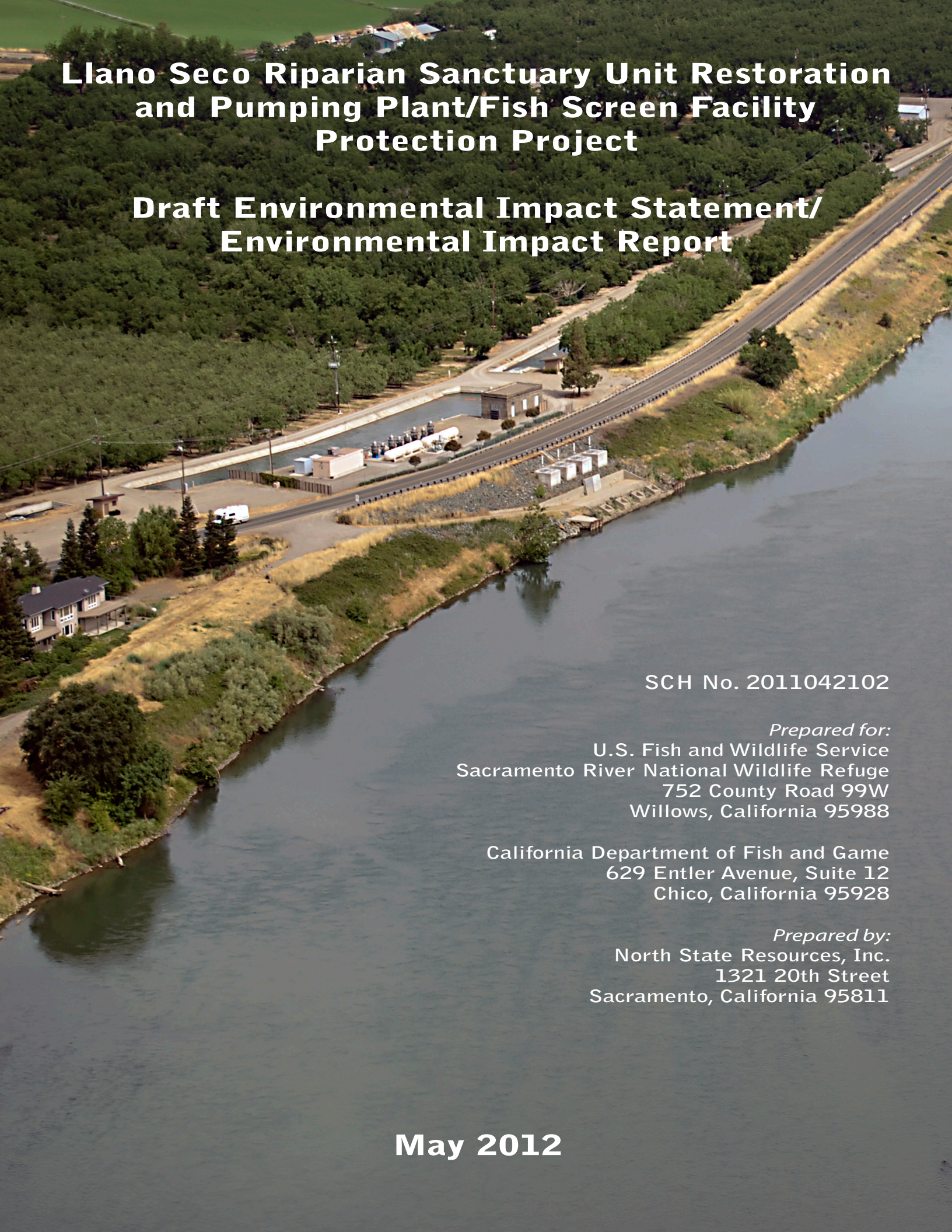

Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project

Draft Environmental Impact Statement/ Environmental Impact Report

SCH No. 2011042102

Prepared for:
U.S. Fish and Wildlife Service
Sacramento River National Wildlife Refuge
752 County Road 99W
Willows, California 95988

California Department of Fish and Game
629 Entler Avenue, Suite 12
Chico, California 95928

Prepared by:
North State Resources, Inc.
1321 20th Street
Sacramento, California 95811

May 2012

Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project

Draft Environmental Impact Statement/ Environmental Impact Report

Project Location: Sacramento River National Wildlife Refuge, Butte and Glenn Counties, California

Abstract: The proposed action (proposed project) evaluated in this Draft EIS/EIR consists of a combination of measures to restore riparian habitat at the Llano Seco Riparian Sanctuary Unit (Riparian Sanctuary) of the Sacramento River National Wildlife Refuge (Sacramento River NWR) and to protect the alignment of the Sacramento River at the water diversion for the Princeton-Codora-Glenn and Provident Irrigation Districts (PCGID-PID) pumping plant and fish screen facility at River Mile 178. Habitat restoration is needed because the Riparian Sanctuary is currently dominated by non-native plants and provides poor habitat value for wildlife; bank protection measures are needed to protect the water diversion for the PCGID-PID pumping plant and fish screen facility. The restoration plan includes removing non-native and invasive plants, cleaning up flood debris, and planting native species at varying frequencies and densities. Bank protection measures being considered include installation of spur dikes or traditional riprap combined with maintenance or removal of the existing revetment on a peninsula upstream of the facility.

Contacts:

Daniel W. Frisk, Project Leader
Sacramento National Wildlife Refuge Complex
U.S. Fish and Wildlife Service
752 County Road 99W
Willows, CA 95988
Phone: (530) 934-2801

Tracy McReynolds
California Department of Fish and Game
629 Entler Avenue, Suite 12
Chico, CA 95928
Phone: (530) 895-5111

Close of Comment Period: June 25, 2012

Executive Summary

The U.S. Fish and Wildlife Service (Service) and the California Department of Fish and Game (CDFG) prepared a Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) to analyze the environmental impacts of implementing the Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project (Riparian Sanctuary project). The document was prepared in compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). This chapter summarizes the contents of the EIS/EIR, including the alternatives analyzed in detail, purpose and need, areas of controversy, environmental consequences and mitigation measures, and issues to be resolved.

ES.1 Overview of Project and Alternatives

The proposed action (proposed project) evaluated in the Draft EIS/EIR consists of a combination of measures to restore riparian habitat at the Llano Seco Riparian Sanctuary Unit (Riparian Sanctuary) of the Sacramento River National Wildlife Refuge (Sacramento River NWR) and to protect the alignment of the Sacramento River at the water diversion for the Princeton-Codora-Glenn and Provident Irrigation Districts (PCGID-PID) pumping plant and fish screen facility at River Mile (RM) 178. The 950-acre Riparian Sanctuary is located 15 miles southwest of Chico on the east bank of the Sacramento River between River Mile 176.5 and 178 in the southwest corner of Butte County. The PCGID-PID pumping plant and fish screen facility was constructed in 1999 to consolidate three unscreened pumping plants on the river. The facility has a capacity of 600 cubic feet per second and is the fourth largest on the Sacramento River. It serves nearly 30,000 acres of orchards, row crops, rice, and wetlands and supports agricultural fields for waterfowl, the federally listed giant garter snake (*Thamnophis gigas*), and other wetland-dependent wildlife species. The project area discussed in this Draft EIS/EIR encompasses approximately 400 acres of the Riparian Sanctuary, a peninsula north of the Riparian Sanctuary that includes the Llano Seco Island 2 unit of the Sacramento River NWR and State lands managed by the Central Valley Flood Protection Board, and the banks of the Sacramento River adjacent to and just upstream of the Riparian Sanctuary (between RM 178 and 180).

One level of restoration is evaluated in the EIS/EIR that involves site-specific plantings across approximately 400 acres of the Riparian Sanctuary. Two types of bank protection measures are evaluated: spur dikes (Alternative 2) and traditional riprap (Alternatives 3 and 4). These measures have been combined with the restoration alternative to create three action alternatives. The traditional riprap measure includes two subalternatives, with or without a low berm, and one of the action alternatives (Alternative 4) combines the traditional riprap with removal of existing revetment on the north side of the upstream peninsula. Several alternative bank protection and restoration measures were considered during project planning, but were eliminated from further consideration based on feasibility, cost, and environmental considerations (see Chapter 2, Description of Alternatives, for additional details).

ES.2 Purpose, Need, and Project Objectives

The purpose of the Riparian Sanctuary project is to restore habitat at the Riparian Sanctuary and to protect the PCGID-PID pumping plant and fish screen facility. The efficiency of the fish screen at the pumping plant is being threatened by bank erosion on the Riparian Sanctuary and the migration of the Sacramento River. The project is needed to provide habitat for endangered species and migratory birds, improve overall riparian health along the Sacramento River, and protect the fish screen and intake facility to maintain their functions. Habitat restoration is also needed at the Riparian Sanctuary to achieve Service management goals and objectives for the Sacramento River NWR identified in the Comprehensive Conservation Plan for the refuge.

The following CEQA project objectives were identified for the Riparian Sanctuary project:

- improve habitat conditions at the Riparian Sanctuary to contribute to endangered species recovery and overall riparian health;
- use an interdisciplinary scientific approach to restore riparian habitat at the Riparian Sanctuary; and
- protect the operation of the PCGID-PID pumping plant and fish screen facility from anticipated river meander.

ES.3 Areas of Controversy and Issues to Be Resolved

Few areas of concern were identified during the scoping period in April–May 2011. Attendees at the public workshop held on May 10, 2011, in Ord Bend, as well as agencies who submitted comments in letters to the CDFG or Service, expressed support for the Riparian Sanctuary project because of its potential benefits to wildlife and to the agricultural community that relies on the PCGID-PID pumping plant. The primary concerns expressed by the public were construction access to the Riparian Sanctuary via private roads and water deliveries downstream of the pumping plant. Agencies that submitted comments reminded the Service and CDFG of their obligations to conduct a thorough analysis of environmental impacts and consider all permits that may be required. No specific design-related concerns were identified during the EIS/EIR scoping period. No unresolved issues were identified during preparation of the EIS/EIR.

ES.4 Summary of Environmental Consequences

The alternatives evaluated in the Draft EIS/EIR would result in temporary and long-term effects on environmental resources in the project area. The majority of the adverse effects would be temporary, and long-term effects would be mostly beneficial as a result of the restoration of riparian habitat and protection of the PCGID-PID pumping plant and fish screen facility. Table ES-1 summarizes the environmental impacts discussed in Chapter 3 of the EIS/EIR and lists the mitigation measures identified to reduce potentially significant adverse effects (Note that “LTS” in the table refers to less than significant). Water quality impacts during construction could be significant for the low berm option of Alternatives 3 and 4, even with implementation of the identified mitigation measures, and the potential net loss of bank swallow habitat under Alternatives 2 and 3 could be significant, even with

implementation of the identified mitigation measures. No other potentially significant and unavoidable impacts were identified for the action alternatives. Without action (No-Action Alternative), the pumping plant and fish screen facility would be at risk of shutting down, and the resulting adverse effects could be significant. Significant cumulative impacts could result from the loss of bank swallow habitat with implementation of Alternatives 2 and 3, but other cumulative impacts would primarily be beneficial with restoration of the Riparian Sanctuary, protection of the pumping plant and fish screen facility, and re-establishment of natural processes along the Sacramento River (Alternative 4 only).

ES.5 Preferred Alternative

The Service and CDFG have selected Alternative 4 (Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings) as the preferred alternative. This alternative provides the most environmental benefits by removing existing riprap to restore natural riverine processes along the Sacramento River and to provide habitat for the bank swallow.

ES.6 Public Involvement and Next Steps

In accordance with NEPA and CEQA review requirements, the Draft EIS/EIR is being circulated for public and agency review and comment for a 45-day period after the Service's Notice of Availability is published in the Federal Register and the CDFG's Notice of Completion is submitted to the State Clearinghouse. A public meeting will be held near the project area during the review period to solicit comments on the document and respond to questions; notice of this meeting will be published in the local newspapers. In addition, written comments from the public, reviewing agencies, and stakeholders will be accepted during the public comment period. Copies of the Draft EIS/EIR are available online at http://www.riverpartners.org/where-we-work/sanctuary/sanctuary.html and at these locations:

Sacramento NWR Complex Office 752 County Road 99W Willows, CA 95988 Phone: (530) 934-2801	River Partners Office 580 Vallombrosa Ave Chico, CA 95926 Phone: (530) 894-5401	Orland Free Library 333 Mill Street Orland, CA 95963 Phone: (530) 865-1640
PCGID-PID Office 258 South Butte Street Willows, CA 95988 Phone: (530) 934-4801	CDFG Office 629 Entler Ave, Suite 12 Chico, CA 95928 Phone: (530) 895-5111	Chico Branch Library 1108 Sherman Avenue Chico, CA 95926 Phone: (530) 891-2762

A Final EIS/EIR will be prepared and circulated in accordance with NEPA and CEQA requirements. The final document will include responses to comments received during the review period for the Draft EIS/EIR and necessary changes to the document. The Service will then prepare a Record of Decision to announce its decision regarding the alternatives considered, briefly summarize comments received and issues of concern, and identify environmental commitments of the selected alternative. CDFG will also prepare findings pursuant to CEQA to announce its decision on the proposed project and identify required mitigation measures, including adopting a mitigation monitoring and reporting program.

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Table ES-1. Summary of Impacts and Mitigation Measures

Impact Statement	Level of Significance Before Mitigation				Mitigation Measure(s)	Final Level of Significance
	Alternative 1	Alternative 2	Alternative 3	Alternative 4		
Land Use						
Impact LU-1: Construction activities could disrupt or conflict with nearby land uses.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)
Impact LU-2: Implementation of the Riparian Sanctuary project could change land uses in the project area.	Potentially Significant	LTS	LTS	LTS	None required for Alternative 1. None necessary for action alternatives.	Significant (Alternative 1) LTS (Action Alternatives)
Impact LU-3: Implementation of the Riparian Sanctuary project could conflict with management plans for the project area.	Potentially Significant	LTS	LTS	LTS	None required for Alternative 1. None necessary for action alternatives.	Significant (Alternative 1) LTS (Action Alternatives)
Geology, Fluvial Geomorphology, and Soils						
Impact GS-1: Construction activities would disturb soil and could result in erosion or loss of topsoil.	No Impact	Significant	Significant	Significant	Mitigation Measure GS-1: Implement construction measures to reduce soil erosion.	LTS (Action Alternatives)
Impact GS-2: Implementation of the Riparian Sanctuary project could modify the channel morphology of the Sacramento River between RM 177.5 and RM 179.	LTS	LTS	LTS	LTS	None necessary.	LTS
Impact GS-3: Implementation of the Riparian Sanctuary project could expose people or structures to geologic hazards.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)
Water Resources						
Impact WR-1: Construction activities could result in short-term increases in turbidity and sediment levels that could degrade water quality and affect the beneficial uses of the Sacramento River.	No Impact	Significant	Significant	Significant	Mitigation Measure WR-1: Implement measures to minimize increased turbidity levels in the Sacramento River during construction.	LTS (Alternative 2, Alternative 3 and 4 with no berm) Significant (Alternative 3 and 4 with berm)

Table ES-1. Summary of Impacts and Mitigation Measures

Impact Statement	Level of Significance Before Mitigation				Mitigation Measure(s)	Final Level of Significance
	Alternative 1	Alternative 2	Alternative 3	Alternative 4		
Impact WR-2: Disturbance of streambed sediments and stockpiling could release mercury into the environment, which could degrade water quality, contaminate soils, and affect the beneficial uses of the Sacramento River.	No Impact	LTS	Significant	Significant	Mitigation Measure WR-2: Sample streambed sediments and properly dispose of mercury-rich sediment.	LTS (Action Alternatives)
Impact WR-3: Construction and implementation of the Riparian Sanctuary project could release hazardous materials into the environment, which could degrade water quality and affect the beneficial uses of the Sacramento River.	LTS	Significant	Significant	Significant	Mitigation Measure WR-3: Implement measures during construction and restoration activities to prevent accidental discharge of potentially hazardous materials.	LTS
Impact WR-4: Implementation of the Riparian Sanctuary project could increase turbidity and sedimentation in the Sacramento River for several years after construction, which could degrade water quality and affect the beneficial uses of the Sacramento River.	LTS	LTS	LTS	LTS	None necessary.	LTS
Impact WR-5: Implementation of the Riparian Sanctuary project could modify flood flows through the project area as a result of the change in the Sacramento River channel and restoration activities and expose people, property, or structures to flood risks.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)
Impact WR-6: Restoration of the Riparian Sanctuary would require the use of ground water, which could deplete groundwater supplies in the groundwater basin.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)

Table ES-1. Summary of Impacts and Mitigation Measures

Impact Statement	Level of Significance Before Mitigation				Mitigation Measure(s)	Final Level of Significance
	Alternative 1	Alternative 2	Alternative 3	Alternative 4		
Fishery Resources						
Impact FR-1: In-water construction activities could result in the direct mortality of or injury to anadromous and resident fishes, including special-status fishes.	No Impact	Significant	Significant	Significant	Mitigation Measure FR-1: Implement measures to minimize the injury or mortality of rearing and migratory juvenile anadromous and resident fishes.	LTS (Action Alternatives)
Impact FR-2: Construction activities could result in increased erosion and sedimentation levels that could adversely affect anadromous and resident fishes.	No Impact	Significant	Significant	Significant	Mitigation Measure WR-1: Implement measures to minimize increased turbidity levels in the Sacramento River during construction.	LTS (Action Alternatives)
Impact FR-3: Construction of the Riparian Sanctuary project could result in accidental spill of hazardous materials that could adversely affect fishes.	No Impact	Significant	Significant	Significant	Mitigation Measure WR-3: Implement measures during construction and restoration activities to prevent accidental discharge of potentially hazardous materials.	LTS (Action Alternatives)
Impact FR-4: Implementation of the Riparian Sanctuary project could result in impacts to spawning, rearing, and migratory habitat for anadromous and resident fishes, including designated critical habitat and essential fish habitat.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)
Impact FR-5: Implementation of the Riparian Sanctuary project could result in impacts to anadromous and resident fishes from in-water activities, increased turbidity, or hazardous materials spills.	Potentially Significant	LTS	LTS	LTS	None required for Alternative 1. None necessary for action alternatives, but Mitigation Measure WR-3 helps minimize impact.	Significant (Alternative 1) LTS (Action Alternatives)

Table ES-1. Summary of Impacts and Mitigation Measures

Impact Statement	Level of Significance Before Mitigation				Mitigation Measure(s)	Final Level of Significance
	Alternative 1	Alternative 2	Alternative 3	Alternative 4		
Vegetation, Wildlife, and Sensitive Biological Resources						
Impact VW-1: Construction and implementation of the Riparian Sanctuary project could modify habitats in the project area and increase the spread of invasive plant species.	Potentially Significant	LTS	LTS	LTS	None identified for Alternative 1. None necessary for action alternatives.	Significant (Alternative 1) LTS (Action Alternatives)
Impact VW-2: Construction of the Riparian Sanctuary project could result in placement of fill material into waters of the United States and disturbance of wetlands.	No Impact	Significant	Significant	Significant	Mitigation Measure VW-2: Compensate for the loss of jurisdictional wetlands in the riparian restoration designs.	LTS (Action Alternatives)
Impact VW-3: Construction and implementation of the Riparian Sanctuary project could affect special-status plant and animal species in fresh emergent wetland habitat on the upstream peninsula.	No Impact	No Impact	No Impact	LTS	None necessary.	LTS (Alternative 4)
Impact VW-4: Construction and implementation of the Riparian Sanctuary project could remove or disturb elderberry shrubs and adversely affect the federally listed valley elderberry longhorn beetle.	LTS	Significant	Significant	Significant	Mitigation Measure VW-4a: Protect preserved elderberry shrubs during construction. Mitigation Measure VW-4b: Implement a mitigation plan for elderberry shrubs that must be removed.	LTS
Impact VW-5: Construction and implementation of the Riparian Sanctuary project could adversely affect nesting bank swallows and their habitat.	No Impact	Significant	Significant	Significant	Mitigation Measure VW-5a: Conduct pre-construction surveys for nesting bank swallows and install netting along the bank. Mitigation Measure VW-5b: Compensate for the loss of bank swallow habitat. (Alternatives 2 and 3 only)	Potentially Significant (Alternatives 2 and 3) LTS (Alternative 4)

Table ES-1. Summary of Impacts and Mitigation Measures

Impact Statement	Level of Significance Before Mitigation				Mitigation Measure(s)	Final Level of Significance
	Alternative 1	Alternative 2	Alternative 3	Alternative 4		
Impact VW-6: Construction and implementation of the Riparian Sanctuary project could adversely affect other special-status species that nest or breed in the project area and their habitat.	LTS	Significant	Significant	Significant	Mitigation Measure VW-6: Conduct pre-construction surveys for nesting special-status bird species, raptors, special-status mammals, and special-status reptiles.	LTS
Impact VW-7: Implementation of the Riparian Sanctuary project could restrict terrestrial wildlife movement through the project area.	No Impact	No Impact	No Impact	No Impact	None necessary.	n/a
Cultural Resources						
Impact CR-1: Construction and implementation of the Riparian Sanctuary project could affect the integrity of site CA-BUT-2658.	No Impact	Significant	Significant	Significant	Mitigation Measure CR-1a: Provide an archaeological monitor during all activities at the Riparian Sanctuary near site CA-BUT-2658. Mitigation Measure CR-1b: Allow only native grass restoration and minimal maintenance within the boundaries of site CA-BUT-2658.	LTS (Action Alternatives)
Impact CR-2: Construction activities could disturb or damage previously undiscovered historical or archaeological resources or human remains.	No Impact	Significant	Significant	Significant	Mitigation Measure CR-2a: Implement treatment measures and record previously undiscovered resources. Mitigation Measure CR-2b: Implement treatment measures for human remains.	LTS (Action Alternatives)
Transportation and Traffic						
Impact TT-1: Construction activities could increase traffic or affect circulation on nearby roads or highways.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)
Impact TT-2: Implementation of the Riparian Sanctuary project could affect long-term traffic or circulation on nearby roads or highways.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)

Table ES-1. Summary of Impacts and Mitigation Measures

Impact Statement	Level of Significance Before Mitigation				Mitigation Measure(s)	Final Level of Significance
	Alternative 1	Alternative 2	Alternative 3	Alternative 4		
Air Quality						
Impact AQ-1: Construction activities could generate short-term vehicle or equipment emissions or air pollutants that could affect local or regional air quality.	No Impact	Significant	Significant	Significant	Mitigation Measure AQ-1: Implement a fugitive dust and emissions reduction plan.	LTS (Action Alternatives)
Impact AQ-2: Implementation of the Riparian Sanctuary project could affect air quality over the long term.	No Impact	LTS	LTS	LTS	None necessary, but Mitigation Measure AQ-1 helps minimize impact.	LTS (Action Alternatives)
Noise						
Impact NO-1: Construction activities could generate noise above acceptable standards and expose sensitive receptors to substantial noise levels.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)
Impact NO-2: Implementation of the Riparian Sanctuary project could increase ambient noise levels in the project area over the long term.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)
Aesthetics						
Impact AE-1: Construction activities could degrade the visual character of the project area or modify scenic views of the vicinity.	No Impact	LTS	LTS	LTS	None necessary	LTS (Action Alternatives)
Impact AE-2: Implementation of the Riparian Sanctuary project could modify the visual character of the project area over the long term.	No Impact	LTS	LTS	LTS	None necessary.	LTS (Action Alternatives)

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Appendix D. Terrestrial Biology Supporting Information

Appendix E. Mitigation Monitoring and Reporting Program

Appendix F. Draft EIS/EIR Distribution List

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AADT	average annual daily traffic
ACHP	Advisory Council on Historic Preservation
ACID	Anderson-Cottonwood Irrigation District
ARB	California Air Resources Board
Basin Plan	*Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin*
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CCAA	California Clean Air Act
CCP	Comprehensive Conservation Plan
CDFG	California Department of Fish and Game
CEQ	President's Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH4	methane
CO	carbon monoxide
CO2	carbon dioxide
Corps	U.S. Army Corps of Engineers
County	Butte County or Glenn County
CRHR	California Register of Historical Resources
CWA	Clean Water Act
dB	logarithmic decibel
dBA	"A-weighted" decibel scale
dbh	diameter at breast height
DPS	Distinct Population Segment
DWR	California Department of Water Resources
EFH	Essential Fish Habitat
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit

FR	Federal Register
G	units of gravity
General Permit	General Construction Activity Stormwater Permit
GHG	greenhouse gas
I-	Interstate
Ldn	day-night average sound level
Leq	equivalent noise levels
Lmax	maximum noise level
LOS	level of service
MBTA	Migratory Bird Treaty Act
ml	milliliters
MMRP	mitigation monitoring and reporting program
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO2	nitrogen dioxide
NOI	Notice of Intent
NOP	Notice of Preparation
N2O	nitrous oxide
NSR	North State Resources, Inc.
NTU	Nephelometric turbidity unit
NWR	National Wildlife Refuge
OHWM	ordinary high water mark
PCEs	primary constituent elements
PCGID-PID	Princeton-Codora-Glenn and Provident Irrigation Districts
PGA	peak ground acceleration
PM2.5	fine particulate matter (particulate matter less than 2.5 microns in aerodynamic diameter)
PM10	particulate matter less than 10 microns in aerodynamic diameter
ppm	parts per million
PRC	California Public Resources Code
RBDD	Red Bluff Diversion Dam
Regional Water Board	Regional Water Quality Control Board
Riparian Sanctuary	Llano Seco Riparian Sanctuary Unit

Riparian Sanctuary project	Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project
RM	River Mile
ROD	Record of Decision
RPR	California Rare Plant Rank
Service	U.S. Fish and Wildlife Service
SIP	State Implementation Plan
SO2	sulfur dioxide
SR	State Route
State	State of California
State Water Board	State Water Resources Control Board
USC	United States Code
$\mu g/m^3$	micrograms per cubic meter

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Chapter 1 Introduction

This Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) was prepared by the U.S. Fish and Wildlife Service (Service) and the California Department of Fish and Game (CDFG) to analyze the environmental impacts of implementing the Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project (Riparian Sanctuary project). The document was prepared in compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). This chapter discusses the project background, purpose of and need for the project, intended uses of this document, compliance with NEPA and CEQA, public involvement in the NEPA/CEQA process, and organization of the Draft EIS/EIR.

1.1 Overview of Project

The proposed action (proposed project) evaluated in this Draft EIS/EIR consists of a combination of measures to restore riparian habitat at the Llano Seco Riparian Sanctuary Unit (Riparian Sanctuary) of the Sacramento River National Wildlife Refuge (Sacramento River NWR) and to protect the alignment of the Sacramento River at the water diversion for the Princeton-Codora-Glenn and Provident Irrigation Districts (PCGID-PID) pumping plant and fish screen facility at River Mile (RM) 178. Habitat restoration is needed because the Riparian Sanctuary is currently dominated by non-native plants and provides poor habitat value for wildlife; bank protection measures are needed to protect the water diversion for the PCGID-PID pumping plant and fish screen facility over the long term. The proposed restoration plan includes removing non-native and invasive plants, cleaning up flood debris, and planting native species at varying frequencies and densities. Bank protection measures being considered include installation of spur dikes or traditional riprap with or without a low berm, as well as the possible removal of existing revetment along the Sacramento River upstream of the facility and the Riparian Sanctuary.

River Partners, in cooperation with the Service and PCGID-PID, secured funding from Ecosystem Restoration Program grants to investigate the feasibility of restoration options for the Riparian Sanctuary and of various protection measures along the banks of the Sacramento River in the vicinity of the Riparian Sanctuary to protect the PCGID-PID pumping plant and fish screen facility. The Ecosystem Restoration Program is implemented by CDFG, the Service, and the National Marine Fisheries Service (NMFS). The planning and implementation process for the Riparian Sanctuary project includes three phases: Phase 1 was feasibility studies (completed in 2005); Phase 2 is additional technical studies, project design, environmental compliance, and permitting; and Phase 3 is implementation of the project. Additional funding will need to be secured for Phase 3 and is anticipated to come from state or federal sources or a combination of the two.

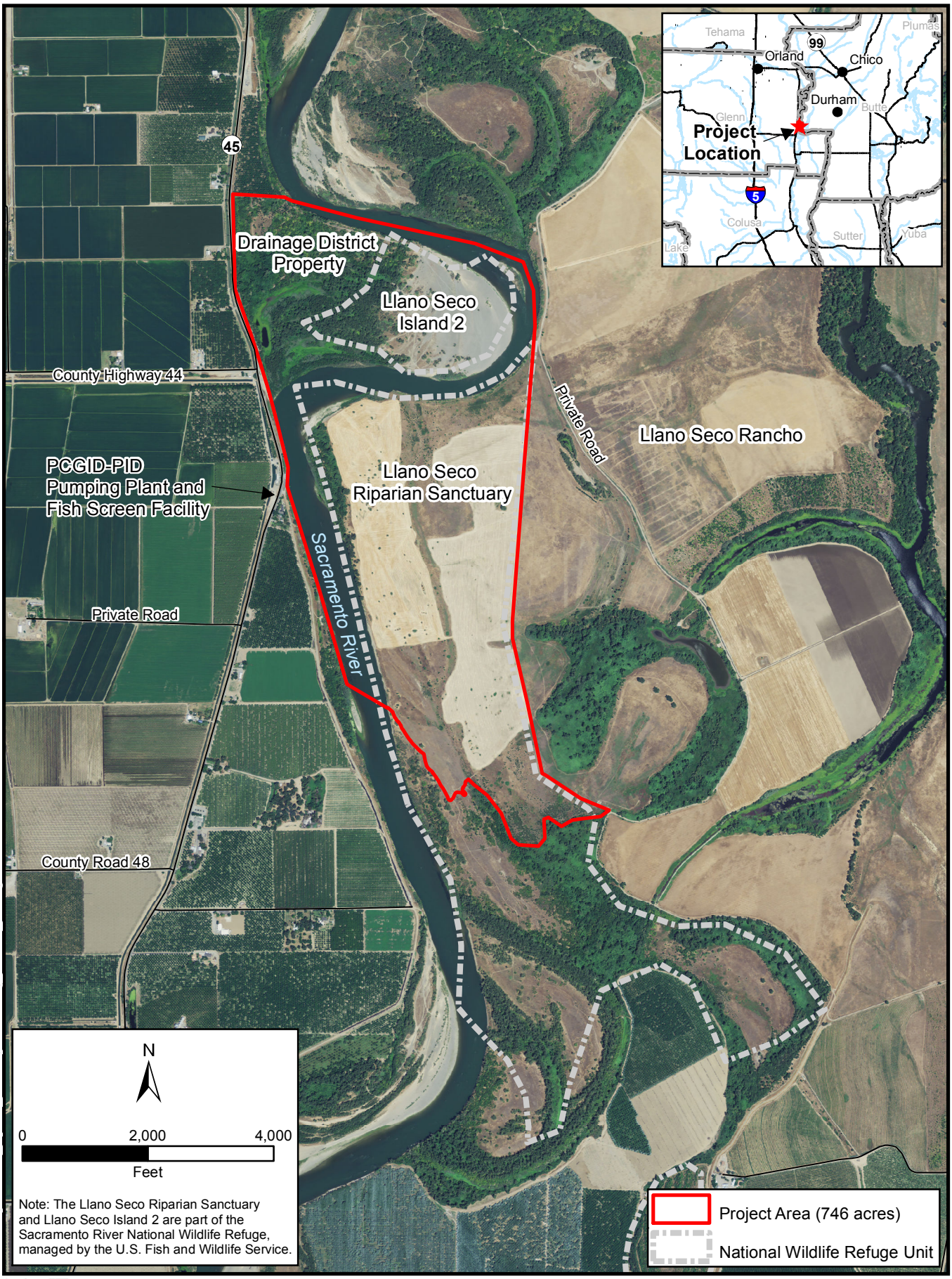
1.2 Project Location and Background

The project area discussed in this Draft EIS/EIR encompasses approximately 400 acres in the northern portion of the Riparian Sanctuary, a peninsula north of the Riparian Sanctuary, and the banks of the Sacramento River adjacent to and just upstream of the Riparian Sanctuary (between RM 178 and RM 180) (Figure 1-1). The 950-acre Riparian Sanctuary is located 15 miles southwest of Chico on the east bank of the Sacramento River between RM 176.5 and RM 178 in the southwest corner of Butte County. The peninsula across from the Riparian Sanctuary contains federal (Llano Seco Island 2 refuge unit), state, and private lands, which are in Butte and Glenn counties. The Riparian Sanctuary and Llano Seco Island 2 are part of the Sacramento River NWR, a refuge managed by the Service as part of the Sacramento NWR Complex.

The Riparian Sanctuary was once part of the historic Llano Seco Rancho, a nearly 18,000-acre ranch established in 1844 by a Mexican government land grant. In 1991, the Service acquired the lands currently known as the Riparian Sanctuary along with other properties that became part of the Sacramento River NWR and North Central Valley Wildlife Management Area–Llano Seco Unit. The land acquisition was part of the Joint Management Agreement between Parrot Investment Company, The Nature Conservancy, CDFG, and the Service to cooperatively manage lands on the Llano Seco Rancho. During the 1970s, portions of the Llano Seco Rancho, including the Riparian Sanctuary, were cleared of riparian and other native vegetation to support expanded agricultural production. No irrigation systems were installed at the Riparian Sanctuary because it experiences frequent flooding. The Riparian Sanctuary has been largely out of agricultural production for nearly 15 years, and much of the vegetation has become dominated by non-native and invasive noxious weeds. Currently, just over 200 acres are farmed with dryland row crops to help control weeds.

The peninsula north (upstream) of the Riparian Sanctuary is dominated by riparian woodlands and exposed floodplain. The Llano Seco Island 2 refuge unit encompasses approximately 100 acres of the peninsula. Most of the peninsula outside of the Llano Seco Island 2 boundary is State-owned and is managed by the Central Valley Flood Protection Board as part of the Sacramento-San Joaquin Drainage District (Drainage District). In the 1980s, rock revetment was installed by the U.S. Army Corps of Engineers (Corps) on the north side of the peninsula to hold the Sacramento River in place. Most of the revetment lies on the Drainage District property; the remainder is on private and Service-managed lands. The private lands are on the west side of the peninsula and primarily contain orchards.

The other component of the Riparian Sanctuary project is the PCGID-PID pumping plant and fish screen facility at RM 178, across the Sacramento River from the Riparian Sanctuary. In 1999, the PCGID-PID consolidated three existing unscreened pumping plants on the Sacramento River into a single pumping plant with a state-of-the-art fish screen at RM 178. The $11 million project was funded by the Department of the Interior's Anadromous Fish Screen Program, CDFG (CALFED Bay-Delta Category III Program), PCGID-PID, and the Metropolitan Water District. Flow from the Sacramento River is currently diverted into the pumping plant through the fish screen, which was installed to protect endangered fish species such as juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*).



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 1-1
Project Location

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With a capacity of 600 cubic feet per second, the pumping plant is the fourth largest on the Sacramento River and serves nearly 30,000 acres of orchards, row crops, rice, and wetlands. In addition, the water sustains habitat in the agricultural fields for waterfowl, the federally listed giant garter snake (*Thamnophis gigas*), and other wetland-dependent wildlife species. The efficiency of the fish screen at the pumping plant is being threatened by bank erosion on the Riparian Sanctuary and the migration of the Sacramento River.

Rock revetment was placed along the Camp 2 Bend of the river upstream of the Riparian Sanctuary by the Corps in 1985 and 1986, more than a decade prior to construction of the pumping plant, to hold the Sacramento River in place and ensure that flood flows would continue to be diverted from the river through the Goose Lake overflow structure and into the Butte Basin to the east. Since placement of the revetment in 1986, the natural riverbank west and south (downstream) of the Corps revetment and directly across from the pumping plant has eroded approximately 600 feet. Continued erosion is predicted to change the angle of flow and velocity of the water passing the fish screen, trapping fish against the screen rather than sweeping them past. If that happens, the pumping plant facility would not meet NMFS guidelines for operation of pumping plant fish screens.

1.3 Purpose of and Need for the Action

The President's Council on Environmental Quality (CEQ) regulations for implementing NEPA require that a brief statement of purpose and need be included in an EIS to explain the reason an agency is proposing an action and considering alternatives (40 Code of Federal Regulations (CFR) Section 1502.13). Similarly, CEQA requires that an EIR include a statement of the objectives to be achieved by a proposed project (CEQA Guidelines Section 15124 subd. (b)). The objectives are intended to help the implementing agency develop a reasonable range of alternatives and to aid decision makers in preparing findings and, if necessary, a statement of overriding considerations. The purpose of and need for action and the objectives of implementing the Riparian Sanctuary project are described below.

1.3.1 Purpose and Need

The purpose of the Riparian Sanctuary project is to restore habitat at the Riparian Sanctuary and to protect the PCGID-PID pumping plant and fish screen facility. The project is needed to provide habitat for endangered species and migratory birds, improve overall riparian health along the Sacramento River, and protect the fish screen and intake facility to maintain their functions.

The Service acquired the lands associated with the Llano Seco Rancho "to protect, enhance, and restore riparian forests, freshwater wetlands, and grassland habitats" (Silveira 1992). In 2005, the Service completed the Sacramento River NWR Comprehensive Conservation Plan (CCP) to guide management of the refuge, including the lands associated with the Llano Seco Rancho, over a 15-year period (U.S. Fish and Wildlife Service 2005). The CCP describes the refuge vision, goals, objectives, and strategies for managing wildlife, habitat, public use, and other resources at the refuge. The Wildlife and Habitat Goal for the refuge is to contribute to the recovery of endangered and threatened species and provide a natural diversity and abundance of migratory birds and anadromous fish through restoration and management of viable riparian habitats along the Sacramento River using the principles of landscape

ecology. The Riparian Sanctuary project is one of many site-specific projects identified in the Sacramento River NWR CCP that would fulfill the purposes of the refuge. Specifically, the restoration component would be consistent with Objective 1.1, Strategy 1.1.4, and the pumping plant and fish screen facility protection component would be consistent with Objective 1.2, Strategy 1.2.1 and Strategy 1.2.3.

The collaborative process used to develop and refine the project description complies with the Partnership Goal of the Sacramento River NWR CCP, which is to promote partnerships to preserve, restore, and enhance a diverse, healthy, and productive riparian ecosystem in which the Sacramento River NWR plays a key role. The Riparian Sanctuary project is consistent with the strategies for coordinating refuge activities with the Sacramento River Conservation Area Forum (3.1.3); working with the California Department of Water Resources and the Reclamation Board on floodplain management issues (3.1.4); and promoting new partnerships to support restoration, enhancement, and management of riparian habitat and riparian flora and fauna (3.1.8).

The Riparian Sanctuary has been exposed to extensive disturbance associated with removal of native vegetation and use of the land for agricultural production, which has created a challenge for the Service in achieving its goal of enhancing and restoring riparian forests and other native habitats on the lands it manages. The Riparian Sanctuary currently provides low-quality habitat for wildlife species because it lacks native vegetation, particularly woody riparian forests like those that existed on the land in the past. The habitat is dominated by yellow star thistle (*Centaurea solstitialis*), milk thistle (*Silybum marianum*), perennial pepperweed (*Lepidium latifolium*), sharp-leaved fluellin (*Kickxia elatine*), black mustard (*Brassica nigra*), wild radish (*Raphanus sativus*), and Johnsongrass (*Sorghum halepense*) (Oswald and Ahart 1996). Without active restoration, these conditions are likely to persist despite the historic presence of native riparian forests in the area, regular seasonal floods that can eliminate the non-native plants, and the proximity of the Riparian Sanctuary to native seed sources (River Partners 2005). Current habitat conditions contribute little to endangered species recovery, migratory bird habitat, and overall riparian health. Restoration activities are therefore needed to help the Service achieve its goals for acquiring the Riparian Sanctuary and for managing the Sacramento River NWR according to the CCP.

As a related action in the same reach of the Sacramento River, the PCGID-PID pumping plant is in need of protection from river meander and bank erosion. The fish screen at the pumping plant requires sweeping (parallel) flow to allow the fish to be swept by instead of being trapped at the screens. NMFS has recommended an approach velocity of less than 0.4 foot per second for fish screens to protect small juvenile salmonid fry from becoming trapped—approach velocity is that component of river velocity that is perpendicular to the fish screens (MBK Engineers 2005). Over the past 20 years, the meander of the Sacramento River has been changing just upstream of the intake facility between RM 178 and RM 179. The bank of the river at the northern end of the Riparian Sanctuary without revetment has eroded approximately 600 feet over the past 20 or more years, an average of 40 feet per year. Further erosion of this bank could change the angle of the flow approaching the pumping plant and increase the approach velocity, which would reduce the efficiency of the fish screen facility and eventually affect the operation of the pumps themselves. Bank protection measures are needed across from and just upstream of the pumping plant to protect the pumping plant and to ensure that river flows continue to pass by the screen instead of perpendicular to them.

