Proposed Action and other alternatives analyzed in this EIS/EIR account for these other essential considerations through the carefully developed balancing of fishery restoration measures and the preservation of an economically valuable source of clean, renewable hydropower.

## Federal Power Act

Originally enacted in 1920, the FPA (16 USC 791-828c) provided for cooperation between FERC and other federal agencies, including resource agencies, in licensing and relicensing power projects. The FPA provides FERC the exclusive authority to license non-federal hydroelectric power projects on navigable waterways and federal lands. Many of the subsequent amendments have not involved resource issues; however, the 1935 and 1986 amendments

added new requirements to incorporate fish and wildlife concerns in licensing, relicensing, and exemption procedures.

FERC is authorized to issue licenses to construct, operate, and maintain dams, water conduits, reservoirs, and transmission lines to improve navigation and to develop power from any streams or other bodies of water over which it has jurisdiction (16 USC 797[e]). Navigable waters (for which FERC has jurisdiction under the Commerce Clause) are defined to include "streams or other bodies of water over which Congress has jurisdiction to regulate commerce among foreign nations and among the States" (16 USC 796). Any license application for a project must contain conditions deemed necessary by the federal department that has jurisdiction to protect the resources (16 USC 797[e]).

The FPA requires PG&E to file an application with FERC for an amendment to the existing license to operate the hydroelectric facilities. Licenses are normally issued for terms of 30 years but may be issued for terms of up to 50 years (16 USC 799). The selected project must be the project best adapted to a comprehensive plan for improving or developing a waterway for several public benefits, including the "adequate protection, mitigation and enhancement of fish and wildlife" (16 USC 803[a]). These conditions are to be based on recommendations received pursuant to the FWCA from the USFWS, NOAA Fisheries, and state fish and wildlife agencies (16 USC 803[j][1]). The FPA empowers FERC to resolve any instances in which such recommendations are viewed as inconsistent, while according "due weight to the recommendations, expertise, and statutory responsibilities" of the resource agencies.

# Clean Water Act

## Section 401, Water Quality Certification

Section 401 of the CWA (33 USC 1251 *et seq*.) requires that proposed actions with federal agency involvement, including actions requiring federal agency approvals of a license or permit, that may result in a discharge of a pollutant into waters of the United States must not violate state or federal water quality standards. Section 401 also requires that any applicant for a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities that may result in any discharge into navigable waters shall provide the licensing or permitting agency a certification from the state in which the discharge originates. The certification shall state that any such discharge will comply with the applicable provisions of the following CWA sections:

- 301: Effluent Limitations
- 302: Water Quality Related Effluent Limitations
- 303: Water Quality Standards and Implementation Plans
- 306: National Standards of Performance

- 307: Toxic and Pretreatment Effluent Standards

The SWRCB must issue its water quality certification before FERC can approve PG&E's license amendment for the Hydroelectric Project. Similarly, CWA Section 401 water quality certification is needed before the Corps can issue Section 404 permits for the discharge of dredged or fill material.

## Section 402, National Pollutant Discharge Elimination System

In 1972, the CWA was amended to provide that the discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. The 1987 amendments to the CWA, which added Section 402(p), established a framework for regulating municipal and industrial stormwater discharges under the NPDES program.

The CWA, therefore, requires that all point sources that discharge pollutants into waters of the United States must obtain an NPDES permit. The NPDES program controls direct discharges into navigable waters. Direct discharges, or point source discharges, are from discrete conveyances such as pipes or human-made ditches and sewers. NPDES permits, which are issued by the state, contain industry-specific, technology-based, and/or water quality–based limits and establish pollutant monitoring and reporting requirements.

The regulations provide that discharges of stormwater to waters of the United States from construction projects that encompass 1 or more acres of soil disturbance are effectively prohibited unless the discharge is in compliance with an NPDES Permit. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. The permit will then set forth the conditions and effluent limitations under which a facility may make a discharge.

While federal regulations allow two permitting options for stormwater discharges (individual permits and general permits), the SWRCB may elect to adopt the statewide General Permit. The General Permit requires all discharges whose construction activity disturbs 1 acre or more to:

- develop and implement a SWPPP that specifies BMPs to minimize accelerated erosion and prevent all construction pollutants from contacting stormwater;
- eliminate or reduce nonstormwater discharges to storm sewer systems and other waters of the nation; and
- perform inspections of all BMPs.

The California Central Valley RWQCB will enforce any General Permit issued for the Restoration Project. Restoration Project construction activity subject to a General Permit would include clearing, grading, disturbances to the ground such as stockpiling, or excavation that results in soil disturbances of at least 5 acres of total land area. Construction activity resulting in soil disturbances of less than 5 acres is subject to a General Permit if it is part of a larger common plan of development that encompasses 5 or more acres of soil disturbance or if it results in significant water quality impairment. The SWPPP for the Restoration Project will apply to all construction clearing, grading, or disturbances to the ground such as stockpiling or to excavation that results in soil disturbance. The SWPPP will also address construction-related nonstormwater discharges and hazardous material spill prevention and recovery.

## Section 404

Section 404 of the CWA requires that a permit be obtained from the Corps for the discharge of dredged or fill material into waters of the United States, including wetlands. The Corps has jurisdictional authority to regulate all activities that dredge, dam, or divert navigable waters or that result in the deposit of dredged and fill material into waters of the United States, which includes perennial and intermittent streams, lakes, ponds, and nonisolated wetlands.

Under the Corps's evaluation, an analysis of practicable alternatives is a screening mechanism used to determine the appropriateness of permitting a discharge (CWA Section 404[b][1]). The Corps's evaluation also includes an analysis of compliance with other requirements of EPA guidelines, a public interest review, and an evaluation of potential impacts on the environment in compliance with NEPA.

General Nationwide Permits may be issued for similar actions with similar environmental effects, or individual permits may be issued for separate actions. Permit requirements for Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) are less extensive and prohibit the unauthorized obstruction or alteration of any navigable waters of the United States without a permit from the Corps. Where applicable, the Corps combines the permit requirements of Section 10 with those of Section 404 under one permit application. Restoration actions, except water acquisitions, water allocations, and water rights adjudications, may require successfully completing the Section 404 and Section 10 compliance process.

To issue a Nationwide Permit under Section 404, the Corps must ensure that the discharge will not violate the state's water quality standards. In California, all Nationwide Permits related to FERC project activities that may result in a discharge to a surface water of the United States must obtain an individual 404 permit, which requires a Section 401 water quality certification or a waiver of certification from the SWRCB. Additionally, the Corps must comply with the requirements of Section 7 of the ESA (16 USC 1531-1544) and Section 106 of the National Historic Preservation Act (NHPA) (16 USC 470). The Restoration

Project, if approved, will likely be authorized under Section 404 by the use of several Nationwide Permits and Letter of Permission (LOP). The Corps uses an abbreviated process to issue Letters of Permission for individual actions that have minimal adverse environmental effects.

An LOP is a type of Standard Permit issued through an abbreviated processing procedure, which includes coordination with federal and state fish and wildlife agencies as required by the FWCA, and a public interest evaluation, but without publishing of an individual public notice. Activities that qualify for processing through LOP procedures are fill activities that do not qualify for existing nationwide permit(s) or other general permit. These fill activities have minor impacts and therefore do not warrant more detailed processing. The LOP will be used only for those projects where the applicant performs a thorough pre-application coordination among the regulatory and resource agencies.

The LOP is an expedited process for an individual permit, where a decision to issue authorization is made within 45 days. (CWA 33 USC 1344; 33 CFR 325.2(e)(1)(ii).)

# Federal Endangered Species Act

Section 7 of the ESA of 1973 (16 USC 1531-1544, as amended) requires federal agencies, in consultation with the USFWS and the NOAA Fisheries, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of these species. The required steps in the Section 7 consultation process are as follows:

- Agencies request information from the USFWS and NOAA Fisheries regarding the existence of listed species or species proposed for listing in a project area.
- Following receipt of the USFWS and NOAA Fisheries responses to this request, lead 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.
- Lead agencies initiate formal consultation with the USFWS and NOAA Fisheries if the proposed action would affect listed species.
- The USFWS and NOAA Fisheries prepare a biological opinion to determine whether the action would jeopardize the continued existence of listed species or adversely modify their critical habitat.
- If a finding of jeopardy or adverse modifications is made in the biological opinion, the USFWS and NOAA Fisheries recommend reasonable and prudent alternatives that would avoid jeopardy, and the lead 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.

Because the Restoration Project is a CALFED action that could result in the destruction or adverse modification of the critical habitat of one or more species, Reclamation, as the federal lead agency, must comply with Section 7 of the federal ESA. In addition, the FERC license amendment approval process and the Corps Section 404 authorization, as federal actions, also will require compliance with Section 7 of the ESA.

The Restoration Project is funded by CALFED, and therefore, it is required, as a condition of several CALFED agreements, that an Action Specific Implementation Plan (ASIP) be prepared. An ASIP serves as a single document for entities implementing CALFED actions to simultaneously fulfill the requirements of the federal ESA, the California ESA, and the NCCPA. ASIPs provide project-level compliance with these acts and tier from the CALFED Multi-Species Conservation Strategy, which served as the CALFED programmatic biological assessment and NCCP and the CALFED programmatic biological opinions and NCCP determination. In the context of compliance with Section 7 of the federal ESA, the ASIP will serve as the biological assessment for the Restoration Project.

An ASIP will be prepared to assess the effect of the Restoration Project on the species listed or proposed for listing that are covered in the CALFED programmatic biological opinions. Although it is not anticipated, listed or proposed species that could be affected by the Restoration Project, but which are not covered under the CALFED programmatic biological opinions, will also be evaluated in the ASIP. The ASIP will be submitted with a request for formal Section 7 consultation with the USFWS and NOAA Fisheries. The formal consultation concludes within 90 days of the request for consultation being submitted to the USFWS and NOAA Fisheries. During consultation, the ASIP findings are reviewed. Based on that review, discussions may take place to modify the proposed action's features, designs, mitigation measures, and management plans to protect listed species while satisfying project objectives to the extent practicable. Within 135 days of beginning formal consultation, the USFWS and NOAA Fisheries must prepare biological opinions to determine whether the Restoration Project would jeopardize the continued existence of listed species or adversely modify or destroy their critical habitat.

## Fish and Wildlife Coordination Act

The FWCA (16 USC 661 et seq.) requires federal agencies to consult with the USFWS, NOAA Fisheries, and the state fish and wildlife resource agency (in this instance, the DFG) before undertaking or approving water projects that control or modify surface water. Under Subsection 2(a) of the FWCA, federal agencies are responsible for consulting with the USFWS for the purpose of conserving wildlife resources by preventing their loss and damage and providing for their

development and improvement in connection with water resource projects. Also, under Subsection 2(b), the USFWS is required to report its recommendations for wildlife conservation and development and the results expected and to describe the potential damage to wildlife attributable to the project and the measures proposed for mitigating or compensating for this damage. Federal agencies undertaking water projects are required to fully consider recommendations made by the USFWS, NOAA Fisheries, and the state fish and wildlife resource agency in project reports, such as the NEPA and CEQA documents, and to include measures to reduce impacts on wildlife in project plans. A Draft Fish and Wildlife Coordination Act Report is provided in Appendix Q of this document, and can also be accessed on the web site for the USFWS's Sacramento Office (http://sacramento.fws.gov), under the section titled "Of Special Interest."

# Federal Clean Air Act

The federal Clean Air Act, promulgated in 1970 and amended twice thereafter (including the 1990 amendment), establishes the framework for modern air pollution control. The purpose of the federal Clean Air Act (42 USC 7401-7661) is to protect and enhance the quality of the nation's air resources and, thereby, to promote the public health and welfare and the productive capacity of its population. The Clean Air Act requires that any federal action be evaluated to determine its potential impact on air quality in the project region. Specifically, the federal agency must make a conformity determination.

The Clean Air Act directs the EPA to establish ambient air standards for six pollutants: ozone, carbon monoxide, lead, nitrogen dioxide, particulate matter, and sulfur dioxide. The standards are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety and the latter to protect environmental values, such as plant and animal life.

The primary legislation that governs federal air quality regulations is the Clean Air Act Amendments of 1990 (CAAA). The CAAA delegates primary responsibility for clean air to the EPA. The EPA develops rules and regulations to preserve and improve air quality, as well as delegating specific responsibilities to state and local agencies.

The EPA has established NAAQS for criteria pollutants (Table 4.13-3). Criteria pollutants include CO, $NO_2$, $SO_2$, ozone, PM10, and lead.

Areas that do not meet the federal NAAQS shown in Table 4.13-3 are called *nonattainment* areas. For these nonattainment areas, the federal Clean Air Act requires states to develop and adopt SIPs, which are air quality plans showing how air quality standards will be attained. The SIP, which is reviewed and approved by the EPA, must demonstrate how federal standards will be achieved. Failing to submit a plan or secure approval could lead to denial of federal funding and permits for improvements such as highway construction and sewage

treatment plants. In cases where the SIP is submitted by the state but fails to demonstrate achievement of the standards, the EPA is directed to prepare a Federal Implementation Plan. In California, the EPA has delegated authority to prepare SIPs to the California Air Resources Board, which, in turn, has delegated that authority to individual air districts.

## National Historic Preservation Act

Section 106 of the NHPA (16 USC 470 *et seq*.) requires federal agencies to evaluate the effects of federal undertakings on significant cultural resources, termed historic properties. It requires federal agencies to coordinate with the SHPO and possibly the Advisory Council on Historic Preservation (ACHP) regarding the effects an undertaking may have on historic properties. Reclamation, FERC, and Corps involvement in implementing the Restoration Project activities and in authorizing federal licenses and permits triggers the need to comply with Section 106.

Section 106 defines the purpose and requirements of the federal review process to ensure that historic properties are considered during federal project planning and execution under the administration of the ACHP. The federal agency involved in a proposed project is responsible for initiating and completing the Section 106 review process. In general, Section 106 requires the federal agency to consult with the SHPO regarding a proposed project's effect on properties listed or eligible for listing on the NRHP. Other agencies may work with the SHPO and the ACHP throughout the process and may include other participants (e.g., federal and nonfederal agencies, Native American tribes, or applicants for federal grants, licenses, or permits) when proposed actions may affect their interests or activities.

Compliance with Section 106 will follow these steps:

- Historic or archaeological properties in the Restoration Project area, including properties listed on the NRHP and those properties that Reclamation and the SHPO agree are eligible for listing on the NRHP, are identified.
- If the Restoration Project is determined to have an adverse effect on historic properties, consultation with the SHPO and possibly the ACHP occurs to develop alternatives or mitigation measures to allow the project to proceed.

## American Indian Religious Freedom Act of 1978

The American Indian Religious Freedom Act of 1978 (42 USC 1996 *et seq.*) sets forth the policy of the U.S. Department of the Interior for protecting and preserving the observance of traditional Native American religions. The act requires that federal agencies evaluate their policies and procedures to ensure

compliance with the act. This consultation process will be coordinated with compliance with Section 106 of the NHPA.

## Indian Trust Assets

Indian Trust Assets are legal interests in property rights held by the United States for Indian Tribes or individuals. Trust status originates from rights imparted by treaties, statutes, or executive orders. Indian Trust Assets are lands (including reservations and public domain allotments), minerals, water rights, hunting and fishing rights, other natural resources, money, or claims. Assets include real property, physical assets, or intangible property rights. Indian Trust Assets cannot be sold, leased, or otherwise alienated without federal approval. They do not include things in which a tribe or individuals have no legal interest, such as off-reservation sacred lands or archeological sites in which a tribe has no legal property interest. Reclamation requires that NEPA documents include a determination of whether a project will have any impacts on Indian Trust Assets.

## Executive Order 11990, Protection of Wetlands

Executive Order 11990 is an overall wetlands policy applicable to all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. It requires affected federal agencies to follow avoidance, mitigation, and preservation procedures and to obtain public input before proposing new construction in wetlands. Derived from Executive Order 11990 is the Corps's "no net loss" policy for wetlands, which requires that any loss of wetlands be compensated for by creating wetlands with the same or similar value at a minimum one-to-one compensation-to-loss ratio.

The Restoration Project must be consistent with the overall wetlands policy contained in Executive Order 11990 because of the CWA Section 404 compliance requirements.

## Executive Order 12898, Environmental Justice

Environmental justice refers to the fair treatment of people of all races, income, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no person or group of people should shoulder a disproportionate share of negative environmental impacts resulting from the execution of environmental programs. Reclamation requires that NEPA documents include a determination of whether a project will have such negative impacts.

# California Water Code

Title 14 of the California Water Code is a body of law that among other things controls the appropriation and use of California's surface waters and the protection of surface water and groundwater. A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, nonwasteful use. Water rights are property rights, but their holders do not own the water itself—they possess the right to use it. The exercise of some water rights requires a permit or license from the SWRCB.

# California Environmental Quality Act

The Restoration Project is also subject to CEQA (Public Resources Code §21000 et seq.). SWRCB CEQA compliance is required as part of its responsibilities for implementing the provisions of the CWA (33 USC 1251 et seq.). Section 401 of the CWA requires that any applicant for a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities that may result in any discharge into the navigable waters shall provide the licensing or permitting agency a certification from the state in which the discharge originates.

Section 13160 of the California Water Code designates the SWRCB as the state water pollution control agency for all purposes stated in the Federal Water Pollution Control Act (33 USC 1251 et seq.) and any other federal act. The SWRCB's issuance of the water quality certification is a "discretionary" project[4] subject to CEQA compliance. The SWRCB will use the EIS/EIR for CEQA compliance. Section 401 of the CWA is discussed in greater detail on page 5-9.

# California Endangered Species Act

The CESA (Fish and Game Code §§2050–2068) generally parallels the main provisions of the federal ESA (16 USC 1531–1544) and is administered by the DFG. A state lead agency is required to consult with the DFG to ensure that any action it undertakes is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of essential habitat.

The CESA prohibits the "taking" of listed species except as otherwise provided in state law. Unlike the federal ESA, CESA applies the take prohibitions to species under petition for listing (state candidates) in addition to listed species.

[4] *Project* means the whole of an action that has a potential to result in either a direct or a reasonably foreseeable indirect physical change in the environment and that involves the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies (CEQA Guidelines §15378).

Section 86 of the California Fish and Game Code defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

Section 2081 of the California Fish and Game Code expressly allows the DFG to authorize the incidental take of endangered, threatened, and candidate species if all of the following conditions are met:

- the take is incidental to an otherwise lawful activity;
- the impacts of the authorized take are minimized and fully mitigated;
- the permit is consistent with any regulations adopted in accordance with Sections 2112 and 2114 (legislature-funded recovery strategy pilot programs in the affected area) and
- the applicant ensures that adequate funding is provided for implementing mitigation measures and monitoring compliance with these measures and their effectiveness.

The CESA provides that an incidental take permit obtained under the federal ESA may authorize the taking of endangered or threatened species listed under the CESA, with no further CESA authorization or approval (Fish and Game Code Section 2080.1).

## Natural Community Conservation Planning Act

The Natural Community Conservation Planning Act (Fish and Game Code Section 2800 et seq.) was passed in 1991 and added to the CESA. This act provides for voluntary cooperation among DFG, landowners, and other interested parties to develop natural community conservation plans (NCCPs) that provide for early coordination of efforts to conserve species listed under CESA and reduce the likelihood for new listings of species. The primary purpose of the act is to preserve species and their habitats while allowing reasonable and appropriate development to take place. In compliance with this act, the CALFED program prepared the MSCS that served as a programmatic NCCP. In July 2000, DFG approved the MSCS through its issuance of an NCCP Determination. In 2002, a new Natural Community Conservation Planning Act was signed into law that replaced the act of 1991. This new act included a clause that "grandfathered" all approved programmatic NCCPs (i.e., the CALFED MSCS and NCCP Determination) as continuing to be in affect (Section 2830[c]).

In compliance with CESA and NCCPA, an ASIP will be prepared that will serve as the project-level NCCP for the Restoration Project. As described above in the section on the federal ESA, the ASIP is a means for entities implementing CALFED actions to simultaneously fulfill the requirements of the federal ESA, CESA, and NCCPA. The ASIP will evaluate California-listed and unlisted species that are covered in the CALFED programmatic NCCP determination. Although it is not anticipated, California-listed species that could be affected by the Restoration Project, but which are not covered under the CALFED

programmatic NCCP determination, will also be evaluated in the ASIP and take authorization sought under CESA Section 2081.

## Lake and Streambed Alteration Agreement Program

Sections 1601 and 1603 of the California Fish and Game Code address permitting requirements for any action that alters a streambed and has a related potential to adversely affect fish and wildlife resources. If construction activity could potentially have a substantial adverse effect on fish or wildlife resources, reasonable modifications or measures to protect these resources are required. The DFG is empowered under these code sections to propose modifications or measures to protect fish and wildlife resources.

## California Regulations for Environmental Justice

Environmental justice is defined in statute as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (California Government Code Section 65040.12).

California State agencies are firmly committed to the achievement of environmental justice. Environmental justice for all Californians will be attained when all Californians, regardless of race, culture, or income, enjoy the same degree of protection from environmental and health hazards and equal access to decision-making processes.

## California Clean Air Act

The purpose of the California Clean Air Act (Stats 1988, ch 1568), as administered by the California Air Resources Board and the regional air quality management districts, is to protect and enhance the quality of California's air resources and, thereby, to promote and protect ecological resources and public health and welfare through the effective and efficient reduction of air pollutants, while recognizing and considering the effects on California's economy.

The California Clean Air Act of 1988 substantially added to the authority and responsibilities of air districts. The California Clean Air Act designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation control measures. The California Clean Air Act focuses on attainment of the state ambient air quality standards, which, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The California Clean Air Act requires designation of attainment and nonattainment areas with respect to state ambient air quality standards. The

California Clean Air Act also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for carbon monoxide, sulfur dioxide, nitrogen dioxide, or ozone. These Clean Air Plans are specifically designed to attain these standards and must be designed to achieve an annual 5% reduction in district-wide emissions of each nonattainment pollutant or its precursors. No locally prepared attainment plans are required for areas that violate the state PM10 standards.

The California Clean Air Act requires that the state air quality standards be met as expeditiously as practicable, but, unlike the federal Clean Air Act, does not set precise attainment deadlines. Instead, the act establishes increasingly stringent requirements for areas that will require more time to achieve the standards.

The California Clean Air Act emphasizes the control of "indirect and area-wide sources" of air pollutant emissions. The California Clean Air Act gives local air pollution control districts explicit authority to regulate indirect sources of air pollution and to establish traffic control measures (TCM). The California Clean Air Act does not define indirect and area-wide sources. However, Section 110 of the federal Clean Air Act defines an indirect source as

> "A facility, building, structure, installation, real property, road, or highway which attracts, or may attract, mobile sources of pollution. Such term includes parking lots, parking garages, and other facilities subject to any measure for management of parking supply…"

TCMs are defined in the California Clean Air Act as "any strategy to reduce trips, vehicle use, vehicle miles traveled, vehicle idling, or traffic congestion for the purpose of reducing vehicle emissions."

Recently enacted amendments to the California Clean Air act impose additional requirements designed to ensure an improvement in air quality within the next five years. More specifically, local districts with moderate air pollution that do not achieve "transitional nonattainment" status by December 31, 1997, must implement the more stringent measures applicable to districts with serious air pollution.

The effects of the Restoration Project on air quality must be considered during the EIR process. During construction, Reclamation may be required to consult with the California Air Resources Board or appropriate air quality management district to ensure that Restoration Project construction conforms to regulations contained in the federal Clean Air Act and California Clean Air Acts and their implementing regulations.

## Shasta County Permits

Reclamation will obtain all of the required permits for the Restoration Project from the appropriate Shasta County offices. Zoning, administrative, and user

permits will be obtained from the Department of Planning. Encroachment, transportation, and floodplain development permits will be obtained from the Department of Public Works. Grading and hazardous material permits will be obtained from the Department of Environmental Health. The permit to construct and operate, burning permit, and fugitive emission control permits will be obtained from the Air Quality Management District. Reclamation will submit device information sheets to the Air Quality Management District.

## Tehama County Permits

Reclamation will obtain all of the required permits for the Restoration Project from the appropriate Tehama County offices. Demolition and building permits and the floodplain development permit will be obtained from the Department of Building and Safety. County road encroachment permits will be obtained from the Department of Public Works. Hazardous materials applications will be filed with the Department of Environmental Health. The air pollution control district permit, fugitive dust permit, and agricultural burn permit will be obtained from the Tehama County Air Pollution Control District. Reclamation will submit device information sheets to the Tehama County Air Pollution Control District.

Chapter 6
# Related Projects

## Introduction

This chapter identifies other projects that may influence or be influenced by the Restoration Project and discloses their specific relationships to the Restoration Project. These projects were addressed in the "Cumulative Impacts" analyses found at the end of each resource section in Chapter 4.

Several agreements, investigations, programs, studies, plans, and proposed projects relate to the Restoration Project in different ways. Within the Battle Creek watershed—both downstream and upstream of proposed Hydroelectric Project modifications—the Restoration Project could affect and be affected by:

- continued interim flow agreements;
- actions at the Coleman National Fish Hatchery; watershed activities, community strategies, studies, and stewardship programs implemented by the BCWC;
- potential upstream hydropower development;
- gravel removal or introduction activities;
- sediment reduction programs; and
- long-term operational strategies of private trout-rearing facilities in the watershed.

The Restoration Project would be directly supported by engineering investigations of fish passage, information from nearby reference watersheds, development of wildlife habitat areas, continuing operations of state-run hatcheries, and continuing development of conservation easements and water rights. Because the support of local landowners and stakeholders is important to Restoration Project success, the related project discussions emphasize stakeholder concerns and proposed strategies to address them.

On a broader scale that extends to the upper Sacramento River, the Central Valley, and the CALFED solution area, the Restoration Project will benefit from and contribute important technical information to several larger restoration efforts through monitoring programs, continuing habitat studies, and other

information generated through the adaptive management process. The Restoration Project could help meet the goals of the CVPIA (Title 34, PL 102-575); the CALFED ERP (CALFED 2000b); the Comprehensive Monitoring, Assessment, and Research Program (CMARP)/CALFED Science Program; the Comprehensive Assessment Monitoring Program (CAMP); and other recovery, restoration, management, and enhancement plans for threatened and endangered species and their habitat. Figures 6-1 and 6-2 summarize these related projects and how they relate to the Restoration Project, beginning with those projects that could have the most direct and substantial effects on the Restoration Project in the Battle Creek watershed (Figure 6-1), followed by those related projects that support and will receive benefits from the Restoration Project (Figure 6-2).

# Projects That Could Directly Affect or Be Affected by the Restoration Project

## Interim Flow Agreements between the Bureau of Reclamation and Pacific Gas & Electric Company

Since 1995, Reclamation and PG&E[1] have entered into three consecutive interim flow agreements designed to increase continuous minimum instream flows in several reaches of Battle Creek. These agreements, referred to as the 1995, 1998, and 2003 Interim Flow Agreements, have led PG&E to provide increased flows above the license-required flows of 3 cfs in North Fork Battle Creek and 5 cfs in South Fork Battle Creek. These agreements, representing a partnership between PG&E, federal and state fisheries agencies, and restoration funding entities (CVPIA and CALFED), have allowed interim flow increases in the lower half of the Restoration Project affecting salmon and steelhead while a permanent or long-term arrangement could be reached. CALFED is providing funding for the 2003 Interim Flow Agreement, which is a continuation of the previous agreements reached in 1995 and 1998 that were funded under CVPIA. The temporary flow increase specified in the Interim Flow Agreements is authorized by a FERC license article stating there can be short-term modifications of flow for purposes of fishery management or diversion maintenance upon mutual agreement of PG&E and DFG (Interim Flow Agreement Exhibit A Article G). In relation to fishery management, temporary closure of fish ladders on North Fork and South Fork Battle Creek have been authorized by the fish agencies (Appendix B).

The 2003 Interim Flow Agreement partially pays PG&E for continuing to make temporary water supplies of up to 30 cfs available, primarily, to meet the fish and wildlife needs in both the South Fork and North Fork Battle Creek until implementation of the long-term Restoration Project has been completed. This

[1] Pacific Gas and Electric Company, a utility regulated by the California Public Utility Commission, owned the Battle Creek Hydroelectric Project (FERC Project Number 1121) at the time this document was prepared.

implementation, scheduled for 2004, would end the need for the 2003 Interim Flow Agreement. PG&E is currently required under the Hydroelectric Project's license from FERC to provide the following minimum instream flow releases: 3 cfs at Eagle Canyon and Wildcat Diversion Dams on North Fork Battle Creek and 5 cfs on South Fork Battle Creek. Under the 2003 Interim Flow Agreement, PG&E increases instream flows to 30 cfs through reductions in its hydropower diversions. PG&E provides the first 12.5 cfs at no cost and is compensated to maintain flows above 12.5 cfs up to 30 cfs in either of the forks of the creek. The agreement maintains 30 cfs in North Fork Battle Creek but also maintains seasonal flow augmentations in each of the forks, based on environmental conditions and needs. The actual determination of seasonal flow augmentation in either fork is based on monitoring and adaptive management principles in accordance with consultations between PG&E, the resource agencies, and Reclamation. The intent of the 2003 Interim Flow Agreement is to provide immediate habitat improvement in the lower reaches of Battle Creek as implementation of the more comprehensive Restoration Project moves forward. When Battle Creek has been improved by the implementation of the long-term Restoration Project, the flows provided by this interim agreement will have helped improve conditions for anadromous fish runs, thereby assisting in the strengthening of foundation stocks of anadromous fish in Battle Creek.

# Coleman National Fish Hatchery

## Hatchery Operations

The Coleman National Fish Hatchery is located on the north side of Battle Creek about 6 miles upstream of the confluence of Battle Creek and the Sacramento River. Because of its location on Battle Creek, facility operations at the hatchery are intimately linked to the Battle Creek watershed.

The authorized purpose of the Coleman National Fish Hatchery is to mitigate for the effects of Shasta Dam on salmonid populations. Shasta Dam resulted in the loss of approximately 187 miles of spawning and rearing habitat for anadromous salmonids (approximately 50% of the chinook salmon and steelhead spawning and rearing habitats) (Skinner 1958). To mitigate for habitat lost behind Shasta Dam, the federal government established the Shasta Salvage Plan, which contained several features, including the construction and operation of a fish hatchery (Moffett 1949).

The Coleman National Fish Hatchery was constructed on Battle Creek in 1942, and fish culture operations began in 1943 (Figure 6-3). The hatchery currently propagates three salmonid stocks: fall-run chinook salmon, late-fall-run chinook salmon, and steelhead. Risks that hatchery operations may pose to natural populations of steelhead and chinook salmon in Battle Creek include introduction, spread, or amplification of fish pathogens; deleterious genetic effects of hatchery fish on natural stocks; exceedance of the habitat carrying capacities; and fish migration blockage or delay (USFWS 2001a). Operational

and or physical modifications to address some of these issues are underway or being addressed in support of the Restoration Project (USFWS 2001a).

As governed by federal law, principles and legislation, the Coleman National Fish Hatchery will (1) continue to operate to mitigate for the losses of anadromous salmonids associated with the construction of Shasta Dam, (2) participate in species restoration and recovery programs as necessary or appropriate, (3) continue to assess and modify its operations to reduce or avoid impacts on stocks listed as endangered species, and (4), in support of CVPIA and CVPIA's AFRP, continue to attempt to reduce impacts on natural populations basinwide.

The hatchery is managed under an interagency agreement between USFWS and Reclamation. The existing 1993 interagency agreement supercedes all previous agreements between USFWS and Reclamation pertaining to the operation and funding of the hatchery. The agreement stipulates that USFWS will continue to operate, maintain, and evaluate the facility "for the salvage, protection, and preservation of fish spawned in the upper Sacramento River Basin prior to the construction of Shasta and Keswick Dams" (USFWS 2001a, Attachment 3-1). Reclamation will reassume financial responsibility for the facility and arrange for recovery costs from project beneficiaries in accordance with federal reclamation law.

Figure 6-3
Coleman National Fish Hatchery

## Endangered Species Act Requirements

The recently completed biological assessment for Coleman National Fish Hatchery operations (USFWS 2001a) describes fish propagation programs at the Coleman National Fish Hatchery and assesses the potential impacts resulting from those artificial propagation programs to naturally produced salmonids. It fulfills USFWS's obligations for consultation with NOAA Fisheries under Section 7(2)(a) of the ESA of 1973 (16 USC 1531-1544). The current biological assessment is intended to provide a single, comprehensive source of information to describe and assess the impacts of current or proposed operations of the Coleman and Livingston Stone National Fish Hatcheries on ESA-listed, Central Valley populations of anadromous salmonids. The ESA Section 7(2)(a) consultation process is specifically designed to determine if proposed activities are likely to jeopardize the continued existence of listed species or to result in the destruction or adverse modification of their critical habitats.

In addition to filling this customary role as part of the ESA Section 7 consultation process, the biological assessment also focuses on potential impacts of hatchery facilities and operations within the Battle Creek watershed and addresses many of the concerns raised during the Coleman National Fish Hatchery reevaluation process. USFWS recognizes the importance of integrating hatchery operations

with natural salmonid production in Battle Creek, especially in light of pending restoration activities within the watershed.

Within the biological assessment, USFWS acknowledges that incidental take of ESA-listed species of anadromous salmonids may occur during the course of conducting fish propagation programs. In some cases, incidental take estimates are directly quantifiable, while in many other cases, impacts can only be assessed qualitatively. As a result of the submission of the biological assessment, USFWS expects that NOAA Fisheries will issue a biological opinion and incidental take authorization to cover the incidental take of all ESA-listed, Central Valley salmonids affected by the described artificial propagation activities. USFWS will work with NOAA Fisheries to ensure that the biological opinion clearly indicates the need for a new biological assessment when the Restoration Project is completed USFWS pers. comm. 2001b).

The current biological opinion will be in effect over the short term (less than 10 years) and a new consultation will be triggered by its expiration date or by a change in the resource brought on by the Restoration Project. USFWS will prepare a new biological assessment when the Restoration Project is complete (USFWS pers. comm. 2001b).

## Battle Creek Watershed Conservancy Formation

In 1997, the Western Shasta Resource Conservation District received CALFED Bay-Delta Program funding to organize and develop a conservancy for the Battle Creek watershed. The conservancy's guiding watershed "community" plan was intended to supplement existing technical plans for hydropower, water flow, hatchery production, and water supply. The Battle Creek watershed plan addressed:

- identification of important factors affecting aquatic habitats of spring-run chinook salmon, especially those on private lands or affecting private interests;
- recommended projects and programs to address these factors; and
- description of a monitoring program to evaluate current conditions and results from such projects and programs.

This community plan, when combined with the technical plan, would result in a two-tiered total plan for the watershed. The funding supported the following activities:

- conducting monthly conservancy meetings that focused on restoration efforts and technical planning in the watershed and semiannual public meetings that collected related public input on that planning;
- conducting educational tours of restoration or otherwise significant sites;

- developing articles for publication in local newspapers;
- arranging for on-site television coverage of restoration plans and activities;
- developing booklets, handouts, and brochures for use in meetings and for distribution to interested individuals;
- developing a watershed-wide database that listed private landowners, interested members of the general public, agency contacts, private businesses, environmental groups, and others; and
- assembling a library of published material about the watershed.

The benefits of the conservancy include its ability to bring all involved parties together to discuss watershed restoration efforts, to include community-related issues not found in other technical plans prepared by the agencies, and to provide educational opportunities directed at developing a greater public appreciation and "buy-in" for the restoration efforts.

## Battle Creek Watershed Assessment Report

In 1998, the Working Group received CALFED Bay-Delta Program funding to complete the Battle Creek Watershed Assessment Report. The report is expected to be completed by July 2003 with the support of the Working Group and Terraqua Consulting. The report describes the ecological state of the Battle Creek watershed and the historical roles it has played, particularly in the development of hydroelectric power and fish culture. It also describes several predecessor salmon restoration plans for Battle Creek that produced only modest results because of the lack of sufficient habitat information and restoration funding.

Because the Watershed Assessment Report contemplates a substantial reallocation of streamflow away from hydroelectric production, including the complete removal of some dams and their appurtenant facilities, it carefully spells out the steps taken to assign species priorities (e.g., winter-run chinook salmon) to each stream reach. It also takes care to determine the factors of greatest concern (e.g., upstream migration, spawning, egg incubation) for the successful production of each priority species in each target reach. It defines the streamflow and temperature parameters needed to serve each priority species and target reach and to resolve each production-limiting factor. The report also sets out those physical actions and the monitoring and evaluation needed to achieve and sustain the restoration of salmon and steelhead in Battle Creek.

Overall, the Watershed Assessment Report provides the essential biological criteria and information on which negotiations between PG&E and the federal and state natural resource agencies were conducted to arrive at the MOU described in Chapter 3 of this EIS/EIR.

# Battle Creek Watershed Community Strategy

The Battle Creek Watershed Community Strategy was prepared in 1999 for the BCWC (Paquin-Gilmore 1999). The Battle Creek Watershed Project is a cooperative project of the Tehama County Resource Conservation District and the BCWC. It is supported by grant funds from CVPIA (Title 34, PL 102-575) and CALFED Bay-Delta Program.

The Battle Creek Watershed Community Strategy is a long-term plan developed as a response to the Restoration Project. The strategy is the result of extensive public input from many community meetings and reflects the concerns and goals of local stakeholders regarding the Battle Creek watershed. It emphasizes strategies and actions to support the restoration of chinook salmon to Battle Creek and the continuation of a healthy, fully functioning watershed. Recognizing the stewardship responsibilities that all landowners assume within the watershed, the strategies emphasize "on-the-ground" actions and Best Management Practices to ensure the continued health of the watershed.

The Battle Creek Watershed Community Strategy describes the watershed, private and public lands, their uses, the Coleman National Fish Hatchery, and the communities of Manton, Mineral, Shingletown, and Viola. It also describes the formation and ongoing work of the Working Group and BCWC in facilitating restoration efforts and progress in the watershed. Most importantly, it clearly states the community issues and recommendations regarding the following community concerns:

- protection of existing water rights,
- threats to local economic activities,
- restrictions on land use,
- increased federal ownership and presence,
- control of invasive weeds,
- private stewardship options in the future,
- preservation of the rural landscape, and
- fuels management.

The strategy offers several potential solutions and accompanying action items reflecting the position of those landowners, businesses, and residents that will be most directly affected in the long term by the changes caused by implementation of the Restoration Project.

Because of its insights regarding the concerns and likely responses of the local populace to Restoration Project implementation, several of the mitigation measures presented in the land use, water quality, public health and safety, and other sections of this EIS/EIR rely heavily on recommendations made in the Battle Creek Watershed Community Strategy. Most importantly, the BCWC is

well suited to foster long-term acceptance of the Restoration Project by the local community, which will be a critical component to the success of adaptive management and the Restoration Project. The perception of the Restoration Project by local community members ranges from "it's a government-imposed burden" to "it's a worthy project that we want to help." If the BCWC and the MOU parties can work together to successfully implement the Restoration Project, the challenge will be to give members of the local community a reason to embrace the Restoration Project. The BCWC has suggested that if the local community is encouraged to participate in adaptive management monitoring and data management, community acceptance, a sense of ownership in the outcome of the Restoration Project, and the eventual success of the Restoration Project are far more probable than in the absence of such encouragement.

# Suggested Water Quality Monitoring

Inasmuch as it is motivated and funded to do so, the BCWC, with participation from local schools, may be the organization most suited to monitoring certain aspects of the watershed that either fall within or are complementary to future adaptive management of the Restoration Project.

## Sediment Quality Monitoring

One of the most easily measured symptoms of deleterious land use practices is an increase in sedimentation within Battle Creek. The BCWC could partner with local schools to initiate sediment quality monitoring. Using relatively simple scientific sampling regimens, young residents of the watershed could provide an early-warning system for the health of the Battle Creek uplands, while learning about and forming a connection with the unique populations of salmon and steelhead that will be restored in their watershed.

## Ongoing Watershed Assessment

Sediment quality monitoring is useful in detecting erosion problems. The BCWC believes that a locally developed, long-term watershed assessment program would be able to prevent erosion problems before they occur or, at least, before they affect stream habitat in the Restoration Project. The BCWC could help landowners in the upper watershed implement appropriate land-use practices that would protect against ecological impacts and avoid the need for future regulatory actions.

## Water Temperature and Climate Monitoring

Water temperature and climate monitoring will be elements of adaptive management and are activities that might be done efficiently and cost-effectively

by the BCWC. Depending on the BCWC's interest, it may be possible for the resource agencies to train and fund the BCWC to collect this critical information. Some private landowners may not allow resource agency personnel to access Battle Creek for monitoring but would allow access to a member of the community. In these situations, it is possible that key adaptive management monitoring elements, such as temperature monitoring, would be feasible only with the support and participation of the local community.

### Data Management and Dissemination

The BCWC operates and maintains an information system in which data collected as part of the Restoration Project can be stored and disseminated. This system enables the BCWC and local community members to monitor changes in the watershed and to assess the effects of those changes on the fish populations and habitat in the Restoration Project area. This system complements and, in many respects, outperforms agency-maintained databases that have been designed for Central Valley–wide applications. The BCWC foresees using this information system as a critical way to assist in the adaptive management process.

## Battle Creek Watershed Stewardship

The BCWC received CALFED Bay-Delta Program funding for implementing tasks essential for the stewardship of the Battle Creek watershed. This BCWC project directed long-term protection of the public investment in the watershed through the following tasks:

- implementation of a watershed strategy,
- development of a workgroup to address upper watershed processes,
- implementation of fuels management and fire defense improvements,
- planning and implementation of conservation easements, and
- control of noxious weeds.

Five benefits from this stewardship effort were:

- reduced stressors on the anadromous fish in Battle Creek;
- protection, restoration, and maintenance of ecological processes and functions in the watershed;
- maintenance and restoration of riparian communities with local landowner cooperation;
- completion of a future work plan to further reduce stressors; and

- setting of the stage for further cooperation by landowners as restoration efforts continue, which will also further reduce stressors.

## Battle Creek Watershed Stewardship, Phase II

The BCWC is conducting a series of initiatives under the program titled "Battle Creek Watershed Stewardship, Phase II." This program is funded by AFRP and was approved for federal funding throughout the CALFED 2001 proposal solicitation process. It reflects the goal of integrating CALFED and AFRP in habitat restoration in the Central Valley.

The specific objectives of the program are described below.

- Conduct an assessment of watershed conditions in the upper watershed and for the lands lying upslope and downstream of the Restoration Project reaches. The watershed assessment will (1) characterize the physical condition of fish-bearing stream channels throughout the watershed, using state-of-the-art stream survey techniques developed and implemented by the U.S. Forest Service's Aquatic and Riparian Effectiveness Monitoring Program; (2) establish monitoring sites that will be used for long-term monitoring of in-channel stream conditions as indices of land use impacts to streams; and (3) characterize land use and upland conditions that could affect streams, using protocols established by the State of California's North Coast Watershed Assessment Program.
- Implement, in close cooperation with resource agencies and local schools, a watershed information system to assist the monitoring, assessment, and adaptive management of the Restoration Project. The system will include an updating of the KRIS (Klamath Resource information System) Battle Creek watershed information management program that was developed to support the Restoration Plan. The updated watershed information system will be structured to store, display, and analyze spatial and nonspatial data collected as part of the watershed assessment, long-term stream monitoring, and the Adaptive Management Program specified under the MOU.
- Sustain implementation of the watershed strategy, through outreach by BCWC's board of directors and watershed coordinator, to the area's schools, communities, agencies, and landowners.

## Greater Battle Creek Watershed Working Group

The Working Group was created to recognize the value of coordinating the planning, implementation, and evaluation of all fish habitat restoration and watershed projects among public agencies, nonprofit organizations, and private landowners within the greater Battle Creek watershed in order to maximize restoration of all naturally produced anadromous fish and maintain, and restore, as necessary, a healthy watershed and landscape.

Various objectives for the greater Battle Creek watershed that were identified by the Working Group include:

- establishing a transparent, balanced, collaborative, respectful, and inclusive forum for communication that ensures activities within the watershed are synchronized and that goals, objectives, and evaluative processes of agencies and organizations are coordinated;
- taking necessary steps to develop a comprehensive greater watershed strategy to ensure that fish, habitat restoration, or watershed projects support and make important contributions to the recovery of, and have no long-term adverse effect on, listed species (i.e., winter-run and spring-run chinook salmon and steelhead), the restoration of nonlisted naturally produced runs (i.e., fall-run and late fall-run chinook salmon), production of chinook salmon for sport and commercial uses, production of steelhead for in-river sport uses, and the continued health of the riparian and upland habitat;
- identifying specific needs for new projects based on the comprehensive greater watershed strategy and current or planned activities within the watershed;
- adopting and applying principles of science and, as appropriate, adaptive management processes to actions considered and undertaken in the comprehensive greater watershed strategy;
- engaging agencies, organizations and the public to provide information on the comprehensive greater watershed strategy and adaptive management processes, identifying and communicating issues and proposed projects, and maximizing compatibility of activities of the Coleman National Fish Hatchery, Livingston Stone National Fish Hatchery, Restoration Project, and agencies, private industries, and nonprofit organizations operating within the greater Battle Creek watershed;
- establishing and implementing a review process for fish, fish habitat restoration, and watershed projects undertaken within the greater Battle Creek watershed that may result in endorsement by members of the Working Group;
- defining and developing administrative processes to guide the Working Group in accomplishing its objectives effectively and efficiently; and
- reviewing and proposing communication and education programs for the Battle Creek community.

The Working Group has developed a draft MOU that memorializes/captures these objectives for the Battle Creek watershed. The Working Group seeks to encourage projects that are consistent with a community- and science-based greater watershed strategy and that incorporate the principles of adaptive management (to be adopted by the Working Group) and establish programmatic linkages between the major actions in the watershed, on the stream course, and with the Coleman and Livingston Stone National Fish Hatcheries. The Working Group provides an opportunity for stakeholders, agencies, and the public to

participate in open coordinated discussions on various watershed activities in the greater Battle Creek watershed.

Working Group members will provide input on plans or projects reviewed by the Working Group. Members of the Working Group also seek to advance:

- the Multi-Species Conservation Strategy,
- CVPIA doubling goals of naturally produced salmonids pursuant to AFRP,
- FERC policy regarding hydroelectric project compatibility with comprehensive plans,
- CALFED ecosystem restoration goals to restore and enhance habitat, ecosystem functions and processes, and
- BCWC community strategy goals.

# Lassen Lodge Hydropower Project

The Lassen Lodge Hydropower Project is a proposed 7,000-kilowatt hydroelectric generating station to be constructed on the western slopes of the Cascade Range near the town of Mineral, an unincorporated community in Tehama County, California. The project would be sited along the south bank of South Fork Battle Creek at elevations between 3,062 and 4,310 feet above mean sea level. At this site, South Fork Battle Creek drains an area of approximately 33 square miles south and west of Lassen Volcanic National Park.

The project would consist of a natural, grouted rock and boulder diversion approximately 80 feet long and 5 feet high with a concrete stem wall, a concrete intake, and approximately 19,200 feet of buried penstock from elevation 4,310 feet down to the powerhouse at elevation 3,062 feet. The intake would include fish screens and valves for sluicing silt from the intake. The powerhouse would be constructed of a reinforced concrete substructure, a superstructure of concrete block and metal, and an electrical substation adjacent to the powerhouse.

The Tehama County Power Authority previously licensed the Lassen Lodge Hydropower Project on January 30, 1986, under FERC Project 5350. It later surrendered the license because it was unable to negotiate site control for the powerhouse and other components of the project. The current applicant has obtained all required easements for the project and property access (Hagood 2001) and is now FERC Project number is 11894.

The proposed project is located upstream of South Diversion Dam and above Panther Creek. Previous studies have listed the natural streambed features near Panther Creek as the absolute upstream barrier for anadromous salmonids. Since 1998, the resource agencies' position has been that the natural features (a waterfall referred to as Panthers Grade) are not a total barrier to anadromous fish

passage but appear to be a temporary or partial barrier under certain low flow conditions. The issue is currently being investigated.

## Gravel Removal Agreements

Between 1988 and 1995, PG&E and DFG entered into and renewed a series of streambed alteration agreements that permitted PG&E to dispose of gravel and sand that had accumulated behind South, Inskip, and Coleman Diversion Dams. Disposal included placing the gravel and sand immediately downstream of the dam from which they were dredged. The cleaning became necessary when the gravel and sand restricted flow to the fish ladders and canal inlet. The intent of these agreements was to mimic natural downstream sediment movement and to enhance the spawning gravel for salmon and steelhead. Enhanced spawning habitat is consistent with the Restoration Project. Currently, DFG and PG&E are working to formalize this agreement and will include the final version as part of the FERC license amendment for the Hydroelectric Project.

## U.S. Forest Service Sediment Reduction Programs

The U.S. Forest Service has been conducting a few limited programs in the Battle Creek watershed related to stream restoration. These programs have included several road restoration measures, such as culvert replacements, that are intended to reduce sediment delivery to the stream. In the summer of 2000, Lassen National Forest assessed wildfire fuels in the Battle Creek watershed under a contract with the BCWC. Although all national forest lands in the watershed are outside the Restoration Project and outside the area that will be adaptively managed, the long-term success of the Restoration Project could be compromised if the U.S. Forest Service does not remain committed to reducing sediment delivery to Battle Creek (Chapell pers. comm.).

## Other Trout-Rearing Facilities

The watershed includes one state hatchery and nine private trout-rearing facilities operated by Mt. Lassen Trout Farms, Inc. These private facilities rear rainbow and brown trout for stocking in private ponds and lakes throughout California (Mt. Lassen Trout Farms 1998). Although these facilities are located above the anadromous habitats of Battle Creek, some facilities, such as the main brood stock facility, are near Hydroelectric Project power canals. Concern has been expressed about possible disease transmission between the canals and these facilities (Mt. Lassen Trout Farms 2000). For example, pathogens from infected chinook salmon and steelhead in Battle Creek could be conveyed with flow and fish diverted from Battle Creek. The pathogens could be transferred to fish farms through seepage of canal flow into the spring-water source for the hatchery operations or by birds and mammals that may eat infected fish and subsequently

carry the pathogen to fish-rearing ponds. Potential socioeconomic impacts associated with these private trout-rearing facilities are analyzed in Section 4.16, "Other NEPA Analyses."

DFG stocks put- and take- rainbow trout in the lakes, reservoirs, and stream reaches above the barriers on the two forks of Battle Creek. Steelhead and rainbow trout are the same species, but rainbow trout is the resident form. Put-and-take steelhead stocking may risk outbreeding depression, loss of genetic fitness, and increased competition to the steelhead population in lower Battle Creek. Outbreeding depression and increased competition may occur if the strain of the stocked steelhead differs from the strain of steelhead in lower Battle Creek. A wide variety of nonnative strains are raised at Darrah Springs State Fish Hatchery, and they, at least, could accidentally co-mingle with Battle Creek–origin fish. If the two strains co-mingle via downstream or accidental release in areas occupied by steelhead of Battle Creek–Sacramento River origin, they may interbreed or compete. However, the processes for producing sterile steelhead are thorough enough to ensure that all fish produced are sterile.