In combination with the eroding bank on the Riparian Sanctuary, another threat to the PCGID-PID pumping plant is the deterioration of existing revetment on the upstream peninsula (approximately at RM 178.5), which could eventually fail and cause the river to cut off the bend (Ayres Associates 2010a). Although this cut off would restore river processes and may be desired by resource agencies, without bank protection along the Riparian Sanctuary, the cut off could further erode the western end of the Riparian Sanctuary where no revetment is in place and shift the river alignment farther away from the fish screen. If the fish screen were to become inoperable or fail to meet NMFS guidelines, the pumping plant could be forced to shut down, preventing the irrigation districts from meeting their obligations to deliver water to agricultural and other customers in the region (MBK Engineers 2005).

1.3.2 CEQA Project Objectives

The following CEQA project objectives were identified for the Riparian Sanctuary project:

- improve habitat conditions at the Riparian Sanctuary to contribute to endangered species recovery and overall riparian health;
- use an interdisciplinary scientific approach to restore riparian habitat at the Riparian Sanctuary; and
- protect the operation of the PCGID-PID pumping plant and fish screen facility from anticipated river meander.

1.4 Type of Environmental Document

This document is a joint EIS and EIR that is designed to comply with the requirements of both NEPA (42 United States Code [USC], Section 4321 et seq.) and CEQA (California Public Resources Code [PRC], Section 21000 et seq.). NEPA and CEQA require government agencies to evaluate the environmental impacts of their proposed actions or projects before making formal commitments to carry them out and to involve the public in the process. For this project, a project-level EIS was determined to be the appropriate NEPA document, and a project EIR was determined to be the appropriate CEQA document. A project EIR evaluates the environmental impacts of a specific project (CEQA Guidelines, Section 15161) and focuses primarily on the changes in the environment that would occur because of project implementation, including all phases of a particular project (i.e., planning, construction, and operation). By preparing a single document that complies with both statutes, the lead agencies have been able to avoid an unnecessary duplication of effort.

This Draft EIS/EIR discloses relevant information about the alternatives being considered and invites all interested parties to play a role in both the decision-making process and implementation of the decision. The document provides federal, state, and local decision makers with detailed information concerning the environmental, social, economic, and cultural impacts and the significance of these impacts.

1.5 Joint Compliance Approach

1.5.1 Lead and Responsible Agencies

The Service is the federal lead agency under NEPA and will be responsible for issuing a Record of Decision (ROD) to identify the selected alternative and measures that will be adopted to avoid or minimize environmental impacts and for consultations under the federal Endangered Species Act (ESA) and National Historic Preservation Act (NHPA). CDFG is the state lead agency under CEQA and will be responsible for certifying the Final EIR and issuing findings for the Riparian Sanctuary project. Funding for the planning phase of the Riparian Sanctuary project was authorized by the CDFG through the Ecosystem Restoration Program; funding for implementation of the project is expected to come from state or federal sources or a combination of the two. PCGID-PID will be responsible for constructing the bank protection measure(s) and adhering to any mitigation measures specific to the bank protection measure(s). The Service will be responsible for implementing the restoration activities and any mitigation measures specific to the restoration activities. Long-term maintenance of the project components will be the responsibility of PCGID-PID (bank protection measures), the Service (restoration plan), and possibly one or more state or federal agencies, if additional support is needed for larger maintenance efforts for the bank protection measures.

The Draft EIS/EIR is being circulated to responsible public resource agencies, permitting agencies, trustee agencies, the State Clearinghouse, and interested stakeholders. The following responsible, permitting, and trustee agencies have been identified:

- PCGID-PID
- U.S. Army Corps of Engineers
- Central Valley Flood Protection Board
- Central Valley Regional Water Quality Control Board
- NMFS
- Office of Historic Preservation
- California State Lands Commission
- California Department of Transportation
- Butte County

1.5.2 Anticipated Permits and Approvals

Implementation of the Riparian Sanctuary project would require compliance with several federal, state, and local laws and regulations. NEPA requires integration of other environmental laws and executive orders into the EIS preparation process to the extent possible (40 CFR Section 1502.25), and both NEPA and CEQA require that the environmental document include a list of applicable permits or approvals (40 CFR Section 1502.25 and 14 CCR Section 15124). Table 1-1 identifies the permits or approvals that may be needed for project implementation. Discussions of applicable laws, regulations, and policies are provided in the resource sections of Chapter 3. Other agencies may use the information provided in this EIS/EIR for their permitting and approval processes.

Table 1-1. Potential Federal, State, and Local Permits and Approvals

Approving/Responsible Agency	Responsibility or Permit/Approval Required	Law/Regulation/Policy Requirement
Federal Agencies		
U.S. Fish and Wildlife Service	Project approval/NEPA compliance	NEPA requires preparation of an EIS for a proposed action that may significantly affect the quality of the human environment.
	Special Use Permit	Maintenance access across Sacramento River NWR would require a special use permit from the Service.
	ESA Section 7 consultation	Section 7 of the ESA requires a federal agency to consult with the Service and/or NMFS to ensure that its actions would not adversely affect federally listed species or critical habitat.
	NHPA Section 106 consultation	Section 106 of the NHPA requires a federal agency to take into account the effects of its actions on historic properties and consult with the State Historic Preservation Officer if its actions could affect historic properties.
National Marine Fisheries Service	Magnus-Stevens Fishery Conservation and Management Act consultation	For projects that may affect Essential Fish Habitat of species covered under the act, the lead agency must consult with NMFS to identify measures to reduce or avoid impacts.
U.S. Army Corps of Engineers	Clean Water Act Section 404 permit	Section 404 of the Clean Water Act requires issuance of a permit for activities that would result in the discharge of dredged or fill material into waters of the United States.
	Rivers and Harbors Act Section 10 (33 CFR 322) permit	Section 10 requires a permit for construction of any structure in or over any navigable water of the United States.
	Rivers and Harbors Act Section 14 (33 USC 408) letter of permission	33 USC 408 authorizes the Corps to issue permits for modifications to projects designed to protect river banks.
State Agencies		
CDFG	Project approval/CEQA compliance	CEQA requires preparation of an EIR when a proposed project may have a significant effect on the environment.

Table 1-1. Potential Federal, State, and Local Permits and Approvals

Approving/Responsible Agency	Responsibility or Permit/Approval Required	Law/Regulation/Policy Requirement
	California Endangered Species Act incidental take permit or authorization	Section 2081 of the California Fish and Game Code requires individuals or agencies to obtain an incidental take permit for otherwise lawful activities that could adversely affect state-listed species.
	Streambed Alteration Agreement	Section 1602 of the Fish and Game Code requires an entity to notify CDFG of any proposed activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake.
Regional Water Quality Control Board	Clean Water Action Section 401 water quality certification	Section 401 of the Clean Water Act requires applicants for federal permits to obtain water quality certification from the State for activities that would discharge pollutants into navigable waters.
	National Pollutant Discharge Elimination System permit (General Construction Activity Storm Water Permit)	Section 402 of the Clean Water Act requires project proponents to obtain coverage under a permit for discharges to navigable waters that are not otherwise covered under Section 404.
Office of Historic Preservation	NHPA Section 106 consultation	The State Historic Preservation Officer will be consulted by the Service to review the project and its effects on historic properties (if any).
Central Valley Flood Protection Board	Encroachment permit	Title 23 of California Code of Regulations requires the Board to issue a permit for activities that encroach on flood protection projects.
California State Lands Commission	Lease or permit	Section 6501 of the Public Resources Code requires the State Lands Commission to issue a lease or permit for activities on lands under their jurisdiction, which includes land underlying navigable waters.
California Department of Transportation	Encroachment permit	Section 660 of the California Streets and Highways Code requires Caltrans to issue a permit for activities that encroach on a state highway.

Table 1-1. Potential Federal, State, and Local Permits and Approvals

Approving/Responsible Agency	Responsibility or Permit/Approval Required	Law/Regulation/Policy Requirement
Local Agencies		
Princeton-Codora-Glenn and Provident Irrigation Districts	Project review	The PCGID-PID Boards will likely need to review and consider the project in terms of its effects on the pumping plant facility.
Butte County	Transportation permit	Butte County requires transportation permits for overweight or oversized loads transported on any county-maintained road.
Land Owner	Access easement/road maintenance agreement	Private property rights give the land owner the ability to grant access through private property.

1.5.3 Similarities of and Differences between NEPA and CEQA

NEPA and CEQA are procedural laws requiring the evaluation of environmental impacts associated with discretionary actions or approvals. The objectives of NEPA are to ensure that agencies make decisions based on an understanding of the environmental consequences of the proposed action and inform and involve the public during the decision-making process. The primary objectives of CEQA are to disclose environmental impacts and to avoid or reduce them when feasible. CEQA also requires an agency to adopt "feasible" mitigation measures for any "significant effect on the environment," which makes it more substantive than NEPA.

CEQA and NEPA sometimes use different terms for similar concepts. For example, CEQA uses the term "proposed project," while NEPA uses the term "proposed action" to refer to the activities being proposed or the action being taken by the lead agency. For readability, this document uses NEPA terms, except when the context requires CEQA terminology.

Although the environmental review process is similar, differences exist between the two acts. Key differences include the level of detail for analyzing project alternatives, the significance of environmental impacts, and the mitigation monitoring requirement under CEQA. Discussions of these differences are provided below.

Alternatives Analyses

An alternatives analysis in a NEPA document is more rigorous than in a CEQA document. Under NEPA, the general rule is that all alternatives must be analyzed and discussed at the same level of detail. In contrast, CEQA requires only enough information about the alternatives to allow for meaningful comparison. In addition, under NEPA, alternatives to the proposed action are identified early on and are described in detail. Under CEQA, alternatives are identified for the purpose of avoiding or substantially lessening at least one of the significant effects of the project, while attaining most of the project objectives. CEQA alternatives are typically described at a general level of detail and are evaluated in

comparison with the proposed project to identify significant effects that may be reduced or avoided. When preparing a joint NEPA/CEQA document, the alternatives analysis must meet the more comprehensive NEPA requirements.

Significance Determination

CEQA requires lead agencies to "determine whether a project may have a significant effect on the environment" (PRC Section 21082.2). Significance thresholds are used when preparing an EIR to determine if the environmental effects would be substantial or potentially substantial based on factual or scientific evidence. Under NEPA, once a decision to prepare an EIS is made, the magnitude of the impact is evaluated, but its significance is not judged. NEPA does not require that a determination of significant impacts be stated in environmental documents.

Because of the obligation under CEQA to mitigate significant effects on the environment when feasible, significance thresholds are used in this EIS/EIR to characterize impacts as significant or less than significant. For significant impacts, mitigation measures are identified to reduce or avoid impacts, where feasible, as required by CEQA. CDFG will be required to adopt feasible mitigation measures when it approves the project or prepare findings of fact and a statement of overriding considerations (if applicable) for impacts that cannot be adequately mitigated. Mitigation measures may be adopted by the Service when it prepares the ROD.

Mitigation and Monitoring Program

Under CEQA, when a lead agency adopts changes to a project or conditions of project approval, the agency must also "adopt a reporting or mitigation monitoring program…to ensure compliance during project implementation" (PRC Section 21081.6). NEPA does not explicitly require the mitigation of significant impacts or adoption of a monitoring program for mitigation measures that may be adopted by a federal agency, but it does require a discussion of measures that can be taken to reduce adverse effects if such measures are not already included in the proposed action or alternatives. Some federal agencies may elect to adopt mitigation measures and implement a monitoring program to enforce implementation of the measures. For significant impacts in this EIS/EIR, mitigation measures have been identified to avoid or reduce environmental effects in compliance with CEQA. A mitigation monitoring and reporting program is appended to the Draft EIS/EIR and will be adopted by CDFG upon project approval. The Service may choose to implement the mitigation monitoring and reporting program.

1.6 Public Involvement During NEPA/CEQA Process

1.6.1 Public Scoping

A public scoping period was initiated in April 2011 and extended into May 2011. A Notice of Intent (NOI) to prepare a joint EIS/EIR for the Riparian Sanctuary project was published in the Federal Register on April 12, 2011 (Volume 76, Number 70). The CDFG submitted a Notice of Preparation (NOP) to the State Clearinghouse on April 28, 2011. The NOI and NOP announced the scoping period and provided information on a public workshop. Public comments were received through May 27, 2011. Copies of all comment letters received are included with copies of the NOP and NOI in Appendix A.

The Service and CDFG held a public workshop on May 10, 2011, from 4:00 p.m. to 6:30 p.m., at the Ord Bend Community Hall near the project area to provide information on the Riparian Sanctuary project and solicit comments from the public and other agencies. Staff from the Service, CDFG, River Partners, and the design and consultant teams were present to answer questions and receive comments. The public workshop included a brief presentation concerning the project and roles of team members, work stations to discuss various aspects of the project and environmental document, and an open forum to discuss comments with agency representatives. Handouts made available to attendees provided information on the workshop format and on the project and alternatives; a comment form was provided to submit written comments.

The scoping process resulted in the submission of comments from three agencies and one local citizen. Table 1-2 summarizes the comments received.

Table 1-2. Summary of Comments Received During Scoping

Commenter	Date of Letter	Key Issue Areas	Recap of Comments
Tom Edgar, local citizen	May 10, 2011	Access, Water Distribution, Water Rights	▪ Discuss public access, particularly for disabled, in EIS/EIR ▪ Concern with water distribution south of the Sacramento Delta and water rights for water in Sacramento River ▪ Address effects of riverbend cut off on delivery of water downstream
Katy Sanchez, Program Analyst Native American Heritage Commission	May 13, 2011	Cultural Resources	▪ Conduct a records search for cultural resources ▪ Conduct an archaeological survey, if required, and prepare a report ▪ Conduct a Sacred Lands file search ▪ Consult with Native American tribes ▪ Consider mitigation for undiscovered cultural resources and human remains
James Herota, Staff Environmental Specialist Flood Projects Improvement Branch, Central Valley Flood Protection Board	May 16, 2011	Hazards (Flooding), Hydrology	▪ Permit needed for activities in floodplain of the Sacramento River ▪ Discuss cumulative effects ▪ Consider effects of woody vegetation on floodplain function ▪ Consider hydraulic impacts
Cy R. Oggins, Chief Division of Environmental Planning and Management, California State Lands Commission	May 26, 2011	Land Use, Biology, Air Quality, Cultural Resources, Water Quality, Recreation	▪ State holds tidelands, submerged lands, and beds of navigable waterways (sovereign lands) in public trust ▪ Lease or permit needed for alteration of sovereign lands ▪ Provide detailed project description in EIS/EIR ▪ Address impacts on sensitive species, potential spread of invasive plants, and use of existing habitat by wildlife ▪ Discuss noise impacts on fish and birds ▪ Consider benefits to upstream revetment when identifying preferred alternative

Table 1-2. Summary of Comments Received During Scoping

Commenter	Date of Letter	Key Issue Areas	Recap of Comments
			▪ Provide greenhouse gas analysis consistent with latest CEQA Guidelines and discuss cumulative effects ▪ Consider submerged archaeological resources ▪ Address effects on water quality ▪ Discuss short-term and long-term effects on recreation

1.6.2 Key Areas of Concern

Few areas of concern were identified during the scoping period. Most attendees at the scoping meeting and agencies who submitted comments expressed support for the Riparian Sanctuary project because of its potential benefits to wildlife and the agricultural community that relies on the PCGID-PID pumping plant. The primary concerns expressed by the public were construction access to the Riparian Sanctuary via private roads and water deliveries downstream of the pumping plant. Agencies that submitted comments reminded the Service and CDFG of their obligations to conduct a thorough analysis of environmental impacts and consider all permits that may be required. No specific design-related concerns were identified during the EIS/EIR scoping period.

1.6.3 Public Review

This document is being circulated to local, state, and federal agencies and to interested organizations and individuals who may wish to review and comment on the contents of the document. Publication of this Draft EIS/EIR initiates the beginning of a 45-day public review period. The Service and CDFG will hold a public meeting during the review period to solicit public comments on the document and respond to questions. In addition to comments received during the public meeting, written comments will be accepted throughout the review period.

A notice of the public hearing time and location will be published in the local newspapers and on the Service, CDFG, and River Partners websites prior to the hearing date. All written comments and questions regarding the Draft EIS/EIR that raise issues under NEPA, CEQA, or both, should be addressed to either of the following agency representatives:

Daniel W. Frisk, Project Leader
Sacramento National Wildlife Refuge Complex
U.S. Fish and Wildlife Service
752 County Road 99W
Willows, CA 95988

Tracy McReynolds
California Department of Fish and Game
629 Entler Avenue, Suite 12
Chico, CA 95928

The Draft EIS/EIR will be sent to the State Clearinghouse and will be available online at the River Partners website: http://www.riverpartners.org/where-we-work/sanctuary/sanctuary.html

Copies of the Draft EIS/EIR will be available for review at the following locations:

Sacramento NWR Complex Office 752 County Road 99W Willows, CA 95988 Phone: (530) 934-2801	River Partners Office 580 Vallombrosa Ave Chico, CA 95926 Phone: (530) 894-5401	Orland Free Library 333 Mill Street Orland, CA 95963 Phone: (530) 865-1640
PCGID-PID Office 258 South Butte Street Willows, CA 95988 Phone: (530) 934-4801	CDFG Office 629 Entler Ave, Suite 12 Chico, CA 95928 Phone: (530) 895-5111	Chico Branch Library 1108 Sherman Avenue Chico, CA 95926 Phone: (530) 891-2762

1.7 Organization of This EIS/EIR

This EIS/EIR contains the information required for EISs and EIRs by the CEQ regulations for implementing NEPA (40 CFR Section 1502) and the CEQA Guidelines (PRC Sections 15120-15131). It is organized into the following chapters:

- **Executive Summary:** Summarizes the EIS/EIR contents and includes a summary table of the anticipated impacts and proposed mitigation measures.
- **Chapter 1. Introduction:** Provides an overview of the EIS/EIR and the proposed action, including the project background and anticipated permitting requirements, a description of the purpose of and need for action and project objectives, and a comparison of NEPA and CEQA.
- **Chapter 2. Description of Alternatives:** Describes the alternatives considered in detail, discusses the development of the alternatives, and briefly describes alternatives eliminated from further consideration.
- **Chapter 3. Affected Environment and Environmental Consequences:** Describes the affected environment, analyzes the environmental impacts or consequences of each alternative, and identifies mitigation measures to reduce or avoid significant impacts.
- **Chapter 4. Other Statutory Considerations:** Discusses cumulative impacts, growth-inducing effects, irreversible and irretrievable commitments of resources, and significant and unavoidable impacts to comply with other requirements of NEPA and CEQA.
- **Chapter 5. Consultation and Coordination:** Identifies agencies and individuals that contributed to the preparation of this document and were involved in ensuring compliance with other environmental laws.
- **Chapter 6. References**: Lists references cited in the EIS/EIR, organized by chapter.
- **Index:** Provides an index of key terms used throughout the EIS/EIR and the page numbers for where they appear in the document.
- **Appendices**: Provide supporting and technical information for scoping, the alternatives, biological resources, mitigation measures, and the environmental review process.

Chapter 2 Description of Alternatives

This chapter summarizes the alternatives development process, describes the alternatives carried forward for evaluation in this Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR), identifies the preferred alternative and environmentally superior alternative, and discusses alternatives eliminated from further consideration. The alternatives development process incorporated input from various agencies, stakeholders, the public, and engineering consultants and involved several studies and modeling efforts to design options for bank protection along the Sacramento River at River Mile 178 and restoration of the Llano Seco Riparian Sanctuary Unit (Riparian Sanctuary) as part of the Riparian Sanctuary Restoration and Pumping Plant/Fish Screen Facility Protection Project (Riparian Sanctuary project). During the process, several alternatives for bank protection were eliminated from further consideration, and three alternatives were retained for further analysis. Two alternatives for restoration of riparian habitat were also considered, and one alternative was carried forward for further analysis.

The studies and reports used to develop and describe the alternative bank protection and restoration options are available on the River Partners website at http://riverpartners.org/where-we-work/sanctuary/documents.html. The latest versions of the main reports are included in Appendix B; these include:

- Ayres Associates 2010a, 2-Dimensional Hydraulic Modeling for Pumping Plant Protection and Riparian Restoration at the Llano Seco Unit on the Sacramento River near RM 178 – Supplemental Design Report
- Ayres Associates 2010b, Draft Design Alternatives Report: Pumping Plant Protection and Riparian Restoration at the Llano Seco Unit on the Sacramento River, Sacramento River Mile 178.0L
- Larsen 2010, Llano Seco Riparian Sanctuary Channel Study: Meander Bend Migration and Cutoff Modeling
- Ayres Associates 2011, Sediment Transport Analysis for the Riparian Restoration at the Llano Seco Unit on the Sacramento River (Draft)

In addition to these reports, additional details on the restoration plan for the Riparian Sanctuary are included in Appendix C.

2.1 Development of Alternatives

In 2004, River Partners and an interdisciplinary team began studies to evaluate changing conditions along the Sacramento River near River Mile (RM) 178; examine measures to protect the Princeton-Codora-Glenn and Provident Irrigation Districts (PCGID-PID) pumping plant and fish screen facility; and develop restoration options for the Riparian Sanctuary, a unit of the Sacramento River National Wildlife Refuge (NWR). The U.S. Fish and Wildlife Service (Service) and PCGID-PID have examined a range of

alternatives in coordination with River Partners and other parties to meet both agencies' objectives. This process has involved an open, science-based, interactive process to educate stakeholders and build consensus on sound solutions.

Several studies were conducted during Phase 1 of the planning and implementation process to evaluate changing conditions of the river and identify measures to protect the PCGID-PID facility. Eric Larsen and others with the University of California, Davis, have conducted a number of studies along the Sacramento River to evaluate river meander. To support the Riparian Sanctuary project, Larsen (2004, 2010) used a numerical model of meander bend migration and bend cut-off between RM 177 and about RM 182 to simulate future migration scenarios. Mussetter Engineering, Inc. (2004), conducted a study of the geomorphic and anthropogenic history of the river and evaluated future conditions of the river under various scenarios. Ayres Associates (2005, 2010a) evaluated hydraulic changes in the river and adjacent floodplain as a result of restoration activities on the Riparian Sanctuary and a potential bend cut-off upstream; their study used a 2-dimensional hydraulic model of the Sacramento River from RM 173 to RM 194. These studies were used to refine alternative bank protection measures and the restoration plan in feasibility studies prepared by MBK Engineers and River Partners.

MBK Engineers conducted a screening-level assessment of various alternatives that could protect the PCGID-PID pumping plant and fish screen facility (MBK Engineers 2005). This study considered six main alternatives with several sub-alternatives and evaluated the expected life of the facility with implementation of each alternative, the effectiveness of the alternative to protect the facility, the implementation costs, annual operations and maintenance costs, and the estimated time to implement the alternative. It also considered ecological benefits for aquatic and terrestrial habitat as well as the potential need to implement mitigation measures for adverse effects. The descriptions and assessment of the alternatives incorporated modeling results from Larsen (2004), Mussetter Engineering, Inc. (2004), and Ayres Associates (2005) and input from resource agencies, stakeholders, and others participating in the Technical Advisory Committee formed for the project. The study identified concerns with some of the alternatives due to ineffectiveness of protecting the pumping plant and fish screen facility and high costs, resulting in the elimination of some of the alternatives from further consideration (see Section 2.4 for alternatives eliminated from further consideration). Consequently, the most feasible alternatives were subject to an additional assessment.

Larsen (2010) and Ayres Associates (2010a) updated their modeling studies to incorporate more recent data on the river alignment and conditions and focus on the bank protection measures considered to be the most feasible by MBK Engineers (2005). Ayres Associates used the results of the most recent modeling to further assess the bank protection measures in the *Draft Design Alternatives Report* (Ayres Associates 2010b). This report discusses three main alternatives and three sub-alternatives, which were slightly modified from MBK Engineers (2005), and assesses the costs and feasibility of each alternative. The results of the design report were further discussed with the resource agencies and Technical Advisory Committee to identify the alternatives that should be carried forward in the environmental analysis. The bank protection alternatives described in Section 2.2 were the outcome of the combined efforts of the feasibility study; modeling; alternatives design; and collaboration between multiple agencies, stakeholders, and the public.

River Partners completed a *Riparian Restoration Feasibility Study for the Riparian Sanctuary* in 2005 to investigate the feasibility of restoration and management of the 950-acre Riparian Sanctuary (River Partners 2005). Three alternatives were evaluated (no-action, full planting, and site-specific planting), and approximately 400 acres of the Riparian Sanctuary were deemed suitable for restoration activities. The benefits and disadvantages of each alternative were assessed, and the full planting alternative was eliminated from further consideration because it would not meet flood control objectives at the Riparian Sanctuary.

2.2 Description of Alternatives

This section describes the No-Action Alternative and three action alternatives derived from the *Draft Design Alternatives Report* (Ayres Associates 2010b) and the *Riparian Restoration Feasibility Study for the Riparian Sanctuary* (River Partners 2005). The alternatives selected for evaluation and assessed in this document represent a reasonable range of alternatives, as required by the National Environmental Policy Act (NEPA). An overview of the construction methods and standard practices that would be used to implement the action alternatives is provided at the end of this section. Alternatives considered but eliminated from further evaluation are discussed in Section 2.4. Table 2-1 summarizes the features of each alternative described in detail below.

Table 2-1. Summary of Alternatives Features

Alternative	Bank Protection Measure	Restoration Activity
Alternative 1: No-Action Alternative	No specific measures	Weed removal and natural recruitment
Alternative 2: Spur Dikes and Site-Specific Plantings	Spur dikes	Site-specific plantings across Riparian Sanctuary
Alternative 3: Traditional Riprap and Site-Specific Plantings	Traditional riprap with or without low berm	Site-specific plantings across Riparian Sanctuary
Alternative 4: Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings	Traditional riprap with or without low berm and upstream rock removal	Site-specific plantings across Riparian Sanctuary

2.2.1 Alternative 1: No-Action Alternative

Under the No-Action Alternative (Alternative 1), bank protection measures and restoration activities would not be implemented in the project area. The existing revetment on the north side of the peninsula (2,450 linear feet at RM 179.4) and along Camp 2 Bend just north of the Riparian Sanctuary (4,860 linear feet at RM 178.5) would be left in place, and maintenance responsibilities would not change. No additional revetment would be installed along the Sacramento River adjacent to the Riparian Sanctuary to protect the PCGID-PID pumping plant and fish screen facility. Figure 2-1 shows the locations of the existing revetment in relation to the Riparian Sanctuary.

The upstream revetment at Camp 2 Bend (RM 178.5) and on the peninsula (RM 179.4) is part of the Sacramento River Bank Protection Project and Sacramento River Flood Control Project and was originally part of the Butte Basin overflow area flood control plan (Woodward-Clyde Consultants 1986).

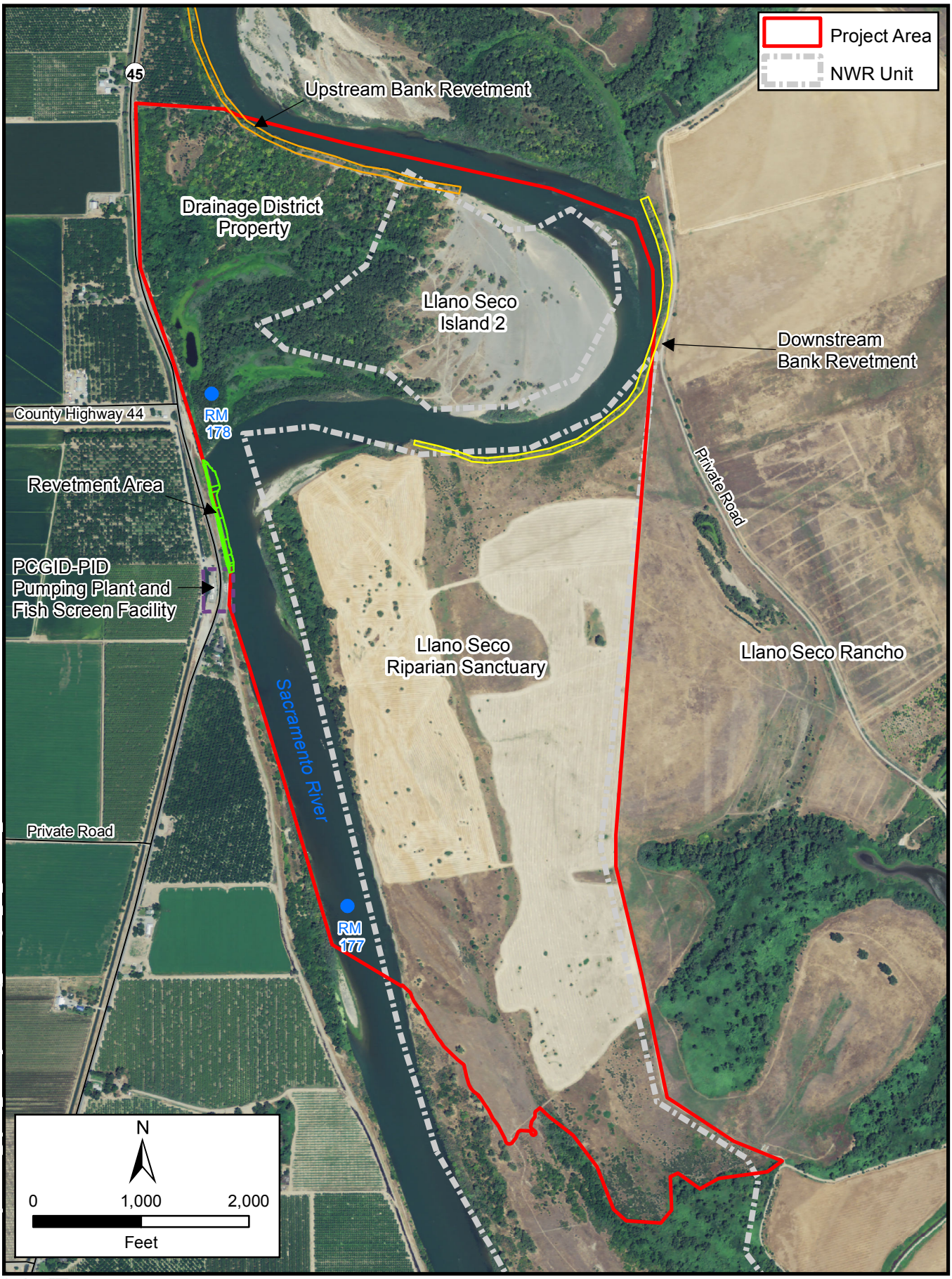
Operation and maintenance responsibility of the revetment at RM 178.5 on the left bank and at RM 179.4 on the right bank was transferred to the State (California Department of Water Resources (DWR)) from the U.S. Army Corps of Engineers (Corps) in 1986 under an agreement that requires the State to maintain the revetment in perpetuity. These revetment projects are subject to the Supplement to Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project, Unit No. 140 (U.S. Army Corps of Engineers 1960). The manual states that repairs for serious damage of the revetment in the event of a flood or other cause will be based on the actions recommended by DWR. Guidance is provided on inspections of the revetment to determine the need for repairs. In the event that the revetment is lost, the State has a legal responsibility to restore it to as-built conditions that existed in 1986. Documentation on as-built conditions may come from as-built drawings, but in the event that such drawings are known to differ from actual conditions, the State obligations would need to be clarified through negotiations with the Corps. The level of ongoing maintenance for each revetment project reflects resource limitations and prioritization of projects and decisions.

As part of ongoing maintenance of the pumping plant and fish screen facility, PCGID-PID may need to periodically clean the fish screens, replace damaged or worn facility components, and remove vegetation around the facility to ensure that it continues to operate as designed. If new or larger maintenance activities are needed in the future, such as dredging in front of the facility to remove sediment, these actions would be evaluated in separate environmental documents, as appropriate. As the Sacramento River changes its course over time, emergency measures may need to be implemented to protect the facility. Under the No-Action Alternative in this document, no future bank protection actions are assumed, and if emergency action becomes necessary, it would be part of a separate action.

No specific restoration activities would be implemented at the Riparian Sanctuary, but current weed control practices, which include planting and managing row crops and using herbicides, would continue to be implemented by the Service. Revegetation of the Riparian Sanctuary would rely on natural recruitment of plants that are currently present in and near the project area, which are primarily non-native species.

2.2.2 Alternative 2: Spur Dikes and Site-Specific Plantings

Under Alternative 2, bank protection measures would consist of installing spur dikes along the Sacramento River on the northern side of the Riparian Sanctuary, and restoration activities on the Riparian Sanctuary would consist of site-specific plantings across the entire site. Management of the upstream revetment would be the same as described under Alternative 1. Implementation of these activities would involve the applicable construction methods and standard practices described in Section 2.2.5. The bank protection measures and restoration activities are described below.



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 2-1
Existing Revetment Near Project Area

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Spur Dikes

An in-channel dike field consisting of eight rock spur dikes would be installed between the downstream end of the existing revetment and the apex of the bend at the northwest end of the Riparian Sanctuary to hold the river's current alignment (Figure 2-2). The dike field would extend about 2,000 feet along the river. The dikes would be spaced 225 feet apart, and each dike would extend 75 feet out from the bank, perpendicular or transverse to the flow of the river, and be about 60 feet wide at the ground level, narrowing to 12 feet at the top. Most of the dikes would be located on an existing gravel bar that is exposed during low water levels, and they would become partially inundated as water levels increase. The dikes would be approximately 20 feet high, which is two-thirds the height of the bank at the bank line, and would slope down into the river. Each dike would require approximately 1,125 cubic yards of riprap, which is equivalent to 1,520 tons (approximately 12,160 total tons of riprap).

The dikes are not designed to redirect the flow toward the pumping plant, but they would prevent further bank erosion and maintain the existing alignment of the Sacramento River between the northern side of the Riparian Sanctuary and the pumping plant and fish screen facility, assuming the upstream revetment along the north side of the peninsula continues to protect that reach and the peninsula is not cut off. The spur dikes would include areas of soft riverbank between the dikes for continued natural regeneration of riparian forest.

Construction of the spur dikes would take approximately 5 weeks for installation of the dikes and between 4 months and 1 year for overall activities, including preparation, worker training, staging, and related activities. This bank protection measure is expected to provide long-term protection for the pumping plant and fish screen facility (50 years) as long as the upstream revetment is maintained and the river does not cut off the peninsula. An upstream cut off would reduce the length of time the spur dikes are effective.

Restoration

Approximately 400 acres of the Riparian Sanctuary would be restored to native riparian habitat to benefit wildlife and achieve the goals of the Service for managing the land. The restoration method would integrate modern farming practices and ecological science, while the restoration design would accommodate bank protection measures and incorporate flood control objectives. Planting locations and species would be influenced by site-specific conditions, such as where flooding or future changes to the river corridor may occur. Once established, native plants would be expected to outcompete non-native plants, limiting the potential for non-native plants to invade the site and reducing long-term maintenance efforts. Details of the restoration activities are available in the *Riparian Restoration Feasibility Study for the Riparian Sanctuary* (River Partners 2005) and in Appendix C.

The restoration design incorporates a range of tree densities across the Riparian Sanctuary (Figure 2-2, Table 2-2). Tree densities would range from low to high, with higher densities along the Sacramento River on the west side of the Riparian Sanctuary and on the east side of the Riparian Sanctuary and lower densities along a flood conveyance channel through the center of the Riparian Sanctuary. In the lower tree-density areas, native grasses, forbs, vines, shrubs, and occasional trees would be planted to provide relatively open cover for floodwater conveyance. The design includes a high proportion of shrubs, vines,

and understory species that match well with the site conditions and would provide important structural features and nesting habitat for wildlife species. Once established, these plants provide less resistance to flow than trees and limit the invasion of invasive plants, such as giant reed, that may pose a greater threat to floodwater conveyance.

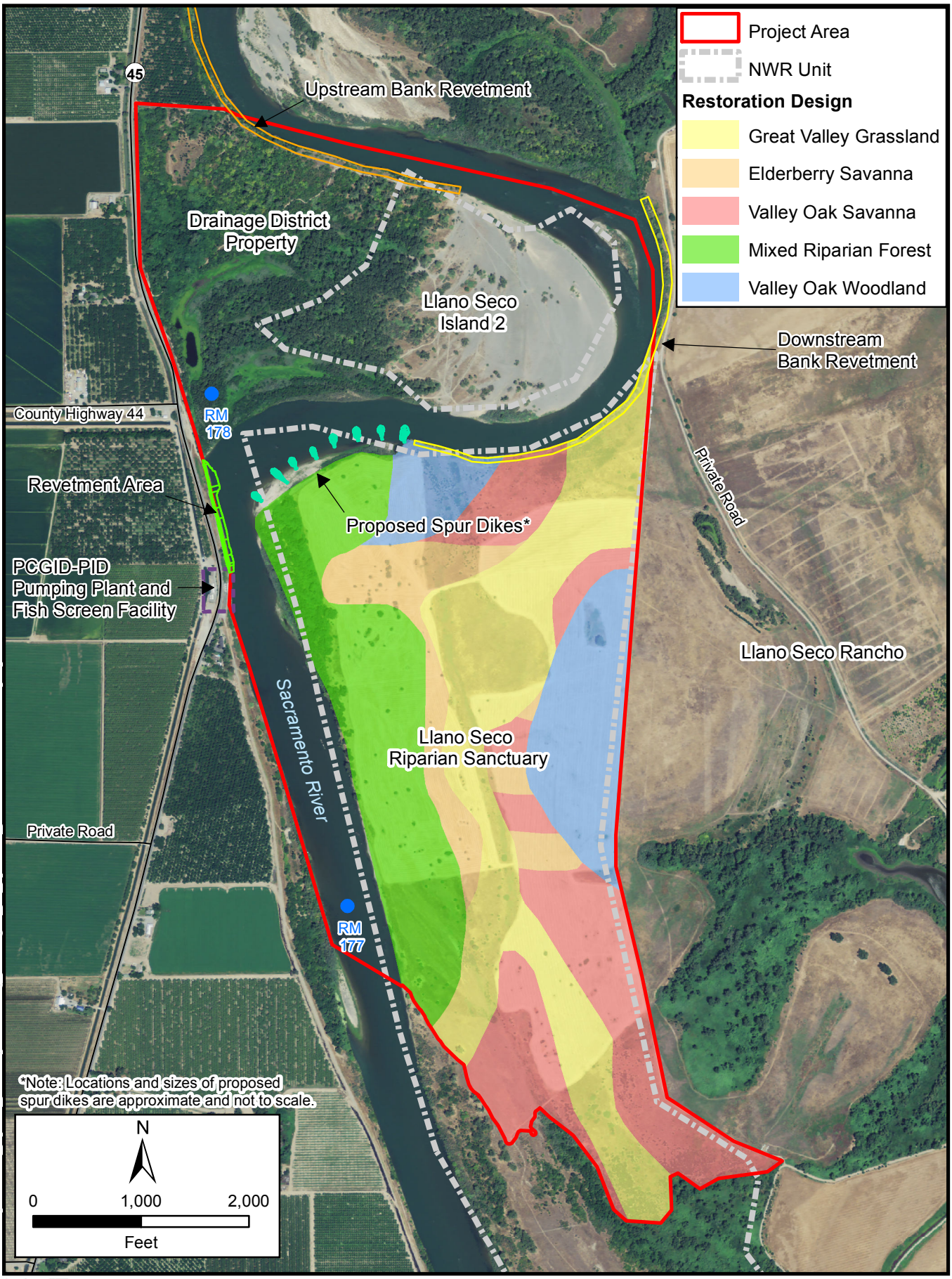
Table 2-2. Tree Densities and Design Considerations for Restoration of the Riparian Sanctuary

Tree Density/ Community	Range of Tree Density (trees/acre)	Approximate Acreage	Design Considerations (Physical and Biological Parameters)
Low/Great Valley Grassland	6	116 acres	▪ Serves as flood conveyance corridors and firebreak ▪ Concentrated along open areas, swales, and drainage ways ▪ Provides a distinct habitat type for wildlife and reduces competition from non-native understory grasses and forbs ▪ Plants propagate vegetatively and provide a variety of brush habitat for wildlife ▪ Vegetation to consist of flexible, multi-stemmed plants
Medium/ Elderberry and Valley Oak Savanna	33-37	134 acres	▪ Designed for flood conveyance ▪ Concentrated in central portion of the Riparian Sanctuary, adjacent to grasslands
High/Valley Oak Woodland and Mixed Riparian Forest	104-122	149 acres	▪ Concentrated near existing riparian habitat ▪ Provides a mixture of fast-growing species and slow-growing species, offering short-term and long-term wildlife habitat and providing bank stabilization

Source: River Partners 2005 and Appendix C

Other considerations in the restoration design include planting elderberry shrubs away from long-term maintenance areas to minimize potential conflicts (i.e., compliance with the Endangered Species Act) and planting plants with extensive root networks (e.g., grasses and willows) along the north bank to increase the shear strength of the soil and reduce erosion. Although the design does not maximize tree cover and structure, the diversity of vegetation and structure would support a variety of fish and wildlife (including endangered and threatened species, anadromous fish, and migratory birds), enhance habitat in adjacent conservation areas, and reduce the potential for invasive non-native plants to become established over the long term, while maintaining adequate floodwater conveyance.

Restoration activities would include preparing the site, planting native plants, irrigating plants for the first 3 years, and monitoring and managing the restored areas. As part of the design, an access road would be established along the northern side of the Riparian Sanctuary to provide access to the restoration areas as well as to the bank protection measures for maintenance (see Section 2.2.5, Construction Overview for Bank Protection Measures).



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 2-2
Alternative 2: Spur Dikes and Site-Specific Plantings

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Prior to planting activities, the following site preparation activities would be implemented:

- The Pacific Gas and Electric Company underground gas pipeline would be marked, so it can be avoided and protected during planting activities.
- Existing native plants (larger than 3 feet tall), elderberry shrubs, and large patches of native plants (typically larger than 100 square feet with more than 90 percent cover) would be flagged or protected with fencing or other measures to minimize potential damage during restoration activities. The native vegetation would be incorporated into the restoration design and preserved, to the extent feasible. For elderberry shrubs that must be removed, a mitigation plan would be prepared.
- Flood debris would be cleaned up, and the areas to be restored would be disked and floated to smooth the surface for irrigation and tractor operations (mowing and spraying).
- Areas to be planted with herbaceous species would be sprayed and mowed for two seasons before planting.
- Areas with non-native plants would be sprayed with herbicides approved by the Service. All spraying would be implemented according to county and state permitting and reporting requirements and label specifications. Herbicides may include Roundup (glyphosate), 2,4-D, Milestone (milk thistle), Rodeo (for areas adjacent to water bodies), Garlon (for woody species control), and Habitat/Polaris (for giant reed control).

Plant material would be collected from local Sacramento River ecotypes using a variety of plant propagation techniques or would be obtained from local nursery stock. Planting plans would be developed based on the best season for planting the individual species, availability of the plant material, and the type of plant material. For example, the planting of cottonwood and willow cuttings is best done in January or February when the trees are dormant. Acorns should be planted directly into the field during the fall. For nursery-grown plants, a lead time of 12 to 18 months is required from time of material collection to transplant. Nursery material should be planted in the spring or fall when weather conditions are cool and moist. Table 2-3 lists plant species that may be used in each plant community.

Table 2-3. Preliminary Plant List for Restoration of the Riparian Sanctuary

Tree Density	Holland Type	Sawyer and Keeler-Wolf Classification	Preliminary Species List
Low	Great Valley Willow Scrub	Arroyo Willow Series	Sandbar willow, black willow, arroyo willow, mulefat, buttonbush, elderberry, California wild rose, coyote brush, clematis, Fremont cottonwood, mugwort, gumplant, goldenrod, showy milkweed, stinging nettle, California blackberry, California wild grape, poison oak, Santa Barbara sedge, deer grass, Dutchman's pipevine, valley oak
	Mule Fat Scrub	Mulefat Series	
	Valley Wildrye Grassland	Creeping Ryegrass Series	Creeping wildrye, purple needlegrass, blue wildrye, meadow barley

Table 2-3. Preliminary Plant List for Restoration of the Riparian Sanctuary

Tree Density	Holland Type	Sawyer and Keeler-Wolf Classification	Preliminary Species List
Medium	Elderberry Savanna	Mexican Elderberry Series	Valley oak, elderberry, box elder, poison oak, creeping wildrye, Santa Barbara sedge, deer grass, coyote brush, California rose, clematis, Dutchman's pipevine, western sycamore, Oregon ash, mugwort
	Valley Oak Savanna	Valley Oak Series	
High	Great Valley Cottonwood Riparian Forest	Fremont Cottonwood Series	Fremont cottonwood, black willow, arroyo willow, sandbar willow, valley oak, box elder, Oregon ash, western sycamore, buttonbush, California wild grape, California blackberry, California wild rose, elderberry, coyote brush, mugwort, creeping wildrye, Santa Barbara sedge, clematis, Dutchman's pipevine
	Great Valley Mixed Riparian Forest	Fremont Cottonwood Series	
	Great Valley Valley Oak Riparian Forest	Valley Oak Series	
	Valley Oak Woodland	Valley Oak Series	Valley oak, elderberry, box elder, poison oak, creeping wildrye, Santa Barbara sedge, deer grass, coyote brush, California rose, clematis, Dutchman's pipevine, western sycamore, Oregon ash, mugwort

Source: River Partners 2005

Approximately 55,500 woody plants would be planted on the Riparian Sanctuary, and approximately 325 acres would be planted with native grasses and herbaceous plants, including low-density areas and understory openings within the medium- and high-density areas. Initial planting of woody plants would take place in the fall (oaks and nursery stock) and would continue through winter and spring (direct cuttings). Some plants may need to be replanted based on monitoring results after the first year, but the overplanting of plants is expected to reduce the need to replant.

Native grasses would be planted at a seeding rate of 12 to 15 pounds per acre with a no-till drill. Plugs of native grass and sedge species that do not reproduce well by seed (i.e., Santa Barbara sedge and deer grass) or grow well vegetatively (creeping wildrye) would be used. Mugwort and gumplant would be propagated by direct seeding similar to that of native grasses between the months of December and February. Golden rod, showy milkweed, and stinging nettle would be grown in the nursery (from Sacramento Valley ecotypes) and planted as plugs.

Following the plantings, the restored areas would be irrigated for the first 3 years to maintain soil moisture until the plants are self-sufficient, and weed control and herbivore protection efforts would be implemented during the first 3 years. A groundwater well would be installed at the Riparian Sanctuary to pump water through a drip line system along the rows of plantings. Details on the well will be determined during final design, and the depth of the well would depend on the depth to ground water at the site. A diesel-powered generator is expected to be used to supply power to the well during its operation. The drip line system would be oriented in a north-south direction along the rows of plants with three emitters per plant spaced 12 inches apart. The drip line system would consist of underground main lines and aboveground components. The design flow estimate is 0.6 gallon per hour per emitter (approximately 1.8 gallons per plant per hour). Design of the watering system would comply with

applicable federal, state, and county laws and ordinances. The aboveground components of the system would be removed at the end of the 3-year period, and the groundwater well may be removed or converted to a solar powered pump to be used for cattle water on nearby lands or for long-term vegetation and conveyance management at the discretion of the Service.

Herbicides approved by the Service would be used to control weeds along tree rows. For woody invasive plants, manual removal and increased herbicide treatments would be required. Spraying and mowing should be implemented every 3 to 6 weeks during the growing season for at least the first 2 years. The Riparian Sanctuary would be monitored regularly to assess damage, if any, caused by herbivores. Herbivore control measures may include installing barriers around trees, implementing weed control measures, and disking/mowing.

The restored areas would be monitored monthly for 3 years after the plantings, which would consist of:

- monthly field reports,
- end-of-season monitoring,
- annual photo points,
- annual end-of-season memos, and
- final report.

2.2.3 Alternative 3: Traditional Riprap and Site-Specific Plantings

Under Alternative 3, bank protection measures would consist of installing riprap with or without a low berm along the Sacramento River on the northern side of the Riparian Sanctuary, and restoration activities on the Riparian Sanctuary would consist of site-specific plantings across the entire site. Implementation of these activities would involve the construction methods and standard practices described in Section 2.2.5. The bank protection measures are described below, and the restoration activities would be the same as described for Alternative 2. Management of the upstream revetment would be the same as described under Alternative 1.

Traditional Riprap

Traditional riprap revetment would be installed along the existing Sacramento River bank from the end of the existing riprap, along the northwestern side of the Riparian Sanctuary, to a point almost directly across from the pumping plant and fish screen facility, extending 2,500 or 2,700 feet along the riverbank, depending on the berm option, to protect the riverbank from further erosion (Figure 2-3, Figure 2-4). This revetment includes two options: excavating a toe trench without a low berm or installing a low berm. Both options are described below.

The riprap revetment would use a layer of bank armor to protect the riverbank from further erosion and would mostly follow the existing bank line. This work would require sloping (cutting back) the existing near-vertical eroding bank to a slope that would allow the stable placement of rock riprap. The riprap would be extended to a depth of at least 5 feet below the existing average thalweg (low point of the river) to prevent undercutting during high flows. The average top of armor elevation would be 95 feet (the top of bank elevation is approximately 100 feet National Geodetic Vertical Datum), and the minimum

thickness would be 3 feet. The armor would contain an adequate mix of soil and sand materials to support woody vegetation on the finished rock slope. Vegetation removal for installation of the riprap would be limited to the minimum necessary for access and installation of the riprap.

Construction of the riprap would take approximately 5 weeks for in-water work, 10 to 12 weeks for all construction, and about 4 months to 1 year for overall activities, including preparation, worker training, staging, and related activities. The bank protection measures would be expected to provide long-term protection for the pumping plant and fish screen facility (50 years) and would be expected to hold the river in place even if the upstream reach cuts through the peninsula.

No Berm

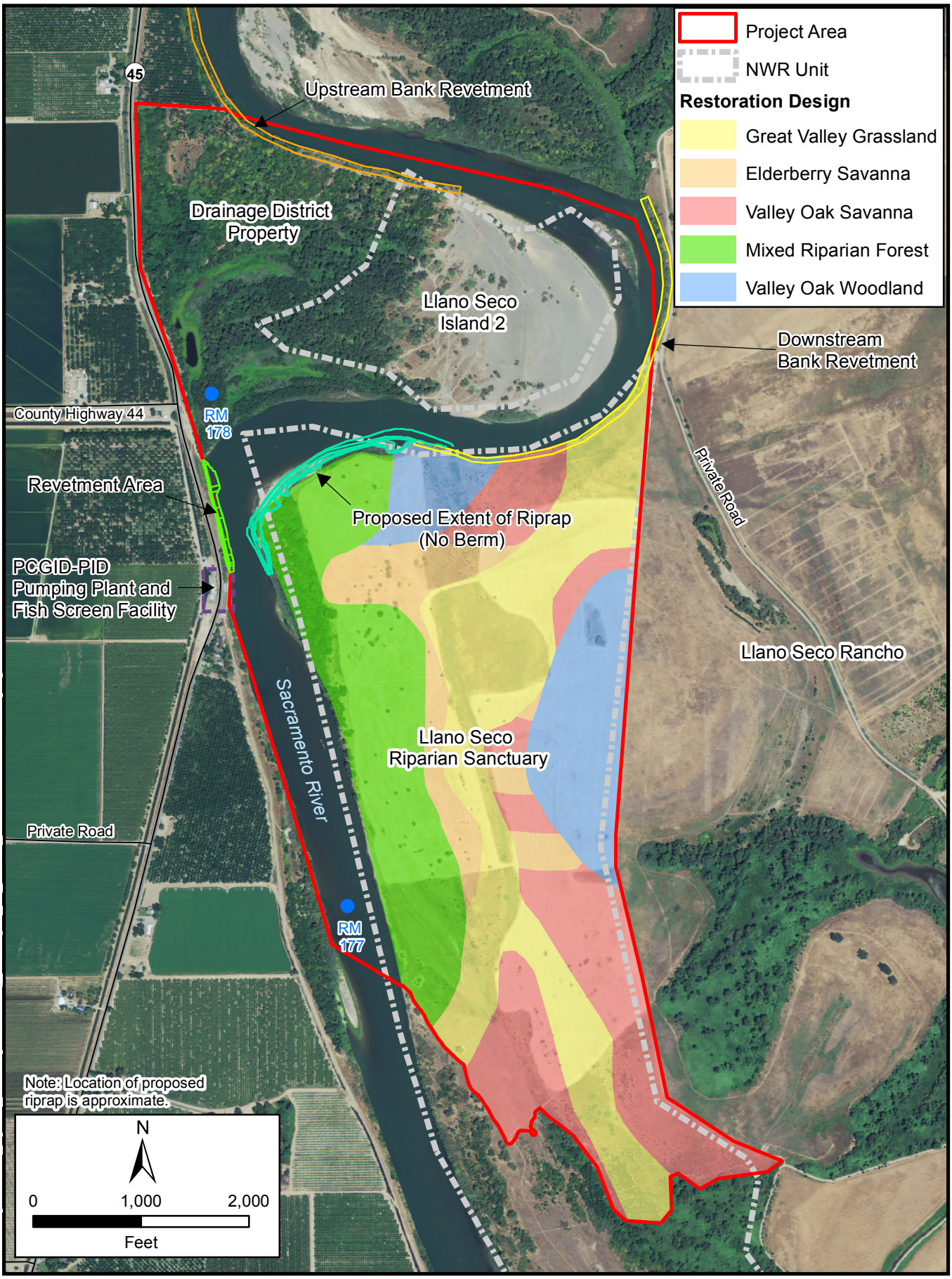
Under the no berm option, a toe trench would be excavated a minimum of 3 feet below the river thalweg and backfilled with sand and gravel to provide scour protection. The foundation excavation for the toe trench would be quite extensive and would take place during the summer. Excavation below the summer mean water level would be done slowly to minimize water quality issues, resulting in a longer construction period. It is expected that approximately 66,000 cubic yards of material (89,100 tons) would be excavated for the toe trench. Installation of the riprap and backfill would require approximately 36,000 tons of quarry stone and 20,000 tons of soil-filled quarry stone. Under this option, the riprap revetment would extend a total distance of about 2,500 feet along the riverbank and would extend approximately 100 feet out from the bank (Figure 2-3). Most of the revetment would be along the existing gravel bar, and some excavation activities and revetment installation would take place just off the gravel bar on the upstream and downstream sides. Activities for the no berm option would not extend further into the river than the width of the gravel bar, as it is exposed during low water levels.

Low Berm

The low berm option would include the riprap revetment and a low berm just above or at the summer water level to provide for a smooth flow line alignment, scour protection for the toe of the armor, a reservoir of stone materials as erosion occurs at the toe, and a low-level planting surface for extending riparian vegetation close to the summer water line. The edge of the low berm would follow a smooth curve alignment along the entire site while the bank armor above the berm would be against the existing eroded bank and would be placed among the existing trees to minimize removal of riparian vegetation. The low berm option would involve minimal bank excavation and would not require toe trench excavation. The low berm would extend approximately 150 feet out from the bank and 2,700 feet along the riverbank, and some of the berm would extend beyond the existing gravel bar (about 50 feet into the river at low water levels) (Figure 2-4). Installation of the riprap and low berm would require approximately 44,400 tons of quarry stone and 24,750 tons of soil-filled quarry stone.

Restoration

In addition to the site-specific plantings described under Alternative 2, revegetation is proposed on both the bank and low berm areas under this alternative. The low berm option provides an additional area suitable for planting riparian vegetation or allowing natural recruitment. If native vegetation is planted, it would come from the same local stock as described for the site-specific plantings, and the irrigation system would be extended to include the additional planted areas.



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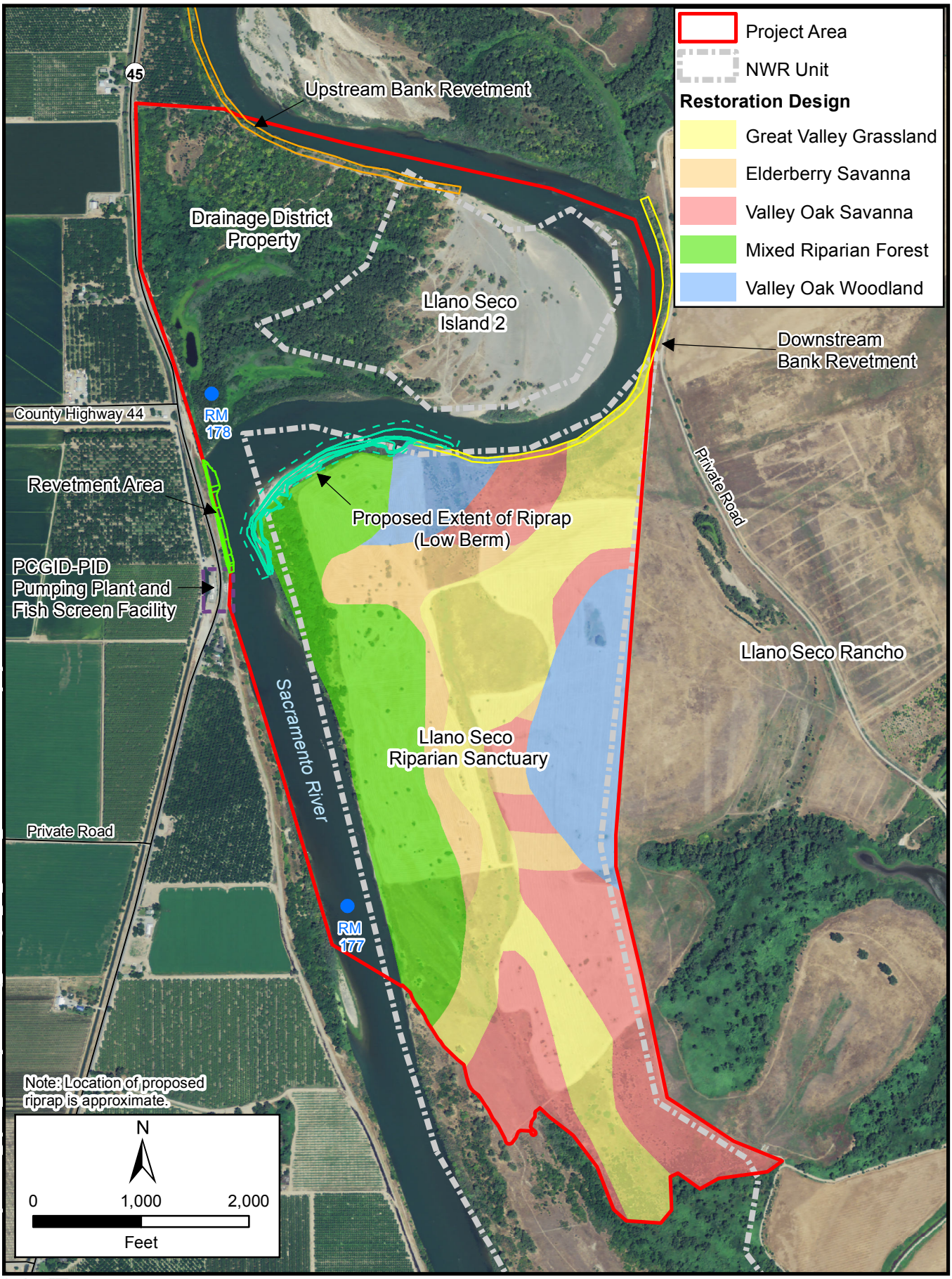
North State Resources, Inc.

Riparian Sanctuary Project

Figure 2-3
Alternative 3: Traditional Riprap (No Berm) and Site-Specific Plantings



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 2-4
Alternative 3: Traditional Riprap (Low Berm) and Site-Specific Plantings

2.2.4 Alternative 4: Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, bank protection measures would consist of installing riprap with or without a low berm along the Sacramento River on the northern side of the Riparian Sanctuary and removing upstream revetment along the peninsula, and restoration activities on the Riparian Sanctuary would consist of site-specific plantings across the entire site. Implementation of these activities would involve the construction methods and standard practices described in Section 2.2.5. The installation of the traditional riprap with or without the low berm would be the same as described for Alternative 3, and the restoration activities would be the same as described for Alternative 2.

A portion of the existing upstream bank revetment along the north side of the peninsula would be removed, mostly on the Sacramento-San Joaquin Drainage District (Drainage District) property with some removal on the Llano Seco Island 2 refuge unit (Figure 2-5). Approximately 24,500 cubic yards of rock (33,075 tons) are expected to be removed from the upstream bank revetment along approximately 2,260 feet of bank. Removal of the revetment would encourage a natural progression of streambank erosion and large woody debris recruitment while providing habitat for bank swallows that historically occurred in the area. An eventual cut off of the oxbow is predicted to occur naturally within 50 years (Larsen 2004) and would occur sooner with the removal of revetment and if a major flood event takes place. Scour holes behind the existing upstream revetment indicate flow is passing through the revetment, and the removal of revetment would expand the scour holes and eventually cut off the peninsula to create an abandoned oxbow channel segment (Mussetter Engineering, Inc. 2004). This cut off would allow the river to flow parallel to the pumping plant and fish screen facility, which is the desired alignment for the fish screen to properly function, and the traditional riprap on the northern side of the Riparian Sanctuary would hold the river in place to prevent it from migrating further east, away from the facility.

A 20-foot-wide road would be cleared from SR 45 to the existing revetment along the existing access road, which would require vegetation removal and grading. The revetment would be removed by working from the top of the bank with a hydraulic excavator that would reach down the slope between existing woody vegetation to scrape as much of the stone materials off the existing bank as it can reach. All excavated materials would be placed in a truck and immediately hauled off-site to a proper disposal facility or another location for recycling or re-using, or they would be re-used at the Riparian Sanctuary or to protect the upstream private property adjacent to the Drainage District property. Some of the rock would be placed at the existing ground elevation along the adjacent private property, extending between 500 and 700 feet, to protect the private property when the river cuts off (Figure 2-5). This rock would serve as a training levee to prevent scour along the private property, which could happen at the end of the existing riprap once the river cuts off. Remaining rock may be used for the traditional revetment, if authorized. Native grasses may be planted in areas where rock is removed to provide erosion control.

Removal of the upstream revetment would require authorization from the Corps and DWR (Central Valley Flood Protection Board). The Corps installed the revetment in 1985 and 1986 as part of the Sacramento River Bank Protection Project, and operation and maintenance responsibility was transferred to DWR in 1986. The revetment was installed initially for the greater protection of levees along the river,

and it specifically protects the levee just upstream of the PCGID-PID pumping plant and fish screen facility. The Corps would need to issue a letter of permission pursuant to Section 14 of the Rivers and Harbors Act (33 United States Code 408, also referred to as Section 408) to allow the existing revetment to be modified, and the Central Valley Flood Protection Board may need to issue an encroachment permit for the activities.

2.2.5 Construction Overview for Bank Protection Measures

This section presents an overview of the construction methods, processes, and standard practices that would be used to install the bank protection measures described for Alternatives 2 through 4. Generally, the construction process would consist of the following:

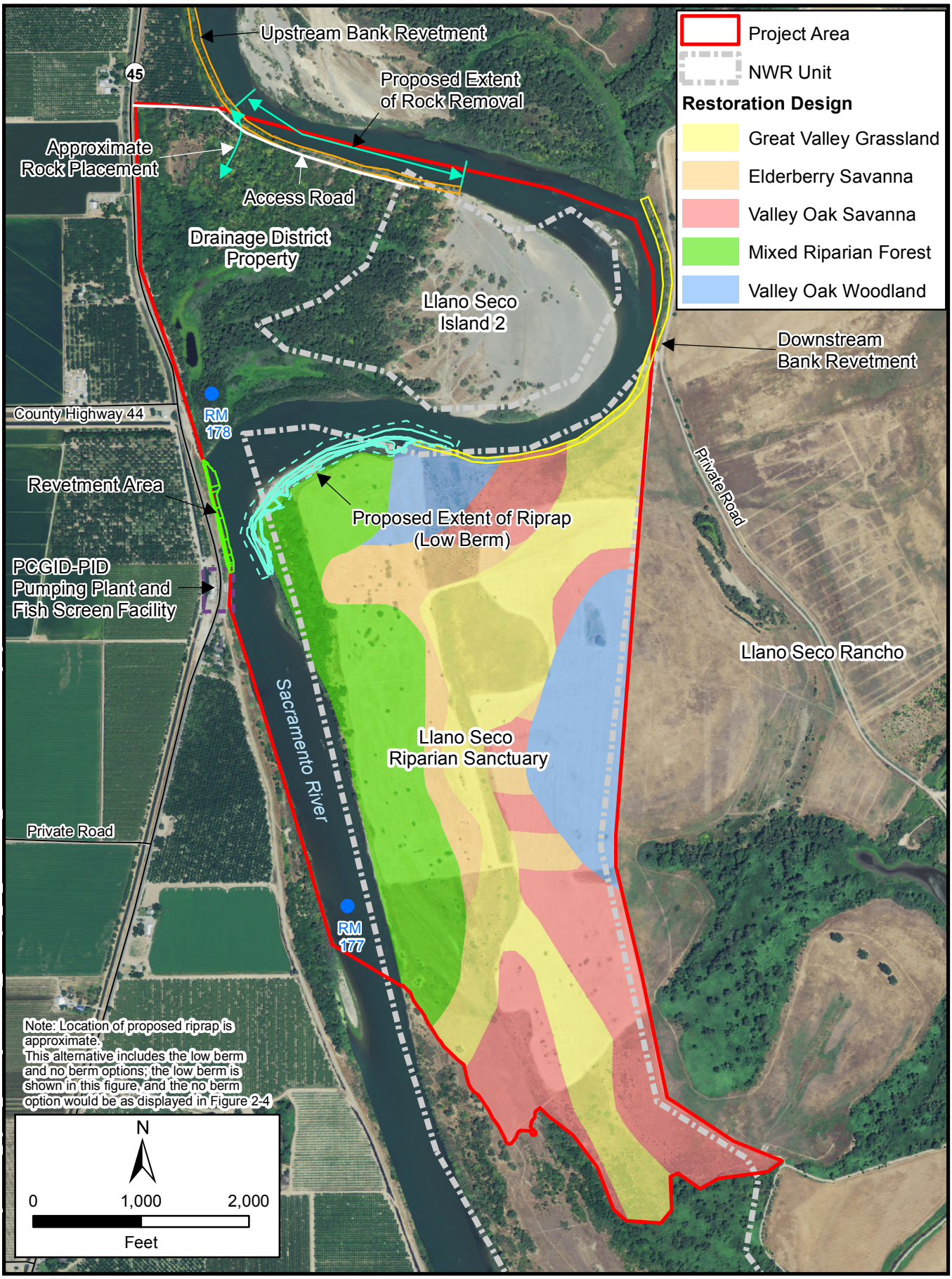
- designating staging areas,
- implementing safety measures and response plans for best management practices,
- hauling materials and equipment to the project area,
- preparing the banks of the Sacramento River for construction,
- installing and excavating rock from the land,
- removing excavated and excess materials and equipment from the project area, and
- monitoring and maintaining the bank protection measure.

Construction activities would begin as soon as the necessary environmental approvals are obtained and funding has been authorized. Construction would likely take place between April 1 and November 30, with in-water construction activities limited to August 1 to October 31. No construction would be permitted during the winter months (i.e., December through March). The anticipated construction season may need to be modified to respond to high water levels in the river or other environmental constraints. Construction would take place during normal working hours (7 a.m. to 7 p.m.) Monday through Friday to minimize disruptions to nearby land uses. All construction activities, including pruning and trimming of vegetation, would be supervised by a qualified biologist.

Staging Areas and Access

Staging areas would be designated in previously disturbed areas or along the tops of the banks with easy access to the river bank and access points. The staging areas would be used for staging of vehicles, fuels, materials, and other associated construction equipment needed throughout the construction period (including installation of bank protection measures and restoration activities). Materials and equipment would be brought to the project area via surface roads (landside). Trucks and vehicles would access the Riparian Sanctuary via State Route (SR) 162 or SR 45 from Interstate 5 or SR 99 and via local private roads on the east side of the Sacramento River, including on the Llano Seco Rancho. Landside access to the peninsula is via SR 45 and across Drainage District land.

An existing dirt road across the northern side of the Riparian Sanctuary would be used as the primary access for construction of the bank protection measure. Access to the river bank on the peninsula would be via an existing road. Internal access within the project area would be restricted to disturbed areas once initial site preparation activities have commenced.



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 2-5

Alternative 4: Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

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The existing road through the northern portion of the Riparian Sanctuary would need to be cleared of vegetation (to a width of approximately 20 feet) and may be improved (graded and possibly laid with gravel) to accommodate heavy equipment and trucks.

Adjacent landowners (i.e., Llano Seco Rancho and the Drainage District) would be notified prior to access across their land, and the necessary authorizations (e.g., access easement agreement, road maintenance agreement) would be obtained to ensure minimal disruptions to their land and daily activities. The agreements would contain measures to minimize dust on private roads by maintaining low vehicle speeds and watering roads, provide proper notification in advance of construction access, maintain access for agricultural traffic, maintain roads in good condition by grading or laying gravel to improve roads disturbed by construction traffic, and other measures negotiated with the landowners.

Construction materials, including quarry stone, would be hauled from a commercial or previously permitted quarry or borrow site located within 100 miles of the project area. Trucks are anticipated to be able to haul 20 tons per truck, and up to six trucks would be expected per hour to the project area. Construction signs would be posted along the haul routes in the immediate vicinity of the project area, and flaggers may be used to minimize traffic problems and ensure public safety during construction. Warning buoys would be placed in the river at the up- and downstream boundaries of the project area for the safety of boaters and other water users.

Site Preparation

Site preparation activities would include the removal or protection of vegetation along the banks of the Sacramento River where riprap or rock would be installed or removed. Some trees may need to be trimmed, and the trees to be avoided may be wrapped with layers of a protective fabric or protected with plywood boxes. Elderberry shrubs at the Riparian Sanctuary, which provide habitat for the federally listed valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), would be protected in place, and a mitigation plan may need to be prepared to identify measures to transplant or replace removed elderberry shrubs on the peninsula.

Invasive plants would be removed using mechanical or chemical treatments or a combination of the two. Vegetation would be cleared to the ground surface, and large tree roots would be removed. Vegetation removed from the site would be used for restoration activities or chipped and taken to an appropriate disposal/recycle facility. Most vegetation removal would be scheduled between late spring and early fall.

Protective fencing would be installed around sensitive resources, such as elderberry shrubs, and around areas to be avoided during construction. Signs and fencing would be used to delineate the construction area and any protected areas.

Construction Activities

Landside construction would require the use of a dump truck to place the rock along the bank and an excavator to move and shape the rock. For the spur dikes, the following activities would be implemented:

- One spur dike would be constructed at a time.

- A ramp would be built from the landside to the location of the spur dike; it would be built around preserved vegetation.
- Rock would be dumped at the end of the ramp by a dump (haul) truck.
- An excavator would work from the ramp to shape, groom, and redistribute the rock to form the spur dike.
- No equipment would work in the water, although the bucket of the excavator would need to move rock in the water.

For the traditional riprap, the following activities would be implemented:

- A platform would be built along the bank to serve as a ramp and access point for the dump trucks and excavator; it would be built around preserved vegetation.
- Rock would be dumped along the platform on the waterside by a dump (haul) truck.
- An excavator would work from the platform to shape, groom, and redistribute the rock to form the revetment.
- No equipment would work in the water, although the bucket of the excavator would need to move rock in the water.
- Once rock is built up to the water level, the dump truck and excavator would work from the river bank and landside to continue building the riprap.
- For the no berm option, the excavator would work from the platform to excavate material from the waterside for the toe trench and backfill to shape the scour protection; the excavation would be alternated with building the riprap to minimize water quality concerns.

Specific measures and best management practices to minimize water quality effects would be identified in a Stormwater Pollution Prevention Plan, and applicable water quality permits would be obtained. Measures would include, but are not limited to:

- Monitoring water quality in the Sacramento River upstream and downstream of the project area to track turbidity levels and other parameters, as appropriate.
- Preventing any substances that could be hazardous to aquatic life from contaminating the soil or entering water courses.
- Establishing a spill prevention and response plan before project construction that includes strict on-site handling rules to keep construction and maintenance materials out of waterways.
- Training all construction personnel in the proper use and cleanup of potentially hazardous materials.
- Cleaning up all spills immediately according to the spill prevention and response plan and notifying the Service immediately of spills and cleanup procedures.
- Providing staging and storage areas for equipment, materials, fuels, lubricants, solvents, and other possible contaminants away from water courses and their watersheds.
- Seeding disturbed areas, including staging areas, with native plants following construction or incorporating disturbed areas into the restoration design, as described under Alternative 2.
- Properly disposing of materials removed from the project area.

- Implementing measures to prevent the spread of invasive plants or noxious weeds into the project area (e.g., washing construction equipment and trucks before entering the area, using certified weed-free products for erosion control and fill material).

Maintenance Activities

Following construction, the following maintenance activities would be the responsibility of PCGID-PID, or an entity designated by PCGID-PID, in coordination with the Service:

- The overall condition of the affected reach of the Sacramento River would be inspected annually. Inspections would be performed on foot along the top of the bank or by boat to view the lower portions of the revetment or spur dikes if the toe is obstructed.

- The condition of the revetment or spur dikes would be noted, especially any movement of rock particles or indications of toe scour.

- Particular attention would be paid to the conditions of the transitions and end points. These are areas of higher turbulence and may need extra attention in the early stages of the measure's lifespan.

- The overall flow path of the main stem of the Sacramento River would be documented to monitor any changes in river thalweg alignment.

- Locations of debris buildup would be noted. Large amounts of buildup would be dispersed to eliminate eddy currents that may affect performance of the bank protection measure.

- All observations would be documented in a log with photodocumentation so that subsequent inspections can monitor the progression of any changes. An annual report should be prepared documenting all inspection and maintenance activities.

- Additional inspections would be performed after every flow greater than bankfull.

- Repairs, such as the addition of rock, would be done in the low-flow period following any damage. Delayed maintenance would be likely to worsen the problem and compromise the integrity of the entire bank protection measure. For repairs that PCGID-PID cannot complete alone, the districts would coordinate with other state and/or federal agencies, as appropriate, to obtain funding and implement the repairs.

- If trees overturn and cause a cavity in the revetment or spur dike layer, the cavities would be re-filled if bare bank is exposed. The overturned tree may or may not need to be removed, depending on safety and turbulence effects.

2.3 Comparison of Alternatives

This section compares the environmental impacts of the alternatives described above based on the analysis presented in Chapter 3 and discusses the preferred alternative, environmentally superior alternative, and least environmentally damaging practicable alternative. Table 2-4 presents a ranking of the alternatives, including the no berm and low berm options of Alternatives 3 and 4, based on the

anticipated environmental impacts. Table 2-5 compares each alternative with respect to the purpose, need, and project objectives, which considers the long-term benefits of the alternatives.

Table 2-4. Ranking of the Alternatives

Topic	Alternative 1 No-Action	Alternative 2 Spur Dikes/ Plantings	Alternative 3 Traditional Riprap/Plantings		Alternative 4 Traditional Riprap/Rock Removal/Plantings	
			No Berm	Low Berm	No Berm	Low Berm
Land use conflicts	1	2	3	4	5	6
Land use changes	6	1	2	3	4	5
Management plan conflicts	6	4	5	3	2	1
Soil disturbance	1	2	4	3	6	5
Channel modification	4	1	2	3	5	6
Geologic hazards	1	2	3	4	5	6
Water quality (turbidity)	1	2	3	4	5	6
Water quality (mercury)	1	2	5	3	6	4
Water quality (hazardous materials)	1	2	5	3	6	4
Flood flows	1	2	3	4	5	6
Fish mortality	1	2	3	4	5	6
Aquatic habitat quality	1	2	3	4	5	6
Aquatic habitat quantity	1	6	5	3	4	2
Invasive plant spread	6	1	2	3	4	5
Fill of waters of the U.S.	1	2	3	5	4	6
Special-status plant loss	1	2	3	4	5	6
Elderberry shrub loss	1	2	4	3	6	5
Bank swallow habitat loss	1	4	5	6	2	3
Special-status wildlife loss	1	2	4	3	6	5
Nesting bird disturbance	1	2	4	3	6	5
Wildlife movement	3	4	5	6	2	1
Undiscovered cultural resources loss	1	2	4	3	6	5
Traffic increase	1	2	5	6	3	4
Air emissions increase	1	2	5	6	3	4
Noise disturbance	1	2	3	4	5	6
Scenic view change	1	2	3	4	5	6
Visual character change	1	5	6	2	4	3
Totals	**47**	**64**	**102**	**103**	**124**	**127**

Note: Ranking values indicate a "1" for the alternative/option with the least adverse impacts and "6" for the worst adverse impacts based on pre-mitigation impacts. Differences between some alternatives may be subtle, so the rankings were assigned based on the analyst's judgment. The rankings are strictly for the topic indicated and do not reflect rankings for other topics that may be closely related. They also do not consider the ability of the alternative to meet the purpose and need or result in long-term benefits (see below for that type of comparison).

Table 2-5. Comparison of the Alternatives and Project Objectives

Project Objective	Alternative 1 No-Action	Alternative 2 Spur Dikes/ Plantings	Alternative 3 Traditional Riprap/Plantings		Alternative 4 Traditional Riprap/Rock Removal/Plantings	
			No Berm	Low Berm	No Berm	Low Berm
Improve Riparian Sanctuary habitat conditions	No	Yes	Yes	Yes	Yes	Yes
Reduce invasive/non-native plant populations	No	Yes	Yes	Yes	Yes	Yes
Provide habitat for endangered species/migratory birds	Low quality	High quality with lower quality along river	High quality with lower quality along river	High quality throughout	High quality with lower quality along river	High quality throughout
Improve riparian health of Sacramento River	No	Yes with less benefit along bank	Yes with less benefit along bank	Yes with some benefit from berm plantings	Yes with benefit from cut off	Yes with benefit from cut off and berm plantings
Use interdisciplinary scientific approach	No	Yes	Yes	Yes	Yes	Yes
Protect pumping plant/fish screen facility	Not over long term	Yes over long term with some risk	Yes over long term with little risk	Yes over long term with little risk	Yes over long term with little risk	Yes over long term with little risk
Stablize bank across from facility	No	Yes	Yes	Yes	Yes	Yes
Meet objectives and strategies of refuge management plan	No	Yes for most	Yes for most	Yes for most	Yes for all	Yes for all

2.3.1 Preferred Alternative

Sec. 1502.14 of the Regulations for Implementing NEPA requires the lead agency to identify a preferred alternative in the EIS. The preferred alternative need not be identified in the Draft EIS/EIR, but must be disclosed in the Final EIS/EIR and Record of Decision. The Service and CDFG have reviewed the alternatives described in this chapter and considered the environmental consequences of each alternative described in Chapter 3. Based on the information contained in this Draft EIS/EIR, the agencies have selected Alternative 4 as their preferred alternative. This alternative provides the most environmental benefits by removing existing riprap to restore natural riverine processes along the Sacramento River and provide habitat for the bank swallow.

2.3.2 Environmentally Superior Alternative

Section 15126.6(e) of the CEQA Guidelines states that if the no-project (or no-action) alternative is the environmentally superior alternative, the lead agency shall also identify an environmentally superior alternative from among the other alternatives. CEQA also requires public agencies to mitigate or avoid

significant effects of a project whenever it is feasible to do so (Public Resources Code Section 21002.1). The three action alternatives provide a range of feasible options for implementing the Riparian Sanctuary project, and the impacts of one or more alternatives on some resource topics would result in less significant impacts when compared with the other alternatives. As a result, it is possible for the lead agencies to select an alternative that would result in the least environmental impacts without carrying forward an action that would have unavoidable impacts.

Based on the analysis of the alternatives in Chapter 3, the No-Action Alternative (Alternative 1) would have the least short-term adverse impacts, but it would not be environmentally superior because it would result in continued dominance of non-native and invasive plants at the Riparian Sanctuary and continued erosion of the Sacramento River on the northwest side of the Riparian Sanctuary, threatening the viability of the fish screens and operation of the PCGID-PID pumping plant and fish screen facility. If the facility cannot operate effectively, severe long-term environmental consequences could result from loss of agricultural and wetland uses on land relying on water deliveries from the facility. Although the rankings in Table 2-4 show the most “1s” for the No-Action Alternative (lowest total), these rankings primarily reflect construction-related impacts, which would not occur under this alternative. As shown in Table 2-5, this alternative would not meet the Riparian Sanctuary project objectives. The key issues relating to dominance of invasive plants and land use and fish impacts from inefficiency of the fish screens over the long term would be the worst for the No-Action Alternative, resulting in potential significant and unavoidable impacts.