Hybridization may lead to outbreeding depression. When genetically divergent populations interbreed, the progeny may be less fit because of a loss of local adaptation (Templeton 1986). Loss of local adaptation may produce divergent phenotypes. For example, crossbred steelhead juveniles risked exposure to predators more often than naturally produced steelhead (Johnson and Abrahams 1991). McEwan (pers. comm.) claims that rainbow trout and steelhead are considered one genetic "metapopulation" in California because they intermingle and breed with each other. The propagated steelhead may possess genotypes maladapted for Battle Creek, let alone the Sacramento River drainage. When mixed by interbreeding, these propagated steelhead could contribute to outbreeding depression. The extent of this potential problem has not been evaluated.

## Darrah Springs Hatchery

Darrah Springs Hatchery is a state-run facility located at Darrah Springs on Baldwin Creek, a tributary to mainstem Battle Creek. It is a key hatchery of DFG's inland fisheries program and raises catchable trout for sport fisheries, using a wide variety of strains, including Eagle Lake and Mt. Shasta–strain steelhead.

# Projects That Support the Restoration Project Purpose and Need

## AFRP- and CVPIA-Related Improvements to the Coleman National Fish Hatchery

Changes have been under way at the hatchery to integrate hatchery operations with the Restoration Project. In the last 12 years, approximately $30 million has been spent renovating the hatchery (USFWS 2000). Much of the work completed or in progress includes three specific actions: constructing an ozonation water treatment plant and water filtration system, screening the hatchery's water intakes, and modifying the hatchery's barrier weir and upstream fish ladder. These actions are fully expected to support the current Restoration Project as described below (USFWS 2001a).

- The newly constructed water treatment plant at the hatchery is capable of sand-filtering 45,000 gpm and ozonating 30,000 gpm of fish production water. The new system's water treatment capabilities will alleviate concerns that potentially disease-carrying fish will pass into upper Battle Creek, where the hatchery obtains its water (USFWS 2001a).
- The hatchery's water intakes will be screened to avoid impacts to naturally produced fish in the system. The new fish screens will comply with screening criteria established by NOAA Fisheries and DFG.
- The proposed modifications to the hatchery's barrier weir and fish ladders will improve the management of fish passage and monitoring. Controlled passage and monitoring of chinook salmon and steelhead into the upper Battle Creek watershed allows runs to be segregated and counted at that point, thus affording the capability to measure and maximize restoration benefits for "at-risk" priority stocks (USFWS 2000).

## Expanded Water Treatment and Filtration at the Hatchery

To correct sediment and disease problems at the Coleman National Fish Hatchery, USFWS has expanded the water treatment system to a 45,000-gpm capacity and the ozonation water treatment system to a 30,000-gpm capacity. Increasing and improving the water filtration and treatment systems will minimize the risk of catastrophic hatchery events and will optimize the hatchery's production capabilities (USFWS1997e).

In 1985, whirling disease (*Myxobolos cerebralis*) infections at the hatchery triggered the destruction of the entire year-class of steelhead smolt production, consistent with hatchery policy, and punctuated the hatchery's need to develop a pathogen-free water supply. The *Coleman National Fish Hatchery Station*

*Development Plan*, approved in 1987 by USFWS, includes a provision for a pathogen-free water supply to benefit hatchery fish production. Ozonation was the identified treatment alternative. An adequately treated water supply minimizes the risk of potential outbreaks of catastrophic diseases affecting hatchery production. It also enables the hatchery to produce healthier juvenile fish more capable of withstanding the rigors of out-migration. These fish also have a better chance of surviving to adulthood.

The complete treatment facility results in:

- potential for restoration of natural production in Battle Creek above the hatchery's water supply intakes by eliminating the hatchery's disease threat and minimizing potential catastrophic events through filtration and disinfection of the water supply;
- likely decrease the egg-incubation and fish-development mortality rate, thus increasing survivorship; and
- likely increase smolt-to-adult survivorship because potential decrease in fish mortality and sublethal effects caused by waterborne pathogens (USFWS 1997a).

The background, previous treatment studies, objectives, water treatment alternatives considered for the Coleman National Fish Hatchery, environmental consequences, and related activities are discussed further in the environmental assessment for the Coleman National Fish Hatchery improvements (USFWS 1997a). The environmental assessment explains the relationship between the improvements and natural fish restoration planning.

## Water Intake Screening

A proposal for funding this project was submitted to CALFED's Ecosystem Restoration Program in 2001. Although not selected for funding at that time, the need and desire for the project is not diminished. Agency management (USFWS, NOAA Fisheries, Reclamation, and DFG) have all agreed that all Coleman National Fish Hatchery water intakes on the mainstem of Battle Creek require screens. Once funding has been secured, permitting, design, and construction are anticipated to take 3 years to complete. Completion of the project is expected to benefit fish in the upper Battle Creek watershed by eliminating any entrainment risks associated with the hatchery water-supply intakes. More detailed discussions of alternatives, their design elements and standards, and environmental consequences will be discussed in future meetings of the Battle Creek Working Group and environmental documentation associated with the intake modification process.

## Modifications to the Hatchery Barrier Weir and Upstream Ladder

The abundance and distribution of salmon and steelhead populations in Battle Creek have been managed since 1952 by the operation of a large, permanent fish barrier weir at the Coleman National Fish Hatchery (DFG 1998). Prior to that time, adult salmon were collected from Battle Creek at seasonally installed racks at the historic Battle Creek Hatchery (USFWS 1957). The fish ladder at the existing permanent dam is closed to create a migration barrier during periods of brood stock congregation and collection (currently September 1 through early March). The primary purposes of the barrier dam and upstream ladder include:

- congregating and collecting brood stock for the hatchery (USFWS 1998b),
- temporally and spatially separating spring-run and fall-run fish to maintain or manipulate stock identity (Reclamation 1998),
- preventing fish from reaching habitat altered by lack of flow and large, unscreened diversions and preventing overpopulation of habitat by large numbers of hatchery fish, and
- monitoring fish movement into the Battle Creek watershed (USFWS 1996).

The present configuration and future operational strategy of the Coleman National Fish Hatchery barrier dam are currently under investigation by a multiagency team assembled by the Greater Battle Creek Watershed Working Group (Working Group). The physical structure and operational strategy of the barrier weir will be modified, as necessary, to accommodate the Restoration Project. Future operations of the barrier weir will be adapted to integrate with restoration activities in Battle Creek. As part of a successful integration strategy, upstream passage of anadromous salmonids will be blocked from September 1 through early March for the purpose of collecting brood stock of fall-run and late-fall-run chinook salmon and steelhead. However, even during this period, fish can be afforded upstream passage via the Coleman National Fish Hatchery spawning building. In fact, this strategy is currently employed for natural-origin late-fall chinook salmon and steelhead adults. In general, the barrier weir, and associated upstream fish ladder, or other conveyance facilities will be operated in a manner such that the restoration potential for target stocks will be achieved in Battle Creek.

Management of the Coleman National Fish Hatchery barrier weir and upstream ladder is one of the factors controlling the abundance of salmon and steelhead in Battle Creek and a concern for the restoration of anadromous salmonids in the watershed (USRFRHAC 1989; DFG 1993, 1996a; USFWS 1995a, 1997c; Bernard et al. 1996). However, restoration actions recently undertaken in the watershed and those proposed to take place in the near future alleviate much of the former concern that prompted prolonged closures. For example, the construction of ozonation water treatment facilities to disinfect water at the hatchery alleviated disease concerns for the upstream passage of salmon (USFWS 1998b). Furthermore, anticipated flow and habitat restoration actions,

including screening diversions, will alleviate concerns about altered quality and insufficient amount of habitat.

Anticipation of Restoration Project implementation and the need to allow recovering populations of salmon and steelhead to migrate upstream throughout the year have affected the management of the barrier weir. In the future, management of the barrier weir may accommodate the movement of naturally produced salmon and steelhead so they can access the best stream reaches at the right times. A panel was convened in light of commitments by USFWS and DFG to explore improvements to the barrier weir that complement or enhance restoration of natural spawners (USFWS 1998b; DFG 1998a). USFWS, with input from the panel, submitted a proposal that received CALFED funding in 1999. Specific objectives of the proposed modifications are designed to more effectively block the passage of fall-run and late-fall-run chinook salmon and to improve the upstream fish ladder as per future agreed upon criteria. USFWS is working with a subgroup of the Battle Creek Working Group to determine design and future operations of this facility prior to initiation of formal NEPA process scheduled for 2004.

Barrier weir and upstream ladder operations or modification can further support or be affected by the Restoration Project because fish trapping and monitoring facilities at the upstream fish ladder will be used to support several adaptive management objectives. Adult anadromous salmonids returning to the Restoration Project area will be captured and sampled for such information as population estimates, run timing, stock, size, and condition. Future activities to monitor upstream migration of adults into the restored portion of the Battle Creek watershed can be modeled after the monitoring conducted at this site by the USFWS office in Red Bluff since 1995 (USFWS 1996).

## Reevaluation Process and Hatchery Management Alternatives Analysis

The Coleman National Fish Hatchery reevaluation process was formally initiated in 1999 in response to the anticipation of the Restoration Project and other concerns. The primary goal of the reevaluation process is to objectively review all aspects of the hatchery facilities and operations to ensure their integration with AFRP-guided restoration efforts in Battle Creek. During a series of public meetings, participants of the reevaluation process, including stakeholders and agency personnel forwarded more than 50 alternative operational strategies for conducting fish propagation activities at the Coleman National Fish Hatchery. Those alternatives are currently being analyzed.

The four major components of the reevaluation process are:

- compilation and analysis of historical hatchery operations and evaluation work,
- determination of mitigation responsibilities,

- analysis of potential impacts of current and proposed production programs on listed stocks of anadromous salmonids, and
- generation and analysis of potential management alternatives to minimize hatchery impacts on naturally produced salmonid populations.

This broad-based reevaluation process is in addition to the ongoing hatchery evaluation program conducted by the USFWS office in Red Bluff (e.g., biological investigations and hatchery permitting, biological assessments, and enhancement permits). Through the Coleman National Fish Hatchery reevaluation process and the biological assessment for Coleman National Fish Hatchery operations (USFWS 2001a), USFWS will address concerns regarding hatchery programs and activities that could potentially affect the restoration of naturally produced populations of anadromous salmonids in Battle Creek. Potential modifications to hatchery activities being examined through the reevaluation process and the adaptive management of hatchery operations will be designed to minimize potentially negative impacts of hatchery activities to naturally produced salmonid populations. Modifications to hatchery activities or facilities that may result from the reevaluation process may necessitate reinitiation of consultation with NOAA Fisheries and amending or revising the biological assessment for hatchery operations.

The alternative hatchery operational and management strategies formulated during the reevaluation process were grouped, based on similarities between alternatives, with some alternative groupings being analyzed by USFWS and others identified to be analyzed by an independent consultant (Harza Engineering Co. 2001). At this point in the analysis process, two reports have been completed by USFWS (USFWS 2002a, 2002b*)* and a draft report has been completed by the independent consultant (Harza Engineering Co. 2001) to assess the feasibility and biological impacts of these alternative management strategies.

In May 2001, several local landowners and other stakeholders responded collectively to the Coleman National Fish Hatchery draft alternatives analysis produced by the independent consultants. The stakeholders expressed concern that the contractors conducting the evaluation were constrained by the budget and might be unable to complete the robust assessment required by the stated scope of work. They were also concerned that limitations on the budget for the reevaluation could limit the ability of all involved to adequately address FESA restoration mandates for anadromous fishes. They expressed concern that without completion of the intended scope of work, other stakeholders, managers from the Coleman National Fish Hatchery, and Reclamation were unlikely to be equipped to make informed decisions on the compatibility of hatchery operations with Battle Creek restoration efforts. The stakeholders advocated further development and disclosure of conceptual models and proposed criteria to guide the reevaluation of the stated scope of work and corresponding tasks.

Based on stakeholder comments and concerns received on the draft hatchery alternatives analysis, and subsequent discussions between USFWS, other agencies, and stakeholders regarding the desired detail and the time frame for completing the analysis prior to beginning construction activities on the

Restoration Project, all parties agreed that it would be necessary to narrow the scope of the hatchery management alternatives analysis. The narrowed scope is designed to initially focus on two particular groupings of alternatives that have been identified to be of most interest to stakeholders in the Battle Creek Watershed Conservancy, including: 1) alternatives related to moving hatchery production of late-fall Chinook and steelhead off of Battle Creek to a new facility located on the Sacramento River and, 2) alternatives related to isolating hatchery fall Chinook from Battle Creek by attracting hatchery broodstock to a water ditch, rather than Battle Creek, for broodstock collections. A report on these alternative groupings is scheduled to be available in the fall of 2003.

### CALFED Science Review Workshop of Battle Creek

In 2002 members of the Battle Creek Watershed Conservancy requested that the CALFED Science Program provide an independent evaluation of some of the specific issues pertaining to Coleman National Fish Hatchery operations and potential impacts on Battle Creek restoration. In response to this request, CALFED's Science Program in cooperation with the Ecosystem Restoration Program is planning a science workshop in the Battle Creek Watershed for the fall of 2003.

The workshop will provide a forum to convene a panel of experts knowledgeable about hatchery-wild salmonid interactions especially in the areas of fish health and disease transmission, genetic divergence of hatchery and natural-origin salmonids, and basic hatchery operations. The panel will provide an independent assessment of the uncertainties surrounding the operation of Coleman National Fish Hatchery and the potential impact on Battle Creek restoration. The workshop may provide conclusions and recommendations or develop a pathway and timeline to address additional information necessary to address uncertainties and the feasibility of evaluating assumptions, potential risks and benefits of selected operational proposals.

## Investigation of Anadromous Fish Passage Alternatives in Upper Battle Creek

The DWR received CALFED Bay-Delta Program funding for a planning and design investigation of fish passage on upper Battle Creek. The study investigated fish ladders for upstream passage of adult salmon and steelhead and fish screen facilities for downstream passage of juveniles. The objective of the study was to provide data and acceptable designs for fish passage facilities to restore the use of Battle Creek salmonid habitat. The scope of work included:

- collection of necessary field data,
- preparation of preliminary designs for three diversion sites (Wildcat, Coleman, and Inskip),

- reconnaissance-level investigations at the South and North Battle Creek Feeder diversions,
- prereconnaissance work for alternative screen sites, and
- preparation of draft CEQA documents for the five diversion sites.

The resulting reconnaissance-level engineering investigation report for improving fish passage facilities on Battle Creek established a baseline from which planning could be conducted to formulate the passage elements of the Restoration Plan. Passage was investigated at the Coleman, Inskip, South, Wildcat, and North Battle Creek Feeder diversions. The report describes the project and its location and then focuses on improving fish passage on Battle Creek through the use of feasible methods that conform to regulations set forth by fish management agencies. Limited by its reconnaissance level of investigation, the report identifies the engineering, operational, and economic issues associated with the fish passage alternatives at each of the five diversion dams studied. The study was intended to allow members of the Working Group to evaluate the feasibility of and maximize the potential for identifying and moving forward with practical passage elements of the alternatives.

The Restoration Project fish passage design technical team considered passage behaviors and biological needs for all anadromous salmonids in Battle Creek. Fish screen and ladder design criteria, including a description for the "fail-safe" criteria, have been defined in the MOU. Additional information on the specific factors considered in the investigation, and how they translated into fish passage design for the Restoration Project, is located in the MOU and in the Department of Water Resources Technical Report *Battle Creek Salmon and Steelhead Restoration Project Fish Ladder and Screen Features: Inskip Diversion, North Battle Creek Feeder Diversion, Eagle Canyon Diversion* (DWR 2000). Maintenance of the fish screens and ladders is discussed in further detail in the project description (Chapter 2).

# Monitoring of Adult and Juvenile Spring-Run and Winter-Run Chinook Salmon and Steelhead in Battle Creek

USFWS has received CALFED Bay-Delta Program funding to obtain annual life history information on spring-run and winter-run chinook salmon in Battle Creek. The primary expected benefits for completing this work include: (1) collecting life history information on a potentially remnant population of spring-run chinook salmon, (2) assessing the effectiveness of the winter-run chinook salmon propagation program, (3) assessing the feasibility of developing a winter-run chinook salmon population in Battle Creek, and (4) evaluating the effectiveness of ongoing restoration actions.

The information collected in this study will help in characterizing existing populations, determining the quality and quantity of available habitat, and identifying possible habitat limitations affecting salmon populations. Information on the following 10 life history factors, for spring-run and winter-run chinook salmon each, will be used to assess the suitability of the current habitat and provide an evaluation tool for restoration activities:

- number of adults returning;
- timing of adult migration;
- age, size, and gender of returning adults;
- timing of spawning;
- timing of fry emergence;
- growth rate of juvenile salmon;
- timing of juvenile emigration;
- size of emigrating salmon;
- genetic analysis of tissue samples collected from adult and juvenile chinook salmon; and
- potential limiting factors affecting survival at various life stages.

Aspects of this proposal will address recommendations by the Winter Chinook Salmon Recovery Team and AFRP to assess the feasibility of developing a winter-run chinook salmon run in Battle Creek. In 1998, USFWS received funding for this effort and added an additional life history factor, location of spawning, to its data collection.

## Sacramento River–Wide Focused Study

Reclamation's Sacramento River–Wide Focused Study, which has been funded by CALFED, will identify and implement additional fish passage projects at locations such as the Coleman National Fish Hatchery on Battle Creek. It will provide construction cost data, feasibility information, draft CEQA documentation, and basic water temperature and streamflow data for the Restoration Project. This information will be used to quantify the costs and prioritize measures to eliminate the identified system stressors and facilitate the restoration of remnant populations of steelhead, spring-run chinook salmon, and, perhaps, winter-run chinook salmon.

The objectives of this program are to provide data and acceptable designs for fish passage facilities and to restore the use of this prime salmonid habitat; its goal is to develop preliminary designs and environmental work in coordination with CALFED staff, USFWS, NOAA Fisheries, and other interested agencies or private entities. The final design will be completed by the DWR, and

construction will proceed as part of the alternative selected for implementation of the Restoration Project.

## Battle Creek Wildlife Area

The Battle Creek Wildlife Area contains more than 480 acres of riparian, freshwater marsh, and oak woodland wildlife habitat that were acquired by the Wildlife Conservation Board and are managed by DFG. The wildlife area includes land on both sides of lower Battle Creek approximately 3 miles upstream of its confluence with the Sacramento River. The area is a climax community that includes cottonwoods, sycamores, oaks, willows, maples, wild grapes, and blackberries and an abundance of perennial grasses and wildflowers. It is home to diverse wildlife, including wood ducks and other waterfowl, deer, coyotes, bald eagles, osprey, egrets, and otters. The Battle Creek Wildlife Area is part of a plan developed to conserve property with outstanding riparian and wetland habitats. Its goals are to protect wildlife species and their habitat and to improve this habitat with a balance of riparian restoration, wetland enhancement and development, salmon and steelhead spawning area preservation, fish habitat development, and public access for bird watching, nature study, and fishing (DFG 1995).

The Battle Creek Wildlife Area has two distinct units: a western unit that includes the western curve of Battle Creek and the eastern unit adjacent to the Coleman National Fish Hatchery, which is divided by Battle Creek into northern and southern sections. The Battle Creek Wildlife Area also serves Redding area developers who have indicated a willingness to finance the enhancement of off-site lands for riparian and wetland values if they would be allowed to develop residential properties on similar lands near Redding. Other local governments have also strongly supported an area where lands would be enhanced to offset losses caused by development projects (Aumack and Paquin-Gilmore 1999).

## Tehama Wildlife Area

The Tehama Wildlife Area is located approximately 3 miles south of the town of Paynes Creek and south of the Restoration Project. It includes 46,900 acres of oak woodland, grasslands, and chaparral. There are also rugged canyons throughout the area, and it is a winter range for black-tailed deer. Camping, hunting, and fishing are allowed in the Tehama Wildlife Area.

## Conservation Easements and Conservation Water Rights

The intended goals of conservation easements are to preserve high-quality riparian habitat adjacent to wildlife-compatible agriculture and to limit the future

impacts of landscape fragmentation, instream physical disturbance, and new wells and septic systems. TNC hypothesizes that the purchase of conservation easements in a watershed with at-risk native species will help maintain and enhance functional riparian habitat and streambank conditions and will help minimize threats that stem from extensive human impacts, including water use.

The goal of TNC's Lassen Foothills Project is to partner with private landowners, local organizations, and the community to ensure the sustainability and economic viability of private land uses and the ongoing health of the area's plants and animals. As of May 2000, TNC has protected more than 830,000 acres in the eastern Sacramento Valley. Approximately half of this land, which includes ranch land and streamside habitat, has been safeguarded through the use of conservation easements with private landowners. The other half includes two preserves that TNC owns or manages. The Vina Plains Preserve is a 4,600-acre nature preserve with native grassland and vernal pools that support a wide variety of native species, many of which are rare or endangered. The Gray Davis Dye Creek Preserve is a 37,450-acre nature preserve, working cattle ranch, and outdoor laboratory. These two preserves run demonstration projects that include habitat restoration, rotational grazing, prescribed burning, and other range management techniques that are both economically viable and compatible with a healthy ecosystem.

TNC has established one conservation easement within the Battle Creek watershed and is negotiating with several landowners about possibly acquiring others. In 1999, it purchased a conservation easement on the 36,000-acre Denny Ranch, which is located on both the north and south sides of Highway 36 about 7 miles northeast of the intersection of Highway 36 and Highway 99. The easement is the largest in California history. The property will continue to be operated as a privately owned working cattle ranch, while its natural communities are permanently preserved from subdivision and development land uses. Important components of this property are its increasingly rare natural grassland communities with native bunchgrasses and wildflowers, numerous vernal pools, and blue oak woodlands. The Denny Ranch is also important because it links protected BLM lands on its western borders with the Tehama National Wildlife Refuge to the east. In turn, the wildlife refuge adjoins Lassen National Forest and TNC's Gray Davis Dye Creek Preserve. Linking easement properties to protected lands is one of TNC's key strategies.

TNC believes that the next important step in protecting salmon and steelhead along Battle Creek is protecting the relatively pristine riparian habitat along the stream from alteration and preventing the loss or alteration of its cold spring water by well development. In this project, TNC, working in partnership with the BCWC, plans to acquire conservation easement interests from willing landowners on resource-rich Battle Creek properties with the potential for future development. These easements will provide conservation protection of natural processes while maintaining the land in private agricultural use and ownership. It is intended that the terms of the easements, although they may vary slightly to fit a particular property, will help ensure protection of the riparian habitat,

prevent excessive water extraction and use, and ensure connectivity of the stream to the surrounding land.

The BLM has also acquired conservation easements on two properties in lower Battle Creek, including land along the mouth of the stream. The purpose of these easements, acquired in October 2000 on the Gover Ranch, is to conduct riparian restoration activities along Battle Creek and the Sacramento River and to maintain the agricultural nature of these properties. The BLM will be developing a conservation plan for these properties and anticipates implementing restoration activities during the next 15–20 years. Although the BLM is not actively seeking other conservation easements or land acquisitions in the Battle Creek watershed at this time, it will entertain proposals by willing sellers for new acquisitions or easements in the future (Schultz pers. comm.). The BCWC and local landowners have predicted that BLM land acquisition would increase public access to Battle Creek and likely heighten human impacts on sensitive populations of salmon and steelhead (Lee and McCampbell 1998).

USFWS and TNC have obtained a conservation easement on Digger Creek in Shasta and Tehama Counties. In late September 2001, the TNC acquired the 1,844-acre Wildcat Ranch, which has approximately 2 miles of frontage along North Fork Battle Creek (TNC 2002). The ranch is just downstream from the 990-acre Canyon Ranch, which TNC previously had protected with a conservation easement. TNC will hold Wildcat Ranch for about 2 years to carry out studies and land stewardship work. It then will place a conservation easement on it and sell it to a private buyer (TNC 2002). TNC will hold and monitor the conservation easement to ensure compliance with its terms.

## Butte, Deer, and Mill Creek Reference Watersheds

Monitoring relevant to adaptive management of Battle Creek is routinely conducted in the Butte, Deer, and Mill Creek reference watersheds. With some variations in specific methodologies, population estimates of adult fall-run and spring-run chinook salmon and estimates of juvenile chinook salmon production are generated annually in each of these watersheds. From these estimates, cohort replacement rates are calculated. Other fish population data, either recently collected or anticipated in the near future, include genetic sampling of spring-run and fall-run chinook salmon, life history details of juvenile chinook salmon, and age and growth information from otolith sampling.

Fish habitat is monitored in Butte, Deer, and Mill Creeks, especially in the high-elevation habitat of spring-run chinook salmon. Also, water temperature and water quality monitoring is routinely conducted in these streams.

The data collection of both adult counts and juvenile production is part of long-term federal and state programs expected to continue well into the future. However, other fish population data collection has received direct funding that may be unavailable in the future. Data about fish populations, habitat, and water temperature and quality collected in these reference watersheds will be directly

compared with similar data from Battle Creek as a means of measuring attainment of several adaptive management objectives.