With regard to short-term adverse impacts, Alternative 2 would have the least construction-related impacts (second lowest total in Table 2-4), but the longer term benefits of the spur dikes would be less than Alternatives 3 and 4 (see Table 2-5). Alternative 2 would reduce available bank swallow habitat, possibly resulting in a significant and unavoidable impact, and reduce aquatic habitat moreso than Alternative 4, but similar to Alternative 3. Alternative 3 would have similar construction activities as Alternative 4 (comparable totals in Table 2-4), which would be slightly more intense than Alternative 2. The low berm option of Alternatives 3 and 4 could result in significant and unavoidable water quality impacts from instream construction activities, and Alternative 3, similar to Alternative 2, could result in a significant and unavoidable loss of bank swallow habitat. Because of the potential significant and unavoidable impacts of Alternatives 2 and 3, these alternatives would not be environmentally superior.

In contrast, Alternative 4 would provide substantial long-term environmental benefits with minimal short-term adverse effects. This alternative would result in the greatest benefit to the PCGID-PID pumping plant and fish screen facility while restoring natural processes to the Sacramento River and native riparian habitat at the Riparian Sanctuary. The no berm option would require the most excavation of all alternatives, but all of the excavation and most of the riprap placement would take place on the existing gravel bar above the low water level.

Water quality and fish impacts would be the greatest concern during construction, but these impacts would be similar between the action alternatives and are mitigable for the no berm option, as discussed in Chapter 3. Alternative 4 would have the greatest benefit to bank swallow habitat by removing upstream revetment and allowing the river to cut off the peninsula, which would provide for new bank habitat. This cut off would also allow the river to re-establish its natural course, which would benefit the pumping plant

and fish screen facility by maintaining adequate flow velocities and patterns over the long term in combination with the bank protection on the Riparian Sanctuary. The less desirable component of the no berm option is the lack of ability to plant riparian vegetation along the revetment; these features would, however, be available for the low berm option. The low berm would require placement of more material into the river and would have a greater short-term effect on water quality and fishes, with a potential significant and unavoidable impact on water quality, as for Alternative 3 with the low berm. Based on the beneficial and adverse effects of the alternatives and berm options, the no berm option of Alternative 4 would be considered the environmentally superior alternative.

2.3.3 Least Damaging Practicable Alternative

Each alternative bank protection measure would result in the discharge of fill material into the Sacramento River, a navigable water of the United States, which would require permitting under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. In compliance with Section 404(b)(1) of the Clean Water Act, the Corps must consider if the proposed discharge represents the least damaging practicable alternative, considering all significant adverse environmental consequences of the alternative. A discussion of the Riparian Sanctuary project's compliance with the Section 404(b)(1) Guidelines (40 Code of Federal Regulations 230) and the least environmentally damaging practicable alternative will be provided in the application for a permit from the Corps, assuming a standard individual permit is determined to be the appropriate permit. The analysis presented in Chapter 3 of this EIS/EIR and other available information will be used as the basis for ensuring compliance with the Guidelines. This section provides a brief comparison of the alternatives with a focus on their effects on waters of the United States and their practicability for implementation and discusses which alternative may be identified as the least environmentally damaging practicable alternative, based on the analysis in Chapter 3 and pending further analysis for the permit application.

Of the alternatives evaluated in this EIS/EIR, the No-Action Alternative (Alternative 1) would result in the least amount of fill into the Sacramento River and adjacent wetlands (no fill would be necessary); however, this alternative is not considered practicable because it would not achieve the Riparian Sanctuary project purpose and need or objectives.

Of the action alternatives, Alternative 2 (Spur Dikes and Site-Specific Plantings) would result in the least amount of fill in the river compared with the traditional riprap options (Alternatives 3 and 4), and it would meet the project purpose, need, and objectives. Impacts on wetlands along the river would be mitigable through the restoration plan at the Riparian Sanctuary, and impacts on soils, water quality, fish, wildlife (except bank swallow habitat), cultural resources, and air quality would also be mitigable with the measures identified in Chapter 3. The spur dikes would, however, result in a loss of potential habitat for bank swallows, which may not be fully mitigated to achieve no net loss on a regional scale, and would provide less opportunity for restoring vegetation along the revetment than the traditional riprap with low berm. In comparison, Alternative 4 (Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings) with no berm would result in reduced impacts on bank swallow habitat and water quality. As a result, this alternative appears to be the least damaging practicable alternative because it would achieve the project purpose, need, and objectives and all adverse impacts would be adequately mitigated to less

than significant levels. The discharge of dredged or fill into the Sacramento River would be minimized under Alternative 4, but is unavoidable.

2.4 Alternatives Considered but Eliminated from Further Evaluation

Six additional alternatives were considered to protect the PCGID-PID pumping plant and fish screen facility, and one other alternative was considered for restoration of the Riparian Sanctuary. The facility protection alternatives were discussed in *Pumping Plant Protection Feasibility Study* (MBK Engineers 2005) and were eliminated because of cost, feasibility, and/or effectiveness in protecting the pumping plant and fish screen facility. The full restoration alternative was discussed in *Riparian Restoration Feasibility Study for the Riparian Sanctuary* (River Partners 2005) and was eliminated because of effectiveness and feasibility. These alternatives would not fully achieve the purpose and need for the project or meet the project objectives.

The following alternatives were eliminated for the reasons identified:

- **Monitor Bank Retreat**. This alternative involved a monitoring program and implementation of bank protection measures at a later time, if needed. Monitoring bank retreat would create a risk for the pumping plant and fish screen facility and might not allow for quick implementation of measures to protect the plant, potentially resulting in very high costs for emergency measures.

- **Install Below-Channel Dike Field.** This alternative involved installation of eight rock dikes within the gravel bar instead of in the channel, as described for Alternative 2. A below-channel dike field would likely result in a greater amount of sediment buildup in front of the pumping plant and fish screen facility than current conditions or the other alternatives, requiring frequent removal of sediment from the intakes. It would also likely provide protection of the facility for only approximately 25 years, requiring additional measures over the long term.

- **Install Extended Traditional Riprap Revetment**. This alternative involved traditional riprap as described under Alternative 3, but it would extend downstream to a point past the pumping plant intakes. Extending the riprap revetment beyond the facility would incur higher costs than the alternatives being considered and has not been demonstrated to be more effective.

- **Allow River Bend Cut Off.** This alternative only involved removal of the existing revetment along the northern side of the upstream peninsula to allow the scour holes behind the revetment to cause the river to be cut off at the bend. The river bend cut off was predicted to allow the river to maintain adequate flow velocities in front of the pumping plant and fish screen facility, but without additional measures to protect the downstream reach (at the Riparian Sanctuary), the river could eventually meander to the east away from the facility, making this alternative ineffective.

- **Install Flexible/Moveable Intakes for Pumping Plant**. This alternative involved constructing structural additions (e.g., portable screens, intakes) on the existing facility to allow it to operate with the changes in the river. The effectiveness of flexible or moveable intakes is not known and cannot be demonstrated. Such structures would also likely incur very high costs and could reduce the capacity of the intakes and result in pump downtime as the intakes are moved.

- **Move Pumping Plant**. This alternative included options for abandoning the existing pumping plant and fish screen facility and implementing one of the following options: building a new facility at another location, using an infiltration gallery, installing groundwater wells (e.g., Ranney collectors), or using a distributed pumping system. Plant relocation or use of an infiltration gallery would be extremely expensive. A change in use to ground water would be difficult to obtain, and high costs would be incurred for design, permitting, and construction of wells necessary to serve current PCGID-PID customers. Use of more pumps at the current location would likely exacerbate the existing problems associated with river meander and would not provide a reliable solution.

- **Fully Restore Riparian Sanctuary.** This alternative involved planting dense, diverse riparian vegetation across the site (up to 212 plants per acre). Full planting would maximize wildlife benefits, but it would not meet flood control objectives at the Riparian Sanctuary. The full plantings would restrict flood flows across the site.

Chapter 3 Affected Environment and Environmental Consequences

3.1 Introduction

Chapter 3 contains individual resource sections that address key issues and consider the physical environmental effects of the alternatives, as required by the California Environmental Quality Act (CEQA), as well as the social and economic effects required by the National Environmental Policy Act (NEPA). This chapter discusses applicable laws and regulations, describes the affected environment, and analyzes the environmental consequences of the alternatives described in Chapter 2 for the Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project (Riparian Sanctuary project). NEPA terms are used for the "affected environment" (generally equivalent to the environmental setting under CEQA) and "environmental consequences" (generally equivalent to the impact analysis under CEQA). The description of the affected environment for each resource topic focuses on a localized setting in and around the Llano Seco Riparian Sanctuary Unit (Riparian Sanctuary) and the upstream peninsula, which includes the Llano Seco Island 2 unit of the Sacramento River National Wildlife Refuge (Sacramento River NWR) and the Sacramento-San Joaquin Drainage District (Drainage District) property adjacent to Llano Seco Island 2, with regional information as appropriate. The environmental consequences section focuses on those resources or environmental factors that could be adversely affected by the Riparian Sanctuary project alternatives.

3.1.1 Resources Eliminated from Further Consideration

Based on the nature of the alternatives and a preliminary assessment of potential impacts, several resource topics were not carried forward for detailed analysis. This section discusses the resource topics that were eliminated from further consideration and provides rationale for their elimination.

Socioeconomics, Population, and Housing. Socioeconomics are the general features of the local economy, such as employment, revenue, or economic growth, as well as population trends; this topic is typically considered under NEPA when economic or social effects are interrelated with natural or physical environmental effects (40 Code of Federal Regulations (CFR) 1508.14). CEQA does not require the evaluation of economic impacts, but population and housing are typically evaluated under CEQA. The action alternatives would provide temporary jobs for workers during restoration activities with a few longer term jobs for maintenance activities. These jobs would likely be filled by workers living in the Chico area or local communities. Construction activities could temporarily increase revenue at local restaurants, stores, and other community facilities and would have a beneficial effect on the local community. The action alternatives would not, however, generate a need for housing or increase the local population. Because no adverse impacts are anticipated under the action alternatives, socioeconomics, population, and housing have been eliminated from further analysis. The No-Action Alternative could

have adverse economic effects as a result of changes in downstream uses relying on water delivered by the Princeton-Codora-Glenn and Provident Irrigation Districts (PCGID-PID) pumping plant and fish screen facility if the facility were to stop working; these effects are discussed under Section 3.2, Land Use, and Section 3.4, Water Resources.

Environmental Justice. Environmental justice addresses the disproportionate effect a federal action may have on low-income or minority populations. The alternatives would not increase risks to communities or population centers or disproportionately affect low-income or minority populations. Therefore, environmental justice has been eliminated from further analysis.

Indian Trust Assets. Indian trust assets are legal interests in property held in trust by the United States for Indian tribes or individuals. The Secretary of the Interior, acting as the trustee, holds many assets in trust. Examples of objects that may be trust assets are lands, minerals, hunting and fishing rights, and water rights. While most assets are on reservations, they may also be found off reservations. The United States has a responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, and executive orders. The Riparian Sanctuary and adjacent reach of the Sacramento River are not known to contain any Indian trust assets; therefore, no impacts are anticipated. Indian trust assets have been eliminated from further analysis.

Mineral Resources. Mineral resources include quarry rock, sand, gravel, and other minerals that are of value and may be mined for commercial uses. Counties typically identify locally important mineral resource sites in their general plans to protect the availability of the resource. No known mineral resource sites are located in the project area. The action alternatives would involve the use of mineral resources (e.g., quarry stone, gravel, sand) for the bank protection measures, but none of the alternatives would result in the loss of availability of a mineral resource in the project area. The use of non-renewable resources is discussed in Chapter 4, but impacts on mineral resources in the project area are not further discussed.

Public Services and Recreational Facilities. Public services include fire and police protection, schools, parks, and other public facilities. Recreational facilities include parks, trails, campsites, day use areas, or other recreational areas with built facilities. The project area does not contain any public or recreational facilities, and the alternatives would not increase the demand for public services in the local community or increase the use of recreational facilities. Construction activities would not prevent local service providers from being able to respond to an incident in or near the project area. Because no impacts on public services or public or recreational facilities are anticipated, these topics have been eliminated from further analysis. Effects on recreational uses near the project area are discussed in Section 3.2, Land Use.

Utilities. Utilities include water, wastewater, and storm drainage facilities; energy; natural gas; and other services typical of an urban area. The project area does not include any development, but a natural gas line owned by Pacific Gas and Electric Company crosses through the Riparian Sanctuary from the southeast to the northwest. The gas line will be marked and avoided or protected from disturbance during all activities at the Riparian Sanctuary, as described in Chapter 2. As a result, none of the alternatives would result in a disruption to utility services or the need to modify or expand utility lines. No impacts are anticipated, and utilities have been eliminated from further analysis.

Hazardous Material Sites. Hazardous material sites can expose the public or environment to various hazards that can affect public health or safety. The State Water Resources Control Board (State Water Board) tracks known hazardous material sites and clean-up efforts via the Geotracker system. No sites have been reported in or near the project area. For this reason, no additional discussion of hazardous material sites is included in this document. No impacts are anticipated, and hazardous material sites have been eliminated from further analysis.

Wildfire Hazards. The project area is not in a high severity fire hazard area (California Department of Forestry and Fire Protection 2008). Most of the project area is managed by the U.S. Fish and Wildlife Service (Service), which has primary responsibility for fire prevention and protection. The Service implements fuels management and fire protection projects, as needed, on the Sacramento River NWR. These projects include, but are not limited to, permanent fire breaks, selective cutting along boundaries and developed areas, prescribed burns for fuel reduction, and cooperative agreements with local fire districts for wildfire suppression. Most fires reported on the refuge are human-caused, and wildfire is not a primary concern. Construction activities would comply with Public Resources Code (PRC) Sections 4428 to 4442 and would not increase the risk of wildfire. Because the potential for wildfire is not expected to increase with implementation of the alternatives, this topic has been eliminated from further analysis.

3.1.2 Overview of Resource Sections

Each section includes a discussion of the regulatory framework, affected environment (CEQA environmental setting), methodology, significance criteria, environmental consequences (CEQA impact analysis), and mitigation measures (as appropriate). An overview of the organization and content of each resource section is presented below.

Regulatory Framework

The regulatory framework sections for each resource topic summarize applicable laws, regulations, policies, and planning documents that protect or manage the resource. The section describes federal, state, and local regulations, as applicable, and management plans, such as general plans and land management plans. As appropriate, a brief discussion of the applicability of the law, regulation, policy, or planning document to the Riparian Sanctuary project is provided at the end of the description.

Affected Environment (Environmental Setting)

The affected environment sections for each resource topic describe the existing regional and local conditions based on the most current available information, including results of field surveys conducted for this environmental impact statement/environmental impact report (EIS/EIR) and studies conducted during the planning and design phases of the project. The regional setting varies for each resource topic, ranging from the entire Sacramento River Basin to portions of Glenn and Butte counties, while the local setting is focused on the project area, which consists of approximately 400 acres in the northern portion of the Riparian Sanctuary, the peninsula north of the Riparian Sanctuary (including Llano Seco Island 2 and Drainage District and private property), and the reach of the Sacramento River between approximately River Mile (RM) 178 and RM 180. For some resource topics, such as hydrology, the immediate upstream

and downstream reaches of the river are also discussed in the local setting. The affected environment establishes the context for the analysis pursuant to NEPA (40 CFR Section 1508.27 (a)). The information in this section is used as the environmental baseline for analyzing the significance of potential effects (CEQA Guidelines, Section 15125, subd. (a)).

Environmental Consequences (Impact Analysis)

The environmental consequences sections for each resource topic provide an analysis of environmental effects or impacts, a significance determination for physical impacts, and mitigation measures for significant impacts. The focus of the environmental consequences sections is on the Riparian Sanctuary, upstream peninsula (Alternative 4 only), and adjacent Sacramento River reach for most resource topics, but may extend into adjacent areas for certain topics, such as hydrology and transportation. As required by the CEQA Guidelines, the impacts of a project are defined as "a change in the existing physical conditions in the affected area as they exist at the time the notice of preparation is prepared" (Section 15126.2). For purposes of NEPA, the term "environmental consequences" is synonymous with the term "impacts." Significance thresholds are identified for each resource topic based on the CEQA Guidelines, Appendix G, as amended, and other relevant sources to provide a means of measuring the intensity of the impact, which is a requirement under NEPA (40 CFR Section 1508.27 (b)) as well as CEQA.

Each environmental consequences section is organized into the following subsections:

Methodology. This subsection identifies the methods used to analyze impacts, as well as the key assumptions and data sources used in the analysis process. Sections that incorporate extensive technical information or quantitative assessments reference complementary technical appendices or publicly available reports. Key assumptions used in qualitative analyses are described for those sections that do not rely on quantitative tools.

Significance Criteria. This subsection presents the criteria and thresholds used to identify potentially significant effects on the environment, in accordance with PRC Section 21082.2 and CEQA Guidelines Sections 15064 and 15065. "Thresholds" include guidance provided by the CEQA Guidelines, agency standards, legislative or regulatory requirements as applicable, and professional judgment. All impacts that do not exceed the stated significance criteria described for each section are assumed to be less than significant and are therefore not discussed in detail in the section (PRC Section 21100 and CEQA Guidelines Section 15128).

Impacts and Mitigation Measures. This subsection provides the analysis of environmental impacts and identifies mitigation measures, where appropriate. The subsection includes an impact statement for each individual impact, a discussion of the impact under each alternative, and a list of mitigation measures as appropriate. An alphanumeric coding system is used to present each impact statement and corresponding mitigation measure. Where impacts are similar for multiple alternatives, the analysis includes a discussion of the differences between the impacts instead of a detailed discussion of the impacts to reduce redundancy. An example of the impact analysis structure is provided below.

<u>Impact Statements</u>. An impact statement is a complete sentence that summarizes the potential effects that could occur with implementation of the Riparian Sanctuary project. Following the impact statement, a

detailed discussion of the analysis is provided, organized by alternative, with a conclusion on the significance of the impact before and after mitigation using the significance thresholds.

Mitigation Measures. For significant impacts, mitigation measures are identified to reduce or avoid impacts to the extent feasible. In those instances where no feasible mitigation can be identified or mitigation measures would not adequately reduce impacts, the impact is determined to be significant and unavoidable.

Impact AE-1: Construction activities could result in adverse environmental effects.

Alternative 1 – No-Action Alternative

The impact discussion explains the impact, provides support for the significance determination, and concludes the significance level.

Alternative 2 – Spur Dikes and Site-Specific Plantings

The impact discussion explains the impact, provides support for the significance determination, and concludes the significance level before and after mitigation.

Mitigation Measure AE-1: Implement the mitigation measure.

A brief description of the mitigation measure is provided, including timing, responsibility, and implementation.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

The impact discussion explains the key similarities and differences between impacts under Alternatives 2 and 3, identifies new mitigation (if needed) or refers to the previously identified mitigation, and concludes the significance level before and after mitigation.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

The impact discussion explains the key similarities and differences between impacts under Alternatives 2, 3, and 4; identifies new mitigation (if needed) or refers to the previously identified mitigation; and concludes the significance level before and after mitigation.

3.2 Land Use

This section describes the existing land uses in and adjacent to the project area, including recreational and agricultural uses, and ownership of the project area and adjacent lands, and it analyzes the effects of the alternatives on nearby lands and uses.

3.2.1 Regulatory Framework

Sacramento River National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR Comprehensive Conservation Plan (CCP) guides management of the refuge for a 15-year period (2005–2020) (U.S. Fish and Wildlife Service 2005). It was approved by the Service in 2005 and will be updated as needed to reflect the latest management guidance. The CCP describes the desired future conditions on the Sacramento River NWR and identifies long-range goals and objectives to accomplish the purposes for which the refuge was established. One of the goals identified for the refuge is to

> contribute to the recovery of endangered and threatened species and provide a natural diversity and abundance of migratory birds and anadromous fish through the restoration and management of viable riparian habitats along the Sacramento River using the principles of landscape ecology.

Activities on the Riparian Sanctuary and other Service-managed lands on the refuge need to be consistent with the CCP.

California State Lands Commission Leasing and Permit Regulations

The California State Lands Commission retains jurisdiction over the State of California's sovereign land interests relating to tidelands, submerged lands, and the beds of navigable waters. These lands are held in public trust for the benefit of the people of California. Authorized uses, which may require a lease or permit, include waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. Activities that affect the bed of the Sacramento River, such as dredging or placement of fill into the river, may require authorization by the State Lands Commission through its permitting process.

Farmland Mapping and Monitoring Program

The Farmland Mapping and Monitoring Program, managed by the California Department of Conservation Division of Land Resource Protection, provides data and maps of important farmland to support impact analysis associated with CEQA and other state and local regulations. The extent and types of farmland affected by a project dictate the mitigation requirements for the loss of agricultural lands, which may also be driven by local ordinances or general plan policies. The program provides ratings for agricultural land based on soil quality and irrigation status, with the best quality land being Prime Farmland. The categories mapped by the California Department of Conservation include:

- Prime Farmland (P): Farmland with the best combination of physical and chemical features able to sustain long-term agricultural production.

- Farmland of Statewide Importance (S): Farmland similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture.
- Unique Farmland (U): Farmland of lesser quality soils used for the production of the state's leading agricultural crops.
- Farmland of Local Importance (L): Land of importance to the local agricultural economy as determined by each county's board of supervisors and a local advisory committee.
- Grazing Land (G): Land on which the existing vegetation is suited to the grazing of livestock.
- Urban and Built-up Land (D): Land occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel.
- Other Land (X): Land not included in any other mapping category.
- Water (W): Large bodies of water, such as lakes and rivers.

Butte County General Plan

Butte County adopted the Butte County General Plan 2030 in October 2010. The general plan consists of 10 elements that guide management of the various resources and land uses in the county through the year 2030. The Zoning Ordinance is currently being updated to be consistent with the new general plan, but until it is approved, the current ordinance continues to guide zoning in the county.

The policies of the general plan Land Use Element encourage orderly development near existing infrastructure and transportation facilities, preservation of agricultural lands, and close coordination between the County and public during the planning of growth in the county (Butte County 2010). The protection of agricultural lands and uses is important to the county. The general plan contains policies relating to the protection of sensitive resources, such as riparian habitat and cultural resources, and preservation of agricultural land. Although activities on federal lands are not subject to the County's general plan, adjacent private lands are, and land use compatibility between these lands should be considered.

Glenn County General Plan

The Glenn County General Plan provides a comprehensive plan for growth and development in the county over a 20-year planning period (1992–2012). The general plan provides goals and policies specific to several key issues identified by the County: growth, adequacy of public services and facilities, preservation of agricultural land, and economic development (Glenn County 1993). General plan goals focus on the preservation of agricultural lands, protection and management of natural resources, and protection of public health and safety. The general plan contains policies relating to the protection of sensitive resources, such as riparian habitat and cultural resources, and preservation of agricultural land. Although activities on federal lands are not subject to the County's general plan, adjacent private lands are, and land use compatibility between these lands should be considered.

County Zoning Ordinances

Each County has a zoning ordinance that provides direction on the allowable uses within each zoning district. The ordinances implement the goals and policies of the general plans. The zoning ordinances provide standards for uses and facilities in each zone and identify uses or facilities that require special use

permits. Like the general plans, federal land in the project area is not subject to local zoning ordinances, but adjacent private lands are, and compatibility between the lands should be considered.

3.2.2 Affected Environment

The Sacramento River flows south through the Sacramento River NWR in the northern part of the Sacramento Valley and the project area. Near the project area, the Sacramento River roughly corresponds to the western boundary of Butte County and the eastern boundary of Glenn County. Butte County encompasses approximately 1,680 square miles from the Sacramento River east to the Northern Sierra Nevada foothills (Butte County 2007). Glenn County encompasses approximately 1,317 square miles between the Sacramento River and the Coast Ranges to the west, with steeper terrain in the west and relatively flat features in the east along the river (Glenn County 1993). Both counties are agriculture-based counties with predominantly rural communities. No airports or schools are close to the project area, and the project area is not in an established community.

The Sacramento River NWR is comprised of 10,146 acres in 29 units or properties along a 77-mile stretch of the Sacramento River between Red Bluff and Princeton. The Llano Seco Riparian Sanctuary and Llano Seco Island 2 are units of the refuge that are part of the project area. Refuge lands contain riparian habitat, wetlands, uplands, and intensively managed walnut orchards and row crops. No forest lands exist in or near the project area.

Land Use and Zoning Designations

The project area is in Butte and Glenn counties near the unincorporated community of Glenn, approximately 10 miles east of Willows and 17 miles southwest of Chico. Most of the project area is within the Sacramento River NWR boundary and is managed by the Service. Adjacent lands and lands on the peninsula upstream of the Riparian Sanctuary are in private ownership or managed by the State. The Riparian Sanctuary is entirely in Butte County on the east side of the river, and the upstream peninsula is in both Butte and Glenn counties on the west side of the river north of the Riparian Sanctuary.

The Riparian Sanctuary is designated as a sanctuary or buffer area in the Sacramento NWR CCP and is closed to public access (U.S. Fish and Wildlife Service 2005). The Llano Seco Island 2 is designated for hunting, fishing, wildlife observation, photography, environmental education, and interpretation and is open to the public via the river. The purpose of the sanctuary designation is to minimize disturbance to wildlife, protect sensitive habitats and resources (e.g., cultural resources), and establish a buffer between public use areas and private lands. Public use is encouraged on some portions of the refuge that provide safe recreational opportunities as long as the uses do not conflict with other priority wildlife-dependent recreational uses. Management of these units is guided by the Sacramento NWR CCP and step-down plans prepared for specific uses (e.g., the Hunting and Fishing Plans).

Adjacent private lands are subject to the Butte County and Glenn County general plans. Land adjacent to the Riparian Sanctuary on the east is part of the Llano Seco Rancho in Butte County. The Butte County General Plan designates the land for Agriculture (AG) with 20- to 320-acre minimum parcels (Butte County 2010). The AG designation allows for various agricultural uses, such as farming, livestock grazing, and animal husbandry, and related activities. Private and State lands west of the Llano Seco

Island 2 in Glenn County are designated for Intensive Agriculture (IA) and zoned AE-40. The intensive agriculture designation allows commercial agriculture, such as field and row crops, orchards, grazing, and animal raising (Glenn County 1993). The exclusive agricultural zone allows agricultural production and associated uses. Public utilities and certain other uses are allowed with a use permit.

The Farmland Mapping and Monitoring Program classifies the land in the Riparian Sanctuary as Grazing and Other lands, and land on the peninsula is classified as Other land (California Department of Conservation 2008). None of these lands are protected under Williamson Act land use contracts. Nearby lands on the east side of the Sacramento River are also classified as Grazing and Other lands, with some Unique Farmland and Farmland of Statewide Importance interspersed. Lands at the Llano Seco Rancho east of the Riparian Sanctuary are in agricultural production and designated Prime, Unique, or Other Land, but are not under Williamson Act contract.

Existing Uses

The Sacramento River is a public waterway that provides a diversity of recreational opportunities, including fishing, boating, nature observation and photography, and hiking (California State University, Chico 2008). The river is also a major water source for irrigation of agricultural fields, wildlife habitat, and municipal uses throughout California. Peak use of the river near the project area is in late summer and early fall during the salmon fishing season and dove and deer hunting seasons (August 1–October 30) and in spring during the turkey hunting season and striped bass fishing season (March 15–May 15). PCGID-PID currently withdraw water from the river at their pumping plant and fish screen facility across from the Riparian Sanctuary for distribution to their customers. Downstream of the project area, the Sacramento River flows into the Sacramento-San Joaquin Delta, the California Aqueduct, and the Delta-Mendota Canal. Use of the Sacramento River for water supply and hydrology of the river are discussed in more detail in Section 3.4, Water Resources.

The Sacramento River NWR and Sacramento River Wildlife Area offer recreational opportunities along the Sacramento River. Allowed activities include fishing, hunting, nature observation, hiking, and picnicking. In the vicinity of the Riparian Sanctuary, the Llano Seco Island units, Oxbow unit, Bernard F. Flynn Jr. Wildland Preserve, and Jacinto unit provide public recreational opportunities (California State University, Chico 2010). Some units within the refuge are closed to public access and use, including the Riparian Sanctuary. Access to portions of the refuge and wildlife area is by boat only, and access via land is limited in some areas because of surrounding private lands or lack of public roadways. Recreational facilities, including boat launches, picnic areas, trails, and information kiosks, are present in some units of the refuge and wildlife area. Hunting and fishing are regulated in accordance with applicable federal and state regulations.

The Riparian Sanctuary is primarily open space with fallow land and riparian habitat. Some row crops are present in the northeast portion of the unit, but other than cropland uses, the land has no active uses. The Service originally proposed restoration of the Riparian Sanctuary to its original riparian forest communities in the *Management Plan for the Llano Seco Unit* (U.S. Fish and Wildlife Service 1992). The Service planned to convert the former wheat fields, which have mostly become fallow, to riparian forest. This restoration proposal was never implemented and is now being revisited by the Service as part

of the Riparian Sanctuary project. It was also identified as a management strategy in the Sacramento River NWR CCP (U.S. Fish and Wildlife Service 2005).

The Llano Seco Island 2 is accessible only by boat and is open to hunting (August to May), fishing, wildlife observation, photography, interpretation, and environmental education. Access is from the river via boat only because of surrounding private lands. No public use facilities are currently present at the refuge unit. The Drainage District property on the peninsula is not open to public uses or access and contains mixed riparian habitat.

Lands adjacent to the Sacramento River and project area are used for agricultural production, contain rural residential uses, or contain open space with native riparian vegetation. The Llano Seco Rancho is primarily under agricultural production, in accordance with a conservation easement that allows intensive agriculture in the form of orchards and row crops and maintenance areas that are used for grazing and small grains. The land is also managed for wetlands to support waterfowl and other wildlife. Agricultural activities take place year-round, and the peak growing and harvest season is from April through October.

3.2.3 Environmental Consequences

Methodology

The analysis of land use impacts is based on a review of applicable management plans, aerial photographs, and land use data for the project area; a site visit; and an evaluation of the Riparian Sanctuary project's consistency with the management plans, compatibility with adjacent land uses, and potential to modify the current uses in the project area. The Sacramento NWR CCP guides management of the federally managed land in the project area, and the County general plans guide management of adjacent private lands. These plans were used as the basis for identifying potential land use conflicts.

Significance Thresholds

Land use impacts would be considered significant if the Riparian Sanctuary project would:

- involve changes in the existing environment which, due to their location or nature, could result in conversion of important farmland to non-agricultural use;
- modify land uses in a way that would conflict with existing uses in or near the project area; or
- conflict with the applicable goals, objectives, or strategies of the Sacramento NWR CCP or County general plans.

Impacts and Mitigation Measures

Impact LU-1: Construction activities could disrupt or conflict with nearby land uses.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in construction-related land use conflicts.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction of spur dikes and restoration of the Riparian Sanctuary under Alternative 2 would involve a variety of temporary activities that could disrupt or conflict with agricultural uses on adjacent lands and recreational and other uses in the vicinity. Construction activities would result in increased traffic, dust, vehicle emissions, noise, and human activity for about 5 weeks when the spur dikes are being constructed and 4 months to 1 year for overall construction activities; these effects are discussed in other sections of Chapter 3. These activities, particularly construction traffic through private lands, could periodically disrupt agricultural activities on adjacent lands during the construction season, particularly during peak agricultural periods from April through October. Agreements would be in place with the local landowners to identify measures that would be implemented during construction to minimize disruptions to their lands (see Chapter 2); these agreements and the measures that would be implemented would ensure impacts related to land use disruptions would be less than significant.

A portion of the Riparian Sanctuary is in row crop production, but the intent of the cropland is to control invasive plants and prepare the site for restoration activities. The land is not designated as important farmland. Agricultural activities would cease at the Riparian Sanctuary once restoration activities are initiated, and no agricultural conflicts would arise during construction.

Recreational activities along the Sacramento River between about RM 178.5 and 177.5 would be temporarily disrupted during construction of the spur dikes, which would occur during late summer and early fall and correspond with a peak recreational use period. Boating activity would not be restricted during the construction period. Warning buoys would be placed in the river upstream and downstream of the construction area to alert boaters to the activities and to minimize potential safety concerns for boaters and recreationists, particularly during peak use periods in spring, late summer, and early fall. The Riparian Sanctuary is currently closed to public access, and restoration activities as well as land-based construction activities for the spur dikes would not conflict with recreational uses at the Riparian Sanctuary. Recreational impacts during construction would be less than significant.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of traditional riprap and restoration of the Riparian Sanctuary under Alternative 3 would result in similar land use disruptions and conflicts as described for Alternative 2. In-water construction activities would require about the same amount of time as the spur dikes, but overall construction of the riprap would require a longer period of time due to the need to transport more rock. Construction activities would result in the same types of disturbances to nearby agricultural and recreational uses over a longer period (up to 2 additional months of haul truck traffic). Land, agricultural, and recreational use impacts during construction would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap and restoration of the Riparian Sanctuary under Alternative 4 would result in similar land use disruptions and conflicts as described for Alternative 2 and would require a similar construction period as for Alternative 3. Removal of upstream rock would, however, result in additional disruptions to recreational uses at Llano Seco Island 2 (primarily hunting with boat access) and along more of the Sacramento River, up to about RM 179. No recreational disturbances on the Drainage

District property would be expected because it is not currently used for recreational purposes. Construction activities would require about the same amount of time as under Alternative 3 and would result in the same types of disturbances to nearby agricultural and recreational uses. Land, agricultural, and recreational use impacts during construction would be less than significant.

Impact LU-2: Implementation of the Riparian Sanctuary project could change land uses in the project area.

Alternative 1 – No-Action Alternative

None of the bank protection measures or restoration activities would be implemented under the No-Action Alternative. Current land uses would not be directly altered, and the croplands at the Riparian Sanctuary would continue to be farmed to control invasive plants. Over time, the river is expected to continue to erode along the northwest bank of the Riparian Sanctuary, which would alter flows in the reach of the river near the PCGID-PID pumping plant and fish screen facility. Depending on the effects of the change in flows, uses at the Riparian Sanctuary may change, and efficient operation of the pumping plant and fish screen facility would be threatened (MBK Engineers 2005). Continued erosion of the Riparian Sanctuary may require the Service to modify its management practices at the refuge unit, which could result in stopping agricultural activities and leaving the site to naturalize. Future changes in land use are dependent on the changes in the river, and the Service would continue to manage its lands in response to the changing conditions. Upstream revetment along the peninsula is assumed to be maintained over the long term such that the peninsula does not become cut off, and uses on the peninsula would not change.

If erosion continues along the east bank of the river across from the pumping plant and fish screen facility, the direction of river flow is predicted to change as it approaches the fish screens to be perpendicular instead of parallel, which would affect operation of the fish screens (MBK Engineers 2005). If the fish screens cannot operate effectively, PCGID-PID would not be able to withdraw water from the river and deliver it to their customers adequately, resulting in indirect effects on downstream users who rely on the water supply. Without adequate water supply from the pumping plant and fish screen facility, downstream uses, including agricultural lands and wetlands, could lose an important water source, and the lands may be converted to non-agricultural or non-wetland uses, resulting in severe effects on social and economic conditions and natural resources. PCGID-PID would need to find another means of meeting their water delivery obligations to prevent long-term disruptions to downstream users, which could entail emergency action that would be costly and could result in significant environmental impacts. (Note that implementation of any of the action alternatives is the desired course of action for PCGID-PID to continue operating the pumping plant and fish screen facility.)

Anticipated impacts on land uses and farmland in the project area under the No-Action Alternative would be less than significant; however, the potential effects on downstream uses that rely on the water delivered by the pumping plant and fish screen facility could be significant if the facility can no longer operate effectively.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Installation of spur dikes along the Sacramento River bank on the north side of the Riparian Sanctuary would help protect downstream agricultural and other uses relying on the effective operation of the PCGID-PID pumping plant and fish screen facility. However, the spur dikes would stabilize the river channel and limit natural river processes, such as gravel recruitment, river meander, and natural habitat formation, along the northwest portion of the Riparian Sanctuary, which are important to the ecological health of the river. No changes in use would be expected at the Llano Seco Island 2, Drainage District property, or riparian habitat on the peninsula, assuming upstream revetment is maintained and the river does not cut off the peninsula. Upstream revetment must be maintained to ensure the spur dikes are effective over the long term. As long as the spur dikes are effective, downstream users relying on the water delivered by PCGID-PID would not be adversely affected. The uses of the project area (bank protection measures and riparian habitat) would not conflict with adjacent uses and would benefit agricultural and other uses relying on the pumping plant and fish screen facility, despite the localized adverse effects on natural river processes. The spur dikes would extend into the river above the water surface but would not prevent boaters from using the river in the vicinity.

Uses at the Riparian Sanctuary would change from the current croplands and low-quality wildlife habitat to more diverse and higher quality riparian habitat. The land is not designated as important farmland, and the intent of the croplands is to control invasive plants and prepare the site for restoration. This restoration would return the refuge unit to historic conditions, and the restored riparian habitat would improve use of the Riparian Sanctuary by wildlife and benefit nearby recreational users by providing more scenic views. Land use–related impacts from implementation of Alternative 2 would be less than significant and mostly beneficial.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Installation of traditional riprap along the Sacramento River bank on the north side of the Riparian Sanctuary would provide similar benefits to agricultural and other uses relying on the operation of the PCGID-PID pumping plant and fish screen facility as described for Alternative 2. The traditional riprap is predicted to be more effective than the spur dikes at stabilizing the Sacramento River across from the pumping plant and fish screen facility and is expected to result in longer term benefits to downstream users, despite the localized changes to natural river processes. Installation of a low berm versus no berm would not affect land uses in the project area or downstream, and neither option would create a permanent obstacle to boaters along the river. The restoration benefits would be the same as for Alternative 2. Land use–related impacts would be less than significant and mostly beneficial.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

The traditional riprap would have the same effects as described for Alternative 3. The addition of upstream rock removal under Alternative 4 would encourage a cut off of the peninsula and could change long-term uses of the Llano Seco Island 2 and Drainage District property, while maintaining natural river processes in the reach. Public access for recreation at the Llano Seco Island 2 may be altered with the change in river channel location or may no longer be available, which would be determined at the discretion of the Service and guided by its desired management direction for the refuge unit. Recreation opportunities would continue to be available at nearby areas, and a change in use at the Llano Seco Island

2 would not have a substantial effect on uses in the area. The additional placement of rock along the private property west of the Drainage District property would help protect the uses of that property over the long term as the river cuts off the peninsula. Lands west of SR 45 and the highway itself would be protected from further erosion by the underlying geologic unit, Modesto Formation. The restoration benefits would be the same as for Alternative 2. Land use–related impacts would be less than significant and mostly beneficial.

Impact LU-3: Implementation of the Riparian Sanctuary project could conflict with management plans for the project area.

Alternative 1 – No-Action Alternative

The anticipated changes in uses described under Impact LU-2 may conflict with the Sacramento River NWR CCP, and the lack of restoration at the Riparian Sanctuary would not allow the Service to achieve its management objectives for the refuge unit. Current management actions are minimal and related primarily to invasive plant control, and high-quality riparian habitat is not expected to be restored over time at the Riparian Sanctuary because of the dominance of non-native plants. Because of the lack of restoration activities under this alternative, this alternative would not meet the CCP objectives. The lack of protection for the PCGID-PID pumping plant and fish screen facility could prevent PCGID-PID from fulfilling their management obligations and could have indirect effects on management of downstream lands, as described under Impact LU-2. These impacts could be significant if the facility ceases to operate effectively.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings

The anticipated changes in uses described under Impact LU-2 may conflict with the Sacramento River NWR CCP, but the restoration activities would allow the Service to fulfill its management strategies for the Riparian Sanctuary as described in the CCP. The bank protection measures would limit natural river processes, which are intended to be maintained pursuant to Objective 1.2 in the CCP. However, these measures would also protect the PCGID-PID pumping plant and fish screen facility and ensure compliance with management and operation plans for downstream lands as well as fish screen requirements. The changes in uses would not conflict with designated uses or zoning on adjacent lands and would be consistent with the County general plans as well. Effects of Alternatives 2 and 3 relating to management plan consistency would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

The potential for conflicts with the Sacramento NWR CCP would be similar to those described for Alternatives 2 and 3, except the removal of upstream revetment would allow the Service to achieve its management objectives for maintaining natural river processes. The bank protection measures would provide the same protection as described for Alternatives 2 and 3 for the PCGID-PID pumping plant and fish screen facility. No conflicts would be anticipated at the Riparian Sanctuary or on the upstream peninsula. Effects of Alternative 4 relating to management plan consistency would be less than significant.

3.3 Geology, Fluvial Geomorphology, and Soils

This section describes the geology and soils in the project area and the geomorphology of the Sacramento River in the project vicinity and analyzes the effects of the alternatives on geology, fluvial geomorphology, and soils. The information presented in this section is based on published literature and studies as well as modeling and river analyses completed for the Riparian Sanctuary project.

3.3.1 Regulatory Framework

Sacramento River National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR CCP identifies an objective for incorporating floodplain and river processes into ecological restoration projects to achieve the wildlife and habitat goal of contributing to the recovery of endangered and threatened species and providing natural diversity on the refuge (U.S. Fish and Wildlife Service 2005). Objective 1.2 (Floodplain and River Processes) states that the refuge will "promote recruitment of fish and wildlife habitat by investigating riverbank stabilization, Refuge levees, and floodplain topography for best management options." Strategies are identified to modify levees, restore or enhance bank stabilization features, protect and manage refuge lands in the 100-year floodplain, and coordinate with others on these and related activities. These strategies are directly applicable to the Riparian Sanctuary project.

County General Plans

The Butte County and Glenn County General Plans contain management goals and policies to maintain and enhance geologic and soil conditions in the counties and protect river geomorphology. The Butte County General Plan includes Goal W-6 to improve streambank stability and protect riparian resources, Goal HS-6 to reduce risks from earthquakes, Goal HS-7 to reduce risks from steep slopes and landslides, and Goal HS-8 to reduce risks from erosion (Butte County 2010). The Glenn County General Plan includes goals to protect property from geologic and flooding hazards and to protect water resources in general (Glenn County 1993). The Riparian Sanctuary project would be consistent with the plans.

3.3.2 Affected Environment

The Sacramento River drains the northern part of the Great Valley geomorphic province, which is an alluvial plain about 50 miles wide and 400 miles long (California Geological Survey 2002). This province contains sediments that have been deposited over the past 160 million years. The Sacramento River has a wide floodplain near the project area and has experienced substantial changes in its alignment over the past 100 years. Underlying geologic units have influenced the river's alignment, and the river has likewise influenced the deposition of sediment across its floodplain. This section describes the underlying geologic units, the changing geomorphology of the river near the project area, and the soils that exist in the project area.

Geology

The project area is primarily underlain by stream channel deposits, which extend from the western banks of the Sacramento River to several miles east of the project area (Helley and Harwood 1985). Stream

channel deposits are associated with open, active stream channels that generally lack permanent vegetation and are affected by the constantly changing morphology and hydrologic conditions of the river. These deposits can be 80 feet thick along the Sacramento River. Alluvium is present along the floodplain of the river between the stream channel deposits and Modesto Formation. Alluvium consists of deposits of unweathered gravel, sand, and silt from present-day stream and river systems and forms levees along the Sacramento River. These deposits are associated with younger or more recently developed stream channels and can be up to 30 feet thick. Because the underlying geologic units are relatively young, unique paleontological resources or geologic features are not expected to be present in the project area.

The Modesto Formation forms the western bank of the river where a defined terrace is present and essentially prevents the river from migrating farther west because of its erosion-resistant materials (Larsen et al. 2002). This formation was deposited by younger streams and forms distinct alluvial terraces, alluvial fans, and abandoned channel ridges (Helley and Harwood 1985). Deposits in this formation include unconsolidated, slightly weathered gravel, sand, silt, and clay.

Fluvial Geomorphology

The morphology of the Sacramento River is influenced by sediment mobilization and transport processes, which are affected by hydrology and flood flows. The morphology of a river is determined by the interaction of water and sediment within a channel network as the river deposits and remobilizes sediment along its valley floor. The mass balance resulting from these transport processes indicates the accumulation and removal of sediment and, in turn, determines the channel and floodplain morphology, which are reflected in flood conveyance capacity, stability of natural and engineered river courses, and the complexity of river channel and riparian habitat (Singer and Dunne 2001). The Sacramento River between Hamilton City and Colusa accumulates more sediment than it loses on an annual basis because the reduction in overall channel width in this reach causes water to be sequestered in the wide portion of the reach, which induces overbank flows and subsequent deposition of sediment on bars and adjacent floodplains (Singer and Dunne 2001). The Sacramento River in the vicinity of the project area is a freely meandering channel that forms scrollbar topography and oxbow lakes (abandoned channel segments) (River Partners 2005). This reach of the river varies in width, with a typical width of about 650 feet, and has a down-valley slope (toward the south) of approximately 2.5 x 10-4 (Singer and Dunne 2004). The bed of the river is composed of gravel, sand, and fines with approximately 20 percent of the material being sand-sized or finer sand (Ayres Associates 2011).

The Sacramento River has modified its course near the project area over the past 100-plus years, but it has been restricted from further migration to the west by the Modesto Formation. The alluvial deposits in the historic and current floodplains have continuously eroded and built up, resulting in changes in the river alignment. Levees formed by the deposits as well as bank protection measures along the river banks have influenced the river alignment, somewhat limiting meander. In the project area, revetment (riprap) is present along the north side of the upstream peninsula, north side of the Riparian Sanctuary, east bank of the river upstream of the Riparian Sanctuary, and west bank of the river just upstream of the PCGID-PID pumping plant and fish screen facility. No bank protection is present at the northwest corner of the Riparian Sanctuary along the southern bank of the river, which has experienced ongoing erosion over the

past couple of decades (Larsen 2010 and Mussetter 2004). This erosion has helped to provide a source of material for the formation of an underwater gravel bar across from the facility.

Sinuosity of the river upstream of RM 178 (at the Riparian Sanctuary) has increased over the past century, resulting in oxbows and bends that may cut off in the future to form other oxbows (Water Engineering and Technology, Inc. 1988). Some bends have been constrained from further erosion by geologic formations (e.g., the Modesto Formation) or bank protection measures installed by the U.S. Army Corps of Engineers (Corps) or other agencies. The revetment on the north side of the upstream peninsula has maintained the bend that might otherwise have cut off, and it may also be contributing to the migration of the river farther eastward and downstream (Larsen 2004). Areas of scour have also been identified behind the revetment on the north side of the peninsula, further suggesting that the cut off of the upstream bend may be part of the natural process of this section of river.

The bend just upstream of the Riparian Sanctuary has experienced substantial changes over the past century, as discussed by Larsen (2010). The apex of this bend (point of maximum curvature) moved from an upstream point at approximately RM 180.5 to its current position at RM 179 between 1904 and 2007. Constraints along the western bank have prevented this bend and the bend at RM 178 from moving laterally (east to west). The bend at RM 178 is starting to move farther downstream based on evidence of a slight shift between 1997 and 2007. Larsen (2010) predicts that the river will continue to evolve and the unconstrained bends will move farther downstream, resulting in a shift away from the west bank of the river where the existing PCGID-PID pumping plant and fish screen facility are located. In addition, further retreat of the left bank is predicted to allow the slipface of the underwater bar to approach the pump intakes, causing sedimentation problems near the pumping plant as well as a reduction in stream velocity and approach angle to the fish screens (Mussetter Engineering, Inc. 2004).

Soils

Soils in the project area are deep with a high moisture-holding capacity and are typical of alluvium-formed soils along the Sacramento River. Soils along the banks of the river are silty and sandy, and anaerobic soil conditions are present in swales and wetlands in the project area. Seven soil mapping units have been mapped in the project area (Figure 3.3-1) (Natural Resources Conservation Service 2011). A brief description of each soil unit is provided below based on information in the Soil Survey for Butte Area, Parts of Butte and Plumas Counties (Natural Resources Conservation Service 2006) and Web Soil Survey for Glenn County (Natural Resources Conservation Service 2011). Soil testing at the Riparian Sanctuary in 2004 indicated that the soils have similar characteristics to those mapped by the Natural Resources Conservation Service in the project area, including Gianella silt loam, Parrott silt loam, and Parrott-Vermet Complex (River Partners 2005).

The Gianella soil series consists of very deep, well-drained soils that formed in river alluvium from mixed sources. Gianella soils are on floodplains within meander belts of the Sacramento River. Slopes range from 0 to 2 percent. Surface runoff is slow, and permeability is moderate. The depth to the restrictive layer or hardpan is more than 80 inches. Two Gianella series soil mapping units are in the project area: Gianella sandy loam, 0 to 1 percent slopes, frequently flooded and Gianella silt loam, 0 to 1 percent slopes, frequently flooded. These soil units are considered hydric (i.e., they formed under conditions of

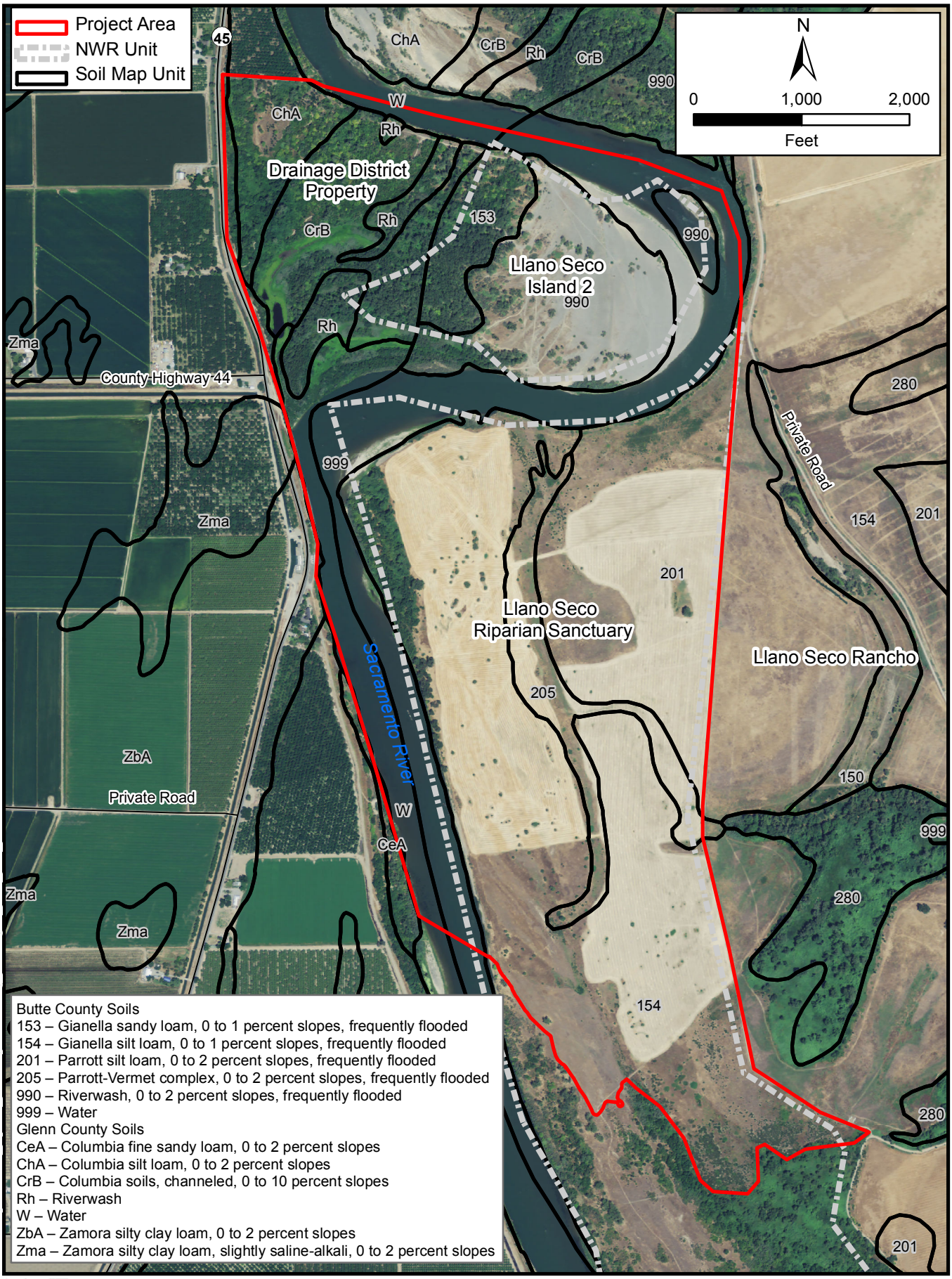
saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper layers). Gianella silt loam is found on the western and southern parts of the Riparian Sanctuary. Gianella sandy loam is found on the west side of Riverwash soils on the peninsula (central part of Llano Seco Island 2).

The Parrott soil series consists of very deep, well-drained soils that formed in silty alluvium from mixed sources. Parrott soils are on Sacramento River floodplains with bar and channel topography. Slopes range from 0 to 2 percent. Surface runoff is very low or low, and permeability is moderate. The soils are occasionally to frequently flooded for very brief to brief periods in December through March. The depth to the restrictive layer or hardpan is more than 80 inches. One Parrott series soil mapping unit and one complex are in the project area: Parrott silt loam, 0 to 2 percent slopes, frequently flooded and Parrott-Vermet complex, 0 to 2 percent slopes, frequently flooded. These soil units are considered hydric. Parrott silt loam is found on the northeast side of the Riparian Sanctuary.

The Vermet series consists of very deep, somewhat poorly drained soils that formed in silty alluvium from mixed sources. Vermet soils are in channels outside of the active meander belt on Sacramento River floodplains with bar and channel topography. Slopes range from 0 to 2 percent. Runoff is negligible to low, and permeability is moderately slow. Water frequently ponds up to several feet deep above the surface for long to very long duration from December through April following flood events. The depth to the restrictive layer or hardpan is more than 80 inches. One Vermet series soil complex is in the project area: Parrott-Vermet complex, 0 to 2 percent slopes, frequently flooded. This soil complex is considered hydric. Parrott-Vermet soil complex is found in the central portion of the Riparian Sanctuary along a flood channel.

The Columbia series consists of moderately well-drained soils that formed in alluvium from mixed sources. Columbia soils are found on floodplains and experience occasional flooding. Slopes range from 0 to 10 percent. Runoff is moderately high to high, and permeability is moderate. The depth to the restrictive layer or hardpan is more than 80 inches. Two Columbia series soil units are in the project area: Columbia silt loam, 0 to 2 percent slopes and Columbia soils, channeled, 0 to 10 percent slopes. These soil units are considered hydric. Columbia soils are found on the west side of the peninsula (Drainage District property).

Riverwash is found along channels and is frequently flooded. Riverwash is formed from sandy and gravelly alluvium derived from igneous and metamorphic rock. Slopes range from 0 to 2 percent, and the soil is excessively drained. The depth to the water table ranges from 0 to 24 inches. This soil unit is considered hydric. Riverwash is found on the east side of the peninsula (most of Llano Seco Island 2).



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 3.3-1
Soil Types

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Geologic and Soil Hazards

The Willows Fault is a northwest-southeast trending fault that transects the Sacramento Valley approximately 6 miles southwest of the project area (Harwood and Helley 1987). Displacement along this fault has not been documented in recent years (i.e., resulting in an earthquake over the past 1.6 million years), although the fault is not necessarily considered inactive (California Geological Survey 2010). Nearby faults with displacement within the past 1.6 million years include the Chico Monocline and Corning faults, located to the northeast and northwest, respectively. Several smaller faults are located in the general vicinity. No Alquist-Priolo Fault Zones have been mapped in or near the project area. The Glenn syncline traverses the project area, generally along the Sacramento River (Harwood and Helley 1987). This syncline is a downfold or trough in the underlying geologic formation, which has influenced the deposition of alluvial material and controlled the course of the Sacramento River.

Geologic hazards in the project area can result from seismic ground shaking, liquefaction, or subsidence. Any area of Butte County may be subject to ground shaking from earthquakes originating from faults in the county or in surrounding areas (Butte County 2007). The California Geologic Survey produces estimates of peak ground acceleration (PGA) values for any given point in California. PGA is a measure of earthquake acceleration on the ground and is measured in units of gravity (G); a value of one is equal to the force of gravity at the Earth's surface. In general, an area with a PGA of 0.001G produces shaking felt by people, and a PGA of 0.50G produces very high shaking that well-designed buildings can withstand. PGA values for the project area range between 0.13G for firm rock and 0.19G for alluvium (California Geological Survey 2011), which indicates the area has the potential to experience very light shaking but no anticipated damage to structures or people.

Ground shaking can result in damage to structures, safety risks to people, and other effects that result in a shift in the ground surface such as liquefaction or landslides. The project area is in an area with high potential for liquefaction because of the presence of a major river system, but it has a low potential for landslides, due to the generally gentle slopes across the land. Subsidence can result from groundwater withdrawals and has a high potential to occur in the project area because of the heavy groundwater use in the vicinity.

Columbia and Gianella series soils have the highest potential for water erosion, followed by Parrott and Vermet series soils (Natural Resources Conservation Service 2011). Riverwash has a lower water erosion potential. Gianella sandy loam and exposed portions of Riverwash soils have moderate susceptibility to wind erosion. The other soils have moderately low susceptibility to wind erosion. Other soil hazards (e.g., expansive or unstable soils) are not expected to be a concern in the project area.

3.3.3 Environmental Consequences

Methodology

The analysis of geology, geomorphology, and soils impacts is based on a review of relevant literature, studies conducted for the Riparian Sanctuary project, and geology and soils data for the project area. Several modeling studies were completed during the planning and design phases of the Riparian Sanctuary project to predict future changes to the Sacramento River with implementation of each

alternative. These results formed the basis for the analysis of impacts on the morphology of the Sacramento River. Geology and soils data from resource agencies were used to assess impacts on the soil types in the project area and the potential for geologic hazards to affect people or structures in the project area. Impacts on soils are discussed quantitatively, but impacts on other topics are discussed qualitatively.

Significance Thresholds

Geology, geomorphology, and soils impacts would be considered significant if the Riparian Sanctuary project would:

- result in substantial soil erosion or the loss of topsoil;
- expose people and structures to potential substantial adverse effects as a result of rupture of a known earthquake fault, strong seismic ground shaking, or seismic-related ground failure; or
- substantially modify the morphology of the Sacramento River, in a manner that would result in substantial erosion, siltation, or flooding.

Impacts and Mitigation Measures

Impact GS-1: Construction activities would disturb soil and could result in erosion or loss of topsoil.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in construction-related impacts on soil resources.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction activities would temporarily disturb approximately 400 acres of soils at the Riparian Sanctuary during access and staging for spur dike construction and site preparation and plantings for the restoration activities. In addition, soils along the Sacramento River at the northwest corner of the Riparian Sanctuary would be temporarily disturbed during removal of low-growing vegetation, placement of rock for the spur dikes, and shaping of the rock by the excavator. Soils in the project area would be exposed to wind and water erosion over the short term, but the restored riparian habitat would protect the soils over the long term. Site preparation for the restoration activities would disturb the topsoil on the Riparian Sanctuary, but the restored riparian habitat would help restore and protect the topsoil and establish a native seed base to provide natural recruitment over the long term, which would improve soil conditions at the Riparian Sanctuary.

Spur dike construction would disturb about 9 acres in the northwest portion of the Riparian Sanctuary where Gianella silt loam is present. The restoration activities would disturb approximately 400 acres across three soil types: Gianella silt loam, Parrott silt loam, and Parrott-Vermet soil complex. These soils have moderate to high potential for wind or water erosion. Soil-disturbing activities could take place at any time of year, and wind and water erosion would be a concern during all phases of construction. Soil erosion can result in indirect effects on water quality, such as from increased turbidity or sedimentation, and on air quality, such as from fugitive dust; these impacts are discussed in Section 3.4, Water

Resources, and Section 3.9, Air Quality, respectively. Because of the large area of disturbance (400 acres) and susceptibility of the soil types in the project area to erosion, construction activities that cause soil erosion would result in a significant impact. Implementation of Mitigation Measure GS-1 would reduce the potential for soil erosion, resulting in a less-than-significant impact.

Mitigation Measure GS-1: Implement construction measures to reduce soil erosion.

The construction contractor will be responsible for implementing measures during all phases of construction to reduce the potential for soil erosion and indirect effects on water quality, air quality, and other resources. PCGID-PID and the Service will be responsible for ensuring that the contractor implements the measures during installation of bank protection measures and restoration activities, respectively. These measures may include, but are not limited to, the following:

- Areas where ground disturbance would occur will be identified in advance of construction and limited to only those areas that have been approved by the Service (for federal lands) or Department of Water Resources (State lands).
- All vehicular construction traffic will be confined to designated access routes and staging areas, as determined at the onset of construction.
- Disturbance will be limited to the minimum necessary to complete all construction and restoration activities.
- To the fullest extent possible, soil disturbance activities will not be conducted during significantly wet or windy weather.
- Erosion and sediment control measures will be in place prior to the onset of the rainy season and will be monitored and maintained in good working condition until disturbed areas have been revegetated. If work activities take place during the rainy season, erosion control structures must be in place and operational at the end of each work day.
- All stockpiles will be covered at the end of the work day during periods of wet or windy weather.
- Revegetation and restoration activities would be implemented during and after construction to help stabilize soils following disturbance.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of traditional riprap and restoration of the Riparian Sanctuary under Alternative 3 would result in similar effects on soils as described for Alternative 2. Construction of the riprap would disturb more soil along the Sacramento River in an approximately 9-acre area because of the need to excavate and place more rock than the spur dikes. Restoration activities would be the same as with Alternative 2, resulting in disturbance to approximately 400 acres of soils. Soil erosion impacts during construction would be significant, but the implementation of Mitigation Measure GS-1, described for Alternative 2, would reduce the potential for soil erosion, resulting in a less-than-significant impact.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap and restoration of the Riparian Sanctuary under Alternative 4 would result in similar effects on soils as described for Alternatives 2 and 3. Removal of upstream rock would, however, result in additional soil disturbance along the north side of the peninsula. Soils along the northern side of the peninsula include Columbia silt loam, Columbia channeled soils, riverwash, and Gianella sandy loam; these soils have moderate to high potential for wind and water erosion. Soil disturbance associated with rock removal would result in similar effects on soil as described for Alternatives 2 and 3. Soil erosion impacts during construction would be significant, but the implementation of Mitigation Measure GS-1, described for Alternative 2, would reduce the potential for soil erosion, resulting in a less-than-significant impact.

Impact GS-2: Implementation of the Riparian Sanctuary project could modify the channel morphology of the Sacramento River between RM 177.5 and RM 179.

Alternative 1 – No-Action Alternative

None of the bank protection measures or restoration activities would be implemented under the No-Action Alternative. Over time, the Sacramento River is expected to continue to retreat southeast away from its current alignment and the PCGID-PID pumping plant and fish screen facility (Larsen 2004, 2010). Erosion would continue along the northwest bank of the Riparian Sanctuary, which would alter flows in the reach of the river near the PCGID-PID pumping plant and fish screen facility. Alteration of the existing hydraulic conditions near the apex of the bend near RM 178 combined with continued bank retreat would cause the slipface of the existing underwater bar to migrate toward the pump intakes (Mussetter Engineering, Inc. 2004). These expected changes would increase sedimentation and modify the approach angle and velocity in front of the pumping plant and fish screen facility, which would prevent the efficient operation of the facility. Operation of the PCGID-PID pumping plant and fish screen facility would be threatened by the changing river alignment, which could entail emergency action that would be costly and could result in significant environmental impacts. Discussions of other consequences of these changes on downstream uses and other resources are provided in Section 3.2, Land Use; Section 3.4, Water Resources; and Section 3.6, Vegetation, Wildlife, and Sensitive Biological Resources.

Without bank protection measures, the current hydrologic processes would continue to affect the local fluvial system as they have in the past, and the morphological changes to the Sacramento River would simply be a result of these naturally occurring processes. Upstream revetment along the peninsula is assumed to be maintained over the long term such that the peninsula does not become cut off, and the river in that reach would also be subject to naturally occurring processes and would be similar to current conditions. Implementation of the No-Action Alternative would have a less-than-significant impact on the Sacramento River between RM 177.5 and RM 179. However, due to the potential impacts of the No-Action Alternative on the continued operation of the pumping plant and fish screen facility, implementation of one of the action alternatives is the desired course of action for PCGID-PID to protect their facility.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Installation of the spur dikes along the northwest side of the Riparian Sanctuary would stabilize the river and prevent it from migrating significantly further to the southeast (Larsen 2004, 2010), while also maintaining flow velocities and vectors near the PCGID-PID pumping plant and fish screen facility during the bank-full flow regime (Ayres Associates 2010). The existing gravel bar that has been accumulating near the apex of RM 178 would be replaced by eight riprap dikes that would extend approximately 75 feet out from the bank across the gravel bar. These dikes would reduce the potential for the bank to erode, although some erosion might occur between the dikes until vegetation becomes established. The upstream reach around the peninsula is predicted to be similar to current conditions over the next 50 years, and the maintenance of the riprap on the northern side of the peninsula would slow erosion of that bank.

The spur dikes would maintain the current alignment of the channel near the bend at the northwest corner of the Riparian Sanctuary that is necessary to protect the PCGID-PID pumping plant and fish screen facility, which is a primary purpose of the Riparian Sanctuary project. Although the spur dikes would artificially restrain the river from its natural meander process, a large portion of the river upstream is already restrained from this process by other bank protection measures. The installation of the spur dikes would simply be an extension of the existing upstream bank protection measures.

As discussed in Section 3.4, Water Resources, floodwater conveyance velocities are expected to decrease over the Riparian Sanctuary floodplain due to the establishment of riparian vegetation as part of restoration activities (Ayres Associates 2010). A decrease in velocity by itself may not cause a direct impact in the project area, but reduced velocities can impede the downstream movement of water, causing increases in river stage upstream and increases in sedimentation due to decreased competency of the river. Increases in river stage can increase the potential impacts of upstream flooding and have other consequences on the river channel. The potential increase in sedimentation in the project area could alter the configuration of the channel and floodplain. Flood conveyance velocities across the floodplain where riparian habitat is restored are not expected to appreciably increase the amount of sediment deposition because flow velocities would retain enough competency to transport most of the mobilized sediments downstream, despite the predicted decrease in conveyance velocities (Ayres Associates 2011). Therefore, it is likely the floodplain and river channel would retain a similar alignment and function as they do under existing conditions.

The spur dikes would likely have little effect on the river channel morphology, and natural hydrologic processes would continue to shape the channel downstream of the spur dikes. The effects on the morphology of the Sacramento River would ultimately be beneficial for the pumping plant and fish screen facility, and the changes to river morphology would be minimal, resulting in a less-than-significant impact on the existing morphology and function of the Sacramento River in the project area.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Installation of traditional riprap, with or without a low berm, along the northwest bank of the Riparian Sanctuary would prevent additional erosion of the riverbank and prevent the bend upstream of the pumping plant and fish screen facility from migrating farther to the southeast (Larsen 2004, 2010), similar

to the spur dikes with Alternative 2. The riprap would likely generate some localized turbulence in the water column due to channel confinement and the roughness of the riprap, but any changes to river morphology would be similar to the spur dikes, with only localized or minor differences. The low berm option would provide for a smooth flow alignment and a planting surface for vegetation, which would likely increase laminar flow through the reach. The restored riparian habitat would have the same effects on the floodplain as described for Alternative 2. The floodplain and river channel are expected to retain a similar alignment and function as they do under existing conditions, and impacts on the existing morphology and function of the Sacramento River in the project area would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, changes to the morphology of the Sacramento River over the short term would be the same as described for Alternatives 2 and 3, but the removal of rock on the upstream peninsula would encourage a cut off of the river and eventually allow natural processes to modify the alignment of the river through the project area. Initially, the removal of the rock is not expected to have any effects on the conveyance of water during peak flows, but over time and sooner than under existing conditions, the river would continue its natural meander cut-off process, which has already been initiated behind the existing revetment (as evidenced by existing scour holes) (Mussetter Engineering, Inc. 2004).

Modeling results indicate that a channel would likely form across the bend of the peninsula within 5 years after removal of the rock, which would eventually cut off the existing meander (Larsen 2010). The formation of a cut-off channel would mobilize an estimated 311 cubic yards of sediment during its formation and likely cause the existing river channel to become abandoned during low flows, forming an oxbow lake (Ayres Associates 2011). It is unclear how the mobilization of sediment and formation of an oxbow lake would affect channel alignment or floodwater conveyance in the project area, but floodwater conveyance is still expected to occur across the Riparian Sanctuary during peak flows. As the river cuts through the peninsula, erosion processes would modify the land and could encroach on the private property to the west and other properties along SR 45. Re-use of the rock along the private property would help stabilize the channel to prevent further erosion of the property. The geologic unit (Modesto Formation) would prevent further erosion west along SR 45 and protect the highway and other properties along the highway.

With the installation of traditional riprap on the northwest side of the Riparian Sanctuary, water flowing through the meander cut-off channel and downstream would maintain favorable alignment with the PCGID-PID pumping plant and fish screen facility (Mussetter Engineering, Inc. 2004). Although the cut-off channel would change the Sacramento River alignment, the changes would be similar to natural processes if no bank protection were in place on the upstream peninsula. In addition, the combination of the cut-off channel and bank protection measures on the northwest side of the Riparian Sanctuary would benefit the PCGID-PID facility, which is a primary objective of the Riparian Sanctuary project. In conclusion, impacts on the existing morphology and function of the Sacramento River in the project area would be less than significant.

Impact GS-3: Implementation of the Riparian Sanctuary project could expose people or structures to geologic hazards.

Alternative 1 – No-Action Alternative

None of the bank protection measures or restoration activities would be implemented under the No-Action Alternative. Current uses in the project area would continue, including farming of croplands at the Riparian Sanctuary, operation of the PCGID-PID pumping plant and fish screen facility, and periodic recreational uses in the vicinity. The potential for earthquakes or other geologic hazards to affect people in the project area or the pumping plant and fish screen facility would be the same as under current conditions (PGA values between 0.13G for firm rock and 0.19G for alluvium and very light shaking anticipated), and this alternative would not increase or decrease the exposure of people to such hazards.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Installation of the bank protection measures and restoration of the Riparian Sanctuary under each of the action alternatives and the additional removal of upstream rock under Alternative 4 would not change the potential for geologic hazards in the project area, as discussed for the No-Action Alternative. Construction workers could be exposed to potential hazards during the construction period, and maintenance and monitoring workers could be exposed over the long term as they periodically access the project area. The distance of the project area from known active faults reduces the potential for substantial ground shaking and severe effects on the land, structures, and people in the project area during an earthquake. The bank protection measures would be composed of riprap, similar to other revetment in the vicinity, and would not be substantially damaged from ground shaking or other earthquake-related impacts. Ground water would be used for irrigation of the restored riparian habitat, but the short-term nature of the irrigation and amount of ground water withdrawn (see Section 3.4, Water Resources, for further discussion) would not be expected to result in substantial subsidence in the project area. Impacts associated with geologic hazards would be less than significant.

3.4 Water Resources

This section describes surface water and groundwater hydrology and water quality and analyzes the effects of the alternatives on the Sacramento River, its tributaries, and the groundwater basin. It also provides a brief discussion of water use, as it applies to the PCGID-PID pumping plant and fish screen facility.

3.4.1 Regulatory Framework

Clean Water Act

The Clean Water Act as amended (CWA) was originally known as the Federal Water Pollution Control Act of 1972. It protects the surface water quality of the nation's waters through enforcement of water quality standards and permits for the discharge of pollutants into navigable waters. Section 303 requires each state to adopt water quality standards for the protection of designated beneficial water uses for water bodies within the state. Section 401 requires applicants for federal permits to obtain water quality certification from the State if the proposed activities would discharge pollutants into a navigable water body. Section 402 establishes a framework for regulating stormwater discharges into surface water by issuance of a National Pollutant Discharge Elimination System permit, which establishes pretreatment standards for discharged water. Section 404 establishes a permitting program for discharges of dredged or fill material into waters of the United States. These and other sections of the CWA are intended to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters to support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." The Riparian Sanctuary project would involve activities that require compliance with the CWA, specifically Sections 401, 402, and 404.

The CWA also requires states to maintain a list of impaired water bodies that do not meet water quality standards and are not supporting the designated beneficial uses. These waters are placed on the Section 303(d) List of Impaired Water Bodies. Inclusion on this list triggers development of a pollution control plan, based on a determination of the Total Maximum Daily Load of pollutants detected in waterways in the state, to make sure that water quality does not exceed the limits established by the CWA. Some reaches of the Sacramento River are on the 303(d) list.

Rivers and Harbors Act

The Rivers and Harbors Appropriation Act of 1899 is commonly known as the Rivers and Harbors Act. It protects navigable waters by restricting unauthorized changes to harbors or rivers, such as from installation of wharfs, dikes, dams, piers, or levees. The Corps administers the act and issues permits for certain activities. Section 10 requires a permit for any activity that would obstruct or alter a navigable water of the United States. These permits are often coordinated with the CWA Section 404 permits.

Sacramento River National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR CCP identifies an objective for incorporating floodplain and river processes into ecological restoration projects to achieve the wildlife and habitat goal of contributing to the recovery of endangered and threatened species and providing natural diversity on the refuge (U.S. Fish and

Wildlife Service 2005). Objective 1.2 (Floodplain and River Processes) states that the refuge will "promote recruitment of fish and wildlife habitat by investigating riverbank stabilization, Refuge levees, and floodplain topography for best management options." Strategies are identified to modify levees, restore or enhance bank stabilization features, protect and manage refuge lands in the 100-year floodplain, and coordinate with others on these and related activities. These strategies are directly applicable to the Riparian Sanctuary project.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1969 is enforced by the State Water Board and the nine Regional Water Quality Control Boards (Regional Water Boards). It defines "waters of the state" as water bodies with boundaries in the state, including any surface or ground water, whether fresh or saline. The intent of the act is to provide a comprehensive program for the protection of water quality and beneficial uses of water through the regulation of waste discharges. Waste discharges may include such substances as wastewater effluent and discharges of fill and dredged material into waters of the state.

California Water Code

The Central Valley Flood Protection Board has jurisdiction over state flood control projects in the Central Valley, including along all tributaries of the Sacramento and San Joaquin rivers and in the Tulare and Buena Vista basins. The Board can authorize the erection, maintenance, and protection of such levees, embankments, and channel rectification as will, in its judgment, best serve the interests of the state. In addition, the Board is responsible for issuing permits for modifications to flood control levees and other facilities installed to protect the public from floods.

Water Quality Control Plan for the Sacramento River and San Joaquin River Basins

The Regional Water Boards adopt and implement water quality control plans that recognize the unique characteristics of each region with regard to natural water quality; past, present, and reasonably foreseeable beneficial uses; and water quality problems. The *Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin* (Basin Plan) is designed to preserve and enhance water quality and protect the beneficial uses of all regional waters, encompassing approximately one fourth of the state (Central Valley Regional Water Quality Control Board 2009). Specifically, the Basin Plan: (1) designates beneficial uses for surface and ground waters; (2) sets narrative and numerical objectives that must be attained or maintained to protect beneficial uses; and (3) defines implementation programs that include specific prohibitions, action plans, and policies to achieve the water quality objectives.

County General Plans

The Butte County and Glenn County General Plans contain management goals and policies to maintain and enhance water quality in the counties and protect the Sacramento River. The Butte County General Plan includes Goal W-1 to maintain and enhance water quality, Goal W-2 to maintain water supply for county uses, Goal W-3 to manage groundwater resources, Goal W-5 to protect water quality, and Goal HS-2 to protect people and property from flood risk (Butte County 2010). The Glenn County General Plan includes goals to protect water resources in general (Glenn County 1993). The Riparian Sanctuary

project would be consistent with the plans by incorporating measures to protect water quality of the Sacramento River.

3.4.2 Affected Environment

The Sacramento River watershed encompasses 27,000 square miles in the northern part of the Central Valley (Sacramento Valley Water Quality Coalition 2004). The Sacramento River is the main drainage in the watershed, and it flows through the project area between the Riparian Sanctuary and upstream peninsula. River flow is influenced by runoff, flow from tributaries, flood control, and operation of Shasta Dam, and most of the water not consumed for irrigation or other purposes eventually returns to the river via various tributaries or percolates into the groundwater aquifer. The river and the underlying groundwater basin are major sources of water supply in the Sacramento Valley. Water quality of the river and ground water are influenced by a variety of natural and anthropogenic factors. This section discusses surface and groundwater hydrology and water quality in and near the project area.

Surface Water Hydrology

The Sacramento River originates above Shasta Lake at Mount Shasta, approximately 125 miles north of the project area, and flows generally south into the Sacramento-San Joaquin River Delta, approximately 105 miles (178 river miles) south of the project area. Flow in the Sacramento River below Shasta Lake is heavily regulated by Shasta Dam. Annual average flow in the river is 19,000 cubic feet per second (cfs), and the 10-year flood flow is estimated at 134,000 cfs, which is controlled by releases through Shasta Dam and is a reduction from an estimated pre-dam flood flow of 218,000 cfs (Sacramento Valley Water Quality Coalition 2004). Summer flow is primarily from winter rain and spring snowmelt runoff that is stored in Shasta Lake and released during the normally dry summer months. Typical summer flow in the Sacramento River is estimated to be 8,000 cfs at Red Bluff, approximately 40 miles north of the project area, and 12,000 cfs just north of Sacramento, approximately 70 miles south of the project area (Heiman and Knecht 2011). Winter flow is from reservoir releases and storm runoff, with diversions to bypass channels reducing flow for flood control. Downstream of Butte City, an elaborate system of levees and bypasses controls flooding along the river, and overflow from the river spills into the Colusa, Sutter, and Yolo bypass channels. Precipitation varies widely throughout the watershed, resulting in highly variable annual and monthly flows along the Sacramento River.

The project area is in the Sacramento Valley subregion of the Sacramento River watershed, between RM 178 and RM 180 (river miles are calculated as distance from the Delta). The Sacramento Valley encompasses approximately 5,500 square miles and extends from Redding, below Shasta Dam, to Sacramento and the Delta (Heiman and Knecht 2011). Precipitation in the valley is primarily in the form of rainfall and ranges from 18 inches (average annual) near Sacramento to 35 inches near Redding.

Flow in the Sacramento River near the project area is measured at Colusa, approximately 25 miles downstream, and was measured at Butte City, approximately 6 miles downstream, through 1995 (U.S. Geological Survey 2011). Peak flow measured at Colusa between 2000 and 2009 ranged from 37,100 cfs in February 2007 to 49,400 cfs in January 2006 (Table 3.4-1). A peak flow of 143,000 cfs was measured in 1995 at Butte City (Table 3.4-2), which is substantially higher than at Colusa during more recent years.

Table 3.4-1. Peak Annual Flow in Sacramento River Measured at Colusa (2000–2009)

Year	Date	Peak Flow in cfs
2000	March 7	43,200
2001	March 6	39,600
2002	January 4	43,300
2003	January 1	46,500
2004	February 20	49,000
2005	May 20	44,200
2006	January 2	49,400
2007	February 11	37,100
2008	January 27	37,900
2009	February 18	38,500

cfs = cubic feet per second

Source: U.S. Geological Survey 2011

Table 3.4-2. Peak Annual Flow in Sacramento River Measured at Butte City (1985–1995)

Year	Date	Peak Flow in cfs
1986	February 19	145,000
1987	March 13	53,600
1988	January 5	50,500
1989	March 11	53,400
1990	January 15	28,800
1991	March 5	33,200
1992	February 13	49,700
1993	January 22	95,100
1994	February 8	27,500
1995	January 10	143,000

cfs = cubic feet per second

Source: U.S. Geological Survey 2011

Hydraulic modeling to support the design phase of the Riparian Sanctuary project identified assumptions for flow in the Sacramento River at RM 181.5, bankfull width of the river at RM 176 and RM 173, and estimated overbank flow at RM 173 (Ayres Associates 2010). Inflow was estimated at 90,455 cfs under bankfull conditions at RM 181.5 and 271,000 cfs for design flow conditions at RM 181.5. Bankfull width was assumed to be 100.16 feet at RM 176 and 100.3 feet at RM 173. Overbank flow at RM 173 was estimated at 111,000 cfs. These assumptions and estimates were used to model river conditions under future scenarios with the Riparian Sanctuary project.

The Butte Basin lies to the east of the Sacramento River and extends from the Butte Slough outfall gates near Meridian (RM 138) to Big Chico Creek near Chico Landing (RM 194), east of the project area. The Butte Basin Overflow Area is an essential element of the flood management system for the Sacramento River. Flood flows are diverted out of the Sacramento River into the Butte Basin and Sutter Bypass via several designated overflow areas (i.e., low points along the east side of the river) that allow high flood flows to exit from the Sacramento River channel. Overflow into the Butte Basin reduces the peak discharge and stage between the main levees of the Sacramento River Flood Control Project. The reduction of discharge and stage in the river is necessary to prevent the overtopping and subsequent failure of the flood control project levees downstream. The Sutter Bypass, in turn, conveys flows to the lower Sacramento River region at the Fremont Weir near the confluence with the Feather River and into the Sacramento River and the Yolo Bypass (U.S. Army Corps of Engineers and California State Reclamation Board 2002).