# Potential Future Habitat Improvement Projects in the Battle Creek Watershed

As major habitat restoration in Battle Creek is achieved through environmental improvements to the Hydroelectric Project and the Coleman National Fish Hatchery, it will be practical to consider a number of smaller-scale habitat improvement projects. These potential projects include placement of spawning gravel in lower Battle Creek downstream of the Coleman National Fish Hatchery and in lower Baldwin Creek. In addition, it is possible to improve fish passage over natural obstacles on Baldwin Creek below Asbury Dam and Soap Creek below Soap Creek Dam. These habitat improvement projects will require the development of proposals, funding sources, and landowner permissions. Other opportunities to improve habitat may be developed throughout the watershed.

## Battle Creek Spawning Gravel Study and Restoration for Winter-Run and Fall-Run Chinook Salmon on Lower Battle Creek

In the future, the DWR would like to place spawning-sized gravel in the lower reaches of Battle Creek to double or triple the area available for salmon spawning. The lower reaches of Battle Creek downstream of the Coleman National Fish Hatchery have been diverted in two places, resulting in a minimal loss of spawning gravel recruitment. Only about 3 miles of the lower part of the creek are available for fall-run chinook salmon spawning. In 1996, as many as 80,000 salmon ascended Battle Creek; however, the Coleman National Fish Hatchery could use only about 11,000. The remaining salmon either spawned in the limited riffle areas on top of other redds or died.

## Gravel Introduction and Natural Barrier Modifications on Baldwin Creek

The proposed gravel introduction and natural barrier modifications on Baldwin Creek would include the improvement of a partial natural barrier and enhancement of existing spawning gravel supplies on a ¼-mile stretch of Baldwin Creek. The project is in the early planning stages and will likely be developed in cooperation with DFG. Improved steelhead habitat resulting from this project would be consistent with the Restoration Project.

# Related Sacramento River and Central Valley Projects and Plans

## Upper Sacramento River Fisheries and Riparian Habitat Management Plan

The Upper Sacramento River Fisheries and Riparian Habitat Management Plan (USRFRHAC 1989) singled out Battle Creek as a key watershed for restoration. Goals of this plan will be achieved with the implementation of the Restoration Project and adaptive management process.

## Central Valley Project Improvement Act

CVPIA (Title 34, PL 102-575) amends the previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses and to include fish and wildlife enhancement as a project purpose equal to power generation. CVPIA identifies a number of specific measures to meet these new purposes. To comply with the purposes and goals of CVPIA and the revised purposes of the CVP, the Department of the Interior is developing programs to improve environmental conditions and modify the CVP's operations, management, and physical facilities and thus its associated environmental conditions. A complete description of CVPIA can be found in the Programmatic EIS for CVPIA (Reclamation and USFWS 1999) and the agencies' ROD for the Programmatic EIS (Reclamation and USFWS 2001).

Section 3406 of CVPIA focuses on fish, wildlife, and habitat restoration. Several subsections of this act are specific to activities in the Battle Creek watershed.

- Section 3406(b)(1) includes developing a program that makes all reasonable efforts to double natural production of anadromous fish in Central Valley rivers and streams.
- Section 3406(b)(3) mandates a water acquisition program to supplement the amount of CVP water dedicated for fish and wildlife restoration by the act.
- Section 3406(b)(11) authorizes the implementation of USFWS's 1987 Coleman National Fish Hatchery Station Development Plan.
- Section 3406(b)(21) authorizes screening of water diversions.
- Section 3406(e)(3) includes measures to eliminate barriers to salmonid migration.
- Section 3406(e)(6) authorizes "other measures" to protect, restore, and enhance salmonid natural production.

## Anadromous Fish Restoration Program

To meet certain provisions of CVPIA (Title 34, PL 102-575), USFWS developed AFRP, which identified 12 actions or evaluations specific to salmon and steelhead restoration in Battle Creek (USFWS 2001b) (Figure 6-4). Of the 12, three are associated with the Coleman National Fish Hatchery and four are elements of the Restoration Project. AFRP actions under way at the Coleman National Fish Hatchery are:

- improving the water intakes,
- improving the barrier weir and upstream ladder, and
- developing a disease-safe water supply.

The Restoration Project–related actions pertain to facilitating anadromous fish passage (i.e., providing fish screens and fish ladders) and improving fish habitat (i.e., increasing instream flows), which constitute the backbone of the Restoration Project.

**Figure 6-4**
**Actions Identified by the AFRP That Would Help Restore Anadromous Fish to Battle Creek**

1. Continue to allow adult spring-run chinook and steelhead passage above the Coleman National Fish Hatchery weir. Allow passage of fall- and late-fall-run chinook and steelhead above the Coleman National Fish Hatchery weir after a disease-safe water supply becomes available to the Coleman National Fish Hatchery.
2. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to increase flows past PG&E's hydropower diversions in two phases to provide adequate holding, spawning, and rearing habitat for anadromous salmonids. The following suggested flows are indicators of magnitude and subject to revision based on additional analyses:

| Diversion | Month | Flow (cfs) |
|---|---|---|
| Keswick[a] | All year | 30 |
| North Battle Creek Feeder[a] | Sept.-Nov.[b] | 40 |
| | Jan.-Apr. | 40 |
| | May-Aug. | 30 |
| Eagle Canyon[c] | May-Nov. | 30 |
| | Dec.-Apr. | 50 |
| Wildcat[c] | May Nov. | 30 |
| | Dec.-Apr. | 50 |
| South[a] | May-Nov. | 20 |
| | Dec.-Apr. | 30 |
| Inskip[a] | May-Nov. | 30 |
| | Dec.-Apr. | 40 |
| Coleman[c] | Sept.-Apr. | 50 |
| | May-Aug. | 30 |

[a] Second phase flows required to support fall-run chinook salmon and steelhead above the Coleman National Fish Hatchery weir, Coleman Powerhouse, and Eagle Canyon Dan, after a disease-safe water supply is available to the Coleman National Fish Hatchery.

[b] The original table of flows in the AFRP document neglected to specify flows at North Battle Creek Feeder in December.

[c] First phase flows required to support winter- and spring-run chinook salmon between the Coleman Powerhouse and Eagle Canyon Diversion Dam while a disease-safe water supply is being developed for the Coleman National Fish Hatchery.

3. Construct barrier racks at the Gover Diversion dam and waste gates from the Gover Canal to prevent adult chinook salmon from entering Gover Diversion.
4. Screen Orwick Diversion to prevent entrainment of juvenile salmonids and straying of adult chinook salmon.
5. Screen tailrace of the Coleman Powerhouse to eliminate attraction of adult chinook salmon and steelhead into an area with little spawning habitat and contamination of the Coleman National Fish Hatchery water supply.
6. Construct fish screens on all PG&E diversions, as appropriate, after both phases of upstream flow actions (see Action 1) are completed and fish ladders on Coleman and Eagle Canyon Diversion Dams are opened.
7. Improve fish passage in Eagle Canyon by modifying a bedrock ledge and boulders that are potential barriers to adult salmonids, and rebuild fish ladders on Wildcat and Eagle Canyon Diversion Dams.
8. Screen Coleman National Fish Hatchery intakes 2 and 3 to prevent entrainment of juvenile chinook and steelhead.
9. Evaluate the effectiveness of fish ladders at PG&E diversions.
10. Evaluate the feasibility of establishing naturally spawning populations of winter-run and spring-run chinook salmon and steelhead through a comprehensive plan to restore Battle Creek.
11. Evaluate alternatives for providing a disease-safe water supply to Coleman National Fish Hatchery so that winter-, spring- and fall-run chinook salmon and steelhead would have access to an additional 41 miles of Battle Creek habitat.
12. Develop a comprehensive restoration plan for Battle Creek that integrates Coleman National Fish Hatchery operations.

(USFWS 2001d)

## Comprehensive Assessment and Monitoring Program

CAMP was established in response to CVPIA (Title 34, PL 102-575). CVPIA directed the Secretary of the Interior to develop a program to evaluate the effectiveness of actions designed to ensure that the natural long-term production of anadromous fish in Central Valley streams would be sustainable by 2002 at levels not less than twice the average levels attained during 1967–1991. The anadromous species included in CAMP are fall-run, late fall-run, winter-run, and spring-run chinook salmon, steelhead, American shad, striped bass, white sturgeon, and green sturgeon. The categories of anadromous fish restoration actions evaluated by CAMP are habitat restoration, water management, fish screens, and structural modifications.

CAMP assesses both the cumulative and relative effectiveness of restoration actions on anadromous fish production. The cumulative effectiveness is evaluated by monitoring adult production of each species and comparing the estimated natural adult production to the target natural adult production (i.e., the anadromous fish doubling goals). The relative effectiveness is evaluated by monitoring the abundance of juvenile chinook salmon in relation to when and where restoration actions have been implemented. Data on adult and juvenile chinook salmon are compiled regularly and made available on the Internet and in published reports.

CAMP monitoring focuses on estimating juvenile production and counts of adults. While CAMP does fund some monitoring projects, it acts primarily as a guide to other studies by maintaining protocols for fish research that facilitate the development of a Central Valley–wide understanding of anadromous fish restoration. Applicable data collected as part of the Restoration Project and adaptive management process will follow CAMP protocols to facilitate the understanding of the Restoration Project's contribution to reaching CVPIA goals.

# Proposed Comprehensive Fisheries Management Plan for the Upper Sacramento River and Its Tributaries

DFG is drafting a comprehensive fisheries management plan for the upper Sacramento River and its tributaries. The objective of this plan is to take a watershed-wide, fisheries management–based view of production potential and population levels of all races of anadromous salmonids. Specific goals set for each upper Sacramento River tributary will integrate the production potential of each stream and the main river from a system perspective. Perennial anadromous salmonid–producing tributaries to be addressed in this plan include Clear, Cow, Cottonwood, Battle, Deer, Mill, and Antelope Creeks. Other streams that occasionally produce anadromous salmonids in good water years will also be addressed, including Sulfur, Churn, and Bear Creeks. Questions regarding Battle Creek will be developed during this open planning process.

# Sacramento Corridor Habitat Restoration Assessment

DFG, TNC, and DWR, in cooperation with the BLM, will study the geomorphic and riparian interactions occurring on an alluvial reach of the Sacramento River between the mouth of Cow Creek and Jellys Ferry Bridge (RMs 280–267), including lower Battle Creek and Anderson Creek. This study will determine restoration possibilities for the integrated complex that includes lands owned and managed by the BLM, lands with conservation easements held by the BLM, and other possible acquisitions by fee or conservation easements from willing sellers within this reach. This work will establish the existing conditions in the river reach for quantifiable attributes that could be monitored to evaluate the effects of land use improvements.

# Recovery Plans for Threatened or Endangered Salmonids

NOAA Fisheries has or is developing recovery plans for winter-run chinook salmon, steelhead, and spring-run chinook salmon.

The NOAA Fisheries' recovery plan for winter-run chinook salmon identified and set priorities for actions necessary to ultimately restore the Sacramento River winter-run chinook salmon as a naturally sustaining population throughout its present range. More immediately, the plan identified actions to prevent any further erosion of the population's viability and its genetic integrity. The plan also included:

- a description of site-specific management actions necessary for recovery;
- objective, measurable criteria that, when met, will allow delisting of the species; and
- estimates of the time and cost to carry out the recommended recovery measures.

Finally, the plan specified Battle Creek as a site for the potential restoration of self-sustaining populations of winter-run chinook salmon.

NOAA Fisheries is currently preparing a recovery plan for steelhead and plans to prepare a recovery plan for spring-run chinook salmon that would likely be prepared jointly with DFG. Much of these plans would likely be based on CALFED's EIS/EIR, their Multi-Species Conservation Plan, and the ERP. No timeline has been set for the completion of these plans.

These recovery plans would link to the Restoration Project by setting numerical goals for viable population levels for three of the species targeted for restoration.

They would likely not include any binding mandates or prescriptions to be specifically implemented in Battle Creek.

## Restoring Central Valley Streams: A Plan for Action

DFG's *Restoring Central Valley Streams: A Plan for Action* (DFG 1993) focused on the potential of the following actions for restoring winter-run chinook salmon, spring-run chinook salmon, and steelhead to Battle Creek:

- preparing and implementing a comprehensive restoration plan for anadromous fish in Battle Creek,
- increasing instream flows, and
- revising management of the barrier weir at the Coleman National Fish Hatchery.

The planning recommendations in this plan for action have already been achieved with the development of the Restoration Plan (Kier Associates 1999a) and the MOU. Implementation of the Restoration Project and adaptive management will meet the goal of increasing instream flows found in the document.

## Central Valley Salmon and Steelhead Restoration and Enhancement Plan

Developed in the early 1990s, the Central Valley Salmon and Steelhead Restoration and Enhancement Plan (DFG 1990a) called for increased instream flows and effective fish screens on Battle Creek. The implementation of the Restoration Project will meet all of the recommendations in this plan specific to Battle Creek.

## Steelhead Restoration and Management Plan for California

The Steelhead Restoration and Management Plan (DFG 1996a) is a follow-up to DFG's *Restoring Central Valley Streams: A Plan for Action* (DFG 1993), stemming from the final recommendations of the California Advisory Committee on Salmon and Steelhead Trout. The Restoration Project would implement several of the actions pertaining to the Battle Creek watershed that were identified in the plan for action.

# CALFED Ecosystem Restoration Program

The Restoration Project is funded in large part by funds allocated as part of the implementation phase of CALFED's ERP. The ERP is organized into a matrix of vision statements that identify what the ERP will accomplish with its stated objectives, targets, and programmatic actions for an ecological process, habitat, species or species group, stressor, or geographical unit. The vision statements provide technical background to increase understanding of the ecosystem and its elements. ERP vision statements about species or processes relevant to the Restoration Project are presented in Table 6-1. The adaptive management actions that will meet ERP visions will be identified later.

# Comprehensive Monitoring, Assessment, and Research Program/CALFED Science Program

In 1998, CALFED approved and funded a joint proposal from the San Francisco Estuary Institute, Interagency Ecological Program, and USGS to develop the CMARP (recently renamed the CALFED Science Program) for CALFED and its member agencies. The proposed program addresses eight CALFED program elements and actions to be implemented over the next 30 years:

- long-term levee protection,
- water quality,
- ecosystem restoration,
- water use efficiency,
- water transfer framework,
- watershed management coordination,
- Delta conveyance, and
- Delta storage.

One of the primary goals of CMARP has been the design and implementation of a monitoring program with several modules that overlap with the Restoration Project. Compliance monitoring provides information needed to determine whether activities are meeting permit or other regulatory requirements. Model verification monitoring provides information to evaluate management alternatives (e.g., for adaptive management). Trend monitoring helps identify long-term changes caused by human and natural factors. The following components are part of the CMARP monitoring program: inventorying existing monitoring programs, developing specific monitoring elements, developing a process for data management, and developing a process for data assessment and reporting.

CMARP is currently developing aquatic and terrestrial baseline monitoring programs. These programs will provide information needed by CALFED managers and scientists to follow the status of and trends in key indicators for ecosystems and several sensitive plant and animals in the Bay-Delta and Central Valley. Geographically, the recommended baseline program for aquatic resources will extend from the bases of the major dams through the Bay-Delta and into the nearshore ocean. The program will include ecosystem processes, as well as specific elements directed to listed and special-status fish species, such as chinook salmon, steelhead, delta smelt, splittail, and green and white sturgeon.

The foundation of the proposed baseline will be built on many of the existing monitoring efforts being conducted under the auspices of CVPIA, CAMP, the Interagency Ecological Program, the Sacramento Watershed Group, the San Francisco Estuary Institute's Regional Monitoring Program, and agency-funded tributary monitoring on the Feather, American, and Tolumne Rivers and on Battle, Deer, Mill, and Butte Creeks. The monitoring program report will identify data gaps and recommend new elements to fill those gaps.

Monitoring and data assessment results from the Battle Creek adaptive management program will be shared with CMARP. Data collections and analyses as part of the adaptive management process (Appendix D) will be coordinated with CMARP's larger aims.

## Delta and Sacramento River Operations and Monitoring

Water diversions from the Sacramento River downstream of Battle Creek, including those at the Red Bluff Diversion Dam and approximately 300 other locations, have been identified as causing problems for fish passage (DFG 1990a). Especially harmful for fish populations from the upper Sacramento River basin are the many unscreened water diversions that can entrain juvenile and adult fish (DFG 1990a). Perhaps the most commonly cited factor negatively affecting populations of salmon and steelhead from Sacramento River tributaries such as Battle Creek is the operation of water pumping plants by federal and state agencies and smaller water diversions within the Bay-Delta (DFG 1990a). These pumps affect the magnitude and direction of flow, tidal cycles, fish entrainment, salinity, water quality, and fish migration (DFG 1990a).

Seeking solutions to the resource problems in the Bay-Delta, federal and state agencies signed a framework agreement in June 1994 that provided increased coordination and communication for environmental protection and water supply dependability. The framework agreement laid the foundation for the Bay-Delta Plan Accord and the CALFED Bay-Delta Program. A programmatic EIS/EIR (CALFED 2000a) released in June 2000 detailed specific actions regarding how water supply operations will be coordinated with endangered species protection and water quality. It also developed long-term solutions to fish and wildlife,

water supply reliability, flood control, and water quality problems in the Bay-Delta.

The well-intended steps proposed in these planning documents may have beneficial effects on fish populations from Battle Creek and should aid the Restoration Project in restoring anadromous fish to Battle Creek. However, it is possible that diversions in the Bay-Delta and Sacramento River will continue to harm fish populations from upper Sacramento River tributaries. If that happens, salmon and steelhead restoration in Battle Creek could be adversely affected. The adaptive management studies in the adaptive management process have been designed to identify those impacts on Battle Creek fish caused by the Hydroelectric Project and to determine when factors from outside the watershed are at play. However, the adaptive management process will not be able to rectify limiting factors outside the watershed.

**Table 6-1.** CALFED Ecosystem Restoration Program Visions for Ecosystem Elements and How the Restoration Project and Adaptive Management Achieve These Visions

| Element | ERP Vision | Achievement Method |
|---|---|---|
| Central Valley streamflows | To protect and enhance the ecological functions that are achieved through the physical and biological processes that operate within the stream channel and associated riparian and floodplain areas in order to contribute to the recovery of species and the overall health of the San Francisco Bay and Sacramento–San Joaquin River Delta area (Bay-Delta). | The Restoration Project will substantially increase streamflows to meet the needs of ERP priority 1 fish species, chinook salmon and steelhead. The Restoration Project's adaptive process contains protocols for changing these streamflows if necessary to increase chinook salmon and steelhead populations or habitat or to assist chinook salmon and steelhead passage. |
| Stream meander | To conserve and reestablish areas of active stream meander, where feasible, by implementing stream conservation programs, setting levees back, and reestablishing natural sediment supply to restore riverine and floodplain habitats for fish, wildlife, and plant communities. | By removing several diversion dams from Battle Creek, the Restoration Project will aid in the reestablishment of active stream meanders to the extent that Battle Creek and its tributaries meander naturally. Furthermore, agreements between PG&E and DFG regarding enhancing the natural sediment supply and sediment routing in Battle Creek have been formalized in the past and will be pursued in the future. |
| Natural floodplains and flood processes | To conserve existing and intact floodplains and modify or remove barriers to over-bank flooding to reestablish aquatic, wetland, and riparian floodplain habitats. | By removing several diversion dams from Battle Creek, the Restoration Project will aid in the reestablishment of natural floodplains and flood processes, even though the Hydroelectric Project has historically had a relatively minor effect on natural flood flows. |
| Coarse sediment supply | To provide a sustained supply of alluvial sediments that are transported by rivers and streams and distributed to riverbed deposits, floodplains, channel bars, riffles, shallow shoals, and mudflats, throughout the Central Valley, Sacramento-San Joaquin River delta (Delta), and San Francisco Bay regions. This would contribute to habitat structure, function, and foodweb production throughout the ecosystem. | By removing several diversion dams from Battle Creek, the Restoration Project will prevent the loss of naturally supplied sediment that can be stored in reservoir impoundments or removed from the system by reservoir dredging operations. On dams that remain, course sediments will be passed downstream during high flow conditions using low-level gates at the dam. |
| Central Valley stream temperatures | To restore natural seasonal patterns of water temperature in streams, rivers, and the Delta to benefit aquatic species by protecting and improving ecological processes that regulate water. | The Restoration Project will substantially increase instream flows, increase spring releases from Hydroelectric Project water collection facilities, and remove interbasin transfers of water to restore natural seasonal patterns of water temperatures in Battle Creek by protecting and improving ecological processes that regulate water. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to meet appropriate water temperature criteria. |

| Element | ERP Vision | Achievement Method |
|---|---|---|
| Riparian and riverine aquatic habitats | To increase their area and protect and improve their quality. Achieving this vision will assist in the recovery of special-status fish and wildlife populations and provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta. The ERP vision includes restoring native riparian communities ranging from valley oak woodland, which is associated with higher, less frequently inundated floodplain elevations, to willow scrub, which is associated with low, frequently inundated floodplain elevation sites such as stream banks, point bars, and in-channel bars. | By removing several diversion dams from Battle Creek, increasing instream flows, and increasing cold-water spring releases from Hydroelectric Project water collection facilities, the Restoration Project will improve riparian and riverine aquatic habitats. It is believed that higher instream flows will aid in the distribution of seeds from riparian plant species and elevate the dry-season water table in the riparian area, fostering an expansion of riparian communities such as willow scrub. |
| Freshwater fish habitats | To protect existing habitat from alteration or loss, to restore altered habitats, and restore areas to a more natural state. Freshwater fish habitat will be increased to assist in the recovery of special-status plant, fish, and wildlife populations. Restoration will provide high-quality habitat for other fish and wildlife dependent on the Bay-Delta. | By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of special-status plant, fish, and wildlife populations. |
| Essential fish habitats | To maintain and improve the quality of existing habitats and to restore former habitats in order to support self-sustaining populations of chinook salmon. | By removing several diversion dams from Battle Creek, increasing instream flows, increasing cold water spring releases from Hydroelectric Project water collection facilities, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining chinook salmon populations. |
| Winter-run chinook salmon | To recover this federally and state-listed endangered species, achieve naturally spawning population levels that support and maintain ocean and inland recreational and ocean commercial fisheries and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley. | By removing several diversion dams from Battle Creek, increasing instream flows, increasing flows from cold water springs, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of winter-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of winter-run chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of winter-run chinook salmon. |

| Element | ERP Vision | Achievement Method |
|---|---|---|
| Spring-run chinook salmon | To recover this federally and state- listed threatened species, achieve naturally spawning population levels that support and maintain ocean and inland recreational and ocean commercial fisheries and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley. | By removing several diversion dams from Battle Creek, increasing instream flows, increasing flows from cold water springs, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of spring-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of spring-run chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of spring-run chinook salmon. |
| Late-fall-run chinook salmon | To recover this stock, which is presently a candidate for listing under the ESA (it is included in the fall-run chinook salmon evolutionarily significant unit), achieve naturally spawning population levels that support and maintain ocean and inland recreational and ocean commercial fisheries and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley. | By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of late-fall-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of late-fall-run chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of late-fall-run chinook salmon. |
| Fall-run chinook salmon | To recover all stocks presently a candidate for listing under the federal ESA to achieve naturally spawning population levels that support and maintain ocean commercial and ocean and inland recreational fisheries, and that fully use existing and restored habitats. This vision will contribute to the overall species diversity and richness of the Bay-Delta system and reduce conflict between protection for this species and other beneficial uses of water and land in the Central Valley. | By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of fall-run chinook salmon. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of fall-run chinook salmon. Furthermore, the adaptive management process contains protocols for changing these streamflows if necessary to specifically meet the habitat needs of fall-run chinook salmon. |
| Steelhead | To recover this species listed as threatened under ESA and achieve naturally spawning populations of sufficient size to support inland recreational fishing that fully use existing and restored habitat areas. | By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of steelhead. Fish passage facilities and prescribed minimum instream flows were determined in part based on the needs of steelhead. Furthermore, the adaptive management process contains protocols for changing these streamflows |

| Element | ERP Vision | Achievement Method |
|---|---|---|
| | | if necessary to specifically meet the habitat needs of steelhead. |
| Anadromous lampreys | To maintain and restore population distribution and abundance to higher levels than at present. The ERP vision is also to better understand life history and identify factors that influence abundance. Better knowledge of these species and restoration would ensure their long-term population sustainability. | By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats to assist in the recovery of self-sustaining populations of anadromous lamprey. Furthermore, monitoring approaches within the adaptive management process will contribute to a better understanding of the life history and will identify factors that influence the abundance of anadromous lamprey. |
| Native resident fish species | To maintain and restore the distribution and abundance of native species, such as Sacramento blackfish, hardhead, and tule perch to contribute to the overall species richness and diversity. Achieving this vision will reduce conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta. | By removing several diversion dams from Battle Creek, increasing instream flows, and providing improved fish passage facilities, the Restoration Project will restore altered freshwater fish habitats and should assist the restoration of the distribution and abundance of native fish species in Battle Creek. |

1 INTERIM FLOW AGREEMENTS BETWEEN RECLAMATION AND PACIFIC GAS & ELECTRIC COMPANY
CALFED-Funded project to continue interim flow of up to 30 cubic feet per second (cfs) to meet fish and wildlife needs in the North Fork of Battle Creek until the long-term Restoration Project implementation is completed.

2 COLEMAN NATIONAL FISH HATCHERY (CNFH):
· CNFH reevaluation process studying hatchery management as it relates to both current and estimated "restored" populations.
· Water treatment facility reduces CNFH disease threat with water filtration and disinfection, may reduce fish mortality and increase survivorship.
· CNFH Intake Alternatives Study assessing water supply requirements, existing intakes, and alternatives to become consistent with Restoration Project.
· Barrier weir and upstream ladder operational strategy being evaluated for maximizing compatibility with Restoration Project.
· Biological Assessment of CNFH Operations describes fish propagation programs and assesses potential impacts resulting from those artificial programs to naturally produced salmonids. Revised Biological Assessment to be written by USFWS.
· USFWS Intraspecific Competition Study recognizes potential risk of hatchery fish to naturally spawned stocks, and will evaluate the existence and relative intensity of competition among hatchery-reared and naturally produced juvenile chinook salmon.

3 BATTLE CREEK WATERSHED CONSERVANCY FORMATION
· CALFED-funded formation of conservancy, consistent with CALFED ERP Strategic Plan commitments for supporting a watershed conservancy.
· Community plan identifies factors affecting salmon and steelhead aquatic habitats, with emphasis on potential impacts of Restoration Project on private lands and interests.
· Active participant in the BCWG, and primary driver for conducting local public communications and outreach regarding the Restoration Project.
· Conducting watershed assessment to identify land use issues and develop information management system for adaptive management and monitoring data.

4 BATTLE CREEK SALMON AND STEELHEAD RESTORATION STUDY/RESTORATION PLAN
· CALFED-funded restoration planning process by the BCWG serves as the technical basis for the Restoration Project, containing essential biological criteria for salmon and steelhead restoration.

5 BATTLE CREEK WATERSHED COMMUNITY STRATEGY
CALFED-funded long-term community watershed strategy for the Battle Creek watershed, developed in response to the Restoration Project emphasizing "on-the-ground" strategies and best management practices to support chinook salmon and steelhead restoration and the continuation of a healthy, fully functioning watershed. The Battle Creek Watershed Community Strategy states the community issues and recommendations regarding water rights, economic threats, land use restrictions, increased Federal ownership and presence, invasive weed control, private stewardship, rural landscape preservation, and fuels management. The strategy suggests that local community participation in adaptive management monitoring and data management, will enhance its acceptance and sense of ownership in the outcome of the Restoration Project.

6 BATTLE CREEK WATERSHED STEWARDSHIP
· CALFED-funded watershed study by the Battle Creek Watershed Conservancy to implement a watershed strategy, address upper watershed processes, implement fuels management and fire defense improvements, conservation easements, and noxious weed control consistent with habitat and water quality protections needed to support the Restoration Project.

7 GREATER BATTLE CREEK WATERSHED WORKING GROUP (GBCWWG)
· The GBCWWG draft vision recognizes the value of coordinating the planning, implementation, and evaluation of all fisheries, restoration and watershed projects among public agencies, nonprofit organizations and private landowners within the Greater Battle Creek Watershed in order to maximize production of all natural anadromous fish runs and maintain, and restore as necessary, a healthy watershed and landscape.

8 LASSEN LODGE HYDROPOWER PROJECT
The Lassen Lodge Hydropower project is a proposed 7,000 kW hydroelectric generating station located along the south bank of the South Fork of Battle Creek located upstream of the existing Battle Creek Hydroelectric Project's South Diversion Dam. There is concern that its construction could limit or reduce the quality of upstream habitat available for salmon and steelhead restoration, and the amount and stability of South Fork Battle Creek flows for achieving downstream restoration.

9 GRAVEL REMOVAL AGREEMENTS:
Restoration Project flows and facility modifications are consistent with recent PG&E and CDFG agreements to removal gravel accumulated behind these diversion dams to mimic natural downstream sediment movement and enhance spawning gravel for salmon and steelhead.

10 GRAVEL INTRODUCTION AND NATURAL BARRIER MODIFICATIONS ON BALDWIN CREEK
This project would include improvement of a partial natural barrier and enhancement of existing spawning gravels supplies on a one-quarter mile stretch of Baldwin Creek. The project is in the early planning stages, and will likely be developed in cooperation with the CDFG. Improved steelhead habitat resulting from this project would be consistent with the Restoration Project.

11 U.S. FOREST SERVICE
U.S. Forest Service programs in the Battle Creek include several road restoration measures, such as culvert replacements that are intended to reduce sediment delivery to the stream. In the summer of 2000, Lassen National Forest assessed wildfire fuels in the Battle Creek watershed under a contract with BCWC. Although all national forest lands in the watershed are outside the Restoration Project area and outside the area that will be adaptively managed, the long-term success of the Restoration Project could be compromised if the U.S. Forest Service did not remain committed to reducing sediment delivery to Battle Creek.

12 BATTLE CREEK WATERSHED PRIVATE TROUT REARING FACILITIES
· Nine private trout-rearing facilities in the watershed are operated by Mt. Lassen Trout Farms, Incorporated. These facilities rear rainbow and brown trout for stocking in private ponds and lakes throughout California. Although these facilities do not interact with fish populations in the anadromous habitat of Battle Creek, some facilities, such as the main broodstock facility, are near Hydroelectric Project power canals. Infected juvenile salmon populations increased by the Restoration Project, and subsequently living in unscreened canals could serve as vectors for disease if borne by predators to hatchery facilities.

13 ENGINEERING INVESTIGATION OF ANADROMOUS FISH PASSAGE IN UPPER BATTLE CREEK
· CALFED-funded planning and design investigation by DWR of fish passage on upper Battle Creek supporting ladder and screen designs for Restoration Project action alternatives.

14 MONITORING OF ADULT JUVENILE SPRING-RUN AND WINTER-RUN CHINOOK SALMON IN BATTLE CREEK
· CALFED-funded study by USFWS to obtain life history information on spring-run and winter-run chinook salmon. Study elements consistent with the Restoration Project adaptive management process include sampling of potentially remnant spring-run population, assessment of winter-run propagation effectiveness, the feasibility of a winter-run chinook salmon population in Battle Creek, and evaluating the effectiveness of ongoing restoration actions.

15 BATTLE CREEK SPAWNING GRAVEL STUDY AND RESTORATION FOR WINTER-RUN AND FALL-RUN CHINOOK SALMON, LOWER BATTLE CREEK
· CALFED-funded study by DWR for placing spawning-sized gravel in the lower reaches of Battle Creek to double to triple the area available for salmon spawning.

16 BATTLE CREEK FISH SCREENS AND PASSAGE
CALFED-funded support for engineering investigations, construction cost data, water temperature and streamflow data needed to eliminate system stressors and facilitate the restoration of remnant populations of steelhead, spring-run chinook salmon, and winter-run salmon consistent with the Restoration Project.

17 BATTLE CREEK WILDLIFE AREA
· The Battle Creek Wildlife Area contains over 480 acres of riparian, freshwater marsh, and oak woodland wildlife habitat acquired by the Wildlife Conservation Board and managed by the CDFG. It is part of a plan developed to conserve property with outstanding riparian and wetland habitats consistent with the Restoration Project.

18 TEHAMA WILDLIFE AREA
· The Tehama Wildlife Area is located about three miles south of the town of Paynes Creek and south of the Restoration Project vicinity. It includes 46,900 acres of oak woodland, grasslands, and chaparral. Its goals to protect wildlife species and their habitat is consistent with the Restoration Project.

19 DARRAH SPRINGS HATCHERY
· Darrah Springs Hatchery is a state-run facility located at Darrah Springs on Baldwin Creek, a tributary to mainstem Battle Creek. It is a key hatchery of the CDFG inland fisheries program and raises catchable trout for sport fisheries using a wide variety of strains including Eagle Lake rainbow trout, Pit River rainbow trout, and Mt. Shasta-strain rainbow trout.

20 CONSERVATION EASEMENTS AND CONSERVATION WATER RIGHTS
Conservation easements preserve high-quality riparian habitat adjacent to wildlife-compatible agriculture and limit the future impacts of landscape fragmentation, instream physical disturbance, and new wells and septic systems. Recent easements secured include:
· The Nature Conservancy's Lassen Foothills Project has the goal of partnering with private landowners, local organizations, and the community to ensure the sustainability and economic viability of private land uses and the ongoing health of the area's plants and animals. As of May 2000, the Nature Conservancy has protected more than 83,000 acres. Approximately half of this land has been safeguarded through the use of conservation easements with private landowners, includng ranch land and streamside habitat.
· In 1999, The Nature Conservancy purchased a conservation easement on the 36,000-acre Denny Ranch. The property will continue to be operated as a privately owned working cattle ranch while its natural communities are permanently preserved from subdivision and development land uses.
· In 2000, the BLM acquired conservation easements on two properties in lower Battle Creek including land along the mouth of the stream, on the Gover Ranch, to conduct riparian restoration activities along Battle Creek and the Sacramento River and to maintain the agricultural nature of these properties.
· The Nature Conservancy and USFWS recently acquired conservation easements on Digger Creek, and on 1,800 acres north of Battle Creek with springs that feed Baldwin Creek.

21 BUTTE, DEER, AND MILL CREEK REFERENCE WATERSHEDS
· Data about fish populations, habitat, and water temperature and quality collected in these reference watersheds will be directly compared with similar data from Battle Creek as a means of measuring attainment of several objectives within the adaptive management strategy of the alternative ultimately selected for implementation.

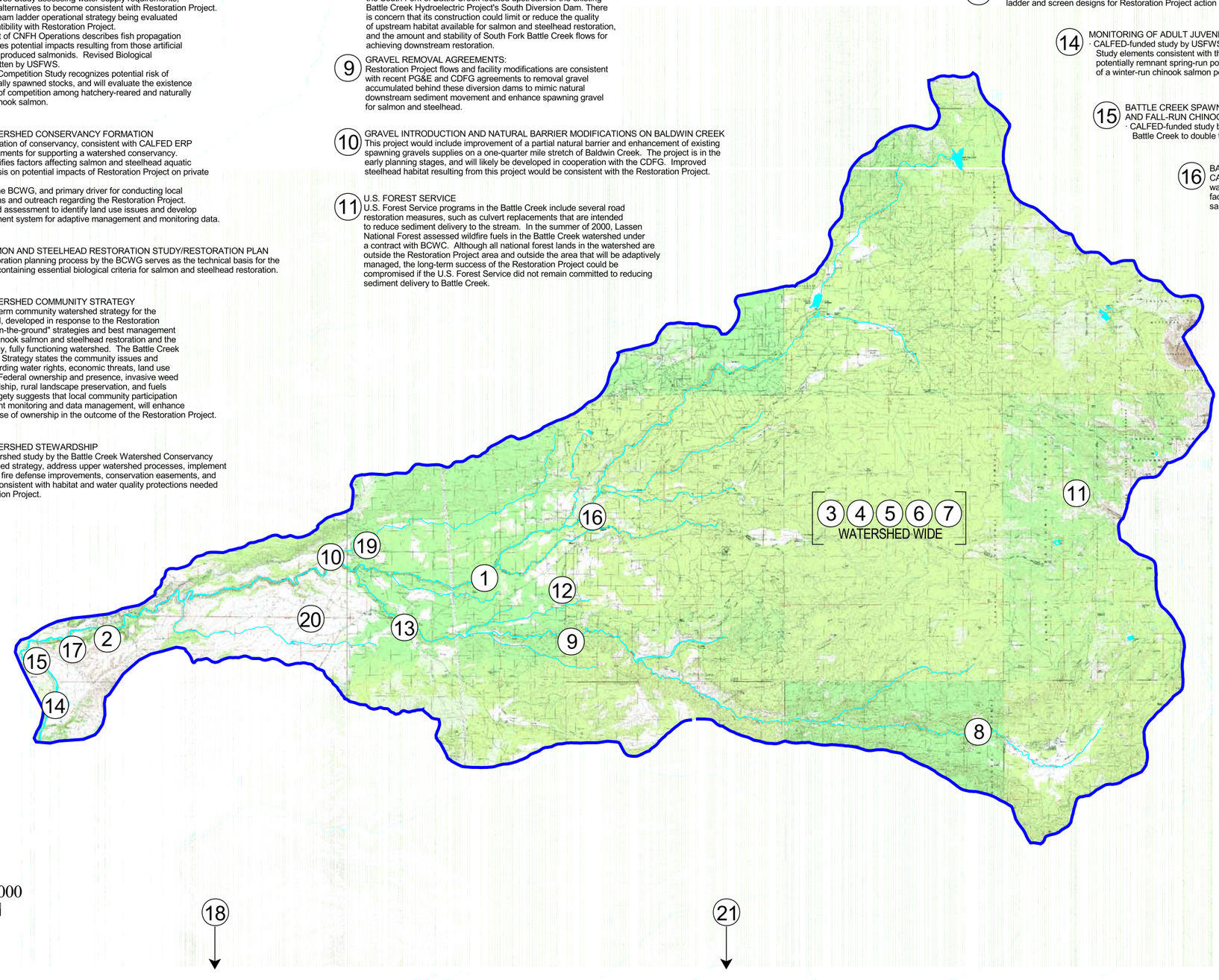



**Figure 6-1**
**Related Projects in and Near the Battle Creek Watershed**

# Upper Sacramento River Projects

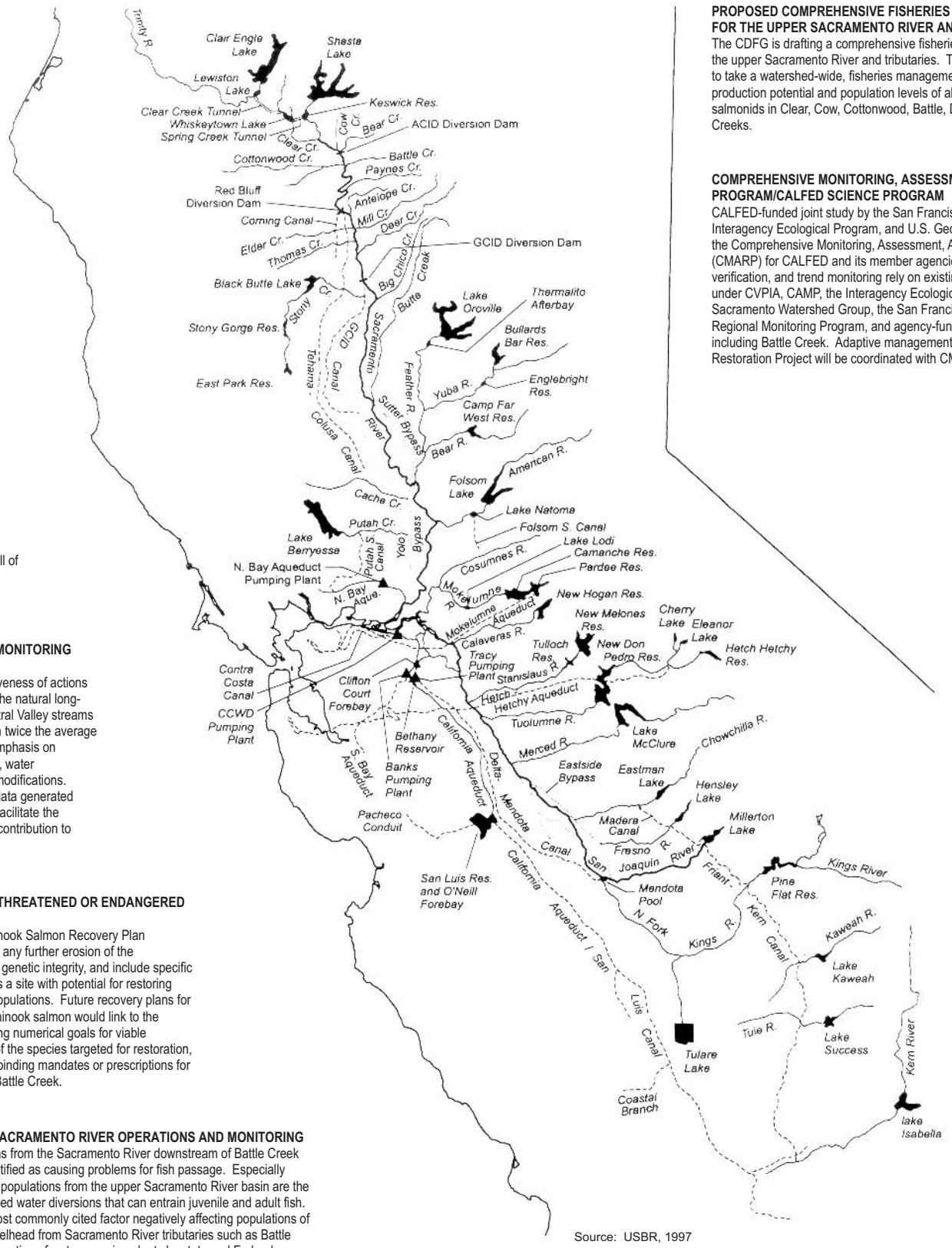
**UPPER SACRAMENTO RIVER FISHERIES AND RIPARIAN HABITAT MANAGEMENT PLAN**
The Upper Sacramento River Fisheries and Riparian Habitat Management Plan singled out Battle Creek as a key watershed for restoration. Goals of this plan will be achieved with the implementation of the Restoration Project and adaptive management.

**SACRAMENTO CORRIDOR HABITAT RESTORATION ASSESSMENT**
The CDFG, The Nature Conservancy, and the DWR will conduct a study, in cooperation with the BLM, of the geomorphic and riparian interactions occurring on an alluvial reach of the Sacramento River between the mouth of Cow Creek and Jellys Ferry bridge (river miles 280 to 267), including lower Battle Creek and Anderson Creek. This study will determine restoration possibilities for the integrated complex that includes lands owned and managed by the BLM, lands with conservation easements held by the BLM, and other possible acquisitions by fee or conservation easements from willing sellers within this reach.

**PROPOSED COMPREHENSIVE FISHERIES MANAGEMENT PLAN FOR THE UPPER SACRAMENTO RIVER AND TRIBUTARIES**
The CDFG is drafting a comprehensive fisheries management plan for the upper Sacramento River and tributaries. The objective of this plan is to take a watershed-wide, fisheries management-based view at production potential and population levels of all races of anadromous salmonids in Clear, Cow, Cottonwood, Battle, Deer, Mill, and Antelope Creeks.

**COMPREHENSIVE MONITORING, ASSESSMENT, AND RESEARCH PROGRAM/CALFED SCIENCE PROGRAM**
CALFED-funded joint study by the San Francisco Estuary Institute, Interagency Ecological Program, and U.S. Geological Survey to develop the Comprehensive Monitoring, Assessment, And Research Program (CMARP) for CALFED and its member agencies. Compliance, model verification, and trend monitoring rely on existing monitoring efforts under CVPIA, CAMP, the Interagency Ecological Program, the Sacramento Watershed Group, the San Francisco Estuary Institute's Regional Monitoring Program, and agency-funded tributary monitoring, including Battle Creek. Adaptive management monitoring from the Restoration Project will be coordinated with CMARP's larger aims.

NOT TO SCALE




Source: USBR, 1997

## Central Valley Projects

**CALFED ECOSYSTEM RESTORATION PROGRAM**
Restoration Project is funded by CALFED, and is an action directed as part of the CALFED Programmatic EIS/EIR Preferred Alternative, which includes the Ecosystem Restoration Program (ERP) ecosystem restoration visions for restoring beneficial ecosystem processes associated with Central Valley streamflows, stream meander, natural floodplains and flood processes, coarse sediment supply, Central Valley stream temperatures, riparian and riverine aquatic habitats, freshwater fish habitats, essential fish habitats, winter-run, spring-run, fall-run, and late-fall-run chinook salmon, steelhead, lamprey, and native resident fish species.

**CENTRAL VALLEY SALMON AND STEELHEAD RESTORATION AND ENHANCEMENT PLAN**
This plan called for increased instream flows and effective fish screens on Battle Creek. The implementation of the Restoration Project will meet all of the recommendations in this plan specific to Battle Creek.

**COMPREHENSIVE ASSESSMENT AND MONITORING PROGRAM**
CVPIA-funded study to evaluate the effectiveness of actions designed to ensure that by the year 2002, the natural long-term production of anadromous fish in Central Valley streams would be sustainable at levels not less than twice the average levels attained during 1967 to 1991, with emphasis on restoration categories of habitat restoration, water management, fish screens, and structural modifications. Applicable Restoration Project monitoring data generated through adaptive management will help to facilitate the understanding of the Restoration Project's contribution to reaching CVPIA goals.

**RECOVERY PLANS FOR THREATENED OR ENDANGERED SPECIES**
The NMFS Winter-Run Chinook Salmon Recovery Plan identified actions to prevent any further erosion of the population's viability and its genetic integrity, and include specific reference to Battle Creek as a site with potential for restoring self-sustaining winter-run populations. Future recovery plans for steelhead and spring-run chinook salmon would link to the Restoration Project by setting numerical goals for viable population levels for three of the species targeted for restoration, but likely not including any binding mandates or prescriptions for specific implementation in Battle Creek.

**DELTA AND SACRAMENTO RIVER OPERATIONS AND MONITORING**
Water diversions from the Sacramento River downstream of Battle Creek have been identified as causing problems for fish passage. Especially harmful for fish populations from the upper Sacramento River basin are the many unscreened water diversions that can entrain juvenile and adult fish. Perhaps the most commonly cited factor negatively affecting populations of salmon and steelhead from Sacramento River tributaries such as Battle Creek is the operation of water pumping plants by state and Federal agencies, and smaller water diversions, within the Bay-Delta. The adaptive management studies will be capable of identifying those impacts on Battle Creek fish caused by the Hydroelectric Project and to determine when factors from outside the watershed are at play.

**RESTORING CENTRAL VALLEY STREAMSA PLAN FOR ACTION**
The CDFG's "Restoring Central Valley StreamsA Plan for Action" focused on the potential for restoring winter-run, spring-run, and steelhead to Battle Creek by the preparation and implementation of a comprehensive restoration plan for anadromous fish in Battle Creek, increasing instream flows, and revised management of the barrier dam at CNFH. The planning recommendations in this document have already been achieved with the development of the Restoration Plan and the MOU. Implementation of the Restoration Project and the Adaptive Management Plan will meet the goal of increasing instream flows found in "A Plan for Action."

**STEELHEAD RESTORATION AND MANAGEMENT PLAN FOR CALIFORNIA**
The Steelhead Restoration and Management Plan is a follow-up to the CDFG's "Restoring Central Valley StreamsA Plan for Action," stemming from the final recommendations of the California Advisory Committee on Salmon and Steelhead Trout. Several of the actions identified in this document that pertain to the Battle Creek watershed will be implemented through the Restoration Project.

**CVPIA**: Title 34, PL 102-575, Section 3406:
- (b)(1): Restoration Project is one of many efforts to double the natural production of anadromous fish in Central Valley Rivers and streams (Anadromous Fish Restoration Plan (AFRP)).
- (b)(3): Restoration Project Interim Flow Agreements, and water acquisition fund element of the Proposed Action consistent with this mandate to acquire water to supplement CVP water dedicated for fish and wildlife restoration.
- (b)(11): authorizes implementation of the USFWS' 1987 Station Development Plan.
- (b)(21): authorizes screening of water diversions.
- (e)(3): Restoration Project facility modifications consistent with this subsection that includes measures to eliminate barriers to salmonid migration.
- (e)(6): Restoration Project is consistent with this subsection that authorizes other measures to protect, restore, and enhance salmonid natural production.

N

**FIGURE 6-2**
**Related Sacramento River and Central Valley Projects**

Chapter 7
# Summary

## Summary of Impacts

Impacts associated with the Action Alternatives (Five Dam Removal, No Dam Removal, Six Dam Removal, and Three Dam Removal Alternatives) and the No Action Alternative are identified in Table 7-1. Most significant impacts would be considered less than significant after implementing the appropriate mitigation measures for the specific resource area identified in Table 7-1 and described in more detail in the appropriate resource section in Chapter 4 of this EIR/EIS. Some significant impacts are considered unavoidable (e.g., on aesthetics and visual resources) because the impact remains significant even after implementing mitigation measures incorporated into the project description or described in each resource section of this document. Other impacts are considered less than significant or beneficial to the resource area.

## Comparison of Alternatives

A comparison between the Proposed Action and each of the Action Alternatives (including the No Action Alternative) is provided below to summarize the relative differences in chinook salmon and steelhead benefits and significant impacts that would be expected under each alternative.

### Proposed Action (Five Dam Removal Alternative) and No Action Alternative

The No Action Alternative would avoid all the short-term construction impacts that would occur under the Proposed Action and would continue flow and fish-passage conditions that were established under the original FERC License Agreement. Beneficial effects for chinook salmon and steelhead associated with Proposed Action improvements to minimum creek flows, spawning and rearing habitat availability, water temperatures, and fish passage would not occur under the No Action Alternative. Because the Proposed Action would have substantial beneficial effects and would not result in a substantial number of significant and unavoidable impacts (impacts that could not be reduced to less-than-significant

levels with recommended mitigation measures), implementing the No Action Alternative does not offer substantial advantages related to avoidance of environmental impact.

The greatest benefit of the No Action Alternative would be avoidance of channel and streamside construction impacts on aquatic and terrestrial biological resources near Hydroelectric Project facilities (e.g. potential fish mortality, aquatic habitat disturbance, riparian forest disturbance, and short-term upland habitat impacts); however, avoidance of these impacts would come at the expense of longer-term fish and wildlife benefits on Battle Creek. Implementing the No Action Alternative would avoid significant impacts to historic properties, including Eagle Canyon, Wildcat, Inskip, and Coleman Diversion Dams and appurtenant facilities, and would avoid significant and unavoidable aesthetic impacts on the Oasis Springs Lodge related to improvements to South Powerhouse and Inskip Diversion Dam facilities. The No-Action Alternative would continue effects associated with continued use and upgrades of Hydroelectric Project diversion dams and canals.