At high stages, water flows from the Sacramento River into the Butte Basin at two locations: the 3B's natural overflow site is located immediately upstream of Dead Man's Reach at RM 186.5, and the M&T Bend Flood Relief Structure is located between Capay and Dead Man's Reach at RM 191. Additional flood flows are diverted out of the Sacramento River into the Butte Basin and Sutter Bypass via the Goose Lake Flood Relief Structure and the Moulton, Colusa, and Tisdale weirs.

The Sacramento River and adjacent lands in and near the project area are in a designated special flood hazard zone of Zone A, as mapped by the Federal Emergency Management Agency (2011). This zone applies to areas where no base flood elevation has been determined, but the areas are subject to a 1 percent annual chance of flood (the 100-year flood). During major flood events, flow in the Sacramento River can flood adjacent lands between State Route (SR) 45 on the west and Angel Slough to the east (The Reclamation Board 1986). Bank protection (i.e., flood control levees) along the Sacramento River has helped control overflow as part of the Sacramento River Flood Control Project, including revetment along the east bank just upstream of the Riparian Sanctuary and along the north side of the upstream peninsula. Instead of flowing directly east over the east bank, flood flows are diverted south through the Riparian Sanctuary and either return to the river or flow across adjacent lands. The Riparian Sanctuary is periodically flooded as a result of overbank flow, which has affected uses of the land (River Partners 2005).

Surface Water Quality

The Sacramento River and its tributaries are generally characterized as having good overall water quality. The water quality of the Sacramento River is commonly attributed to the purity of snowmelt, the primary source of water in the river system. As water flows downstream through the watershed, it accumulates pollutants and constituents associated with human activities, resulting in decreased water quality. Major sources of added constituents are eroded soils, agricultural return flows, runoff from urban areas, discharges from municipal wastewater treatment facilities, and runoff from historic mining activity. Water quality in most reaches is considered good with regard to drinking water parameters.

The State is responsible for protecting water quality in the Sacramento River in accordance with the Basin Plan, which designates beneficial uses of the river and identifies water quality objectives to protect those

uses (Central Valley Regional Water Quality Control Board 2009). The Sacramento River from Shasta Dam to Colusa Basin Drain has the following existing designated beneficial uses:

- Municipal and domestic supply
- Irrigation and stockwatering for agricultural use
- Service supply and power for industrial use
- Contact recreation
- Canoeing and rafting
- Other noncontact recreation
- Warm and cold freshwater habitat
- Warm and cold migration habitat
- Wildlife habitat
- Navigation

General water quality objectives for the river relate to maintaining good water quality such that beneficial uses are not adversely affected and minimizing pollutant levels in discharges into the river. More specific, quantified objectives are identified in the Basin Plan for some pollutants and constituents. The primary water quality issues in the Sacramento Valley include (Heiman and Knecht 2011):

- pesticide contamination of surface and ground water from agricultural and urban sources,
- nitrate contamination of ground water,
- sediment binding pesticides that bioaccumulate through the food chain,
- abandoned mines and discharge of heavy metals,
- mercury from legacy mining operations and natural sources,
- urban runoff, and
- operations of dams and diversions that affect stream flow and water quality.

Pesticides, which can be transported into the river by runoff, pose a risk to human health and aquatic life (Sacramento River Watershed Program 2005). Some pesticides have been reported at levels above toxicity thresholds during water quality sampling of the river, and high levels of pesticide concentrations can affect aquatic habitat, recreational fishing, and water supply uses of the river. The levels of pesticides monitored by the Sacramento River Watershed Program in 2003–2004 did not appear to be high enough to impair or threaten beneficial uses. Aquatic toxicity, which can result in mortality or reproduction problems in fish, has been a concern in some reaches of the river, likely due to agricultural and urban runoff.

Concerns with elevated concentrations of mercury in the river relate to fish consumption and the protection of wildlife and human health. The northwestern Sierra Nevada region was extensively mined for both its hardrock-gold and placer-gold deposits. The watersheds of the American, Bear, Yuba, and Feather rivers were primarily affected by hydraulic mining (U.S. Geological Survey 2000), which are located south (downstream) of the project area, although some mining activities were conducted in watersheds that drain upstream of the project area. Concentrations of mercury in the streambed sediments of 24 sites sampled in California during the U.S. Geological Survey National Water-Quality Assessment Program suggested that sites on the Sacramento River downstream of the Feather River tended to have higher mercury concentrations relative to sites sampled upstream of the confluence of these two rivers because of the locations of historical gold mining (U.S. Geological Survey 2000). However, the reach of the Sacramento River from Hamilton City to Knights Landing, which includes the project area, is listed as

a 303(d) impaired segment for mercury. The source of high levels of mercury is unknown, but analyses of fish tissues sampled in the river between Hamilton City and Knights Landing reported exceedances of the State's mercury screening value (0.3 micrograms per gram), which indicates that mercury concentrations in the river could threaten beneficial uses (U.S. Environmental Protection Agency 2006).

Turbidity is the ability of fluid to scatter and absorb light through the water column, or simply a measure of the cloudiness or haziness of a fluid. The amount of suspended matter and related turbidity levels are a result of natural erosion and sediment transport processes of a fluvial system, with higher discharge volume relating to higher turbidity values. Background turbidity levels of the Sacramento River at Hamilton City range between 1 Nephelometric turbidity units (NTU) to 270 NTU. Turbidity levels fluctuate seasonally in the Sacramento River. During the rainy season (November–April), turbidity levels of the Sacramento River at Hamilton City range between 5 NTU and 70 NTU, and during the dry season (June-October), turbidity levels range between 1 NTU and 5 NTU. Turbidity as a result of naturally occurring processes is not necessarily a detriment to beneficial uses, but elevated levels of turbidity due to anthropogenic activities may adversely affect aquatic organisms and other beneficial uses.

Ground Water

The Sacramento Valley groundwater basin contains 17 subbasins and provides a major source of water supply for agricultural, municipal, and domestic uses (California Department of Water Resources 2003). Sediments underlying the valley have varying permeabilities, and coarser sediments produce larger volumes of water than finer sediments. Wells in the valley can yield between 100 gallons and several thousand gallons of water per minute. Groundwater supplies are becoming more important as a supplemental source of water for agricultural and other uses, particularly in drought years when surface supplies are reduced. Groundwater levels in the West Butte subbasin appear to be declining in areas with higher use, and a 10- to 15-foot decline has been estimated since the 1950s based on a comparison of spring groundwater levels. Groundwater quality is considered to be excellent overall, but some subbasins experience higher salinity and other constituent levels as a result of natural and anthropogenic factors.

The project area is in the West Butte subbasin, near its boundary with the Colusa subbasin. Stream channel deposits underlying the project area represent the upper part of the unconfined zone of the aquifer and have limited water-bearing capacity (California Department of Water Resources 2003). The Modesto Formation along the west bank of the river yields a moderate groundwater supply where gravel and sand predominate. Groundwater flow in the vicinity of the project area is toward the Sacramento River. Depth to ground water in the project area is not known but is likely more than 80 feet (the estimated thickness of the stream channel deposits).

Water Use

PCGID-PID have contracts with the U.S. Bureau of Reclamation to withdraw water from the Sacramento River for water supply (irrigation) between April and October and for agricultural operations and wetlands during the non-irrigation season through their riparian and appropriative rights. Their water rights are senior to those of the Central Valley users. The greatest demand for irrigation water is in the spring when fields are being flooded for rice and in the summer during periods of high temperatures. Table 3.4-3 shows the water supply contracts PCGID-PID have during each month they are entitled to

withdraw water from the river. The combined amount of water both districts can withdraw is 122,540 acre-feet per year.

Table 3.4-3. PCGID-PID Summer Water Supply Contracts

	PCGID Contract (acre-feet)	PID Contract (acre-feet)	Total (acre-feet)	Average Daily (cfs)
April	10,800	7,210	18,010	303
May	13,500	10,830	24,330	396
June	13,190	12,920	26,110	439
July	12,740	9,800	22,540	367
August	11,180	3,500	14,680	239
September	5,000	7,900	12,900	217
October	1,400	2,570	3,970	65
Total	***67,810***	***54,730***	***122,540***	

Source: Borcalli and Associates 1997, as cited in MBK Engineers 2005

PCGID-PID consolidated their pumping plants in 1999 by constructing the current PCGID-PID pumping plant and fish screen facility located on the west bank of the Sacramento River at RM 178. This facility includes state-of-the-art fish screens that comply with requirements of the Central Valley Project Improvement Act Anadromous Fish Screen Program. The pumping plant has capacity to pump 600 cfs to meet the maximum demand.

The Riparian Sanctuary project is designed to maintain operation of the pumping plant and fish screen facility and would not provide PCGID-PID with the ability to withdraw additional water. Existing contracts and licenses to pump regulate the quantity of water pumped by the facility, and these contracts and licenses would not be modified. Water cannot be pumped to additional water districts per the contracts, and the area of use of the water is limited to “place of use” language written into the contracts. For these reasons, PCGID-PID water management or place of use in the future would not be changed by the Riparian Sanctuary project and would remain as it is defined in the contracts. Changes to water use are not discussed further in this document.

3.4.3 Environmental Consequences

Methodology

The analysis of surface water and groundwater hydrology and water quality impacts is based on a review of relevant literature, studies conducted for the Riparian Sanctuary project, and available water quantity and water quality data for the project area. In addition, several modeling studies were completed during the planning and design phases of the Riparian Sanctuary project to predict future changes to the Sacramento River with implementation of each alternative. These results formed the basis for the analysis of impacts on the water resources of the Sacramento River. Impacts on water resources are discussed qualitatively.

Significance Thresholds

Hydrology and water quality impacts would be considered significant if the Riparian Sanctuary project would:

- create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- violate any water quality standards or waste discharge requirements;
- substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in substantial erosion, siltation, or flooding on- or off-site;
- place within a 100-year flood hazard area structures that would impede or redirect flood flows; or
- expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

Impacts and Mitigation Measures

Impact WR-1: Construction activities could result in short-term increases in turbidity and sediment levels that could degrade water quality and affect the beneficial uses of the Sacramento River.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place; therefore, no construction-related increases in turbidity or total suspended solids levels would occur.

Alternative 2 – Spur Dikes and Site Specific Plantings

Under Alternative 2, in-water and near-channel construction activities for installation of spur dikes and restoration activities would temporarily increase turbidity and total suspended solids in the Sacramento River. The eight spur dikes would require placement of approximately 1,520 tons (1,125 cubic yards) of riprap in the river for each spur dike, resulting in a total of 12,160 tons (9,000 cubic yards) for all eight spur dikes. The spur dikes would extend 75 feet from the bank into the river, and most of the dikes would be installed on the existing gravel bar along the northwest side of the Riparian Sanctuary, which would be exposed during construction, minimizing placement of fill into the wetted portion of the channel. The placement of non-native fill material would result in short-term increases in turbidity levels as this material is redistributed within the wetted portion of the channel, off the gravel bar, or where it might enter the river.

Access, staging, and site preparation for restoration activities would disturb soils in upland areas and along the riverbank on the Riparian Sanctuary, which could discharge sediment into the river. In addition, increases in turbidity levels would occur when newly disturbed areas are exposed to rainfall as stormwater runoff dislodges and transports fine sediment from the disturbed soils directly to the

Sacramento River. Newly disturbed, unvegetated, and compacted soils are the most susceptible to erosion because few physical barriers (e.g., vegetation) are available to limit the momentum of coalescing water, which accelerates erosion, and cohesion between soil particles is limited, which increases the potential for particles to be transported. Sediments may be suspended in the river for several hours following construction activities. The extent of downstream sedimentation would be a function of the size and mobility of the substrate. The fine-grained sediments, such as the silt and clay that compose approximately 10 percent of the streambed sediments (Ayres Associates 2011) in the project area, could be carried several thousand feet downstream of the in-water construction area, while larger-sized sediments, such as coarse sands and gravels, tend to drop out of the water column within several feet of the construction area.

Although no excavation of the streambed is anticipated, spur dike construction and restoration activities could result in short-term increases in turbidity and suspended solids concentrations in the water column that could violate the Basin Plan objectives for turbidity for this segment of the Sacramento River and affect beneficial uses. To protect beneficial uses and achieve the water quality objective for turbidity levels in the Sacramento River, activities cannot increase turbidity levels more than 20 percent above background turbidity levels (Central Valley Regional Water Quality Control Board 2009). Although the incorporation of design elements and construction criteria described in Chapter 2 (e.g., monitoring water quality, locating staging areas away from the river, and minimizing in-water activities) is intended to limit the total addition of fine suspended sediment to the Sacramento River, short-term increases in turbidity could exceed the Basin Plan objective as a result of in-water construction activities, which would be a significant impact.

Implementation of Mitigation Measure WR-1 would maintain downstream turbidity levels within Basin Plan objectives during most of the construction activities. However, even with these mitigation measures in place, it is possible that turbidity levels may exceed Basin Plan objectives for limited periods due exclusively to the variable nature of in-water work (i.e., material placement). These instances are expected to be minor and infrequent, and turbidity levels are expected to remain in compliance for most of the construction period. With implementation of Mitigation Measure WR-1, construction-related impacts on water quality from increased turbidity would be less than significant.

Mitigation Measure WR-1: Implement measures to minimize increased turbidity levels in the Sacramento River during construction.

The construction contractor will be required to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP), which will identify measures to be implemented during construction that will minimize disturbance to fine-grained sediments in the Sacramento River and prevent the discharge of sediment into the river from upland activities. PCGID-PID will be responsible for ensuring implementation of these measures and compliance with Basin Plan objectives during installation of bank protection measures. The SWPPP will include, but is not limited to, the following measures:

- Fill material (quarry stone, riprap, and backfill) will be composed of washed materials from a local source. Stone materials will be washed to remove any silts, sand, clay, and organic matter and will be free of contaminants such as petroleum products. Gravel and stone materials will

pass California cleanliness test #227 (or equivalent test) with a value of 85 or greater. Soil-filled quarry stone will only be placed above the average water surface elevation during construction.

- An effective arrangement of silt curtains will be installed downstream of the proposed location of the bank protection measures to limit the downstream transport of disturbed sediments and maintain compliance with Basin Plan water quality objectives for turbidity. In-water construction will move in an upstream direction to allow the silt curtains to sequester any mobilized materials from upstream activities. Silt curtains have been shown to be effective measures of mitigating turbidity levels in dredging operations, but curtains are less effective in water deeper than 21 feet and velocities greater than 1.6 feet per second (Francingues and Palermo 2005). Silt curtains should be installed to sequester as much disturbed sediment as possible given the current hydrologic conditions of the river (e.g., channel depth and velocities) and the performance capabilities of the silt curtains. Silt curtains will be kept in normal working order and allow fish that may enter the curtained area adequate room to exit the area freely. Curtains will also be installed such that they do not prohibit the free movement of fish in the Sacramento River or inhibit or restrict boat traffic. Silt curtains will be left in place until the completion of all in-water work.

- Suitable erosion and sediment control structures (e.g., silt fences, straw wattles, or catch basins) will be used to capture impeded erosion or sediment from upland and near-channel activities before it enters the Sacramento River. Sediment control structures will be placed near the edge of surface water features (i.e., along the bank of the river or along wetland features) to ensure sediment is sequestered before entering the water column. These structures will be installed prior to the start of any construction activities and will need to be cleaned or maintained on a regular basis to retain their effectiveness.

- Bare soil will be kept to the minimum required by designs. Erosion control devices or measures, such as those listed previously, will also be used in areas where vegetation has been removed to reduce short-term erosion prior to the start of the rainy season and before new vegetation becomes established.

- All imported fill material stockpiles will be stored in upland areas with erosion controls properly installed and maintained. All applicable erosion control standards will be required during stockpiling of materials.

- To the maximum extent practicable, activities that increase the potential for erosion in the project area will be restricted to the relatively dry summer and early fall periods to minimize the potential for rainfall events to transport sediment to the river. If these activities must take place during the late fall, winter, or spring, temporary erosion and sediment control structures will be in place and operational at the end of each construction day and maintained until permanent erosion control is in place.

- If on-site erosion control devices are found to be nonfunctional, they will be repaired or replaced immediately or by the end of the work day. In cases where repairs cannot be made immediately for safety reasons, the repairs should be completed as soon as the work can safely be performed.

- Disturbed areas will be revegetated with either native grass planting (hydroseeding) or willow cuttings immediately following construction.

The Service will also be responsible for implementation of erosion control and water quality protection measures during restoration activities, including using erosion and sediment control structures, minimizing bare soil, implementing activities during dry periods as feasible, and revegetating disturbed areas, as listed above.

Alternative 3 – Traditional Riprap with Site-Specific Plantings

Under Alternative 3, construction activities for the traditional riprap, with or without a low berm, would be expected to result in greater temporary increases in turbidity or total suspended solids levels than Alternative 2. Other activities, such as staging, access, and site preparation for restoration activities, would result in similar water quality impacts as described for Alternative 2.

For the no berm option, in-water excavation would be required to remove approximately 89,100 tons of material for the toe trench, and approximately 56,000 tons of riprap and backfill would be placed in the Sacramento River for the revetment. The revetment without a berm would extend 100 feet from the bank into the river, and most of the riprap would be placed on the existing gravel bar along the northwest side of the Riparian Sanctuary. Most excavation for the revetment would take place along the gravel bar. For the low berm, no in-water excavation would be required, but approximately 69,000 tons of riprap would be placed in the river. The revetment with a berm would extend 150 feet from the bank into the river, and some of the riprap would be placed on the existing gravel bar along the northwest side of the Riparian Sanctuary, with the rest going into the river off the gravel bar. These activities would disturb riverbed sediment, which would be mobilized for transport downstream, and result in a greater potential for sediment to enter the water column during revetment-shaping activities, compared to Alternative 2. Similar to Alternative 2, construction measures would be implemented to minimize potential turbidity effects; however, construction of the revetment could result in short-term increases in turbidity and suspended solids concentrations in the water column that could violate the Basin Plan objectives for turbidity in the Sacramento River and affect beneficial uses, resulting in a significant impact.

Implementation of Mitigation Measure WR-1, described for Alternative 2, would reduce construction-related impacts on water quality from the no berm option by reducing the amount of material that is transported downstream. However, as with Alternative 2, in-water activities could result in limited periods of increased turbidity that may exceed Basin Plan objectives. These instances are expected to be minor and infrequent, and turbidity levels are expected to remain in compliance for most of the construction period. With the implementation of Mitigation Measure WR-1, construction-related impacts on water quality from increased turbidity during construction of the traditional riprap without a berm would be less than significant.

For the low berm option, the riprap would extend approximately 50 feet farther into the river than the no berm option, and the silt curtains identified in Mitigation Measure WR-1 would be less effective due to the physical constraints of the silt curtains, which may not accommodate the higher velocities of the Sacramento River 150 feet from the riverbank, particularly as the riprap curves around the bend on the west side of the Riparian Sanctuary. Although the volume of disturbed sediment and sediment transport

is expected to be lower due to the lack of in-water excavation, the placement of riprap up to 150 feet into the river channel would likely still mobilize a moderate volume of sediment. If silt curtains are unable to be used effectively, sediment disturbed by rock placement would likely be directly transported downstream, resulting in increased turbidity levels above the Basin Plan objective for turbidity. Therefore, even with the implementation of Mitigation Measure WR-1, construction activities for the traditional riprap with a low berm would remain significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site Specific Plantings

Under Alternative 4, impacts related to the construction of traditional riprap, with or without the low berm, and site-specific planting would be the same as described for Alternatives 2 and 3. Water quality impacts during construction would be significant. For the reasons noted under Alternative 2, impacts associated with the low berm option would remain significant with implementation of Mitigation Measure WR-1, but impacts associated with the no berm option would be less than significant.

Removal of rock along the north bank of the upstream peninsula has the potential to increase downstream turbidity and suspended solids levels due to increased disturbance and subsequent mobilization of *in-situ* material, resulting in a significant impact. Although the removal of the revetment would be conducted from the stream bank, the bucket of an excavator would enter the water column to remove materials. Implementation of Mitigation Measure WR-1, described for Alternative 2, would reduce turbidity-related water quality impacts from rock removal to less than significant.

Impact WR-2: Disturbance of streambed sediments and stockpiling could release mercury into the environment, which could degrade water quality, contaminate soils, and affect the beneficial uses of the Sacramento River.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place; therefore, no construction-related impacts from release of mercury into the environment would occur.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Under Alternative 2, mercury could be discharged into the Sacramento River from spur dike construction, but no excavation or stockpiling of streambed sediments is anticipated on nearby lands, and soil contamination is not expected. The segment of the Sacramento River between Hamilton City and Knights Landing is listed as a 303(d) impaired water body for mercury from an unknown source. Mercury may be present in streambed sediments in the project vicinity, although the concentration of mercury is likely low.

Disturbance of streambed sediments for spur dike construction could mobilize and transport sediment-bound mercury. Mercury tends to adhere to fine-grained sediments, which compose approximately 10 percent of the streambed sediments in this segment of the Sacramento River (Ayres Associates 2011). Mercury in the suspended sediment could be transported several thousand feet downstream by local currents. The effect of mercury in the water is dependent on the reactivity of mercury, which may be altered by in-channel disturbance or transport, and could include increased mercury in fish tissues in

downstream reaches as well as elevated mercury levels that can affect beneficial uses. These impacts could further contribute to the impairment status of the river and would be significant. Implementation of Mitigation Measure WR-1, described for Impact WR-1, would help impede the transport of any mercury-rich sediment downstream, and construction of the spur dikes would result in a less-than-significant impact on water quality of the Sacramento River from increased mercury concentrations.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Under Alternative 3, construction of traditional riprap, with or without a low berm, could discharge mercury-rich sediment into the Sacramento River, as discussed for Alternative 2, and on nearby lands. The potential environmental effects of the construction activities are related to the potential effects of in-water disturbance, subsequent fluvial transport, and disposal of spoils that contain mercury-rich sediment. In-water activities would be greater for the traditional riprap than the spur dikes because of the need to excavate streambed sediment, and stockpiling or disposal of these sediments in the project area could result in soil contamination if the sediment contains mercury.

Under the no berm option, excavation of approximately 89,100 tons of material from the streambed could disturb mercury-rich sediment, which would increase the potential for elevated mercury concentrations in the Sacramento River downstream of the project area. The excavated materials would also need to be disposed of properly; however, specific disposal locations have not been identified. On-site disposal in upland areas without proper protection measures could result in a significant impact on the environment if soils are contaminated or mercury is discharged into the Sacramento River in runoff, which would further increase water quality impacts beyond the in-water activities and contribute to the impairment status of the Sacramento River. Water quality effects would be minimized with implementation of Mitigation Measure WR-1, described for Impact WR-1, and implementation of Mitigation Measure WR-2 would require that spoils be tested for mercury concentration and disposed in a manner that would prevent any adverse effects to the surrounding environment. With these mitigation measures, mercury-related impacts on water quality, soils, and beneficial uses of the Sacramento River would be less than significant.

The low berm option may also require some excavation and disposal of streambed sediment that may contain mercury, as discussed for the no berm option. Less excavation would be expected under the low berm option, and the amount of sediment that would be disposed would be substantially smaller. However, mercury in the sediment could contaminate soils and affect the environment, resulting in a significant impact. Implementation of Mitigation Measure WR-1, described for Impact WR-1, and Mitigation Measure WR-2 would reduce mercury-related impacts on water quality, soils, and beneficial uses of the Sacramento River to a less-than-significant level.

Mitigation Measure WR-2: Sample streambed sediments and properly dispose of mercury-rich sediment.

The construction contractor will be responsible for testing streambed sediments and properly disposing of any excavated streambed sediment that may contain mercury. PCGID-PID will be responsible for ensuring implementation of these measures and compliance with Basin Plan objectives. The following measures will be implemented during construction:

- Samples will be collected from all streambed material removed from the project area to analyze the material for mercury and methyl-mercury levels.
- While awaiting testing results, all streambed material will be properly stockpiled. Stockpiles will be located at least 300 feet away from the Sacramento River, lined with an impervious liner to prevent any runoff and leaching of contaminants into the soil or water table, and covered in the event of rainfall to prevent runoff.
- If mercury levels exceed 0.2 milligram per liter in the toxicity characteristic leach test, then the sediment is considered a toxic waste by the U.S. Environmental Protection Agency (40 CFR Section 261) and must be disposed of in accordance with all applicable federal, state, and local regulations.
- All terms and conditions of the Clean Water Act Section 401 water quality certification will be adhered to.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, impacts related to the construction of traditional riprap, with or without the low berm, and site-specific planting would be the same as described for Alternatives 2 and 3. Water quality impacts associated with increased mercury levels during construction and soil and other environmental impacts from mercury in stockpiled sediments would be significant. Implementation of Mitigation Measure WR-1, described for Impact WR-1, and Mitigation Measure WR-2, described for Alternative 3, would reduce mercury-related impacts from the traditional riprap and restoration on water quality, soils, and beneficial uses of the Sacramento River to a less-than-significant level.

The additional rock removal and the potential re-use of the rock in the traditional riprap and to protect the private property west of the Drainage District property would increase the potential for mercury to contaminate water quality, soils, and the environment. The removal of the upstream revetment would disturb and mobilize fine sediment that may contain mercury and increase mercury concentrations in downstream water quality. Additional sediment would be mobilized as the river eventually cuts off and flows through the existing peninsula (Larsen 2010), which is predicted to mobilize approximately 311 acre-feet of sediment (Ayres Associates 2011). The mobilized sediment could contain elevated levels of mercury, which could affect water quality and beneficial uses over the long term. If the upstream rock is authorized for re-use as part of the traditional riprap, the rock and sediment would need to be stockpiled at the Riparian Sanctuary until it can be used, which could result in soil contamination or other environmental effects described for Alternative 3 if mercury is present in the stockpiled material.

Implementation of Mitigation Measure WR-1 and Mitigation Measure WR-2 would reduce mercury-related impacts from rock removal and potential stockpiling on water quality, soils, and beneficial uses of the Sacramento River to a less-than-significant level. Although the removal of the revetment would likely cause an unavoidable increase in the mobilization and transport of sediments that may contain mercury, meander cut off is a natural process that has been inhibited in this section of the river due to the existing bank protection measures. Removal of the upstream revetment would help to restore natural hydrologic processes. In addition, a meander cut-off channel could eventually form under existing conditions (Mussetter Engineering, Inc. 2004) and produce a similar effect. Therefore, long-term impacts associated with the cut-off channel would be less than significant.

Impact WR-3: Construction and implementation of the Riparian Sanctuary project could release hazardous materials into the environment, which could degrade water quality and affect the beneficial uses of the Sacramento River.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place, and no construction-related impacts on water quality in the Sacramento River would occur. Current management practices at the Riparian Sanctuary would continue. The Service currently uses herbicides and other treatments to control and inhibit the spread of non-native and invasive plants species. These activities are limited to upland areas and have a low potential to result in the spill of hazardous materials into the Sacramento River and adversely affect water quality. Ongoing activities would have a less-than-significant impact on water quality and beneficial uses as a result of hazardous materials spills.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 2, near-channel construction and refueling activities could result in the discharge of hazardous materials (e.g., oil, grease, gasoline, and solvents) into the Sacramento River or on adjacent lands due to a spill or leaking fluids from equipment. Site preparation and maintenance for restoration activities could result in the release of hazardous materials (herbicides) into the river. The preparation and maintenance of the restored riparian habitat would require weed control using herbicides like Roundup® or a generic herbicide brand with glyphosate as the active ingredient. The Basin Plan identifies a water quality objective for glyphosate of 0.7 milligrams per liter (Maximum Contaminant Level) (Central Valley Regional Water Quality Control Board 2009), and a spill or improper application of the herbicide could violate Basin Plan water quality objectives and have adverse impacts on local species of flora and fauna. The construction measures described in Chapter 2 would help prevent hazardous substances from entering the environment and provide a plan of action in case of a spill of hazardous materials. However, without rapid containment and clean up of a construction-related spill or improper application of herbicides, the discharge of hazardous materials into or adjacent to the Sacramento River could violate water quality objectives and have adverse effects on fauna of any life stage that are near the affected reach, which could also affect beneficial uses of the river and would be significant. Implementation of Mitigation Measure WR-3 during construction and restoration activities would further reduce the potential for hazardous materials to enter the river and surrounding environment and adversely affect water quality or local flora and fauna, resulting in a less-than-significant impact.

Mitigation Measure WR-3: Implement measures during construction and restoration activities to prevent accidental discharge of potentially hazardous materials.

The construction contractor will be responsible for implementing the construction measures listed below to prevent hazardous materials from entering the water column during all construction activities, and the Service will be responsible for ensuring all herbicide use in the project area complies with the herbicide-related measures listed below. Construction measures include:

- Equipment and materials will be stored a minimum of 200 feet away from wetland and surface water features.
- Vehicles and equipment used during construction will receive proper and timely maintenance to reduce the potential for mechanical breakdowns leading to a spill of hazardous materials.
- All construction equipment will be inspected daily for leaks prior to the start of any activities. Steam cleaning will be used to remove any oil, grease, or hydraulic fluid prior to making contact with the waters of the Sacramento River. Untreated wash and rinse water must be adequately treated prior to discharge into the river if that is the desired disposal option.
- Hazardous materials, including fuels, oils, and solvents, will not be stored or transferred within 150 feet of the active Sacramento River channel. Areas for fuel storage, refueling, and servicing will also be located at least 150 feet from the active river channel or within an adequate secondary fueling containment area. In addition, the construction contractor will be responsible for maintaining spill containment booms on-site at all times during construction operations and staging of equipment or fueling supplies. Fueling trucks will maintain a spill containment boom at all times.
- The contractor will develop and implement site-specific best management practices, a water pollution control plan, and emergency spill control plan and will be responsible for immediate containment and removal of any toxins released into the Sacramento River or project area.

Herbicide application measures include:

- To control drift during spray applications, spray applications will follow a site-specific prescription that accounts for terrain and identifies spray exclusion areas, buffer areas, formulation, equipment, droplet size, spray height, application pattern, flow rate, limiting factors of wind speed and direction, temperature, and relative humidity.
- An herbicide spill contingency plan will be developed and implemented for the use of any herbicides.
- The application of herbicides will strictly adhere to the manufacture's instructions, the Service's Pesticide Use Proposal process, and the Sacramento River NWR Integrated Pest Management Plan (U.S. Fish and Wildlife Service 2005, 2009).

- All herbicides will be mixed and used according to their labeled specifications, and the mixing or storage of herbicides will take place more than 100 feet from the Sacramento River. Basal and foliar application of herbicides will also be prohibited within 100 feet of the Sacramento River.
- The cleaning and disposal of herbicide containers will be completed in accordance with federal, state, and local laws, regulations, and guidance.

Impact WR-4: Implementation of the Riparian Sanctuary project could increase turbidity and sedimentation in the Sacramento River for several years after construction, which could degrade water quality and affect the beneficial uses of the Sacramento River.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, ongoing activities associated with operation and maintenance of the PCGID-PID pumping plant and fish screen facility and Riparian Sanctuary could result in increased turbidity in the Sacramento River. Periodic maintenance of the facility includes cleaning the fish screens and replacing or repairing parts of the facility. These activities could result in direct impacts to water quality if the activities require work in the river. However, PCGID-PID would take necessary precautions to minimize potential adverse impacts from increased turbidity during any in-water maintenance of the facility, and impacts from routine maintenance would be less than significant.

Alternative 2 – Spur Dikes and Site-Specific Plantings

The spur dikes would create new areas of scour and deposition in the Sacramento River as the river adjusts to the new channel configuration, which could increase turbidity and total suspended solids for several years after construction. During the first rainy season (November–April) after construction, river discharges would increase, and the channel and riverbank near the spur dikes would be governed by new hydraulic interactions. Downstream increases in turbidity are expected for the first few years after construction, especially during the first major precipitation event of the season when newly disturbed sediments would be most easily mobilized. Background turbidity levels in the Sacramento River are generally much greater during the rainy season than in the dry season. Therefore, any increases in turbidity caused by the hydrologic alteration of the channel by the spur dikes would likely be small relative to the higher turbidity levels the Sacramento River currently experiences (5–270 NTU) during the rainy season. Erosion activities near the spur dikes would not likely generate enough suspended sediment to exceed the Basin Plan objective for turbidity; therefore, impacts would be less than significant.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Traditional riprap, with or without a low berm, would result in similar impacts after construction as those described for Alternative 2. The use of soil-filled quarry rock as a fill material and the larger amount of riprap placed in the river for the traditional riprap would result in slightly greater increases in turbidity than the spur dikes. The soil-filled quarry rock would contain a component of fine gravel, sand, and silt, which would fill the interstitial spaces between the riprap and could be mobilized by increasing volumes of flow in the river during the wet season. Periodic increases in turbidity and suspended solids levels in the Sacramento River downstream of the revetment would not be expected to exceed water quality objectives or adversely affect beneficial uses; therefore, these impacts would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, the traditional riprap, with or without the low berm, would be the same as described for Alternative 3. The additional removal of rock on the north side of the upstream peninsula would substantially increase downstream turbidity levels through exposure of bare soil to water erosion and modification of the river alignment, as discussed in Section 3.3, Geology, Fluvial Geomorphology, and Soils.

The removal of the upstream revetment would expose *in-situ* riverbank and floodplain deposits on the peninsula to unimpeded flowing water along the Sacramento River. As river stage levels increase throughout the wet season, newly exposed (by removal of riprap) areas on the peninsula would erode simply due to contact with flowing water, which would mobilize sediment and further increase downstream turbidity levels. Modeling conducted by Larsen (2010) indicated that a cut-off channel could form within 5 years after removal of the revetment, and sediment modeling conducted by Ayres Associates (2011) indicated that approximately 311 acre-feet of sediment would be eroded during the formation of the cut-off channel. However, the bend cut off would not occur instantaneously, and significant flow would still be expected in the bend as the cut off progresses downstream. As a result, a large portion of the material eroded in the formation of the cut-off channel would actually be deposited in the bend until the cut-off channel becomes hydrologically connected to the downstream end of the peninsula (Ayres Associates 2011).

Although a large portion of the disturbed sediment would end up being stored in an oxbow after the formation of the meander cut off, increases in turbidity are likely to occur downstream of the rock removal area. The greatest increases in turbidity would occur when river stage reaches an elevation that causes the erosion of a surface that was previously unaltered by stream flow. Even in these cases, downstream turbidity levels would not likely exceed the Basin Plan turbidity objective because background turbidity levels are also likely to be much higher during these high-intensity erosion events. Removal of the upstream revetment would support a natural cut-off process that was inhibited in the past and help maintain alignment with the current location of the pumping plant and fish screen facility. In conclusion, although the periodic increases in turbidity and suspended sediment levels associated with the cut-off channel could exceed water quality objectives, these water quality impacts would be associated with the restoration of natural riverine processes and would be less than significant.

Impact WR-5: Implementation of the Riparian Sanctuary project could modify flood flows through the project area as a result of the change in the Sacramento River channel and restoration activities and expose people, property, or structures to flood risks.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, existing flow regimes and water surface elevations of flood waters in the Sacramento River would persist in the project area. The risk of flood-related impacts to infrastructure, property, and people would remain the same as they are under existing conditions. In addition, current levees and infrastructure are designed for the existing channel hydrology. Therefore, the No-Action Alternative would not affect flood hydrology.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings

Under Alternatives 2 and 3, the restored riparian habitat would alter the existing flow on the floodplain through the Riparian Sanctuary. This discussion is based on river meander and hydraulic modeling conducted by Larsen (2004, 2010) and Ayres Associates (2010) to identify the effects of the bank protection measures and restoration plan on flood flows and the volume of water that is diverted into Butte Basin from the Sacramento River. The modeling assumed the low berm traditional riprap option for bank protection and the site-specific plantings for the restoration plan. However, the type of bank protection measure is assumed to be irrelevant because during most flood flow regimes, the river currently overtops existing bank protection revetments and flows through the Riparian Sanctuary. Therefore, the restored riparian habitat has the greatest potential to affect floodwater conveyance through the project area.

The establishment of woody vegetation on the floodplain would slightly increase water surface elevations across the northern half of the Riparian Sanctuary and the floodplain upstream of the project area (Ayres Associates 2010). Ayres Associates (2010) modeled the effects of anticipated bank protection measures and riparian restoration activities using an assumed stream flow of 271,000 cfs, which is the maximum flow anticipated based on the 1957 design flow. Modeling results indicate that flow velocities would increase in the thalweg, which may help maintain the current alignment of the river in front of the PCGID-PID pumping plant and fish screen facility, because higher velocities may help to reduce the accumulation of sediment in the low-flow channel. However, decreases in flood flow velocities would increase water surface elevations across the northern half of the Riparian Sanctuary by approximately 0.2 foot, with upstream areas near the northeast corner of the Riparian Sanctuary experiencing increases of up to 0.5 foot. In addition, the water surface upstream of the project area would also likely experience increases of 0.2 foot (Ayres Associates 2010). The modeled increases in water surface elevations upstream of the project area are anticipated to increase the volume of flood water diverted into Butte Basin at Moulton Weir by approximately 1 percent (2,260 cfs) (Ayres Associates 2010), which could increase flooding in the Butte Basin during the highest anticipated flows. However, the modeled flow regime is only expected to occur for 1 day in a 100-year period (Ayres Associates 2011), and during lower flood stages, a lower volume of water would likely be diverted into the Butte Basin. The anticipated changes in water surface elevations are only slightly higher than would be expected under existing conditions, and they remain well below design capacity elevations and the elevations of the top of the levees (Ayres Associates 2010). Therefore, the combination of the bank protection measures and restoration activities would have a less-than-significant impact from the risk of flooding in the Sacramento River or the Butte Basin.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Bank protection measures and restoration activities under Alternative 4 would result in the same types of impacts as those described for Alternatives 2 and 3, and the addition of rock removal along the north side of the upstream peninsula would further modify the Sacramento River alignment and affect flood flows. The changes in flood potential and hazards discussed below and studies completed for the Riparian Sanctuary project will be considered by the Central Valley Flood Protection Board when issuing a permit to remove rock on the upstream peninsula.

Modeling results from Larsen (2010) indicate that removal of the upstream revetment on the upstream peninsula would likely facilitate the formation of a channel that would cut through the bend (cut-off channel) within the first 5 years. If a cut-off channel forms, it would help the channel maintain a favorable alignment with the PCGID-PID pumping plant and fish screen facility (Mussetter Engineering, Inc. 2004) in combination with the traditional riprap. The cut-off channel is also predicted to eventually hydrologically disconnect the upstream bend of the peninsula from the main channel, which would cause the existing channel on the east side to become an oxbow lake during lower flow regimes. It is unclear to what extent the abandonment of the existing channel would have on flood water conveyance and flood hazards downstream at the Riparian Sanctuary, but it is likely that higher flood flows would continue to flow across the Riparian Sanctuary floodplain. Therefore, impacts associated with flooding would be the same as those described for Alternatives 2 and 3 and would be less than significant.

Impact WR-6: Restoration of the Riparian Sanctuary would require the use of ground water, which could deplete groundwater supplies in the groundwater basin.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, riparian habitat would not be restored at the Riparian Sanctuary. No groundwater supplies would be needed for irrigation purposes, and no impacts would occur. Current uses in the project area would persist, which do not rely on a groundwater supply for irrigation of crops.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 2, ground water would be used for irrigation of restored riparian habitat at the Riparian Sanctuary. Irrigation would take place between March and November, as needed, during the first three years of establishment. A groundwater well and drip system would be installed on-site to provide a water source for irrigation and maximize irrigation efficiency. The system would be expected to supply approximately 4.8 million gallons per month during March and November and 9.7 million gallons per month between April and October to provide sufficient water for the newly planted vegetation. Based on these rates, the total annual water budget is estimated at 77.4 million gallons (approximately 238 acre-feet), resulting in the need for approximately 232 million gallons (713 acre-feet) of water to establish the restored vegetation during the first three years. Because the weather in any given year can affect the soil moisture during the irrigation period, the frequency, duration, timing, and exact volume of the irrigation will be determined during each watering period. For comparison, agricultural practices in the PCGID-PID service areas use approximately 122,540 acre-feet of water during a typical growing season. The volume of water needed for the restored habitat would be substantially less than agricultural practices in the area. Groundwater extraction would also be temporary, and the extracted volume of water would likely be replenished in the local aquifer in a similar amount of time, assuming a steady-state groundwater model. Because the demand on the groundwater aquifer would be temporary and use less water than other local agricultural practices, the restored riparian habitat at the Riparian Sanctuary would have a less-than-significant impact on groundwater supplies in the Sacramento Valley groundwater basin.

3.5 Fishery Resources

This section describes the fishery resources in the project area and evaluates the impacts of the alternatives on these resources. The discussion of fishery resources is based on a focused literature review, informal consultation with resource agencies, and field visits. A discussion of hydrology and water quality impacts, which affect aquatic habitat, is provided in Section 3.4, Water Resources.

3.5.1 Regulatory Framework

Federal Endangered Species Act

Section 9 of the Endangered Species Act (ESA) defines "take" and generally prohibits the "taking" of animal species listed as endangered or threatened (16 U.S. Code (USC) 1532, 50 CFR 17.3). Under the ESA, the "take" of a species listed under the federal ESA is deemed to occur when an intentional or negligent act or omission causes the agent of the action "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The term "harm" includes acts that actually kill or injure wildlife. Such acts may include significant habitat modification or degradation when it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

Section 7 of the ESA requires federal agencies, in consultation with the Secretary of the Interior, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species (plant or animal) or result in the destruction or adverse modification of designated critical habitat for these species.

The Service will be completing an inter-agency consultation with the National Marine Fisheries Service (NMFS) to address listed species and their habitat in the project area. A biological assessment will be prepared for the southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) (Threatened), Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU) (Endangered), California Central Valley steelhead (*O. mykiss*) DPS (Threatened), and Central Valley spring-run Chinook salmon ESU (Threatened). Critical habitat has been designated in the Sacramento River for these federally listed fish species.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan. EFH refers to those waters and substrates necessary for the species' spawning, breeding, feeding, or growth to maturity. "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle. An "adverse effect" in the context of the act refers to any impact that reduces the quality and/or quantity of EFH and may include direct, indirect, site-specific, or habitat-wide

impacts, including individual, cumulative, or synergistic consequences of actions. The act requires federal agencies to consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (Section 305[b][2]). A component of this consultation process is the preparation and submittal of an EFH assessment.

The EFH mandate applies to all species managed under a fisheries management plan. The Pacific Coast Salmon fisheries management plan (Pacific Fishery Management Council 2000) covers Chinook salmon, which inhabit the Sacramento River. An EFH assessment will be prepared as part of the biological assessment to support consultation with NMFS.

Sacramento National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR CCP describes the desired future conditions on the refuge and provides guidance to achieve these conditions. The wildlife and habitat goal of the Sacramento River NWR is to contribute to the recovery of endangered and threatened species, abundance of migratory birds, and protection of anadromous fish by providing natural diversity through the restoration and management of viable riparian habitats along the Sacramento River. An anadromous fish management objective is to provide high quality habitat for anadromous and resident fishes by enhancing and restoring shaded riverine aquatic (SRA) habitat. Some of the strategies used to achieve this objective are:

- implement restoration of mid- and high-elevation riparian forest to create 14,500 linear feet of SRA by 2015;
- restore mid- and high-elevation riparian forest to create a source of large woody debris; and
- ensure recruitment of spawning gravel necessary for creating redd habitat for fall-run Chinook salmon.

California Endangered Species Act

Under the California Endangered Species Act (CESA), the California Department of Fish and Game (CDFG) has the responsibility for maintaining a list of endangered and threatened species (California Fish and Game Code 2070). CDFG also maintains a list of “candidate species,” which are species that CDFG formally identifies as being under review for addition to the list of endangered or threatened species, and lists of “species of special concern,” which serve as species “watch lists.” “Take” of protected species incidental to otherwise lawful management activities may be authorized under Section 2081 of the California Fish and Game Code. Such authorization from CDFG is provided in the form of an incidental take permit.

Pursuant to the requirements of CESA, a public agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the project area and determine whether the proposed project could have a significant impact on such species. CDFG also encourages informal consultation on any proposed project that may affect a candidate species. Effects on state-listed species are discussed in subsection 3.5.3, Environmental Consequences, and measures are recommended, as appropriate, to ensure compliance with CESA. Because of the anticipated need for consultations with NMFS under Section 7 of the ESA, the CDFG may use the NMFS consultation to issue its authorization for incidental take in the form of a memorandum of concurrence that concludes that CDFG adopts the NMFS decision and conditions.

Sections 1600–1616 of the California Fish and Game Code

CDFG has jurisdictional authority over fish and wildlife resources associated with rivers, streams, and lakes under California Fish and Game Code Sections 1600–1616. CDFG must be notified when any person, business, state or local government agency, or public utility proposes an activity that will:

- divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake;
- use material from a streambed; or
- result in the disposal or deposition of debris, waste, or other material where it can pass into any river, stream, or lake.

The notification requirement applies to any work undertaken in or near a river, stream, or lake that flows at least intermittently through a bed or channel. This includes ephemeral streams, desert washes, and watercourses with a subsurface flow. It may also apply to any work undertaken within the flood plain of a body of water.

If CDFG determines that the proposed project or activity could have substantial adverse effects on fish or wildlife, a Streambed Alteration Agreement is required. As part of this agreement, CDFG may require reasonable modifications in the proposed construction that would allow for the protection of the fish and wildlife resources. Because construction activities for the Riparian Sanctuary project would take place in and along the Sacramento River and would involve local and state agencies, PCGID-PID would notify CDFG and request a Streambed Alteration Agreement.

3.5.2 Affected Environment

Aquatic Habitat

The project area is located in a highly meandering reach of the middle Sacramento River, which is bordered by floodplain riparian forest and agricultural lands. The aquatic habitat in the project area consists of a series of riffles, runs, glides, and pools and is dominated by flatwater habitats (e.g., pool, glide, run) (Figure 3.5-1). Pool habitat in the project area occurs as corner scour pools along the outside of bends in the channel that are currently protected with riprap bank revetment. Shallow-water habitat occurs mostly along a couple of large gravel bars forming the inside of bends in the channel and on a riffle located at the upstream-most gravel bar in the project area. Deep pool and shallow littoral and riffle habitats are not considered to be limiting in the project area, and both types of habitat are present in regular sequence in this region of the middle Sacramento River.

Typical channel elevations in the project area range from 48 feet to 103 feet above mean sea level, as shown in Figure 3.5-2, with concomitant pool depths of up to 50 feet. During typical summer flows, the inundated channel of the Sacramento River in the project area is approximately 400 feet wide. Approximately 40 percent of the stream banks in the project area are currently protected by riprap; some have little or no vegetation or large wood, some have natural vegetation, and some have increasing natural vegetative growth with large wood, like the revetment upstream of the pumping plant (Figure 3.5-1). Protected streams banks are, however, less favored habitat for juvenile salmonids than natural eroding banks and associated SRA habitat (Michney and Deibel 1986).

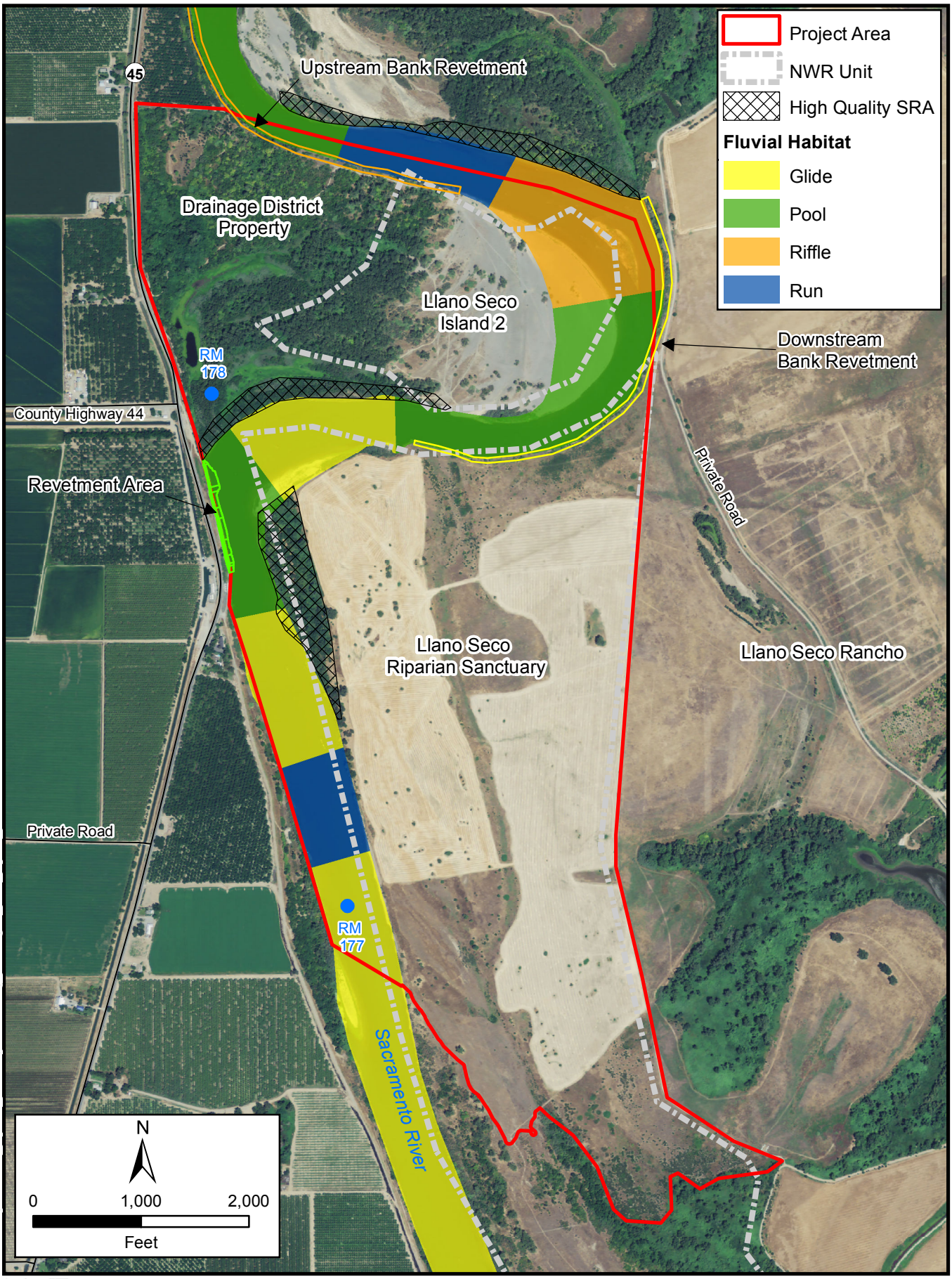
The project area serves as a primary migratory corridor for both adult and juvenile anadromous fish and seasonally provides rearing habitat for the juvenile life stages of anadromous fish and resident fish species. Fall Chinook salmon have been recorded to spawn in and near the project area very infrequently (California Department of Fish and Game 2004a, 2004b), and spawning habitat is marginal due to the small size of gravel on the riverbed. Rearing habitat quality for anadromous salmonids varies within the project area depending on the life stage and species using the habitat features.

Overhanging and inundated aquatic and riparian vegetation in the project area is most abundant along natural banks. SRA habitat generally includes the woody vegetation and cover structures associated with "natural" banks that function to provide shade; sediment, nutrient, and chemical regulation; stream bank stability; and input of woody debris and leaves that provide cover and serve as substrates for food-producing invertebrates. Riparian vegetation along the eroded northwest bank of the Riparian Sanctuary (left or east bank of the river) has only recently become established and does not consist of large or extensive mature tracts of riparian trees. More mature trees are located downstream along the west side of the Riparian Sanctuary. Most of the river bank along the peninsula (right bank) is an exposed gravel bar composed primarily of small gravel, silt, and sand, with minimal vegetative cover. No large woody debris is present along the gravel bar.

The existing bank revetment on the north side of the Riparian Sanctuary was not backfilled with soil and has only been colonized by a low-lying growth of blackberry and wild grape, with an occasional willow. No large wood debris occurs on this existing riprap. Upstream of the Riparian Sanctuary along the existing riprap across the river from the peninsula is a moderately thick willow coverage and a higher frequency of larger established trees that provide some good SRA habitat along approximately 2,000 feet of the river.

The left bank of the Sacramento River in the northwestern portion of the Riparian Sanctuary is a high, nearly vertical, eroding bank (10 to 15 feet high), which extends from the terminus of the existing revetment to a point downstream that is nearly across the river from the PCGID-PID pumping plant and fish screen facility. This high eroding bank does not provide any quality SRA habitat because it is lightly vegetated with short willow scrub. Approximately 85 percent of the top-of-bank habitat currently consists of agricultural crops and invasive weeds.

At the downstream end of the high eroding bank across from the PCGID-PID pumping plant, the river channel forms a large bend and depositional sediment bar at the base of the eroding bank. At the top of this bank, a small area of remnant riparian forest exists. Average vegetative coverage on the gravel bar at this location is approximately 60 percent and is densest near the head of the bar and least dense near the downstream end of the bar. Three distinct bands of vegetation extend out from the eroding bank. The oldest and densest vegetation is directly adjacent to the bank, and the height, complexity, and density of vegetation decreases downstream and towards the center of the channel. The oldest vegetation is approximately 10 to 15 feet tall, and the youngest vegetation is less than 1 foot tall. The vegetative cover consists entirely of young woody trees/shrubs (willows and cottonwoods). No large woody debris or large trees (greater than 6 feet long or 6 inches diameter) occur on this gravel bar feature.



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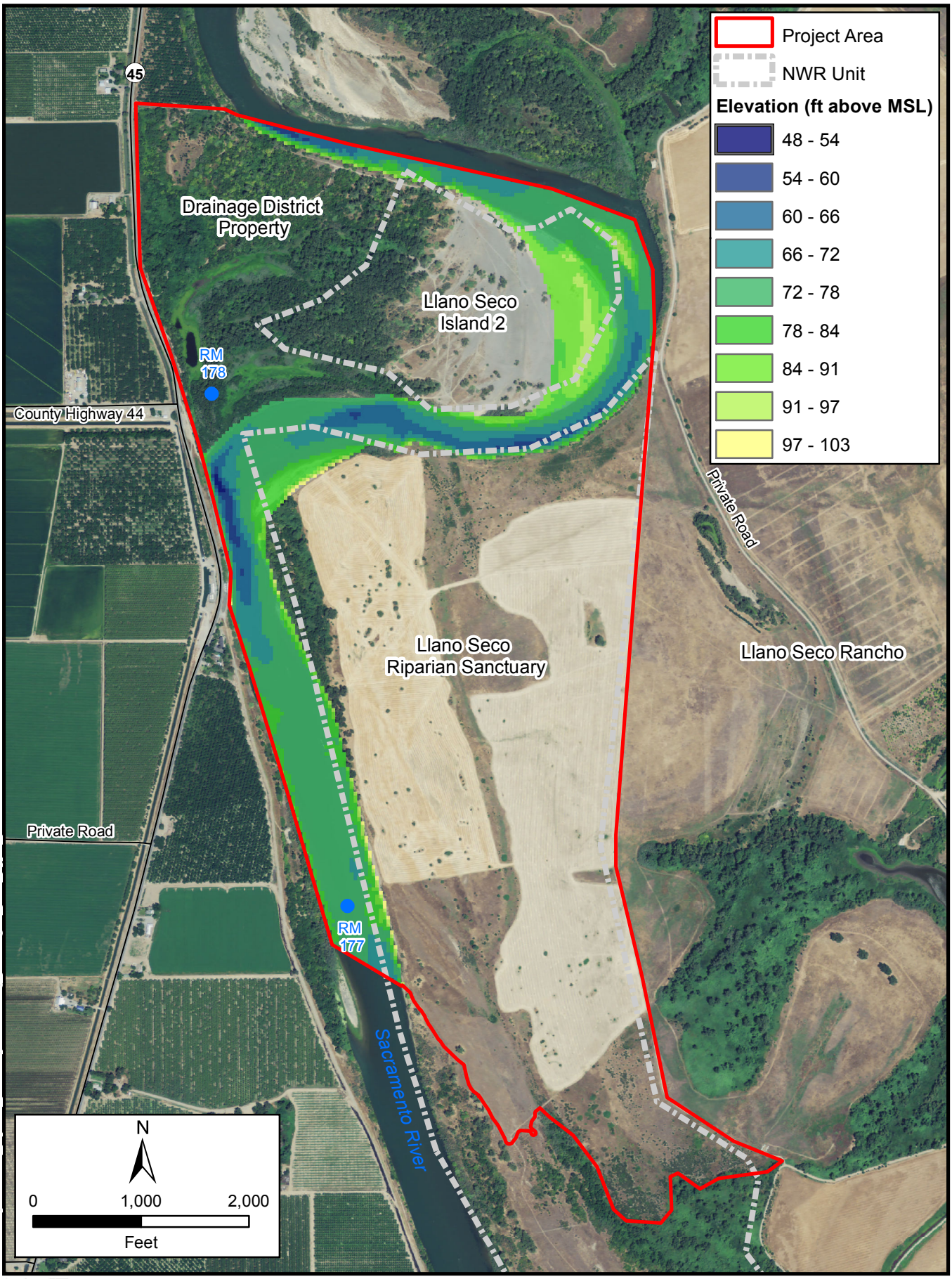
North State Resources, Inc.

Riparian Sanctuary Project

Figure 3.5-1
Fluvial and Aquatic Habitat



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 3.5-2
Channel Hypsometry

Substrate composition is small gravel, sand, and silt, which vary in their relative proportions longitudinally and horizontally across the bar. The bar ranges from approximately 20 to 275 feet wide along its length at seasonal base flows.

Along 2,400 feet of the right bank of the Sacramento River on the southern side of the peninsula, the natural vegetation is very dense, diverse, and complex, providing high quality SRA habitat nearly year round. This vegetation extends from the gravel bar on the peninsula downstream to a portion of existing bank revetment, at RM 177.8R, that is just upstream of the PCGID-PID pumping plant along the SR 45 embankment (see Figure 3.5-1). This bank revetment includes a planted riparian bench with cabled large woody debris.

Fish Communities

More than 30 species of fish are known to occur at least seasonally at one life stage or another in the Sacramento River in the project area. These fish species include both native and introduced species, and a number of these are anadromous. Native anadromous species include Chinook salmon, steelhead, green sturgeon, white sturgeon (*Acipenser transmontanus*), and river lamprey (*Lampetra ayresii*). Non-native anadromous species include American shad (*Alosa sapidissima*) and striped bass (*Morone saxatilis*).

Other Sacramento River fishes are considered resident species, which complete their life cycles entirely within freshwater and often in a localized area. The Sacramento River provides habitat for resident native and introduced coldwater and warmwater fish species. The most common native resident coldwater species is rainbow trout (*Oncorhynchus mykiss*). Other native resident species include Sacramento sucker (*Catostomus occidentalis*), Sacramento pikeminnow (*Ptychocheilus grandis*), three-spine stickleback (*Gasterosteus aculeatus*), hardhead (*Mylopharodon conocephalus*), tule perch (*Hysterocarpus traski*), splittail (*Pogonichthys macrolepidotus*), and sculpin (*Cottus* spp.). Resident warmwater species include, but are not limited to, non-native largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), green sunfish (*Lepomis cyanellus*), bluegill (*L. macrochirus*), black crappie (*Pomoxis nigromaculatus*), white catfish (*Ameiurus catus*), and brown bullhead (*A. nebulosus*). These species are typically present in backwaters, sloughs, and side channels along the Sacramento River. The Sacramento River in the project area supports a recreational fishery nearly year-round for both shoreline and boat anglers. In particular, most anglers target American shad, striped bass, sturgeon, and Chinook salmon. Shoreline river access off of SR 45 at the bend upstream of the pumping plant is used on a regular basis.

Special-Status Fish Species

Suitable habitat is present in the Sacramento River in the project area for the following special-status fish species: Chinook salmon, steelhead trout, green sturgeon, hardhead, river lamprey, and Sacramento splittail (Table 3.5-1). Four runs of Chinook salmon are present in the project area and are distinguished by the timing of adult spawning migrations into the river: fall, late-fall, winter, and spring runs (Vogel and Marine 1991). NMFS has determined that the four Central Valley Chinook salmon runs represent three distinct ESUs: the Central Valley fall/late-fall run ESU, the Central Valley spring-run ESU, and the Sacramento River winter-run ESU. One race of steelhead, the fall/winter-run, is known from Central Valley streams (Busby et al. 1997, McEwan and Jackson 1996). All life stages of salmon are present in the Sacramento River virtually throughout the year (Vogel and Marine 1991) (Figure 3.5-3).

Central Valley Spring-Run ESU Chinook Salmon

Central Valley spring-run ESU Chinook salmon was federally listed as threatened on September 16, 1999 (64 Federal Register (FR) 50394). This designation was unchanged in a June 14, 2004 status review by NMFS (69 FR 33102). The Central Valley spring-run Chinook salmon was also designated as a threatened species under CESA on February 5, 1999. On September 2, 2005, NMFS issued the final rule designating critical habitat for Central Valley spring-run ESU Chinook salmon, which became effective January 2, 2006 (70 FR 52488).

Spring-run Chinook salmon migrate upstream during the spring beginning in March, hold over in deep pools of the mainstem river and its large perennial tributaries where fish can access cold headwaters during the summer months, and spawn from mid-August through mid-October (Figure 3.5-3). Most of the spring-run salmon in the Sacramento River Basin ascend and spawn in the principal tributary streams (Mill, Deer, Clear, and Butte creeks and the Feather River). Egg incubation occurs from mid-August through mid-January. Spring-run salmon in the Sacramento River exhibit an ocean-type life history, emigrating as fry, sub-yearlings, and yearlings. Based on observations at Red Bluff Diversion Dam (RBDD), 65 river miles upstream of the project area, spring-run emigration from the upper Sacramento River typically occurs from November through April (Johnson et al. 1992, Vogel and Marine 1991). Although some spring-run salmon may spawn in the Sacramento River between Red Bluff and Keswick Dam, most are thought to have hybridized with fall-run salmon due to overlapping spawning periods, lack of spatial separation, and redd superimposition (California Department of Fish and Game 1998).

Spring-run Chinook salmon fry emerge from the gravel from November to March (Moyle 2002), and emigration is variable based on changes in river flows, dam operations, water year type, and perhaps most importantly, life stage, as spring-run salmon may migrate downstream as young-of-year, juveniles, or yearlings (National Marine Fisheries Service 2009). Juvenile emigration at RBDD begins as early as October, peaks during the winter months associated with winter flow events, and ends in April (Gaines and Martin 2001). Peak juvenile migration at Knights Landing (88 river miles downstream of the project area) occurs between December and January and again during March and April (Snider and Titus 2000). The Sacramento River in the vicinity of the project area may be used by spring-run Chinook salmon during migratory and rearing life stages. Spawning primarily occurs in large perennial tributaries.

Central Valley spring-run ESU Chinook salmon populations in the Sacramento River and its tributaries have remained relatively depressed; however, some modest increases have occurred in their principal spawning tributaries, such as Deer, Mill, and Butte creeks (California Department of Fish and Game 2004a). Figure 3.5-4 provides annual (2000–2010) population estimates of Central Valley spring-run ESU Chinook salmon (California Department of Fish and Game 2011).

Designated critical habitat for Central Valley spring-run Chinook salmon includes the San Francisco Bay-Delta estuary, mainstem Sacramento River upstream to Keswick Dam, and most of the Sacramento Valley's perennial tributaries with established spring salmon runs, including the Feather River and Feather River Hatchery. Designated critical habitat for Central Valley spring-run Chinook salmon includes all river reaches accessible to the species in the Sacramento and San Joaquin rivers and their tributaries in California, which includes the Sacramento River in the project area.

Table 3.5-1. Special-Status Fish Species Potentially Occurring in the Project Area

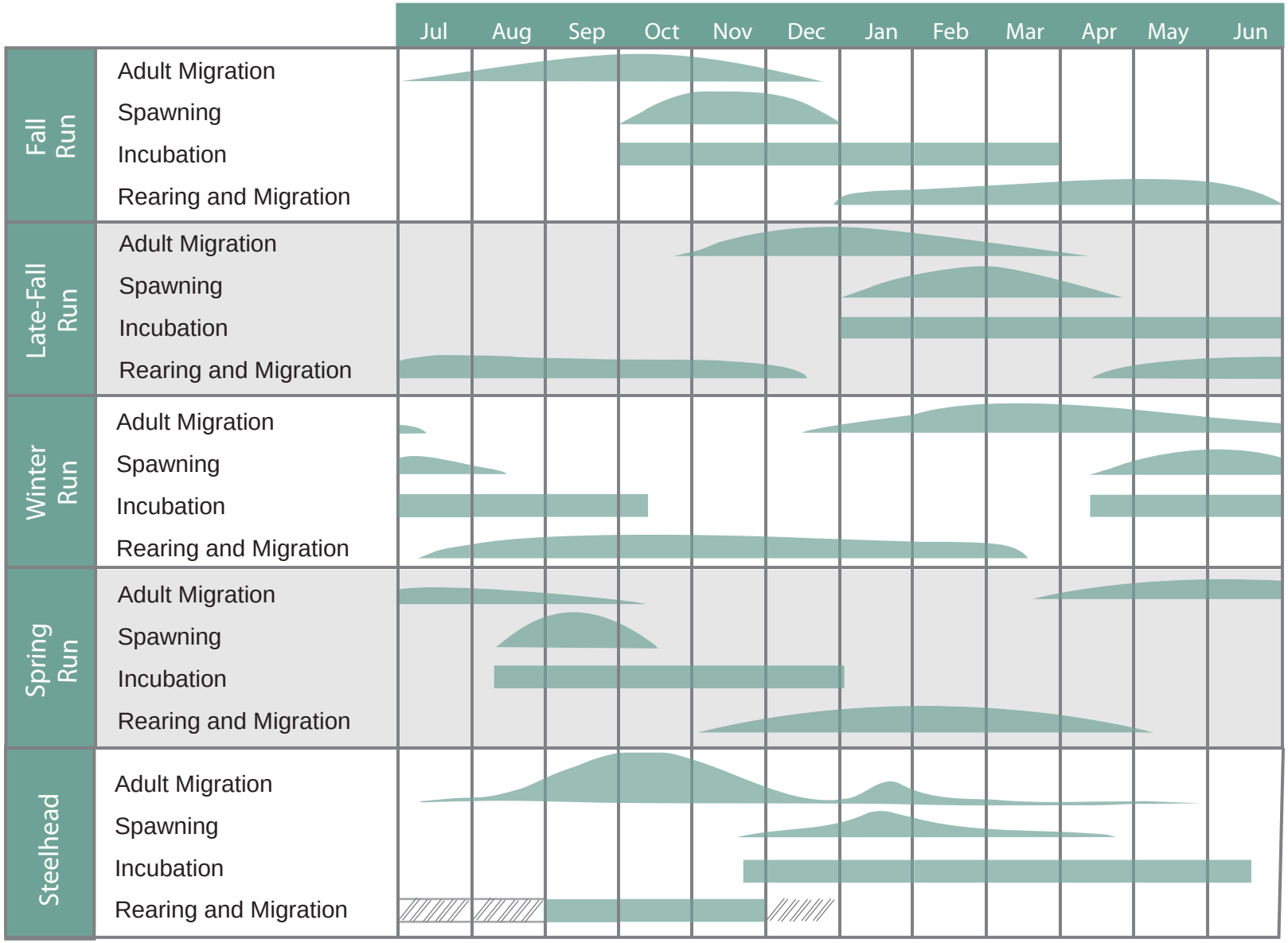
Common Name *Scientific Name*	Listing Status[1] (Fed/State)	General Habitat Description	Habitat in the Project Area
Federally Listed or State-Listed Species			
Central Valley spring-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	FT/ST	Requires cold flowing water, clean spawning gravel, and diverse riverine habitat for rearing. Spawns and rears in perennial and intermittent tributaries and the mainstem of the Sacramento River. Juveniles rear from the winter of hatching through following fall. Adults migrate upstream during the fall and spawn from mid-August to mid-October.	Present in the mainstem Sacramento River and its major perennial tributary streams. Suitable rearing and migration habitat is present within the project area, and the species is known to occur in the project area.
Sacramento River winter-run ESU Chinook salmon (*Oncorhynchus tshawytscha*) Critical Habitat	FE/SE	Requires cold flowing water, clean spawning gravel, and diverse riverine habitat for rearing. Spawns and rears in the mainstem of the Sacramento River. Juveniles rear from the summer/fall of hatching through following spring. Adults migrate upstream during the winter and spawn from mid-April to mid-August.	Present in the mainstem Sacramento River. Suitable rearing and migration habitat is present within the project area, and the species is known to occur in the project area.
Steelhead, California Central Valley DPS (*Oncorhynchus mykiss*) Critical Habitat	FT/ –	Requires cold flowing water, clean spawning gravel, and diverse riverine habitat for rearing. Occurs in the mainstem Sacramento River. Adults migrate upstream during the fall/winter and spawn from winter to early spring. Juveniles rear in natal areas for 1–2 years before migrating to the ocean.	Present in the mainstem Sacramento River and tributary streams. Suitable rearing and migration habitat is present within the project area, and the species is known to occur in the project area.
Green sturgeon, southern DPS (*Acipenser medirostris*) Critical Habitat	FT/–	Spawns in Sacramento and Feather rivers; juveniles are thought to rear mainly in the estuary. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock. Spawns in the mainstem Sacramento River when temperatures range between 46°F and 60°F.	Known to occur in the Sacramento River throughout all accessible reaches upstream at least to Anderson-Cottonwood Irrigation District dam near Redding. Adults are present in the project area seasonally, and juveniles have the potential to be present year-round.

Table 3.5-1. Special-Status Fish Species Potentially Occurring in the Project Area

Common Name *Scientific Name*	Listing Status[1] (Fed/State)	General Habitat Description	Habitat in the Project Area
Other Special-Status Species			
Central Valley fall/late-fall run ESU Chinook salmon (*Oncorhynchus tshawytscha*)	FSC/–	Requires cold flowing water, clean spawning gravel, and diverse riverine habitat for rearing. Spawns and rears in perennial and intermittent tributaries and the mainstem of the Sacramento River. Juveniles typically rear from the winter of hatching through following spring, but some late-fall juveniles may remain until the following fall. Adults migrate upstream during the fall and spawn from mid-October to February.	Present in the mainstem Sacramento River and tributary streams. Suitable rearing and migration habitat is present within the project area, and the species is known to occur in the project area.
Hardhead *Mylopharodon conocephalus*	–/SSC	Quiet, deep pools of large, warm, clear streams over rocks or sand.	Common native, non-game species. All life stages potentially occur in the project area year-round.
River lamprey *Lampetra ayresii*	–/SSC	The biology of river lampreys has not been studied in California; general habitat and life history are thought to be similar to Pacific lamprey: spawning in freshwater rivers and streams with juveniles found in slow-moving current, silty bottom habitats.	Actual distribution and abundance is unknown. May occur seasonally in project area.
Sacramento splittail *Pogonichthys macrolepidotus*	–/SSC	Inhabits backwaters and pools of rivers, streams, and lakes. Tolerant of brackish water.	Common native, non-game species. All life stages potentially occur in the project area year-round.

Status Codes:

E Endangered
T Threatened
FSC Federal species of concern
SSC California species of special concern



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Source: Vogel and Marine 1991; Moyle 2002

Figure 3.5-3
Life History of Sacramento River Chinook Salmon and Steelhead

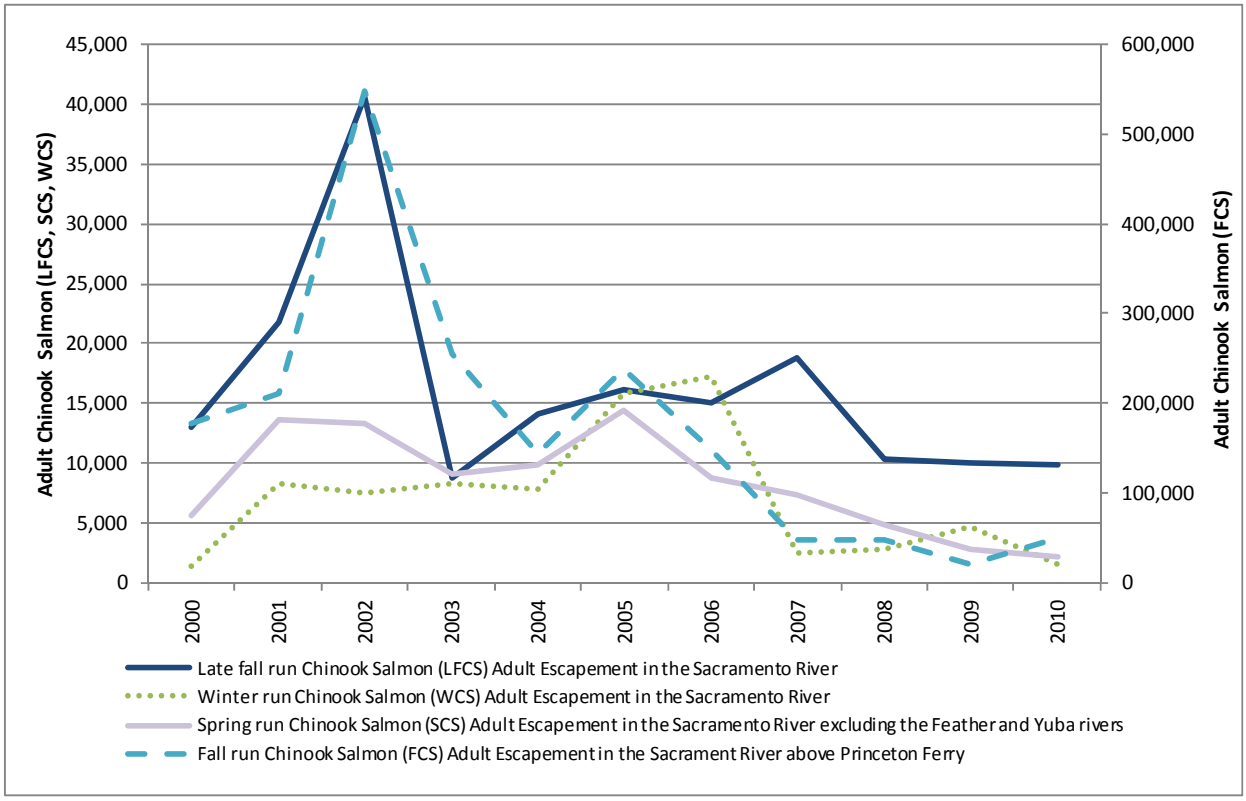


Figure 3.5-4. Adult Chinook Salmon Escapement in the Sacramento River, 2000–2010

Central Valley Fall/Late–Fall Run ESU Chinook Salmon

On September 16, 1999, NMFS determined that listing of Central Valley fall/late-fall run ESU Chinook salmon was not warranted (64 FR 50394), but in April 2004 the agency determined that it merited classification as a Species of Concern due to specific risk factors (69 FR 11975). The ESU includes all naturally spawned populations of fall/late-fall run Chinook salmon in the Sacramento and San Joaquin River basins and their tributaries east of Carquinez Strait, California.

The Central Valley fall/late-fall run ESU Chinook salmon comprises the largest present-day population of Chinook salmon in the Central Valley, although their numbers have been substantially depressed in recent years (Figure 3.5-4). Fall-run Chinook salmon begin to enter the Sacramento River in July, and the run builds through the late summer and fall months, peaking by late September and October (Vogel and Marine 1991). Spawning occurs throughout the upper Sacramento River and most of its tributaries from mid-October through December (Moyle 2002, Vogel and Marine 1991). Spawning densities of fall-run salmon are very high in the Sacramento River from Red Bluff to Keswick Dam (Killam, pers. comms. 2004 and 2006). Juvenile fall-run Chinook salmon rear throughout the Sacramento River and its tributaries. Juvenile fall-run fry may emigrate to the estuary from shortly after they hatch through the spring and summer months following their birth. Of the four Sacramento River salmon runs, fall-run fry, and to a lesser extent winter-run fry, are most commonly observed using and rearing on the shallow bar formations and floodplains in the middle and lower Sacramento River during their transitory seasonal movements. The other salmon runs tend to rear to larger sizes in the upper reaches of the river and its tributaries before emigrating to the estuary as smolts (Vogel and Marine 1991, Johnson et al. 1992).

The late-fall run component of this Chinook salmon ESU enters the Sacramento-San Joaquin estuary and ascends Central Valley streams after the fall run, usually from late October through March (Vogel and Marine 1991). Spawning begins in January and is usually complete by late April. Late-fall run spawning densities are greatest in the upper Sacramento River from Red Bluff to Keswick Dam. Juvenile late-fall run salmon rear in the upper Sacramento River from late April through the following winter before emigrating to the estuary (Vogel and Marine 1991, Moyle 2002) (Figure 3.5-3).

Juvenile fall-run emigration at RBDD begins as early as December, peaking in January and February during winter flow events, decreasing through the spring, and extending to as late as June or July (Gaines and Martin 2001). Late-fall run emigration peaks in April and again around August and can extend as late as January. Peak juvenile emigration at Knights Landing occurs between January and February and April and May for fall-run salmon and during April and December for late-fall run salmon. The Sacramento River in the vicinity of the project area may be used by fall/late-fall run Chinook salmon during migratory and rearing life stages. Although the fall run spawns over a much wider geographic area, extending as far downstream as the project area, spawning primarily occurs in the upper mainstem Sacramento River and its primary tributaries.

Large numbers of the fall-run and late-fall run salmon are spawned and reared by state and federal fish hatcheries in California's Central Valley. The number of hatchery-produced fish may greatly exceed the number of naturally produced fall/late-fall run Chinook salmon in some Central Valley streams, which has led to concern over the viability of certain tributary populations. These runs support valuable and

popular ocean and river commercial and sport fisheries. Figure 3.5-4 provides annual (2000–2010) population estimates for Central Valley fall- and late-fall run Chinook salmon.

Sacramento River Winter-Run ESU Chinook Salmon

The Sacramento River winter-run ESU Chinook salmon was federally listed as endangered under the ESA on January 4, 1994 (59 FR 440), and its endangered status was reaffirmed on June 28, 2005 (70 FR 37169). The winter-run Chinook salmon was also listed by the State as an endangered species under CESA on September 22, 1989. NMFS published proposed critical habitat for winter-run Chinook salmon on August 14, 1992, and the final rule was published on June 16, 1993 (58 FR 33212).

Historically, winter-run Chinook salmon spawned in the cold spring-fed headwaters of the upper Sacramento, Pit, McCloud, and Calaveras rivers (U.S. Fish and Wildlife Service 1995). Following construction of Shasta Dam, deep-water releases during the summer months provided suitable cold-water conditions for winter-run Chinook salmon spawning and rearing downstream of the dam. In response to these conditions, which increased total coldwater spawning habitat available to the winter run, the population increased. In 1969, the winter run exceeded 100,000 salmon; however, during the early 1990s, run size estimates have ranged from about 1,400 fish to as low as about 200 fish in some years. The Sacramento River winter-run ESU Chinook salmon population has exhibited a continuing recovery from the extremely low adult returns observed in the early 1990s. Recent spawning populations range from about 7,000 to 8,000 (California Department of Fish and Game 2004b); however, these levels remain well below draft recovery goals established for this run (National Marine Fisheries Service 2004a). Figure 3.5-4 provides annual (2000–2010) population estimates for winter-run Chinook salmon.

Winter-run Chinook salmon begin their migration up the Sacramento River in December and may spawn from mid-April through mid-August with a peak in spawning occurring from late May through June (Vogel and Marine 1991, Moyle 2002). The egg incubation period extends from mid-April through mid-September. Juvenile winter-run Chinook salmon are known to rear in suitable habitats of the upper and middle Sacramento River, including habitat in the project area. The Sacramento River in the vicinity of the project area may be used by winter-run Chinook salmon during migratory and rearing life stages. Rearing and migratory winter-run Chinook salmon typically use deeper and swifter habitats consistent with ontogenetic shifts in habitat use for salmonids. Spawning primarily occurs in the upper mainstem Sacramento River near Redding (Figure 3.5-2).

Juvenile emigration at RBDD begins as early as mid-July, peaks in September, and decreases into the fall. A significant percentage of winter-run salmon typically migrate downstream of RBDD by December (Poytress 2007, Poytress et al. 2006, Poytress and Carrillo 2008). Peak juvenile migration at Knights Landing occurs between November and February, and juvenile Sacramento River winter-run salmon are in the Delta primarily from November through early May based on data collected from trawls in the Sacramento River at West Sacramento (RM 57) (U.S. Fish and Wildlife Service 2001). The timing of migration may vary somewhat due to changes in river flows, dam operations, and water year type. Winter-run Chinook salmon juveniles remain in the Delta until they reach approximately 4.5 inches and are between 5 and 10 months of age, and they begin emigrating to the ocean as early as November and continuing through May (Fisher 1994, Myers et al. 1998).