## Proposed Action (Five Dam Removal Alternative) and No Dam Removal Alternative

The No Dam Removal Alternative would provide new fish screens and fish ladders at North Battle Creek Feeder, Eagle Canyon, Wildcat, South, Inskip, and Coleman Diversion Dams. The dams, diversions, canals, and spring-water collection systems, however, would remain at the same locations as under the No Action Alternative. The more secure passage benefits and complete absence of diversion-related effects provided by removal of Wildcat, South, and Coleman Diversion Dams under the Proposed Action would not be realized under the No Dam Removal Alternative. The No Dam Removal Alternative also would not realize the potential benefits of minimized flow fluctuations during canal and powerhouse outages that would be provided by connectors at South and Inskip Powerhouses and in the stream channel below Wildcat, South, and Coleman Diversion Dams. The minimum flow requirements (i.e., AFRP minimum flow requirements) below the diversion dams would be higher than the instream flows for the No Action Alternative (i.e., FERC minimum flow requirements), but generally less than under the Proposed Action (i.e., MOU minimum flow requirements) (Section 4.3, “Hydrology”). Substantially greater production of chinook salmon and steelhead would be expected relative to the No Action Alternative. The No Dam Removal Alternative, however, would not incorporate the additional flexibility provided by the higher flow requirements for the Proposed Action relative to support for future adaptive management of flow targets for flow-habitat, fish passage, and water temperature considerations. The No Dam Removal Alternative would also maintain No Action conditions in Soap, Ripley, and Baldwin Creeks. The No Dam Removal Alternative would not provide the production from additional spawning and rearing habitat that would occur in Soap, Ripley, and Baldwin Creeks under the Five Dam Removal Alternative.

The No Dam Removal Alternative would generally result in less channel and stream construction impact and less upland construction effect on aquatic and terrestrial biological resources because Restoration Project improvements would involve mainly upgrading fish ladders and screens at existing dams and would not involve removal of dams and appurtenant facilities or construction of South and Inskip Powerhouse tailrace connectors. However, despite these relative differences, both the No Dam Removal Alternative and Five Dam Removal Alternative would result in the same significant construction impacts on aquatic and terrestrial biological resources because temporary loss of habitat and potential effects on fish and wildlife species would occur under both of these alternatives. Both the No Dam Alternative and Proposed Action would have short-term construction-related sedimentation and erosion impacts that would be mitigated to less-than-significant levels; the No Dam Removal Alternative would generally have slightly less relative impact because of relatively less construction activity under this alternative.

The No Dam Removal Alternative would have impacts similar to the Proposed Action on land use, aesthetics, transportation, noise, air quality, public health and safety, and recreation, although localized differences in impacts for these areas could occur on a temporary basis.

The No Dam Removal Alternative would have less impact on historic dams on Battle Creek than the Proposed Action because all historic properties (including Eagle Canyon, Wildcat, Inskip, and Coleman Diversion Dams) would remain in place under this alternative, although some fish ladder and screen modification would be made immediately adjacent to these structures.

## Proposed Action (Five Dam Removal Alternative) and Six Dam Removal Alternative

The Six Dam Removal Alternative would generally result in chinook salmon and steelhead production and benefits that are similar to those of the Proposed Action. Eagle Canyon Dam would be removed under the Six Dam Removal Alternative, potentially providing more secure passage benefits and complete absence of diversion-related effects. However, the removal of Eagle Canyon Dam would remove the potential for future adaptive management of the water temperature benefits provided by the cold spring water below Eagle Canyon Dam. The Proposed Action would retain Eagle Canyon Dam and the potential to operate Eagle Canyon Dam and Diversion to maximize the benefits of cold water temperature provided by the springs.

The Six Dam Removal Alternative would generally result in slightly greater channel and stream construction impacts and similar upland construction effects on aquatic and terrestrial biological resources because Restoration Project improvements under this alternative would be the same as under the Five Dam Removal Alternative, except Eagle Canyon Diversion Dam and appurtenant facilities would also be removed. The Six Dam Removal Alternative would

result in the same significant construction impacts on aquatic and terrestrial biological resources, except additional effects would occur at the Eagle Canyon Diversion Dam construction site. Temporary loss of habitat and potential effects on fish and wildlife species would occur under both of these alternatives. Both the Six Dam Removal Alternative and Proposed Action would have short-term construction-related sedimentation and erosion impacts that would be mitigated to less-than-significant levels; the Six Dam Removal Alternative would generally have slightly greater relative impact because of slightly greater construction and dam removal activity under this alternative.

The Six Dam Removal Alternative would have impacts similar to the Proposed Action on land use, aesthetics, transportation, noise, air quality, public health and safety, and recreation, although localized differences in impacts for these resource areas could occur on a temporary basis, especially at the Eagle Canyon Diversion Dam site.

The Six Dam Removal Alternative would have slightly greater impacts on historic dams on Battle Creek than the Proposed Action because Eagle Canyon Diversion Dam would be removed in addition to removing Wildcat and Coleman Diversion Dams.

## Proposed Action (Five Dam Removal Alternative) and Three Dam Removal Alternative

The Three Dam Removal Alternative would provide new fish screens and fish ladders at North Battle Creek Feeder, South, and Inskip Diversion Dams. The more secure passage benefits and complete absence of diversion-related effects provided by removal of South Diversion Dam under the Proposed Action would not be realized under the Three Dam Removal Alternative. Eagle Canyon Diversion Dam would be removed under the Three Dam Removal Alternative, potentially providing more secure passage benefits and complete absence of diversion-related effects. However, the removal of Eagle Canyon Diversion Dam would remove the potential for future adaptive management of the water temperature benefits provided by the cold spring water below Eagle Canyon Diversion Dam. The Proposed Action would retain Eagle Canyon Diversion Dam and the potential to operate Eagle Canyon Diversion Dam and Diversion to maximize the benefits of cold water temperature provided by the springs. The Three Dam Removal Alternative also would realize the potential benefits of minimized flow fluctuations during canal and powerhouse outages that would be provided by connectors at South and Inskip Powerhouses and in the stream channel below Wildcat, Eagle Canyon, and Coleman Diversion Dams. The absence of an absolute connector and bypass facility at Inskip Powerhouse, however, could result in benefits less than those realized by minimized flow and water temperature fluctuations under the Five Dam Removal Alternative. The minimum flow requirements (i.e., AFRP minimum flow requirements) below the diversion dams would be higher than the instream flows for the No Action Alternative (i.e., FERC minimum flow requirements), but generally less than

under the Proposed Action (i.e., MOU minimum flow requirements) (Section 4.3, "Hydrology"). Substantially greater production of chinook salmon and steelhead would be expected relative to the No Action Alternative. The Three Dam Removal Alternative, however, would not incorporate the additional flexibility provided by the higher flow requirements for the Proposed Action relative to support for future adaptive management of flow targets for flow-habitat, fish passage, and water temperature considerations. The Three Dam Removal Alternative would also maintain No Action conditions in Soap and Ripley Creeks. The Three Dam Removal Alternative would not provide the production from additional spawning and rearing habitat that would occur in Soap and Ripley Creeks under the Five Dam Removal Alternative.

The Three Dam Removal Alternative would generally result in less channel and stream construction impact and upland construction effect on aquatic and terrestrial biological resources compared to the Proposed Action because Restoration Project improvements under this alternative would not involve removing South, Soap Creek Feeder, or Lower Ripley Creek Feeder Diversion Dams and would not involve construction of the Inskip Powerhouse bypass facility. The Three Dam Removal Alternative would result in the same type of significant construction impacts on aquatic and terrestrial biological resources as the Proposed Action, but impacts would not occur at as many construction sites as identified for the Proposed Action. Temporary loss of habitat and potential effects on fish and wildlife species would occur under both of these alternatives. Both the Three Dam Removal Alternative and the Proposed Action would have short-term construction-related sedimentation and erosion impacts that would be mitigated to less-than-significant levels; the Three Dam Removal Alternative would generally have slightly less relative impact because of less construction and dam removal activity under this alternative.

The Three Dam Removal Alternative would have impacts similar to the Proposed Action on land use, aesthetics, transportation, noise, air quality, public health and safety, and recreation, although impacts would occur only at the facilities proposed to be improved under this alternative.

The Three Dam Removal Alternative would have slightly greater impacts on historic dams on Battle Creek than the Proposed Action because Eagle Canyon Diversion Dam would be removed in addition to removing Wildcat and Coleman Diversion Dams.

# Environmentally Preferred Alternative

According to Reclamation's NEPA Handbook, the alternative, or alternatives, considered to be environmentally preferred should be specified in an EIS. The *environmentally preferred alternative* under NEPA is defined as "the alternative that will promote the national environmental policy as expressed in NEPA's Section 101." Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best

protects, preserves, and enhances historic, cultural, and natural resources. It is implicit in NEPA that the environmentally preferred alternative is a reasonable and feasible alternative. Reclamation is not obliged to select the environmentally preferred alternative but must identify it in the ROD and should, if possible, identify it in the final EIS.

Section 15126.6(e) of the state CEQA Guidelines also requires the state lead agency (SWRCB) to identify the environmentally superior alternative. If the No Action Alternative is also the environmentally superior alternative, the EIR will also identify an environmentally superior alternative from among the other alternatives. For the purposes of this EIS/EIR, the environmentally superior alternative will be referred to as the environmentally preferred alternative, as referred to under NEPA.

On the basis of the analyses of the potential environmental impacts, the Proposed Action, the Five Dam Removal Alternative, has been determined to be the environmentally preferred alternative. The Five Dam Removal Alternative would have more benefits to fish and power generation than the other alternatives. In addition, decommissioning the South Canal under the Five Dam Removal Alternative would provide potential habitat for special-status bat species.

Under the Five Dam Removal Alternative, new fish screens and fish ladders would be constructed at three diversion dams (North Battle Creek Feeder, Eagle Canyon, and Inskip Diversion Dams), and five diversion dams would be removed (Wildcat, South, Soap Creek Feeder, Lower Ripley Creek Feeder, and Coleman Diversion Dams). These modifications would substantially improve the reliability and effectiveness of upstream and downstream fish passage. In addition, powerhouse tailrace connectors are proposed that prevent the discharge of North Fork Battle Creek water to South Fork Battle Creek and the mixing of flow sources, which would prevent false attraction of anadromous fish to South Fork Battle Creek.

In relation to power generation, the annual power benefits associated with the Five Dam Removal Alternative would be greater than the increased annual total and going-forward cost of Hydroelectric Project power compared to the other alternatives (see Section 4.16, “Other NEPA Analysis”). The No Dam Removal, Six Dam Removal, and Three Dam Removal Alternatives would have greater replacement costs and fewer power generation benefits. Greater annual power benefits compared to anticipated replacement power costs under the Five Dam Removal Alternative demonstrates that the Hydroelectric Project would continue to be a low-cost source of electricity.

**Table 7-1.** Summary of Impacts, Levels of Significance, and Recommended Mitigation Measures for the No Action Alternative, Five Dam Removal Alternative (Proposed Action), No Dam Removal Alternative, Six Dam Removal Alternative, and Three Dam Removal Alternative

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| FISH | | | |
| **No Action Alternative** | | | |
| Hydroelectric Project facilities (including fish ladders) and operations would be maintained and operated in accordance with Federal Energy Regulatory Commission (FERC) regulations, and the existing minimum flows would continue to be provided; fish populations would continue to be maintained at levels lower than those targeted by restoration goals | No change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.1-1 Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials | Significant | Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program | Less than Significant |
| Impact 4.1-2 Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities | Significant | Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan | Less than Significant |
| Impact 4.1-3 Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species as a result of removing South, Coleman, and Eagle Canyon Diversion Dams, which would release currently stored fine sediment to the stream channel | Significant | Reclamation will remove diversion dams during low-flow season (July–October) | Less than Significant |
| Impact 4.1-4 Disturbed steelhead and chinook salmon habitat in the stream channel as a result of construction activities | Less than Significant | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-5 Disrupted movement and migration of fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction | Less than Significant | None | Not applicable |
| Impact 4.1-6 Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities | Less than Significant | None | Not applicable |
| Impact 4.1-7 Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities | Less than Significant | None | Not applicable |
| Impact 4.1-8 Reduced habitat and range of some resident warmwater species because of cooler water temperatures | Less than Significant | None | Not applicable |
| Impact 4.1-9 Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams | Less than Significant | None | Not applicable |
| Impact 4.1-10 Increased exposure of rainbow trout to pathogens because of the increase of chinook salmon and steelhead in Battle Creek | Less than Significant | None | Not applicable |
| Impact 4.1-11 Substantially increased capacity indices for spawning and rearing of steelhead and chinook salmon resulting from increased minimum instream flows | Beneficial | None | Not applicable |
| Impact 4.1-12 Substantially increased production indices for fry and juvenile life stages for steelhead and chinook salmon as a result of cooler water temperatures | Beneficial | None | Not applicable |
| Impact 4.1-13 Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of chinook salmon and steelhead over natural barriers | Beneficial | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-14 Increased survival of adults and increased spawning success because removal of five dams and the construction of more reliable effective fish ladders would facilitate passage of chinook salmon and steelhead | Beneficial | None | Not applicable |
| Impact 4.1-15 Potentially increased spawning success and fry production because eliminating the discharge of North Fork Battle Creek water to South Fork Battle Creek would facilitate the return of adult chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek | Beneficial | None | Not applicable |
| Impact 4.1-16 Substantially increased survival of juvenile steelhead and chinook salmon during downstream movement and migration as a result of eliminating some diversions and constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek | Beneficial | None | Not applicable |
| Impact 4.1-17 Reduction of predation-related mortality as a result of removing dams and improving fish ladders | Beneficial | None | Not applicable |
| Impact 4.1-18 Substantially increased production of food for fish resulting from increased minimum instream flows | Beneficial | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.1-19 Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials (similar to Impact 4.1-1) | Significant | Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program (same mitigation as that recommended for Proposed Action, Impact 4.1-1) | Less than Significant |
| Impact 4.1-20 Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities (similar to Impact 4.1-2) | Significant | Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan (same mitigation as that recommended for Proposed Action, Impact 4.1-2) | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-21 Disturbed steelhead and chinook salmon habitat in the stream channel as a result of construction activities | Less than Significant | None | Not applicable |
| Impact 4.1-22 Disrupted movement and migration of fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction (similar to Impact 4.1-5) | Less than Significant | None | Not applicable |
| Impact 4.1-23 Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities (similar to Impact 4.1-6) | Less than Significant | None | Not applicable |
| Impact 4.1-24 Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities (similar to Impact 4.1-7) | Less than Significant | None | Not applicable |
| Impact 4.1-25 Reduced habitat and range of some resident warmwater species because of cooler water temperatures | Less than Significant | None | Not applicable |
| Impact 4.1-26 Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams | Less than Significant | None | Not applicable |
| Impact 4.1-27 Increased exposure of rainbow trout to pathogens because of the increase of chinook salmon and steelhead in Battle Creek (similar to Impact 4.1-10) | Less than Significant | None | Not applicable |
| Impact 4.1-28 Substantially increased capacity indices for spawning and rearing of steelhead and chinook salmon resulting from increased minimum instream flows (similar to Impact 4.1-11) | Beneficial | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-29 Substantially increased production indices for fry and juvenile life stages for steelhead and chinook salmon as a result of cooler water temperatures (similar to Impact 4.1-12) | Beneficial | None | Not applicable |
| Impact 4.1-30 Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of chinook salmon and steelhead over natural barriers (similar to Impact 4.1-13) | Beneficial | None | Not applicable |
| Impact 4.1-31 The construction of more effective fish ladders on North Battle Creek Feeder, Eagle Canyon, Wildcat, South, Inskip, and Coleman Diversion Dams would facilitate passage of chinook salmon and steelhead, which would increase survival of adults and increase spawning success | Beneficial | None | Not applicable |
| Impact 4.1-32 Constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek would substantially increase the survival of juvenile steelhead and chinook salmon during downstream movement and migration | Beneficial | None | Not applicable |
| Impact 4.1-33 Reduction of predation-related mortality as a result of improving fish ladders | Beneficial | None | Not applicable |
| Impact 4.1-34 Substantially increased production of food for fish resulting from increased minimum instream flows (similar to Impact 4.1-18) | Beneficial | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.1-35 Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials (similar to Impact 4.1-1) | Significant | Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program (same mitigation as that recommended for Proposed Action, Impact 4.1-1) | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-36 Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities (Similar to Impact 4.1-2) | Significant | Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan (same mitigation as that recommended for Proposed Action, Impact 4.1-2) | Less than Significant |
| Impact 4.1-37 Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species as a result of removing South, Coleman, and Eagle Canyon Diversion Dams, which would release currently stored fine sediment to the stream channel (similar to Impact 4.1-3) | Significant | Reclamation will remove diversion dams during low-flow season (July–October) (same mitigation as that recommended for Proposed Action, Impact 4.1-3) | Less than Significant |
| Impact 4.1-38 Disturbed steelhead and chinook salmon habitat in the stream channel as a result of construction activities (similar to 4.1-4) | Less than Significant | None | Not applicable |
| Impact 4.1-39 Disrupted movement and migration of fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction (similar to Impact 4.1-5) | Less than Significant | None | Not applicable |
| Impact 4.1-40 Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities (similar to Impact 4.1-6) | Less than Significant | None | Not applicable |
| Impact 4.1-41 Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities (similar to Impact 4.1-7) | Less than Significant | None | Not applicable |
| Impact 4.1-42 Reduced habitat and range of some resident warmwater species because of cooler water temperatures (similar to Impact 4.1-8) | Less than Significant | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-43 Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams (similar to Impact 4.1-9) | Less than Significant | None | Not applicable |
| Impact 4.1-44 Increased exposure of rainbow trout to pathogens because of the increase of chinook salmon and steelhead in Battle Creek | Less than Significant | None | Not applicable |
| Impact 4.1-45 Substantially increased capacity indices for spawning and rearing habitat of steelhead and chinook salmon resulting from increased minimum instream flows (similar to Impact 4.1-11) | Beneficial | None | Not applicable |
| Impact 4.1-46 Substantially increased production indices for fry and juvenile life stages for steelhead and chinook salmon as a result of cooler water temperatures (similar to Impact 4.1-12) | Beneficial | None | Not applicable |
| Impact 4.1-47 Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of chinook salmon and steelhead over natural barriers (similar to Impact 4.1-13) | Beneficial | None | Not applicable |
| Impact 4.1-48 Increased survival of adults and increased spawning success because removal of dams and the construction of more effective fish ladders would facilitate passage of chinook salmon and steelhead (similar to Impact 4.1-14) | Beneficial | None | Not applicable |
| Impact 4.1-49 Potentially increased spawning success and fry production because eliminating the discharge of North Fork Battle Creek water to South Fork Battle Creek would facilitate the return of adult chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek (similar to Impact 4.1-15) | Beneficial | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-50 Substantially increased survival of juvenile steelhead and chinook salmon during downstream movement and migration as a result of ceasing diversions and constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek (similar to Impact 4.1-16) | Beneficial | None | Not applicable |
| Impact 4.1-51 Substantially increased production of food for fish resulting from increased minimum instream flows (similar to Impact 4.1-18) | Beneficial | None | Not applicable |
| Impact 4.1-52 Reduction of predation-related mortality as a result of removing dams and improving fish ladders (similar to Impact 4.1-17) | Beneficial | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.1-53 Mortality and lowered growth rates and reproductive success of fish and other aquatic species in Battle Creek from an accidental spill of petroleum products and other construction-related materials (similar to Impact 4.1-1) | Significant | Construction contractor will implement toxic materials control and spill plans; Reclamation will implement a construction-area fish management program (same mitigation as that recommended for Proposed Action, Impact 4.1-1) | Less than Significant |
| Impact 4.1-54 Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species because of increased sedimentation to North Fork and South Fork Battle Creek as a result of construction activities (similar to Impact 4.1-2) | Significant | Construction contractors will develop and implement a vegetation protection plan and an erosion and sediment plan (same mitigation as that recommended for Proposed Action, Impact 4.1-2) | Less than Significant |
| Impact 4.1-55 Mortality of fish eggs and larvae and reduced reproductive success of fish and other aquatic species as a result of removing South, Coleman, and Eagle Canyon Diversion Dams, which would release currently stored fine sediment to the stream channel (similar to Impact 4.1-3) | Significant | Reclamation will remove diversion dams during low-flow season (July–October) (same mitigation as that recommended for Proposed Action, Impact 4.1-3) | Less than Significant |
| Impact 4.1-56 Disturbed steelhead and chinook salmon habitat in the stream channel as a result of construction activities (similar to Impact 4.1-4) | Less than Significant | None | Not applicable |
| Impact 4.1-57 Disrupted movement and migration of | Less than | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| fish species as a result of dewatering portions of the stream channel and temporarily removing fish ladders during construction (similar to Impact 4.1-5) | Significant | | |
| Impact 4.1-58 Compromised feeding efficiency of sight-feeding fish from erosion and the input of fine sediment as a result of construction and demolition activities (similar to Impact 4.1-6) | Less than Significant | None | Not applicable |
| Impact 4.1-59 Vulnerability of all life stages of fish to injury or mortality from percussion-related energy shock waves, operation of equipment, and becoming trapped in isolated pockets of water during construction activities (similar to Impact 4.1-7) | Less than Significant | None | Not applicable |
| Impact 4.1-60 Reduced habitat and range of some resident warmwater species because of cooler water temperatures (similar to Impact 4.1-8) | Less than Significant | None | Not applicable |
| Impact 4.1-61 Decreased rainbow trout abundance in canals as a result of eliminating some diversions and constructing effective fish screens at three dams (similar to Impact 4.1-9) | Less than Significant | None | Not applicable |
| Impact 4.1-62 Increased exposure of rainbow trout to pathogens because of the increase of chinook salmon and steelhead in Battle Creek (similar to Impact 4.1-10) | Less than Significant | None | Not applicable |
| Impact 4.1-63 Substantially increased capacity indices for spawning and rearing of steelhead and chinook salmon resulting from increased minimum instream flows (similar to Impact 4.1-11) | Beneficial | None | Not applicable |
| Impact 4.1-64 Substantially increased production indices for fry and juvenile life stages for steelhead and chinook salmon as a result of cooler water temperatures (similar to Impact 4.1-12) | Beneficial | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.1-65 Increased survival of adults and increased spawning success because higher instream flows would improve conditions that facilitate passage of chinook salmon and steelhead over natural barriers (similar to Impact 4.1-13) | Beneficial | None | Not applicable |
| Impact 4.1-66 Increased survival of adults and increased spawning success because removal of dams and the construction of more effective fish ladders would facilitate passage of chinook salmon and steelhead (similar to Impact 4.1-14) | Beneficial | None | Not applicable |
| Impact 4.1-67 Potentially increased spawning success and fry production because eliminating the discharge of North Fork Battle Creek water to South Fork Battle Creek would facilitate the return of adult chinook salmon and steelhead to natal spawning habitat in South Fork and North Fork Battle Creek (similar to Impact 4.1-15) | Beneficial | None | Not applicable |
| Impact 4.1-68 Substantially increased survival of juvenile steelhead and chinook salmon during downstream movement and migration as a result of eliminating some diversions and constructing fish screens at the remaining diversions from North Fork and South Fork Battle Creek (similar to Impact 4.1-16) | Beneficial | None | Not applicable |
| Impact 4.1-69 Reduction of predation-related mortality as a result of removing dams and improving fish ladders (similar to Impact 4.1-17) | Beneficial | None | Not applicable |
| Impact 4.1-70 Substantially increased production of food for fish resulting from increased minimum instream flows (similar to Impact 4.1-18) | Beneficial | None | Not applicable |
| BOTANICAL, WETLAND, AND WILDLIFE RESOURCES | | | |
| **No Action Alternative** | | | |
| Botanical, wildlife, and wetland resources would not be affected under the No Action Alternative; the Hydroelectric | No Change | None | |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Project would continue to operate consistent with the current FERC license | | | |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.2-1 Potential disturbance or loss of 7.2 acres of woody riparian vegetation and associated wildlife habitat | Significant | Reclamation will minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat | Less than Significant |
| Impact 4.2-2 Potential introduction of noxious weeds or spread of existing noxious weeds | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites | Less than Significant |
| Impact 4.2-3 Potential loss or disturbance of 12.1 acres of waters of the United States (including wetlands) | Significant | In addition to mitigation recommended for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, and revegetate lost habitat | Less than Significant |
| Impact 4.2-4 Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat | Significant | A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.2-5 Potential disturbance to valley elderberry longhorn beetle habitat | Significant | A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction | Less than Significant |
| Impact 4.2-6 Potential disturbance of foothill yellow-legged frog habitat | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction | Less than Significant |
| Impact 4.2-7 Potential disturbance of northwestern pond turtle habitat | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction | Less than Significant |
| Impact 4.2-8 Potential disturbance of breeding habitat for yellow-breasted chat | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-1, a qualified biologist will survey for breeding yellow-breasted chats before construction begins; if breeding chats are found, the construction contractor will limit removal of riparian vegetation and establish a 500-ft. no disturbance buffer around all active sites until after construction | Less than Significant |
| Impact 4.2-9 Potential disturbance to nesting raptors | Significant | A qualified biologist will survey the project sites to locate active osprey and golden eagle nests before construction begins; if active nests are found, Reclamation will limit construction activities near the nest to the nonbreeding season | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | (mid-July to February), establish a 0.5-mile-radius direct line-of-sight buffer for active golden eagle nests and a 500-foot-radius direct line-of-sight buffer for active osprey nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone around any active nests | |
| Impact 4.2-10 Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls | Significant | A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game | Less than Significant |
| Impact 4.2-11 Possible loss of woody riparian vegetation along the South and Wildcat canals from cessation of flows | Less than Significant | None | Not applicable |
| Impact 4.2-12 Potential disturbance of foraging bald eagles along Battle Creek | Less than Significant | None | Not applicable |
| Impact 4.2-13 Reduction of artificial flow fluctuations and increased survival of amphibians | Beneficial | None | Not applicable |
| Impact 4.2-14 Increase in quantity of amphibian habitat resulting from increased minimum instream flows | Beneficial | None | Not applicable |
| Impact 4.2-15 Substantial increase in quantity of bat roosting habitat in the South Canal tunnels due to termination of water flow through the tunnels | Beneficial | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| **No Dam Removal Alternative** | | | |
| Impact 4.2-16 Potential disturbance or loss of 4.1 acres of woody riparian vegetation and associated wildlife habitat (similar to Impact 4.2-1) | Significant | Reclamation will minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat (same mitigation as recommended for the Proposed Action, Impact 4.2-1) | Less than Significant |
| Impact 4.2-17 Potential introduction of noxious weeds or spread of existing noxious weeds (similar to Impact 4.2-2) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites (same mitigation as recommended for the Proposed Action, Impact 4.2-2) | Less than Significant |
| Impact 4.2-18 Potential loss or disturbance of 11.6 acres of waters of the United States (including wetlands) (similar to Impact 4.2-3) | Significant | In addition to mitigation recommended for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, and revegetate lost habitat (same mitigation as recommended for the Proposed Action, Impact 4.2-3) | Less than Significant |
| Impact 4.2-19 Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat (similar to Impact 4.2-4) | Significant | A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth (same mitigation as recommended for the Proposed Action, Impact 4.2-4) | |
| Impact 4.2-20 Potential disturbance to valley elderberry longhorn beetle habitat (similar to Impact 4.2-5) | Significant | A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction (same mitigation as recommended for the Proposed Action, Impact 4.2-5) | Less than Significant |
| Impact 4.2-21 Potential disturbance of foothill yellow-legged frog habitat (similar to Impact 4.2-6) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-6) | Less than Significant |
| Impact 4.2-22 Potential disturbance of northwestern pond turtle habitat (similar to Impact 4.2-7) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-7) | Less than Significant |
| Impact 4.2-23 Potential disturbance of breeding habitat for yellow-breasted chat (similar to Impact 4.2-8) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-1, a qualified biologist will survey for breeding yellow-breasted chats before construction begins; if breeding chats are found, the construction contractor will limit removal of riparian vegetation and establish a 500-ft. no disturbance buffer around all active sites | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-8) | |
| Impact 4.2-24 Potential disturbance to nesting raptors (similar to Impact 4.2-9) | Significant | A qualified biologist will survey the project sites to locate active osprey and golden eagle nests before construction begins; if active nests are found, Reclamation will limit construction activities near the nest to the nonbreeding season (mid-July to February), establish a 0.5-mile-radius direct line-of-sight buffer for active golden eagle nests and a 500-foot-radius direct line-of-sight buffer for active osprey nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone around any active nests (same mitigation as recommended for the Proposed Action, Impact 4.2-9) | Less than Significant |
| Impact 4.2-25 Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls (similar to Impact 4.2-10) | Significant | A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game (same mitigation as recommended for the Proposed Action, Impact 4.2-10) | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.2-26 Potential disturbance of foraging bald eagles along Battle Creek (similar to Impact 4.2-12) | Less than Significant | None | Not applicable |
| Impact 4.2-27 Increase in quantity of amphibian habitat resulting from increased minimum instream flows (similar to Impact 4.2-14) | Beneficial | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.2-28 Potential disturbance or loss of 7.2 acres of woody riparian vegetation and associated wildlife habitat (similar to Impact 4.2-1) | Significant | Reclamation will minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat (same mitigation as recommended for the Proposed Action, Impact 4.2-1) | Less than Significant |
| Impact 4.2-29 Potential introduction of noxious weeds or spread of existing noxious weeds (similar to Impact 4.2-2) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites (same mitigation as recommended for the Proposed Action, Impact 4.2-2) | Less than Significant |
| Impact 4.2-30 Potential loss or disturbance of 12.1 acres of waters of the United States (including wetlands) (similar to Impact 4.2-3) | Significant | In addition to mitigation recommended for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, and revegetate lost habitat (same mitigation as recommended for the Proposed Action, Impact | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | 4.2-3) | |
| Impact 4.2-31 Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat (similar to Impact 4.2-4) | Significant | A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth (same mitigation as recommended for the Proposed Action, Impact 4.2-4) | Less than Significant |
| Impact 4.2-32 Potential disturbance to valley elderberry longhorn beetle habitat (similar to Impact 4.2-5) | Significant | A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction (same mitigation as recommended for the Proposed Action, Impact 4.2-5) | Less than Significant |
| Impact 4.2-33 Potential disturbance of foothill yellow-legged frog habitat (similar to Impact 4.2-6) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-6) | Less than Significant |
| Impact 4.2-34 Potential disturbance of northwestern pond turtle habitat (similar to Impact 4.2-7) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as recommended | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | for the Proposed Action, Impact 4.2-7) | |
| Impact 4.2-35 Potential disturbance of breeding habitat for yellow-breasted chat (similar to Impact 4.2-8) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-1, a qualified biologist will survey for breeding yellow-breasted chats before construction begins; if breeding chats are found, the construction contractor will limit removal of riparian vegetation and establish a 500-ft. no disturbance buffer around all active sites until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-8) | Less than Significant |
| Impact 4.2-36 Potential disturbance to nesting raptors (similar to Impact 4.2-9) | Significant | A qualified biologist will survey the project sites to locate active osprey and golden eagle nests before construction begins; if active nests are found, Reclamation will limit construction activities near the nest to the nonbreeding season (mid-July to February), establish a 0.5-mile-radius direct line-of-sight buffer for active golden eagle nests and a 500-foot-radius direct line-of-sight buffer for active osprey nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone around any active nests (same mitigation as recommended for the Proposed Action, Impact 4.2-9) | Less than Significant |
| Impact 4.2-37 Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls (similar to Impact 4.2-10) | Significant | A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game (same mitigation as recommended for the Proposed Action, Impact 4.2-10) | |
| Impact 4.2-38 Possible loss of woody riparian vegetation along the South and Wildcat Canals from cessation of flows (similar to Impact 4.2-11) | Less than Significant | None | Not applicable |
| Impact 4.2-39 Potential disturbance of foraging bald eagles along Battle Creek (similar to Impact 4.2-12) | Less than Significant | None | Not applicable |
| Impact 4.2-40 Reduction in artificial flow fluctuations and increased survival of amphibians (similar to Impact 4.2-13) | Beneficial | None | Not applicable |
| Impact 4.2-41 Increase in the quantity of amphibian habitat resulting from increased minimum instream flows (similar to Impact 4.2-14) | Beneficial | None | Not applicable |
| Impact 4.2-42 Substantial increase in the quantity of bat roosting habitat in the South Canal tunnels due to termination of water flow through the tunnels (similar to Impact 4.2-15) | Beneficial | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.2-43 Potential loss or disturbance of 6.0 acres of woody riparian vegetation and associated wildlife habitat (similar to Impact 4.2-1) | Significant | Reclamation will minimize the removal and disturbance of riparian habitat, avoid long-term impacts on woody riparian vegetation and associated habitat, and compensate for the loss of any such habitat (same mitigation as recommended for the Proposed Action, Impact 4.2-1) | Less than Significant |
| Impact 4.2-44 Potential introduction of noxious weeds or spread of existing noxious weeds (similar to Impact 4.2-2) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.7-1, Reclamation will educate construction crews, use appropriate eradication techniques, wash all equipment after | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | leaving noxious weed sites, use weed-free materials for revegetation, perform a post-construction weed inventory, and perform routine inspections at construction sites (same mitigation as recommended for the Proposed Action, Impact 4.2-2) | |
| Impact 4.2-45 Potential loss or disturbance of 11.6 acres of waters of the United States (including wetlands) (similar to Impact 4.2-3) | Significant | In addition to mitigation recommended for the Proposed Action, Impacts 4.4-1 and 4.7-1, Reclamation will prohibit equipment access or staging in jurisdictional waters adjacent to the construction zone, stake and flag wetland areas for avoidance, routinely inspect protected areas, implement stream bank stabilization measures, and revegetate lost habitat (same mitigation as recommended for the Proposed Action, Impact 4.2-3) | Less than Significant |
| Impact 4.2-46 Potential loss or disturbance of common upland woodland and forest communities and associated wildlife habitat (similar to Impact 4.2-4) | Significant | A qualified biologist will identify the species and number of native trees to be removed or affected to protect those not removed and develop a tree planting plan; in addition, a qualified biologist will monitor all newly planted trees for 5 years and inspect pruned sites prior to, immediately after, and 1 year after construction for regrowth (same mitigation as recommended for the Proposed Action, Impact 4.2-4) | Less than Significant |
| Impact 4.2-47 Potential disturbance to valley elderberry longhorn beetle habitat (similar to Impact 4.2-5) | Significant | A qualified biologist will identify and mark valley elderberry longhorn beetle habitat for avoidance during construction; Reclamation will minimize impacts during construction through protection measures and replace any lost habitat post construction (same mitigation as recommended for the Proposed Action, Impact 4.2-5) | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.2-48 Potential disturbance of foothill yellow-legged frog habitat (similar to Impact 4.2-6) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for foothill yellow-legged frogs before construction begins; if frogs are found, a qualified biologist will construct barrier fencing to exclude frogs from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-6) | Less than Significant |
| Impact 4.2-49 Potential disturbance of northwestern pond turtle habitat (similar to Impact 4.2-7) | Significant | In addition to mitigation recommended for the Proposed Action, Impact 4.2-3, a qualified biologist will survey for northwestern pond turtles before construction begins; if turtles are found, a qualified biologist will construct barrier fencing to exclude turtles from the work area and relocate frogs to nearest suitable habitat until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-7) | Less than Significant |
| Impact 4.2-50 Potential disturbance of breeding habitat for yellow-breasted chat (similar to Impact 4.2-8) | Significant | A qualified biologist will survey for breeding yellow-breasted chats before construction begins; if breeding chats are found, the construction contractor will limit removal of riparian vegetation and establish a 500-ft. no disturbance buffer around all active sites until after construction (same mitigation as recommended for the Proposed Action, Impact 4.2-8) | Less than Significant |
| Impact 4.2-51 Potential disturbance to nesting raptors (similar to Impact 4.2-9) | Significant | A qualified biologist will survey the project sites to locate active osprey and golden eagle nests before construction begins; if active nests are found, Reclamation will limit construction activities near the nest to the nonbreeding season (mid-July to February), establish a 0.5-mile-radius direct line-of-sight buffer for active golden eagle nests and a 500-foot-radius direct line-of-sight buffer for active osprey nests, and maintain a 0.5-mile direct line-of-sight helicopter exclusion zone | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | around any active nests (same mitigation as recommended for the Proposed Action, Impact 4.2-9) | |
| Impact 4.2-52 Potential disturbance of bats in canal tunnels and on rocky cliffs and outcrops along canyon walls (similar to Impact 4.2-10) | Significant | A qualified biologist will survey construction sites, nearby tunnels, rocky cliffs and outcrops, and other potential bat habitats that could be adversely affected by construction to determine the presence or absence of bats; Reclamation will restrict construction activities to non-use periods or outside the breeding and hibernation periods if sites are found that support maternity colonies or large concentrations of roosting bats; if impacts are unavoidable during any season, Reclamation will implement selected minimizing actions to reduce disturbance of roosting bats; construction scheduling, buffer zones, and other mitigation measures will be developed in consultation with bat specialists, U.S. Fish and Wildlife Service, and the California Department of Fish and Game (same mitigation as recommended for the Proposed Action, Impact 4.2-10) | Less than Significant |
| Impact 4.2-53 Possible loss of woody riparian vegetation along the Wildcat Canal from cessation of flows (similar to Impact 4.2-11) | Less than Significant | None | Not applicable |
| Impact 4.2-54 Potential disturbance of foraging bald eagles along Battle Creek (similar to Impact 4.2-12) | Less than Significant | None | Not applicable |
| Impact 4.2-55 Reduction of artificial flow fluctuations and increased survival of amphibians (similar to Impact 4.2-13) | Beneficial | None | Not applicable |
| Impact 4.2-56 Substantial increase in the quantity of amphibian habitat resulting from increased minimum instream flows (similar to Impact 4.2-14) | Beneficial | None | Not applicable |
| HYDROLOGY | | | |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| **No Action Alternative** | | | |
| Current hydrology would not change; Hydroelectric Project facilities and operations would be maintained and operated in accordance with FERC regulations, and the existing minimum flows would continue to be provided | No Change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.3-1 In-water construction could result in short-term disruption of streambed and flows | Less than Significant | None | Not applicable |
| Impact 4.3-2 Coleman Diversion Dam removal could reduce the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse | Beneficial | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.3-3 In-water construction could result in short-term disruption of streambed and flows (similar to Impact 4.3-1) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.3-4 Removal of Eagle Canyon Diversion Dam could result in minor, slight increases to downstream bed elevations | Less than Significant | None | Not applicable |
| Impact 4.3-5 In-water construction could result in short-term disruption of streambed and flows (similar to Impact 4.3-1) | Less than Significant | None | Not applicable |
| Impact 4.3-6 Coleman Diversion Dam removal could reduce the 10-, 25-, and 50-year floodwater surface profiles at Inskip Powerhouse (similar to Impact 4.3-2) | Beneficial | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.3-7 In-water construction could result in short-term disruption of streambed and flows (similar to Impact 4.3-1) | Less than Significant | None | Not applicable |
| Impact 4.3-8 Coleman Diversion Dam removal could reduce the 10-, 25-, and 50-year floodwater surface profiles | Beneficial | None | Not Applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| at Inskip Powerhouse (similar to Impact 4.3-2) | | | |
| WATER QUALITY | | | |
| **No Action Alternative** | | | |
| The No Action Alternative would not affect water quality. Under the No Action Alternative, the Hydroelectric Project would continue to operate consistent with the current FERC license. | No change | | |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.4-1 Increased erosion and subsequent discharge of settleable material into Battle Creek as a result of removing diversion dams and constructing fish screens and fish ladders | Significant | Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board | Less than significant |
| Impact 4.4-2 Potential spills of hazardous materials could occur | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills | Less than significant |
| Impact 4.4-3 Removal of South and Coleman Diversion Dams could cause erosion of minor amounts of sediment from behind the dam | Less than Significant | None | Not applicable |
| Impact 4.4-4 Minor amounts of sediment released by the removal of Coleman Diversion Dam would be deposited at the County Road Bridge | Less than Significant | None | Not applicable |
| Impact 4.4-5 Short-term increased turbidity and settleable material load on the Coleman National Fish Hatchery water treatment plant as a result of removing Coleman Diversion Dam | Less than significant | None | Not Applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.4-6 Increased erosion and subsequent discharge of settleable material into Battle Creek as a result of constructing fish screens and fish ladders (similar to Impact 4.4-1) | Significant | Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board (same mitigation as recommended for the Proposed Action, Impact 4.4-1) | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.4-7 Potential spills of hazardous materials could occur (similar to Impact 4.4-2) | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as recommended for the Proposed Action, Impact 4.4-2) | Less than Significant |
| **Six Dam Removal Alternative** | | | |
| Impact 4.4-8 Increased erosion and subsequent discharge of settleable material into Battle Creek as a result of removing diversion dams and constructing fish screens and fish ladders (similar to Impact 4.4-1) | Significant | Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board (same mitigation as recommended for the Proposed Action, Impact 4.4-1) | Less than Significant |
| Impact 4.4-9 Potential spills of hazardous materials could occur (similar to Impact 4.4-2) | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as recommended for the Proposed Action, Impact 4.4-2) | Less than Significant |
| Impact 4.4-10 Removal of South and Coleman Diversion Dams could cause erosion of minor amounts of sediment from behind the dam (similar to Impact 4.4-3) | Less than Significant | None | Not applicable |
| Impact 4.4-11 Minor amounts of sediment released by the removal of Coleman Diversion Dam would be deposited at the County Road Bridge (similar to Impact 4.4-4) | Less than Significant | None | Not applicable |
| Impact 4.4-12 Short-term increased turbidity and settleable material load on the Coleman National Fish Hatchery water treatment plant as a result of removing Coleman Diversion Dam (similar to Impact 4.5-5) | Less than Significant | None | Not Applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.4-13 Increased erosion and subsequent discharge of settleable material into Battle Creek as a result of removing diversion dams and constructing fish screens and fish ladders (similar to Impact 4.4-1) | Significant | Reclamation will develop an erosion control plan in coordination with the Central Valley Regional Water Quality Control Board (same mitigation as recommended for the Proposed Action, Impact 4.4-1) | Less than Significant |
| Impact 4.4-14 Potential spills of hazardous materials could occur (similar to Impact 4.4-2) | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as recommended for the Proposed | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | Action, Impact 4.4-2) | |
| Impact 4.4-15 Removal of Coleman Diversion Dam could cause erosion of minor amounts of sediment from behind the dam (similar to Impact 4.4-3) | Less than Significant | None | Not applicable |
| Impact 4.4-16 Minor amounts of sediment released by the removal of Coleman Diversion Dam would be deposited at the County Road Bridge (similar to Impact 4.4-4) | Less than Significant | None | Not applicable |
| Impact 4.4-17 Short-term increased turbidity and settleable material load on the Coleman National Fish Hatchery water treatment plant as a result of removing Coleman Diversion Dam (similar to Impact 4.4-5) | Less than Significant | None | Not Applicable |
| GROUNDWATER | | | |
| **No Action Alternative** | | | |
| Groundwater would not change under the No Action Alternative | No Change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.5-1 Potential spills of hazardous materials could occur and contaminate the shallow groundwater system | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills | Less than significant |
| **No Dam Removal Alternative** | | | |
| Impact 4.5-2 Potential spills of hazardous materials could occur and contaminate the shallow groundwater system (similar to Impact 4.5-1) | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as recommended for the Proposed Action, Impact 4.5-1) | Less than significant |
| **Six Dam Removal Alternative** | | | |
| Impact 4.5-3 Potential spills of hazardous materials could occur and contaminate the shallow groundwater system (similar to Impact 4.5-1) | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as recommended for the Proposed Action, Impact 4.5-1) | Less than significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| **Three Dam Removal Alternative** | | | |
| Impact 4.5-4 Potential spills of hazardous materials could occur and contaminate the shallow groundwater system (similar to Impact 4.5-1) | Significant | Reclamation will implement measures designed to avoid or minimize hazardous spills (same mitigation as recommended for the Proposed Action, Impact 4.5-1) | Less than significant |
| LAND USE | | | |
| **No Action Alternative** | | | |
| The No Action Alternative would not impact land use; the No Action Alternative is not expected to conflict with general plans and established land uses, alter existing land uses, displace a large number of people, or convert agricultural land to nonagricultural land | No Change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.6-1 Conversion of lands disturbed by construction activities from open space to Restoration Project support would substantially conflict with existing land uses | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.6-2 Conversion of lands disturbed by construction activities from open space to Restoration Project support would substantially conflict with existing land uses (similar to Impact 4.6-1) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.6-3 Conversion of lands disturbed by construction activities from open space to Restoration Project support would substantially conflict with existing land uses (similar to Impact 4.6-1) | Less than Significant | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.6-4 Conversion of lands disturbed by construction activities from open space to Restoration | Less than | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Project support would substantially conflict with existing land uses (similar to Impact 4.6-1) | Significant | | |
| GEOLOGY AND SOILS | | | |
| **No Action Alternative** | | | |
| Geological and soil resources would not change | No change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.7-1 Potential accelerated water and wind erosion from construction activities | Significant | The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites | Less than Significant |
| Impact 4.7-2 Construction workers could be exposed to falling rocks | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.7-3 Potential accelerated water and wind erosion from construction activities (similar to Impact 4.7-1) | Significant | The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites (same mitigation as recommended for the Proposed Action, Impact 4.7-1) | Less than Significant |
| Impact 4.7-4 Construction workers could be exposed to falling rocks (similar to Impact 4.7-2) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.7-5 Potential accelerated water and wind erosion from construction activities (similar to Impact 4.7-1) | Significant | The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites (same mitigation as recommended for the Proposed Action, Impact 4.7-1) | Less than Significant |
| Impact 4.7-6 Construction workers could be exposed to falling rocks (similar to Impact 4.7-2) | Less than Significant | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| **Three Dam Removal Alternative** | | | |
| Impact 4.7-7 Potential accelerated water and wind erosion from construction activities (similar to Impact 4.7-1) | Significant | The construction contractor will implement an erosion and sediment control plan in addition to implementing best management practices at all construction sites (same mitigation as recommended for the Proposed Action, Impact 4.7-1) | Less than Significant |
| Impact 4.7-8 Construction workers could be exposed to falling rocks (similar to Impact 4.7-2) | Less than Significant | None | Not applicable |
| AESTHETICS AND VISUAL RESOURCES | | | |
| **No Action Alternative** | | | |
| Aesthetics and visual resources would not change under the No Action Alternative; the No Action Alternative would not alter existing views of Hydroelectric Project facilities or affect any scenic vistas. | No Change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.8-1 Construction of tailrace connectors, new fish screens and fish ladders, and associated facilities would reduce scenic quality at the Oasis Springs Lodge | Significant and Unavoidable | Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break up the appearance of the cut in the hillside | Significant |
| Impact 4.8-2 Proposed construction of tailrace connector, bypass chute, and fish screen and fish ladders would alter views from adjacent area | Less than Significant | None | Not applicable |
| Impact 4.8-3 Removal of diversion dams and associated construction would not substantially reduce scenic quality from public viewing areas | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.8-4 Construction of fish screens and fish ladders and associated facilities would reduce scenic quality at the Oasis Springs Lodge (similar to Impact 4.8-1) | Significant and Unavoidable | Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | up the appearance of the cut in the hillside (same mitigation as recommended for the Proposed Action, Impact 4.8-1) | |
| Impact 4.8-5 Proposed construction of fish screen and fish ladders would alter views from adjacent area (similar to Impact 4.8-2) | Less than Significant | None | Not applicable |
| Impact 4.8-6 Construction of fish screens and fish ladders and associated project activities would substantially reduce scenic quality from public viewing areas (similar to Impact 4.8-3) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.8-7 Construction of tailrace connectors, new fish screen and fish ladder and associated facilities would reduce scenic quality at the Oasis Springs Lodge (similar to Impact 4.8-1) | Significant and Unavoidable | Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break up the appearance of the cut in the hillside (same mitigation as recommended for the Proposed Action, Impact 4.8-1) | Significant |
| Impact 4.8-8 Proposed construction of tailrace connector, bypass chute, and fish screen and fish ladders would alter views from adjacent area (similar to Impact 4.8-2) | Less than Significant | None | Not applicable |
| Impact 4.8-9 Removal of diversion dams and associated construction would substantially reduce scenic quality from public viewing areas (similar to Impact 4.8-3) | Less than Significant | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.8-10 Construction of new fish screen and fish ladder and associated facilities would reduce scenic quality at the Oasis Springs Lodge (similar to Impact 4.8-1) | Significant and Unavoidable | Reclamation will implement a revegetation plan and Reclamation will apply an acid wash to the rock face along the proposed access road to break up the appearance of the cut in the hillside (same mitigation as recommended for the Proposed Action, Impact 4.8-1) | Significant |
| Impact 4.8-11 Construction of the channel with armoring or revetment would alter views of the South Fork | Significant and Unavoidable | None | Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| creek bank | | | |
| Impact 4.8-12 Proposed construction of fish screens and fish ladders would alter views from adjacent area (similar to Impact 4.8-2) | Less than Significant | None | Not applicable |
| Impact 4.8-13 Removal of diversion dams and associated construction would substantially reduce scenic quality from public viewing areas (similar to Impact 4.8-3) | Less than Significant | None | Not applicable |
| TRANSPORTATION | | | |
| **No Action Alternative** | | | |
| The No Action Alternative would not result in the construction of new access roads or improvements to existing roads, other than those already planned as a part of the operation and maintenance plan for the Hydroelectric Project | No change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.9-1 Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways | Less than Significant | None | Not applicable |
| Impact 4.9-2 Construction traffic could damage county and private roadways | Less than Significant | None | Not applicable |
| Impact 4.9-3 Construction traffic or activities could delay emergency vehicle response times | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.9-4 Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways (similar to Impact 4.9-1) | Less than Significant | None | Not applicable |
| Impact 4.9-5 Construction traffic could damage county and private roadways (similar to Impact 4.9-2) | Less than Significant | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.9-6 Construction traffic or activities could delay emergency vehicle response times (similar to Impact 4.9-3) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.9-7 Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways (similar to Impact 4.9-1) | Less than Significant | None | Not applicable |
| Impact 4.9-8 Construction traffic could damage county and private roadways (similar to Impact 4.9-2) | Less than Significant | None | Not applicable |
| Impact 4.9-9 Construction traffic or activities could delay emergency vehicle response times (similar to Impact 4.9-3) | Less than Significant | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.9-10 Construction and removal activities at the Restoration Project sites would result in increased traffic volumes on state, county, and private roadways (similar to Impact 4.9-1) | Less than Significant | None | Not applicable |
| Impact 4.9-11 Construction traffic could damage county and private roadways (similar to Impact 4.9-2) | Less than Significant | None | Not applicable |
| Impact 4.9-12 Construction traffic or activities could delay emergency vehicle response times (similar to Impact 4.9-3) | Less than Significant | None | Not applicable |
| NOISE | | | |
| **No Action Alternative** | | | |
| The No Action Alternative would not increase noise levels above existing levels in the vicinity of the Restoration Project or at the locations of nearby sensitive receptors. | No change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.10-1 Exposure of noise-sensitive uses to noise and vibration from blasting | Significant | The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices | Less than Significant |
| Impact 4.10-2 Exposure of noise-sensitive land uses to noise from on-site construction activities | Significant | Reclamation will implement noise reducing construction practices | Less than Significant |
| Impact 4.10-3 Exposure of noise-sensitive land uses along site access roads to construction-related truck noise | Significant | Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00a.m. to 9:00p.m | Less than Significant |
| Impact 4.10-4 Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.10-5 Exposure of noise-sensitive uses to noise and vibration from blasting (similar to Impact 4.10-1) | Significant | The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices (same mitigation as recommended for the Proposed Action, Impact 4.10-1) | Less than Significant |
| Impact 4.10-6 Exposure of noise-sensitive land uses to noise from on-site construction activities (similar to Impact 4.10-2) | Significant | Reclamation will implement noise reducing construction practices (same mitigation as recommended for the Proposed Action, Impact 4.10-2) | Less than Significant |
| Impact 4.10-7 Exposure of noise-sensitive land uses along site access roads to construction-related truck noise (similar to Impact 4.10-3) | Significant | Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00a.m. to 9:00p.m (same mitigation as recommended for the Proposed Action, Impact 4.10-3) | Less than Significant |
| Impact 4.10-8 Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities | Less than Significant | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| (similar to Impact 4.10-4) | | | |
| **Six Dam Removal Alternative** | | | |
| Impact 4.10-9 Exposure of noise-sensitive uses to noise and vibration from blasting (similar to Impact 4.10-1) | Significant | The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices (same mitigation as recommended for the Proposed Action, Impact 4.10-1) | Less than Significant |
| Impact 4.10-10 Exposure of noise-sensitive land uses to noise from on-site construction activities (similar to Impact 4.10-2) | Significant | Reclamation will implement noise reducing construction practices (same mitigation as recommended for the Proposed Action, Impact 4.10-2) | Less than Significant |
| Impact 4.10-11 Exposure of noise-sensitive land uses along site access roads to construction-related truck noise (similar to Impact 4.10-3) | Significant | Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00a.m. to 9:00p.m (same mitigation as recommended for the Proposed Action, Impact 4.10-3) | Less than Significant |
| Impact 4.10-12 Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities (similar to Impact 4.10-4) | Less than Significant | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.10-13 Exposure of noise-sensitive uses to noise and vibration from blasting (similar to Impact 4.10-1) | Significant | The construction contractor will implement noise and blast mitigation plan including but not limited to notification of blasting to nearby landowners, pre-blast alarms, continued noise monitoring, and best management practices (same mitigation as recommended for the Proposed Action, Impact 4.10-1) | Less than Significant |
| Impact 4.10-14 Exposure of noise-sensitive land uses to noise from on-site construction activities (similar to Impact 4.10-2) | Significant | Reclamation will implement noise reducing construction practices (same mitigation as recommended for the Proposed Action, Impact | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | 4.10-2) | |
| Impact 4.10-15 Exposure of noise-sensitive land uses along site access roads to construction-related truck noise (similar to Impact 4.10-3) | Significant | Reclamation will construct an alternative haul route at least 750 feet from the nearest occupied residences and limit trucking operations to the hours of 7:00a.m. to 9:00p.m (same mitigation as recommended for the Proposed Action, Impact 4.10-3) | Less than Significant |
| Impact 4.10-16 Exposure of noise-sensitive land use to noise from operation of the Restoration Project facilities (similar to Impact 4.10-4) | Less than Significant | None | Not applicable |
| AIR QUALITY | | | |
| **No Action Alternative** | | | |
| Air quality would not change under the No Action Alternative | No change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.11-1 Construction-related emissions in excess of allowable thresholds | Significant | The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District | Less than Significant |
| Impact 4.11-2 Increased emissions from operational and maintenance activities would contribute to violation of air quality standards | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.11-3 Construction-related emissions in excess of allowable thresholds (similar to Impact 4.11-1) | Significant | The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District (same as mitigation | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | recommended for the Proposed Action, Impact 4.11-1) | |
| Impact 4.11-4 Increased emissions from operational and maintenance activities would contribute to violation of air quality standards (similar to Impact 4.11-2) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.11-5 Construction-related emissions in excess of allowable thresholds (similar to Impact 4.11-1) | Significant | The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District (same as mitigation recommended for the Proposed Action, Impact 4.11-1) | Less than Significant |
| Impact 4.11-6 Increased emissions from operational and maintenance activities would contribute to violation of air quality standards (similar to Impact 4.3-2) | Less than Significant | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.11-7 Construction-related emissions in excess of allowable thresholds (similar to Impact 4.11-1) | Significant | The construction contractor will comply with best management practices for emissions controls; Reclamation will obtain all applicable permits required by the Shasta County Air Quality Management District and the Tehama County Air Pollution Control District (same as mitigation recommended for the Proposed Action, Impact 4.11-1) | Less than Significant |
| Impact 4.11-8 Increased emissions from operational and maintenance activities would contribute to violation of air quality standards (similar to Impact 4.11-2) | Less than Significant | None | Not applicable |
| PUBLIC HEALTH AND SAFETY | | | |
| **No Action Alternative** | | | |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| The No Action Alternative is expected to have no impacts on public health and safety in addition to those already anticipated as part of the current operations at the existing facilities | No change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.12-1 Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration Project sites | Significant | Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; and evaluate potential hazards at each project site and develop a plan to minimize risk to the public | Less than Significant |
| Impact 4.12-2 The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials | Significant | Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule | Less than Significant |
| Impact 4.12-3 Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals | Significant | Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues | Less than Significant |
| Impact 4.12-4 Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes | Significant | Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health | Less than Significant |
| Impact 4.12-5 Helicopter operations at some of the Restoration Project sites could result in worker injury or fire | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.12-6 Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration | Significant | Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Project sites (similar to Impact 4.12-1) | | and evaluate potential hazards at each project site and develop a plan to minimize risk to the public (same mitigation as recommended for the Proposed Action, Impact 4.11.12-1) | |
| Impact 4.12-7 The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials (similar to Impact 4.12-2) | Significant | Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule (same mitigation as recommended for the Proposed Action, Impact 4.11.12-2) | Less than Significant |
| Impact 4.12-8 Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals (similar to Impact 4.12-3) | Significant | Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues (same mitigation as recommended for the Proposed Action, Impact 4.11.12-3) | Less than Significant |
| Impact 4.12-9 Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes (similar to Impact 4.12-4) | Significant | Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health (same mitigation as recommended for the Proposed Action, Impact 4.11.12-4) | Less than Significant |
| Impact 4.12-10 Helicopter operations at some of the Restoration Project sites could result in worker injury or fire (similar to Impact 4.12-5) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.12-11 Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration Project sites (similar to Impact 4.12-1) | Significant | Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; and evaluate potential hazards at each project site | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | and develop a plan to minimize risk to the public (same mitigation as recommended for the Proposed Action, Impact 4.11.12-1) | |
| Impact 4.12-12 The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials (similar to Impact 4.12-2) | Significant | Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule (same mitigation as recommended for the Proposed Action, Impact 4.11.12-2) | Less than Significant |
| Impact 4.12-13 Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals (similar to Impact 4.12-3) | Significant | Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues (same mitigation as recommended for the Proposed Action, Impact 4.11.12-3) | Less than Significant |
| Impact 4.12-14 Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes (similar to Impact 4.12-4) | Significant | Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health (same mitigation as recommended for the Proposed Action, Impact 4.11.12-4) | Less than Significant |
| Impact 4.12-15 Helicopter operations at some of the Restoration Project sites could result in worker injury or fire (similar to Impact 4.12-5) | Less than Significant | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.12-16 Construction workers could be exposed to hazardous or toxic materials disturbed during construction, modification, or removal activities at the Restoration Project sites (similar to Impact 4.12-1) | Significant | Reclamation will develop and implement a spill prevention, containment, and countermeasure plan; reduce use of hazardous materials at project sites; and evaluate potential hazards at each project site | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | and develop a plan to minimize risk to the public (same mitigation as recommended for the Proposed Action, Impact 4.11.12-1) | |
| Impact 4.12-17 The public could be exposed to hazardous or toxic materials associated with or disturbed during construction, modification, or removal activities at the Restoration Project sites; public access to construction areas could also increase the potential for exposure to hazardous materials (similar to Impact 4.12-2) | Significant | Reclamation will clearly mark all construction sites as hazardous and off-limits to the public, backfill or cover excavation areas at each day end, lock access areas to prevent public entry, and notify nearby sensitive receptors and residents of activity schedule (same mitigation as recommended for the Proposed Action, Impact 4.11.12-2) | Less than Significant |
| Impact 4.12-18 Increased vehicle traffic along private access roads during construction activities could endanger residents and domestic animals (similar to Impact 4.12-3) | Significant | Reclamation will limit construction vehicle speed to 5 mph on private roads, limit construction vehicle traffic on private roads to daylight hours only, and establish complaint line for residents to notify authorities of excessive vehicle speeds/safety issues (same mitigation as recommended for the Proposed Action, Impact 4.11.12-3) | Less than Significant |
| Impact 4.12-19 Dewatering activities at the Restoration Project sites could provide breeding grounds for mosquitoes (similar to Impact 4.12-4) | Significant | Reclamation will maximize public protection with applicable mosquito abatement districts and control agencies, and inform workers to take appropriate precautions to protect health (same mitigation as recommended for the Proposed Action, Impact 4.11.12-4) | Less than Significant |
| Impact 4.12-20 Helicopter operations at some of the Restoration Project sites could result in worker injury or fire (similar to Impact 4.12-5) | Less than Significant | None | Not applicable |
| PUBLIC SERVICES AND UTILITIES | | | |
| **No Action Alternative** | | | |
| The No Action Alternative would not affect public services and utilities and is not expected to contribute to the | No Change | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| increased usage of those public services and utilities described in the document | | | |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.13-1 Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services | Significant | The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments | Less than significant |
| Impact 4.13-2 Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities | Less than Significant | None | Not applicable |
| Impact 4.13-3 Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities | Less than Significant | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.13-4 Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services (similar to Impact 4.13-1) | Significant | The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments (same mitigation as recommended for the Proposed Action, Impact 4.13-1) | Less than significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.13-5 Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities (similar to Impact 4.13-2) | Less than Significant | None | Not applicable |
| Impact 4.13-6 Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities (similar to Impact 4.13-3) | Less than Significant | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.13-7 Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services (similar to Impact 4.13-1) | Significant | The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments (same mitigation as recommended for the Proposed Action, Impact 4.13-1) | Less than significant |
| Impact 4.13-8 Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities (similar to Impact 4.13-2) | Less than Significant | None | Not applicable |
| Impact 4.13-9 Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities (similar to Impact 4.13-3) | Less than Significant | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.13-10 Significant Proposed activities at the Restoration Project sites may increase demands on fire, police, and emergency medical services (similar to Impact 4.13-1) | Significant | The construction contractors will implement practicable and conventional precautions to ensure the safety of workers and the general public, use physical barriers and sign postings consistent with standard construction safety management | Less than significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | practices, provide notice to county law enforcement and fire protection agencies during proposed activities, and adhere to standard precautions and approaches required by the California Department of Forestry and Protection and Shasta and Tehama County Fire Departments (same mitigation as recommended for the Proposed Action, Impact 4.13-1) | |
| Impact 4.13-11 Proposed activities at the Restoration Project sites may increase demand on solid waste and hazardous waste disposal facilities (similar to Impact 4.13-2) | Less than Significant | None | Not applicable |
| Impact 4.13-12 Relocation or removal of electric transmission facilities could temporarily affect services provided by utilities (similar to Impact 4.13-3) | Less than Significant | None | Not applicable |
| RECREATION | | | |
| **No Action Alternative** | | | |
| The No Action Alternative would not result in any changes to the existing recreational resources in and around the Restoration Project. | No change | None | Not applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.14-1 Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge | Significant and Unavoidable | Reclamation will notify Oasis Springs Lodge of construction activity schedule, provide monetary compensate for loss of recreation revenues (if necessary), and work with lodge operators to further reduce impacts on recreational opportunities | Significant |
| Impact 4.14-2 Construction activities could temporarily reduce recreational resources and activities | Significant | Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Impact 4.14-3 Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights | Significant | Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationalists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity | Less than Significant |
| Impact 4.14-4 Removing canals and installing fish screens to stop movement of fish into the remaining canals would virtually eliminate the resident trout populations and recreational trout fishing in the canals | Less than Significant | None | Not applicable |
| Impact 4.14-5 Increased flows in North Fork and South Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities | Beneficial | None | Not applicable |
| **No Dam Removal Alternative** | | | |
| Impact 4.14-6 Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge (similar to Impact 4.14-1) | Significant and Unavoidable | Reclamation will notify Oasis Springs Lodge of construction activity schedule, provide monetary compensate for loss of recreation revenues (if necessary), and work with lodge operators to further reduce impacts on recreational opportunities (same mitigation as recommended for the Proposed Action, Impact 4.14-1) | Significant |
| Impact 4.14-7 Construction activities could temporarily reduce recreational resources and activities (similar to Impact 4.14-2) | Significant | Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity (same mitigation as recommended for the Proposed Action, Impact 4.14-2) | Less than Significant |
| Impact 4.14-8 Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights (similar to Impact 4.14-3) | Significant | Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationalists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity (same mitigation as | Less than Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | recommended for the Proposed Action, Impact 4.14-3) | |
| Impact 4.14-9 Installing fish screens to stop movement of fish into the canals would virtually eliminate the resident trout populations and recreational trout fishing in the canals (similar to Impact 4.14-4) | Less than Significant | None | Not applicable |
| Impact 4.14-10 Increased flows in North Fork and South Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities (similar to Impact 4.14-5) | Beneficial | None | Not applicable |
| **Six Dam Removal Alternative** | | | |
| Impact 4.14-11 Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge (similar to Impact 4.14-1) | Significant and Unavoidable | Reclamation will notify Oasis Springs Lodge of construction activity schedule, provide monetary compensate for loss of recreation revenues (if necessary), and work with lodge operators to further reduce impacts on recreational opportunities (same mitigation as recommended for the Proposed Action, Impact 4.14-1) | Significant |
| Impact 4.14-12 Construction activities at Inskip Diversion Dam could reduce recreational opportunities and revenues at the Oasis Springs Lodge (similar to Impact 4.14-2) | Significant | Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity (same mitigation as recommended for the Proposed Action, Impact 4.14-2) | Less than Significant |
| Impact 4.14-13 Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights (similar to Impact 4.14-3) | Significant | Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationalists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity (same mitigation as recommended for the Proposed Action, Impact 4.14-3) | Less than Significant |
| Impact 4.14-14 Removing canals and installing fish screens to stop movement of fish into the remaining canals | Less than Significant | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| would virtually eliminate the resident trout populations and recreational trout fishing in the canals (similar to Impact 4.14-4) | | | |
| Impact 4.14-15 Increased flows in North Fork and South Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities (similar to Impact 4.14-5) | Beneficial | None | Not applicable |
| **Three Dam Removal Alternative** | | | |
| Impact 4.14-16 Construction activities at Inskip Diversion Dam could reduce recreational opportunities at the Oasis Springs Lodge (similar to Impact 4.14-1) | Significant and Unavoidable | Reclamation will notify Oasis Springs Lodge of construction activity schedule, provide monetary compensate for loss of recreation revenues (if necessary), and work with lodge operators to further reduce impacts on recreational opportunities (same mitigation as recommended for the Proposed Action, Impact 4.14-1) | Significant |
| Impact 4.14-17 Construction activities could temporarily reduce recreational resources and activities (similar to Impact 4.14-2) | Significant | Reclamation will notify land and property owners of construction schedule and minimize construction during periods of high recreational activity (same mitigation as recommended for the Proposed Action, Impact 4.14-2) | Less than Significant |
| Impact 4.14-18 Construction activities, including the use of equipment and storage areas, may temporarily impede public access to Battle Creek for kayaking and to private property where landowners may grant public access by selling hunting and fishing rights (similar to Impact 4.14-3) | Significant | Reclamation will notify nearby land and property owners of construction schedule, post signage notifying recreationalists of construction activity and schedule, store heavy equipment alongside access roads and roadways to allow passage of the public, and minimize construction during periods of high recreational activity (same mitigation as recommended for the Proposed Action, Impact 4.14-3) | Less than Significant |
| Impact 4.14-19 Installing fish screens to stop movement of fish into the canals would virtually eliminate the resident trout populations and recreational trout fishing in the canals (similar to Impact 4.14-4) | Less than Significant | None | Not applicable |
| Impact 4.14-20 Increased flows in North Fork and South | Beneficial | None | Not applicable |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| Fork Battle Creek could increase the opportunities for kayaking, rafting, and/or fishing activities (similar to Impact 4.14-5) | | | |
| CULTURAL | | | |
| **No Action Alternative** | | | |
| No impacts would occur to cultural resources; the diversion dams and canals would continue to be affected by existing use and upgrades | No Change | None | Not Applicable |
| **Five Dam Removal Alternative (Proposed Action)** | | | |
| Impact 4.15-1 Removal of historic properties | Significant and Unavoidable | HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties | Significant |
| Impact 4.15-2 Historic properties would be adversely affected | Significant | HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation recommended for the Proposed Action, Impact 4.15-1) | Less than significant |
| Impact 4.15-3 Potential damage to archaeological deposits as a result of vehicular traffic | Significant | Access roads will be flagged during construction, and traffic will be limited to these areas | Less than Significant |
| **No Dam Removal Alternative** | | | |
| Impact 4.15-4 Historic properties would be adversely affected (similar to Impact 4.15-2) | Significant | HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other | Less than significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | interested parties (same as mitigation recommended for the Proposed Action, Impact 4.15-2) | |
| Impact 4.15-5 Potential damage to archaeological deposits as a result of vehicular traffic (similar to Impact 4.15-3) | Significant | Access roads will be flagged during construction, and traffic will be limited to these (same as mitigation recommended for the Proposed Action, Impact 4.15-3) | Less than significant |
| **Six Dam Removal Alternative** | | | |
| Impact 4.15-6 Removal of historical properties (similar to Impact 4.15-1) | Significant and Unavoidable | HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation recommended for the Proposed Action, Impact 4.15-1) | Significant |
| Impact 4.15-7 Historic properties would be adversely affected (similar to Impact 4.15-2) | Significant | HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation recommended for the Proposed Action, Impact 4.15-2) | Less than significant |
| Impact 4.15-8 Potential damage to archaeological deposits as a result of vehicular traffic (similar to Impact 4.15-3) | Significant | Access roads will be flagged during construction, and traffic will be limited to these areas (same as mitigation recommended for the Proposed Action, Impact 4.15-3) | Less than significant |
| **Three Dam Removal Alternative** | | | |
| Impact 4.15-9 Removal of historic properties (similar to Impact 4.15-1) | Significant and Unavoidable | HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other | Significant |

| Impact | Level of Significance | Recommended Mitigation Measure(s) | Level of Significance after Mitigation |
|---|---|---|---|
| | | interested parties (same as mitigation recommended for the Proposed Action, Impact 4.15-1) | |
| Impact 4.15-10 Eligible historic properties would be adversely affected (similar to Impact 4.15-2) | Significant | HAER documentation will be prepared for all eligible properties, and a CD-ROM containing the interviews and summary report of the Battle Creek Watershed Conservancy's study will be prepared and distributed to historical societies and other interested parties (same as mitigation recommended for the Proposed Action, Impact 4.15-2) | Less than significant |
| Impact 4.15-11 Potential damage to archaeological deposits as a result of vehicular traffic (similar to Impact 4.15-3) | Significant | Access roads will be flagged during construction, and traffic will be limited to these areas (same as mitigation recommended for the Proposed Action, Impact 4.15-3) | Less than significant |

Chapter 8
# List of Contributors

## Consultant Contribution

| Contributor | Degree(s) | Years of Experience | Experience and Expertise |
|---|---|---|---|
| Brad Angell | J.D.<br>B.S. | 1 | Regulatory compliance, environmental law, and project coordination. |
| Edward Beedy | Ph.D.<br>M.A.<br>B.S. | 25 | Wildlife biology, zoology; author and naturalist; teaching, lecturing. |
| Eric Berntsen | M.S.<br>B.A. | 5 | Water resources, watershed restoration, erosion and sediment control planning. |
| Russ Brown | Ph.D.<br>M.S.<br>B.S. | 25 | Hydrodynamics, water quality, and aquatic habitat; project management and planning. |
| Dave Buehler | B.S. | 21 | Environmental acoustics, architectural acoustics, industrial noise and vibration control. |
| Susan Bushnell | B.S. | 11 | Plant ecology, conservation and resource studies. |
| Joel Butterworth | M.S.<br>B.A. | 16 | Impact assessment, erosion and sediment control planning, soil evaluation, and geomorphology. |
| David Byrd | M.A.<br>B.A. | 9 | Professional and architectural historian. |
| Steven Centerwall | B.S. | 16 | Principal; environmental policy analysis and planning. |
| Jim Estep | B.S. | 20 | Wildlife biology and management. |
| Shannon Hatcher | B.S. | 2 | Air quality and noise. |

| Contributor | Degree(s) | Years of Experience | Experience and Expertise |
|---|---|---|---|
| Carol-Anne Hicks | B.S. | 2 | Document coordination and publication. |
| Maryann Hulsman | B.S. | 1 | Environmental policy analysis and planning. |
| Kim Hunter | M.S. (2)<br>B.A. | 1 | Project coordinator. |
| Nathan Jennings | M.S.<br>B.A. | 8 | Project management and design of GIS/GPS applications and digital image processing. |
| Will Kohn | B.S. | 7 | Wildlife surveys and conservation biology. |
| Tim Messick | M.A.<br>B.A.<br>A.A. | 6 | Mapping, illustration, information design, and electronic publishing. |
| Steve Renehan | M.A.<br>B.A. | 8 | Hydrology, data collection, analysis, and modeling. |
| Terry Rivasplata | B.S. | 20 | Senior planner in management, preparation of environmental plans, and instructor. |
| Gabriel Roark | B.A. | 4 | Archaeology, historical research, and cultural resources evaluations. |
| Katherine Robinson | B.A. | 5 | Writer, editor. |
| Gregg Roy | B.S. | 14 | Project manager and economist, multidisciplinary studies and preparing socioeconomic, economic, recreation, and farmland conversion impacts. |
| Brad Schafer | B.S. | 6 | Biology, plant ecology, forest ecology. |
| Warren Shaul | M.S.<br>B.S. | 19 | Fish biologist; population modeling, statistical design and application, fishery management. |
| Colleen Smith | B.A. | 10 | Water resources project manger; NEPA; CEQA; environmental planning, wetland ecology. |
| John Sterling | B.A. | 19 | Wildlife biology, migratory bird ecology. |
| Craig Stevens | B.S. | 13 | Water resources; CEQA; NEPA; CALFED Bay-Delta Program manager. |

| Contributor | Degree(s) | Years of Experience | Experience and Expertise |
|---|---|---|---|
| Darle Tilly | A.B. | 20 | Technical writer and editor. |
| Ellen Unsworth | M.S.<br>B.A. | 7 | Scientific communication. |
| Erin VanDehey | B.S. | 8 | Fisheries biologist and ecologist. |
| Ed West | Ph.D.<br>M.S.<br>B.S. | 24 | Wildlife biologist; ecological research and applied management of rare, threatened, and endangered wildlife. |
| Margaret Widdowson | Ph.D.<br>B.Sc. | 6 | Biologist and wetland ecologist. |
| William Widdowson | B.S. | 14 | Biologist, avian specialist. |
| John Zanzi | B.S. | 19 | Landscape Architect; project design and implementation. |

# Agency Contribution

| Contributing Entity | Contributor |
|---|---|
| Battle Creek Watershed Conservancy | Sharon Paquin-Gilmore |
| Bureau of Reclamation | Jim Goodwin, Civil Engineer |
| | Dave Gore, Mid-Pacific Regional Engineer |
| | Buford Holt, Environmental Specialist |
| | Mary Marshall, Environmental Specialist |
| | Mike McCulla, Geologist |
| | Patrick Welch, Archaeologist |
| | Carl Werder, Project Manager |
| | Jim West, Archaeologist |
| California Department of Fish and Game | Harry Rectenwald, Environmental Scientist |
| | Steve Turek, Environmental Manager |
| California Department of Water Resources | Cosme Diaz, Civil Engineer |
| Federal Energy Regulatory Commission | TJ LoVullo, License Coordinator |
| National Marine Fisheries Service | Mike Tucker, Fishery Biologist |
| Pacific Gas & Electric Company | Sheila Byrne, Biologist |
| | Sally Lubben, Senior Business Planner |
| | Jean Oscamou, Supervising Engineer |
| | Angela Risdon, License Coordinator |
| | Curtis Steitz, Biologist |
| State Water Resources Control Board | Jim Canaday, Environmental Scientist |
| U.S. Fish and Wildlife Service | Bart Prose, Fish and Wildlife Biologist |
| | Tricia Parker, Fishery Biologist |
| | Scott Hamelberg, Fishery Biologist |

Chapter 9
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