The critical habitat designation includes the Sacramento-San Joaquin Delta and the Sacramento River, within all accessible reaches, including the reach in the project area. Constituent elements of anadromous salmonid critical habitat include seasonal timing and volume of streamflows sufficient to allow the fish to migrate, reproduce, and rear; suitable streambed and bank conditions to support spawning, incubation, and larval development; suitable water quantity and quality and floodplain connectivity to form and maintain physical habitat to support juvenile development, growth, and mobility; natural cover such as shade, submerged and overhanging vegetation and large wood, log jams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; and freshwater migration corridors free of obstruction with water quantities and quality and natural cover that support juvenile and adult fish migration and survival (69 FR 71880).

Central Valley Steelhead DPS

The Central Valley steelhead DPS was federally listed as threatened on March 19, 1998 (63 FR 13347). Their threatened status was reaffirmed on January 5, 2006, and took effect on February 6, 2006 (71 FR 834). West coast steelhead populations were determined to comprise 10 DPSs (Good et al. 2005). The Central Valley DPS includes all naturally spawned anadromous *O. mykiss* populations occurring below natural and human-made impassable barriers in the Sacramento and San Joaquin rivers and their tributaries; it also includes steelhead propagated at the Coleman National Fish Hatchery and Feather River State Fish Hatchery (71 FR 834).

Steelhead possess one of the most complex life history patterns of the Pacific salmonid species. The term “steelhead” typically refers to the anadromous form of rainbow trout. Similar to other Pacific salmon, steelhead adults spawn in freshwater and spend part of their life history at sea. However, unlike Chinook salmon, steelhead exhibit a variety of life history strategies during their freshwater rearing period and may spawn more than once during their life. The typical life history pattern for steelhead is to rear in freshwater streams for 2 years followed by up to 2 to 3 years of residency in the marine environment. However, juvenile steelhead may rear in freshwater for a period of 1 to 4 years (Busby et al. 1997, Moyle 2002).

Steelhead populations inhabiting the upper Sacramento River basin belong to the Central Valley steelhead DPS as defined by Good et al. (2005). These steelhead populations generally exhibit a life history pattern typical of a fall/winter run. This species historically has provided a popular sport fishery throughout the Sacramento River and its tributaries; however, at present, naturally produced steelhead remain at relatively low levels throughout their range in the Central Valley (Hallock 1989, McEwan 2001).

Steelhead adults may enter the Sacramento River and its tributaries from August through March, but peak migration generally occurs from October through February (Figure 3.5-3). Steelhead spawn in gravel and small cobble substrates usually associated with riffle and run habitat types. Spawning begins in late December and can extend into early April. Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows, using the lower reaches of the Sacramento River and the Delta for rearing and migration before heading to the ocean (National Marine Fisheries Service 2008). The Sacramento River in the vicinity of the project area may be used by steelhead during migratory and rearing life stages where they would use a variety of habitats, but would be most concentrated in areas

with access to deeper water, hydraulic breaks, and cover. Spawning primarily occurs in the upper mainstem Sacramento River and tributary streams.

Critical habitat designations for listed anadromous salmonids published in September 2005 (70 FR 52488) were finalized as part of the recent status reviews and are restricted to the species' anadromous range, which is coextensive with the steelhead-only DPS delineations described in that notice (71 FR 834). Designated critical habitat for Central Valley steelhead DPS includes all river reaches accessible to steelhead in the Sacramento and San Joaquin rivers and their tributaries, which includes the Sacramento River in the project area.

Southern DPS Green Sturgeon

On April 7, 2006, NMFS issued its final rule to list green sturgeon that spawn in rivers south of the Eel River (excluding the Eel River), California (southern DPS) as threatened under the ESA (71 FR 17757), effective June 5, 2006. In the final determination to list the southern DPS as threatened, NMFS identified the reduction of available spawning habitat due to construction of barriers along the Sacramento and Feather rivers as being the principal threat to green sturgeon in the southern DPS (71 FR 17757). Other threats include, but are not limited to, insufficient flow rates, increased water temperature, water diversion, non-native species, poaching, pesticide and heavy metal contamination, and local fishing.

Construction of Shasta and Keswick dams significantly reduced the amount of habitat available to green sturgeon, as well as to anadromous salmonids. The NMFS Biological Review Team considers it possible that the additional habitat behind Shasta Dam in the Pit, McCloud, and Little Sacramento rivers would have supported separate meta-populations, but the team was unable to confirm this idea due to the paucity of historical information (70 FR 17386). Historically, green sturgeon had to migrate farther upstream to find habitat with water temperatures cool enough to trigger spawning. Currently, river temperatures in the Sacramento River downstream of Keswick Dam provide suitable conditions for green sturgeon reproduction (71 FR 17757).

RBDD (RM 243) was a major migration impediment to adult green sturgeon (typically from mid-May to mid-September) until 2012. The Service (Brown 2006) concluded that green sturgeon spawn in the upper Sacramento River, above and below RBDD, based on field sampling. The Anderson-Cottonwood Irrigation District (ACID) diversion dam (RM 298) is also an impediment to migration for green sturgeon from April to November when flashboards are installed. Other potential barriers to green sturgeon include the Sacramento Deep Water Ship Channel locks, Fremont Weir, Sutter Bypass, and the Delta Cross Channel gates (70 FR 17386).

Spawning takes place in deep, fast water from March to July when water temperatures range from 46°F to 60°F. Adult green sturgeon are believed to spawn every 3 to 5 years and reach sexual maturity only after several years of growth (i.e., 10 to 15 years based on sympatric white sturgeon sexual maturity) (California Department of Fish and Game 2002). According to Heublein et al. (2006) all adults leave the Sacramento River prior to September 1. Adults begin upstream spawning migrations into the San Francisco Bay in March, reach Knights Landing during April, and spawn between March and July (Heublein et al. 2006). Peak spawning is believed to occur between April and June and thought to occur

in deep, turbulent pools (Adams et al. 2002). The temporal distribution pattern suggested by recent studies indicates spawning of green sturgeon occurs from April through July (Poytress et al. 2009).

Based on the distribution of sturgeon eggs, larva, and juveniles in the Sacramento River, CDFG (2002) indicated that the southern DPS of green sturgeon spawn in late spring and early summer above Hamilton City, possibly up to Keswick Dam. Although sampling data are limited, based on the length and estimated age of post-larvae captured at RBDD (approximately 2 weeks of age) and the Glenn-Colusa Irrigation District diversion (downstream, approximately three weeks of age), it appears that a majority of southern DPS green sturgeon are spawning above RBDD (National Marine Fisheries Service 2008). According to Poytress et al. (2009), three spawning sites were confirmed in the upper Sacramento River in 2008.

Juveniles may rear in the river for 1 to 3 years before migrating to the estuary, primarily during the summer and fall. Data suggest that 9- to 10-month-old fish would hold over in their natal rivers during the ensuing winter following hatching, but at a location downstream of their spawning grounds (National Marine Fisheries Service 2008). The lack of a significant proportion of juveniles smaller than approximately 8 inches in Delta captures indicates that juvenile southern DPS green sturgeon likely hold in the mainstem Sacramento River, as suggested by Kynard et al. (2005). Laboratory studies by Kynard et al. (2005) indicated that juvenile fish continued to migrate downstream at night for the first 6 months of life, when ambient water temperatures reached 46°F, and downstream migrational behavior diminished while holding behavior increased. Once in the estuary young sturgeon adopt an oceanic foraging habit, which may last between 3 and 13 years before they return for their first spawning season (Moyle 2002).

The Sacramento River in the project area serves as a migratory corridor for adult and juvenile southern DPS green sturgeon, and the river reach is designated critical habitat. Data suggest spawning takes place well upstream of the project area, but based on juvenile behavior patterns, juveniles are expected to be present in the Sacramento River year-round. Green sturgeon are most often found at depths greater than 5 meters (16 feet) with little or no current during summer and fall months (Erickson et al. 2002, Heublein et al. 2006). These habitat conditions are present in the project area, and adult green sturgeon would be expected to be present during the freshwater migration period from April to September.

Hardhead

Hardhead, an endemic native species to California and the Sacramento River, is identified as a California species of special concern (Moyle et al. 1995). Historically, hardhead have been regarded as a widespread and locally abundant species (Moyle et al. 1995). Hardhead are still widespread in the foothill streams, but their specialized habitat requirements, combined with widespread alteration of downstream habitats, have resulted in localized, isolated populations. This makes them vulnerable to localized extinctions.

Hardhead are widely distributed in low- to mid-elevation streams in the main Sacramento-San Joaquin drainage as well as in the Russian River drainage. Their range extends from the Kern River, Kern County, in the south to the Pit River (south of the Goose Lake drainage), Modoc County, in the north. Hardhead are typically found in undisturbed areas of larger middle- and low-elevation streams (Moyle et al. 1995).

Most suitable streams have summer temperatures above 68°F, and optimal temperatures for hardhead (as determined by laboratory choice experiments) appear to be 75-82°F. Hardhead typically inhabit streams below 4,500 feet in elevation.

Hardhead are large cyprinids, reaching standard lengths in excess of 24 inches. Body shape is similar to that of Sacramento pikeminnow, with which they co-occur, but the body is deeper and heavier and the head is less pointed. Hardhead are bottom feeders that forage for benthic invertebrates and aquatic plant material in quiet water and occasionally also feed on plankton and surface insects and cladocerans (Moyle et al. 1995).

Hardhead reach 2 to 3 inches by their first year, but growth slows in subsequent years. Hardhead mature following their second year and presumably spawn in the spring. Hardhead typically spawn between May and June in Central Valley streams, and the spawning season may extend into August in the foothill streams of the Sacramento-San Joaquin river basin (Moyle et al. 1995). Spawning activity has not been documented, but reproductive behavior presumably involves mass spawning in upstream gravel riffles (Moyle 2002).

Hardhead are not particularly abundant in the mainstem Sacramento River according to their rate of capture in rotary screw traps operated by the Service at the Glenn-Colusa Irrigation District diversion (RM 206) and Knights Landing (RM 89.5) (California Department of Fish and Game unpublished data), but they are regularly captured. Considering the habitat preferences and known distribution in the Sacramento River and its tributaries, it is expected that both juvenile and adult hardhead could be present in the project area throughout the year, but they are not expected to be abundant. It is presumed that any spawning would be limited in the project area due to their low abundance in this area of the river and because much of their spawning activity typically occurs in tributary streams.

River Lamprey

River lampreys are anadromous; like salmon, they are born in freshwater streams, migrate to the ocean, and return to freshwater as mature adults to spawn. Also like the salmon, lampreys do not feed during their spawning migration. Mating pairs of lamprey construct a nest by digging together using rapid vibrations of their tails and by moving stones using their suction mouths. They enter streams from July to October; spawning takes place the following spring when water temperatures are between 50°F and 62.6°F. They ascend rivers by alternately swimming upstream in brief spurts and resting by sucking and holding on to rocks. Spawning takes place in low-gradient reaches of streams with gravel and sandy bottoms. Adults die within 4 days of spawning, after depositing between 10,000 and 100,000 very small eggs in a nest. The young hatch in 2 to 3 weeks and swim to areas of low-velocity water where sediments are soft and rich in dead plant materials. They quickly burrow into the muddy bottom, where they filter the mud and water, eating microscopic plants (mostly diatoms) and animals.

Juvenile lampreys will stay burrowed in the mud for 3 to 6 years, moving only rarely to new areas. After a 2-month metamorphosis triggered by unknown factors, they reach an adult morphology, averaging 4.5 inches long. Newly metamorphosed lampreys migrate downstream during winter and spring high-flow events. Adult river lampreys are thought to spend from 2 to 12 months in the estuary or ocean before

returning to the rivers to spawn. River lampreys are known to be present in the Sacramento River (Moyle 2002), but their presence and abundance in the project area is unknown.

Sacramento Splittail

Sacramento splittail was federally listed as threatened on February 8, 1999 (64 FR 5963), but this decision was revoked, and the species was removed from the list of threatened species in 2003 (68 FR 55139). Sacramento splittail are identified as a California species of concern by CDFG but currently have no federal listing status.

Sacramento splittail are a member of the cyprinid family (Cyprinidae). Splittail are distinctive in that the upper lobe of the tail fin is larger and more elongated than the lower lobe. Splittail grow to more than 12 inches in length and exhibit an elongate body with a blunt head. Splittail are primarily freshwater fish but are tolerant of moderate salinity and can live in water with salinities of 10–18 parts per thousand. Spawning begins by late January and early February and continues through July, with most spawning taking place from February through April. Splittail spawn on submerged vegetation in temporarily flooded upland and riparian habitat. Typically, terrestrial shrubs and herbs are preferred over emergent wetland vegetation such as cattails and tules. Spawning occurs in the lower reaches of rivers, bypasses used for flood management, dead-end sloughs, and in larger sloughs such as Montezuma Slough (Daniels and Moyle 1983, Moyle 2002). Considering the life history and habitat preferences of splittail in the Sacramento River and its tributaries, it is expected that both juvenile and adult splittail could be present in the project area throughout the year, but they are not expected to be abundant. Suitable spawning habitat is present in the project area, and it is presumed that splittail could spawn in the project area between January and July.

Critical Habitat

The ESA defines critical habitat as those specific areas within the geographic area occupied by the species, at the time of listing, containing physical and biological features essential to the conservation of the species that may require special management considerations as well as occupied areas that are essential to the conservation of the species. Regulations state that the physical and biological features essential to the conservation of a species include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing of offspring; and habitats that are protected from disturbance or are representative of the historical geographical and ecological distribution of a species. These principal biological or physical elements are known as primary constituent elements (PCEs). NMFS developed a list of PCEs specific to salmon and steelhead and relevant to determining whether occupied stream reaches within a Hydrologic Unit Code or Hydrologic Sub-area fit the definition of “critical habitat.”

The project area is located in CalWater Hydrologic Sub-area 552040, which provides 76 miles of spawning/rearing, rearing/migration, and presence/migration PCEs for Central Valley spring-run ESU Chinook salmon and 131 miles for Central Valley DPS steelhead (National Marine Fisheries Service 2004b). Management activities affecting PCEs in the hydrologic sub-area include agricultural water diversions, point- and nonpoint-source pollution, fish passage, diking and streambank stabilization, and

flood control. The hydrologic sub-area received a high conservation value for Central Valley DPS steelhead because of its important function for all life stages of this species. The Sacramento River in the project area contains PCEs that support rearing and migration for Chinook salmon and steelhead and is designated critical habitat for these species.

The Sacramento River in the project area also provides all of the PCEs identified for southern DPS green sturgeon. The specific PCEs essential for the conservation of the southern DPS green sturgeon in freshwater riverine systems include food resources, suitable substrates, suitable flow regime, suitable water quality, an unimpeded migratory corridor, suitable holding habitats (pools), and sediments free of elevated levels of contaminants.

Essential Fish Habitat

The Sacramento River and its tributaries contain EFH for Chinook salmon, as defined by the Magnuson-Stevens Fisheries Conservation and Management Act of 1994, as amended. The Sacramento River in the project area provides three major components of freshwater EFH for salmon. Adult fall/late-fall run Chinook salmon may periodically spawn in this reach, but most salmon spawning is believed to occur much farther upstream in the Sacramento River and in tributaries. Fry and juveniles of all anadromous fish species are known to occupy suitable rearing habitats nearly year-round, but different runs are seasonally more abundant based on their run timing and river flows.

Factors Affecting Fishery Resources in the Project Area

Modification and curtailment of habitat and range from hydropower, flood control, and consumptive water use have permanently blocked or hindered salmonid access to historical spawning and rearing grounds, resulting in the complete loss of substantial portions of spawning, rearing, and migration PCEs (National Marine Fisheries Service 2008). The past and ongoing actions described below, including salmon habitat restoration, affect anadromous salmonids and other special-status and non–special-status fish species in the project area.

Barriers to Migration

Several human-made barriers to fish migration are present on the Sacramento River. The largest barriers are the Shasta and Keswick dams, located about 124 miles upstream of the project area. These dams are federal components of the Central Valley Project, constructed in the 1930s and 1940s to provide flood protection, water storage, and hydropower generation, but they also serve as barriers to migrating fish. Recent changes in the Central Valley Project mandated by the Central Valley Project Improvement Act of 1992 authorized the project to also provide fish and wildlife benefits.

The ACID diversion dam, also located about 120 miles upstream of the project area, diverts river water during the irrigation season. This was the first diversion dam on the Sacramento River, completed in 1917. It is a flashboard dam typically operated from April through October. In 2001, the CALFED Bay-Delta Program funded improvements of the existing fish screen to correct existing downstream passage deficiencies (entrainment, impingement, and predation of juveniles) and upstream passage deficiencies (injury, stress, crowding, disorientation, and delays of adults). These improvements made an additional

3.5 miles of Sacramento River between the ACID dam and Keswick Dam more readily accessible to all runs of Chinook salmon, steelhead, and sturgeon species for spawning and rearing.

The RBDD, about 65 miles upstream of the project area near Red Bluff, historically created a major impediment to upstream migration of adult salmon (Hallock et al. 1982, U.S. Fish and Wildlife Service 1995, Vogel et al. 1988). To minimize potentially deleterious effects resulting from blocked or delayed migration of adult Chinook salmon (i.e., pre-spawn mortality, reduced egg viability, and shifts in spawning distribution), the dam's diversion gates were opened to allow unimpeded upstream and downstream fish passage during the major fish migration seasons from mid-September to mid-May. The dam gates were closed during the summer irrigation season (mid-May through mid-September) to create a run of the river diversion and deliver irrigation water. Beginning in 2012, a new screened pumping plant to deliver irrigation water will be operated, obviating the need for gates to be lowered and allowing for unimpeded fish passage at RBDD.

Water Temperature

Elevated water temperatures caused by dam operations, water diversions, and land use practices have been implicated in the historic population declines of Sacramento River salmon and steelhead, both in the mainstem river and its tributaries (Busby et al. 1997, Good et al. 2005, Myers et al. 1998, U.S. Fish and Wildlife Service 1995). The effects of water temperature on fishes are largely governed by the fishes' genetic and physiological makeup, temperature levels, and duration of exposure (Reynolds and Casterlin 1980). Elevated water temperatures can have both acute (i.e., lethal) and chronic (i.e., sublethal) impacts on salmon populations. Acute effects occur when temperatures range above or below physiologically tolerated levels. Chronic temperature effects occur when temperatures fall between the acute threshold temperatures and preferred or optimal temperatures (Moyle and Cech Jr. 1988). Chronic effects of elevated temperatures on fish include physiological stress, reduced growth rates, decreased egg viability and subsequent larval survival, and increased vulnerability to disease and predation (Marine 1992).

The U.S. Bureau of Reclamation built a temperature control device on Shasta Dam in 1997. This action was taken to comply with water temperature standards for the protection of fishery resources established by the Basin Plan and required by the 1993 Biological Opinion for Sacramento River winter-run Chinook salmon, which was incorporated into the 1995 Water Quality Control Plan for the Sacramento-San Joaquin Bay-Delta Decision 1641. The Basin Plan standards state that "the temperature shall not be elevated above 56°F in the reach from Keswick Dam to Hamilton City nor above 68°F in the reach from Hamilton City to the I Street Bridge during periods when temperature increases will be detrimental to the fishery" (Central Valley Regional Water Quality Control Board 2007). The temperature control device provides flexibility better manage coldwater storage and discharges at Shasta Dam for the purposes of downstream salmon protection, endangered species recovery, and hydroelectric power generation.

Water Diversions

More than 300 individual irrigation, industrial, and municipal water supply diversions exist along the Sacramento River between Redding and Sacramento, diverting nearly 1.2 million acre-feet of water annually from April through October. A large number of these, primarily small diversions, remained unscreened during the mid- to late 1990s and were believed to cause significant losses of juvenile salmon

and steelhead rearing and emigrating throughout the river during the irrigation and non-irrigation seasons (U.S. Fish and Wildlife Service 1995). Water diversions have reduced survival of emigrating juvenile salmonids through direct losses at unscreened or inadequately screened diversions and indirect losses associated with reduced streamflows. Fish losses at diversions can occur through physical injury, impingement, or entrainment. Delayed passage, increased stress, and increased vulnerability to predation are also factors contributing to mortality at diversions. Diversion impacts on anadromous fish populations depend on diversion timing and magnitude, river discharge, species (i.e., race), life stage, and other factors (U.S. Fish and Wildlife Service 1995).

Since the mid- to late 1990s, numerous diversions have been consolidated or screened and new diversion facilities have been built. Improved fish screening and salvage facilities at major agricultural diversions have been largely successful (e.g., ACID diversion dam fish screen and bypass, RBDD fish screens and bypass, Glenn-Colusa Irrigation District diversion fish screen, and PCGID-PID pumping plant and fish screen facility). Other examples of "larger" screened diversions in addition to the PCGID-PID facility are those owned by the Tehama Colusa Canal Authority, Sutter Mutual Water Company, Richter Brothers, Reclamation Districts 1004 and 108, Pelger Mutual Water Company, Natomas Mutual Water Company, and M&T Chico Ranch. Many other small diversions have been screened through programs like the Family Water Alliance's Sacramento Valley/Delta Fish Screen Program. However, many smaller, unscreened or inadequately screened diversions continue to operate, and their effects remain largely unknown (Hanson 2001).

Bank Stabilization

The development of flood control, reclamation, and water conveyance facilities in the Delta and Sacramento Valley has resulted in the construction of many miles of channels and diversion to increase channel elevations and flow capacity. Levee development in the Central Valley affects spawning habitat, freshwater rearing habitat, freshwater migration corridors, and estuarine habitat PCEs (National Marine Fisheries Service 2008). Levee construction disrupts the natural processes of the river, resulting in habitat-related effects that have diminished, and continue to diminish, conditions for adult and juvenile migration and survival. Many of the levees in the Sacramento River use angular rock, or rock slope protection (riprap), to protect the banks from erosion. The effects of channelization and riprapping include the alteration of river hydraulics and overflow along the bank as a result of changes in bank configuration and structural features (Stillwater Sciences 2006). These changes affect the quantity and quality of nearshore habitat for juvenile salmonids and have been thoroughly studied (Michney and Deibel 1986, U.S. Fish and Wildlife Service 2000, Garland et al. 2002, Schmetterling et al. 2001). These protected slopes generally create nearshore hydraulic conditions characterized by greater depths and faster, more homogeneous water velocities along natural banks, often inhibiting deposition and retention of sediment and woody debris. These changes generally reduce the range of habitat conditions typically found along natural shorelines, especially by eliminating the shallow, slow-velocity river margins used by juvenile fish as refuge from fast currents, deep water, and predators (Stillwater Sciences 2006, National Marine Fisheries Service 2008).

The Sacramento River Bank Protection Project was originally authorized under the Flood Control Act of 1960 (Public Law 86-645). Its purpose is to protect the levees and flood control facilities on the

Sacramento River from the Bay-Delta at Collinsville at RM 0 to Chico Landing at RM 194. The project includes the lower reaches of the American River (RM 0 to RM 23), Feather River (RM 0 to RM 61), Yuba River (RM 0 to RM 11), and Bear River (RM 0 to RM 17), as well as portions of Three Mile, Steamboat, Sutter, Miner, Georgianna, Elk, and Cache sloughs. The project was created in 1959 and initiated by the Corps in 1963 as a means of protecting flood control levees. The project is ongoing subject to Congressional reauthorization. Construction activities authorized to date by the project account for approximately 152 miles of river bank revetment (EDAW 2005).

Riparian Habitat Restoration

Substantial losses of streamside riparian vegetation as a result of land conversion have adversely affected Chinook salmon habitat throughout the Central Valley (The Resource Agency of California 1989, U.S. Fish and Wildlife Service 1995). Riparian vegetation performs critical functions in stream ecosystems by maintaining bank stability, providing overhead and instream cover for aquatic organisms, moderating water temperatures, contributing nutrients and energy, and providing habitat diversity (U.S. Fish and Wildlife Service 1995). Riparian vegetation also provides those elements that make up SRA habitat, a component of critical habitat and EFH.

In recognition of the losses and degradation of riparian habitat in California's Central Valley, state legislation in 1986 (Senate Bill 1086) established a collaborative process between landowners, government agencies, and environmental interests to develop plans for conserving floodplain and riparian habitats along the Sacramento River. The *Upper Sacramento River Fisheries and Riparian Habitat Management Plan* (The Resources Agency of California 1989) was developed through this effort and has provided the foundation for ongoing efforts to conserve and manage vital riparian habitat that is implemented through various programs. As part of this effort, the Service, the U.S. Bureau of Land Management, the State of California, and The Nature Conservancy manage numerous tracts along the river and have implemented various riparian restoration measures.

Some of these tracts of land along the river are managed as part of the Sacramento River NWR. The refuge is currently composed of 29 units along a 77-mile stretch of the Sacramento River between Red Bluff and Princeton. The Sacramento River NWR is currently 10,235 acres, which includes 4,060 acres of remnant riparian and floodplain vegetation; 5,027 acres of restored vegetation/habitats; and 1,148 acres of walnut orchards, row crops, and fallow agricultural lands. Restored vegetation is diverse and includes willow scrub, cottonwood forest, riparian herblands, mixed forest, valley oak forest and woodland, valley oak and elderberry savanna, grasslands, and freshwater wetlands.

Sacramento River Flows and Flood Control Operations

The Sacramento River has a design flow capacity of 160,000 cfs just downstream of the project area (U.S. Army Corps of Engineers and California State Reclamation Board 2002). Shasta Dam provides flood protection to the communities of Redding, Anderson, Red Bluff, and Tehama, as well as the agricultural lands, industrial developments, and communities downstream along the Sacramento River. Private levees or low berms and Corps project levees limit the area of flooding in both urban and agricultural areas. Shasta Dam is operated for an objective release of 79,000 cfs at Redding and 100,000 cfs at Bend Bridge in Red Bluff. Flows greater than 36,000 cfs begin to cause flooding in Redding (U.S. Army Corps of

Engineers and California State Reclamation Board 2002). Tributaries entering the Sacramento River from the west, including Clear, Cottonwood, Elder, Thomes, and Stony creeks, drain runoff from the Coastal Mountain Range. Cottonwood Creek provides the most significant amount of inflow to the Sacramento River in this region. Tributaries from the east that drain runoff from the Cascade and Sierra Nevada mountain ranges include Cow, Bear, Battle, Paynes, Antelope, Mill, Deer, Rock, Big Chico, and Butte creeks. Most of these tributaries are unregulated and can contribute high floodflows to the Sacramento River (U.S. Army Corps of Engineers and California State Reclamation Board 2002).

Sacramento River Flood Control Project

The Sacramento River Flood Control Project was conceived in 1911 and constructed by the Corps. At that time, 80 percent of the proposed 500 miles of river and bypass levees had already been completed under private and municipal levee systems begun in the 1850s (Kelly 1989). Along the Sacramento River, the flood control project consists of setback levees beginning near the town of Ord on the west side and just north of the Butte/Glenn County line on the east. The west bank project levee runs upstream to approximately RM 184. The east bank project levee extends only as far upstream as RM 176. The Central Valley Flood Protection Board (until recently known as the California State Reclamation Board) is responsible for maintenance of the flood control project. The responsibility is passed on to the local reclamation and levee districts or to the California Department of Water Resources where no such district exists. The flood control project includes the rock revetment of about 160 miles of banks and levees, installed to ensure the security of the flood control system (Sacramento River Conservation Area Forum 2003). Additional levees maintained by the Central Valley Flood Protection Board in conjunction with local reclamation districts extend upstream of the Corps project levees.

The Chico Landing to Red Bluff Project, authorized in 1958, extends and modifies the Sacramento River Flood Control Project. This project, sponsored by the Central Valley Flood Protection Board, provides for bank protection (erosion protection) and incidental channel modifications along 50 miles of the Sacramento River between Chico Landing and Red Bluff. In this reach, which includes the Chico Landing Subreach, 21.5 miles of bank protection have been installed to hold the river in place and limit meandering of the channel (U.S. Army Corps of Engineers and California State Reclamation Board 2002).

3.5.3 Environmental Consequences

Methodology

The description of the affected environment for fishery resources is based on available information on populations of special-status fish species in the Sacramento River, discussions with resource agencies, a site assessment and aquatic habitat delineation, and a review of literature and other available documentation on local fishery resources. The information presented in the affected environment was used to determine the potential for special-status fishes to occur in the project area and to characterize the quality of habitat present in the project area; this information was used to determine the potential for special-status fishes and their habitats to be affected by the Riparian Sanctuary project.

Significance Thresholds

Fishery resource impacts would be considered significant if the Riparian Sanctuary project would:

- have a substantial adverse impact, either directly or through habitat modifications, on a special-status fish species;
- adversely modify designated critical habitat for any federally listed species or essential fish habitat for Chinook salmon;
- interfere substantially with the movement of any native resident or migratory fish species;
- substantially diminish habitat for any fish life stage;
- result in displacement of spawning fish such that year-class strength would be substantially reduced; or
- result in the production or discharge of materials that pose a hazard to fish species.

Impacts and Mitigation Measures

Impact FR-1: In-water construction activities could result in the direct mortality of or injury to anadromous and resident fishes, including special-status fishes.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place, and no direct construction-related impacts on fishes would occur. No new revetment would be installed along the Sacramento River adjacent to the Riparian Sanctuary to protect the PCGID-PID pumping plant and fish screen facility.

Alternative 2 – Spur Dikes and Site-Specific Plantings

The Sacramento River in the project area provides migratory habitat for both juvenile and adult special-status fishes, including Chinook salmon, steelhead trout, green sturgeon, hardhead, river lamprey, and Sacramento splittail, and provides rearing habitat for juvenile fishes. Direct injury to or mortality of rearing or migrating juvenile salmonids, green sturgeon, or other special-status fish could result from in-water activities during construction of the eight spur dikes. Juvenile life stages are most vulnerable to in-water construction activities because they are smaller and less mobile than adults and are typically oriented to cover and structure along the shore where construction would take place. Although in-water construction would be localized (limited to approximately 2,000 feet along the river and 75 feet into the river from the bank, with most activities taking place along the exposed gravel bar during low water levels) and temporary (approximately 25 days), the placement and shaping of rock with an excavator in the wetted channel to form the spur dikes could injure, kill, or displace special-status fish in the affected reach of the river during the construction period.

In-water construction activities would be limited to August 1 through October 31, which would minimize the potential for impacts on rearing fish. However, at least one freshwater life stage of the listed anadromous salmonids, resident *O. mykiss,* or other special-status fishes would be present in the project area during that period. Displaced juvenile fish are expected to relocate to suitable habitat outside of the affected reach of the river because suitable juvenile rearing habitat is present nearby and would be able to accommodate the displaced fishes during summer and fall months (i.e., the habitat is not considered to be limiting in the middle Sacramento River in the vicinity of the project area). The seasonal work

restrictions would minimize direct mortality of migratory and resident fish, including federally and state-listed salmonids and federally listed green sturgeon, but spur dike construction could still result in the mortality, or take, of individual listed fishes, which would be significant. Implementation of Mitigation Measure FR-1 would reduce the potential for mortality of or injury to anadromous and resident fishes during in-water construction. This mitigation measure in combination with conditions required by NMFS and CDFG during ESA and CESA consultations and in the Streambed Alteration Agreement would reduce potential effects on individual listed fishes during construction to less than significant.

Site preparation and plantings for the riparian restoration would not require in-water activities and would not result in direct injury to or mortality of fishes. Indirect effects could result from increased pollutants or sediment in runoff as discussed under Impacts FR-2 and FR-3.

Mitigation Measure FR-1: Implement measures to minimize the injury or mortality of rearing and migratory juvenile anadromous and resident fishes.

The construction contractor retained by PCGID-PID for installation of the bank protection measures will be required to minimize in-water activities and to operate equipment slowly and deliberately to alert and scare adult and juvenile salmonids away from the work area. The contractor will be instructed that, before submerging an excavator bucket or laying riprap below the water surface, the excavator bucket will be operated to "tap" the surface of the water, or a person will wade ahead of the equipment to scare fish away from the work area. To avoid impacts to mobile life stages of salmonids that may be present in the water column, the first layers of clean materials that are being placed into the wetted channel will be added slowly and deliberately to allow fish to move from the work area. These measures will avoid or minimize potential injury to and mortality of fish during in-water activities.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

In-water construction activities associated with installation of the traditional riprap, with or without a low berm, under Alternative 3 would result in the same types of impacts as described for Alternative 2. These activities could result in the direct injury to or mortality of juvenile salmonids, green sturgeon, or other special-status fish during construction. The potential for direct impacts to fish is greater with Alternative 3 because in-water construction activities would be more extensive than for Alternative 2 and would require excavation and placement of more material. For the no berm option, in-channel excavation[1] would consist of approximately 89,100 tons of material, and approximately 36,000 tons of quarry stone and 25,000 tons of soil-filled quarry stone would be placed along 2,500 feet of riverbank, extending up to 100 feet across the gravel bar into the river, with most of the riprap on the gravel bar, which is exposed during low water levels when construction would take place. The low berm option would result in the placement of approximately 44,400 tons of quarry stone and 24,750 tons of soil-filled quarry stone along 2,700 feet of riverbank, extending up to 150 feet across the gravel bar and into the wetted channel, particularly near the upstream end of the proposed revetment where the existing gravel bar is narrower and the channel is deeper. Much of the riprap would be placed outside of the wetted channel on the

[1] In-channel refers to activities occurring within the ordinary high water mark of the Sacramento River at the Riparian Sanctuary and do not reflect the lineal extent of in-water work that could occur, which is dependent on seasonal river flows.

existing gravel bar during seasonal low flows, minimizing the extent of in-water work required. Because of the potential for more in-water construction activities, the traditional riprap would result in a greater potential for direct impacts on special-status fishes than the spur dikes, and these impacts would be significant. Implementation of Mitigation Measure FR-1, described for Alternative 2, would minimize the potential for the direct mortality, or take, of listed fishes, and this measure in combination with conditions resulting from ESA and CESA consultations and identified in the Streambed Alteration Agreement would reduce construction impacts to less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, in-water construction-related impacts on fishes would include those described for Alternatives 2 and 3, as well as potential impacts associated with removal of upstream rock. The rock removal would be conducted from the land with an excavator during the seasonal low flow period above the mean water surface elevation and would not require in-water excavation. Special-status fishes in the river could be displaced by equipment along the bank or injured by the incidental rock falling into the river. This would be a significant impact. Implementation of Mitigation Measure FR-1, described for Alternative 2, would minimize the potential for the direct mortality, or take, of listed fishes, and this measure in combination with conditions resulting from ESA and CESA consultations and identified in the Streambed Alteration Agreement would reduce construction impacts to less than significant.

Impact FR-2: Construction activities could result in increased erosion and sedimentation levels that could adversely affect anadromous and resident fishes.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place, and no indirect construction-related impacts on fishes would occur. No new revetment would be installed along the Sacramento River adjacent to the Riparian Sanctuary to protect the PCGID-PID pumping plant and fish screen facility.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction and restoration activities could result in increased turbidity of the Sacramento River as a result of the mobilization of fine-textured materials or discharge of sediment in runoff, as discussed in Section 3.4, Water Resources, which could adversely affect all of the previously mentioned special-status fish species and resident fish species that occur in and near the project area. The turbidity of a water body is related to the concentration of suspended solids. Suspended solids and turbidity generally do not acutely affect aquatic organisms unless they reach extremely high levels (i.e., levels of suspended solids reaching 25 milligrams per liter). At these high levels, suspended solids can adversely affect the physiology and behavior of aquatic organisms and may suppress photosynthetic activity at the base of food webs, affecting aquatic organisms either directly or indirectly (Alabaster and Lloyd 1980). Based on the magnitude of disturbance expected from construction activities, the size of the Sacramento River, its volume, and its rate of flow, no turbidity barrier is expected to form or impede fish migration through the project area. A turbidity barrier is an area of extremely high turbidity levels of sufficient length, duration, or concentration to inhibit the free movement of organisms.

Any juvenile salmon, steelhead, or other special-status fish rearing in the reach of the river in and immediately downstream of the project area could be temporarily affected by an increase in suspended sediment and turbidity as a result of soil disturbance during spur dike installation, placement of rock and other materials into the river for the spur dikes, or restoration-related soil disturbance that increases sediment in runoff. These impacts could result in the displacement of rearing salmonid fishes from their habitat, an increased risk of predation, reduced feeding efficiency, or other disruptions to their social behavior (Michney and Hampton 1984, 1986). Behavioral disruption, even on a temporary basis, could result in increased vulnerability to competitive interactions or predation for juvenile salmon (Berg and Northcote 1985); however, the magnitude of such disruptions is not expected to be high because construction would be scheduled outside of the primary periods of migration and rearing for juvenile salmonids and sufficient suitable habitat is available immediately upstream and downstream of the project area. The anticipated suspended solids and turbidity levels are also not expected to reach levels that would acutely affect aquatic organisms; however, because special-status fishes could be affected by the temporary increase in turbidity, associated impacts would be significant. Implementation of erosion control measures described in Chapter 2, including monitoring water quality to track turbidity levels, staging away from water courses, and seeding disturbed areas, and Mitigation Measure WR-1 identified in Section 3.4, Water Resources, would minimize the potential for increased turbidity during construction and restoration activities to affect fishes, and impacts would be less than significant.

Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap, with or without a low berm, and restoration of the Riparian Sanctuary under Alternatives 3 and 4 would involve similar activities as described for Alternative 2 and would result in the same types of turbidity-related impacts on fishes as described for Alternative 2. The traditional riprap, with or without the berm, would require more in-water activities, including extensive excavation for the no berm option, which could result in a greater increase in turbidity in the Sacramento River and greater effects on anadromous fishes. Additional impacts would result from upstream rock removal under Alternative 4, which would disturb and mobilize stream sediments upstream of the Riparian Sanctuary (in the bend around the peninsula) and could affect more fishes in the upstream reach. As discussed for Alternative 2, implementation of erosion control measures and additional water quality mitigation measures (i.e., Mitigation Measure WR-1) would reduce the potential for adverse effects on fish, and impacts from turbidity and sedimentation would be less than significant.

Impact FR-3: Construction of the Riparian Sanctuary project could result in accidental spill of hazardous materials that could adversely affect fishes.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place, and no indirect construction-related impacts on fishes would occur. No new revetment would be installed along the Sacramento River adjacent to the Riparian Sanctuary to protect the PCGID-PID pumping plant and fish screen facility.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction and restoration activities could result in a spill of hazardous materials (e.g., oil, grease, gasoline, solvent) into the Sacramento River. In addition, operation of construction equipment within or adjacent to the river would increase the potential for hazardous materials to enter the river (e.g., from construction equipment that is leaking fluids). Equipment would need to be refueled periodically in the project area, which could result in minor fuel and oil spills. Without rapid containment and clean-up of a spill, these materials could be toxic to both special-status and resident fish species and their habitat, depending on the proximity of the spill to the Sacramento River. Oils, fuels, and other contaminants could have deleterious impacts to all salmonid and non-salmonid life stages during construction activities, which would be a significant impact. Implementation of hazardous material measures described in Chapter 2, including preventing hazardous substances from entering the water, properly cleaning up hazardous materials spills, and complying with a spill prevention and response plan, and Mitigation Measure WR-3 identified in Section 3.4, Water Resources, would minimize the potential for hazardous materials spills during construction and restoration activities to affect fishes, and impacts would be less than significant.

Impact FR-4: Implementation of the Riparian Sanctuary project could result in impacts to spawning, rearing, and migratory habitat for anadromous and resident fishes, including designated critical habitat and essential fish habitat.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place and no bank protection measures or restoration activities would be implemented. No temporary construction-related impacts on aquatic habitat would occur. Natural processes along the Sacramento River would continue to modify aquatic habitat in the project area not already altered, particularly through ongoing localized erosion and deposition along natural stream banks like at the northwestern corner of the Riparian Sanctuary. The No-Action Alternative would not have an effect on aquatic habitat because any changes would be the result of ongoing natural processes.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Temporary Impacts. Temporary impacts on aquatic habitat would result from construction of the spur dikes, and the installation of spur dikes in the river would permanently alter aquatic habitat on the northwest side of the Riparian Sanctuary. Construction activities would temporarily disturb juvenile rearing habitat, including designated critical habitat and EFH, where the spur dikes are installed, making the habitat temporarily unsuitable either through an increase in suspended sediments and turbidity or by temporary physical disturbance in the wetted channel. These types of temporary impacts are discussed in Impacts FR-1, FR-2, and FR-3, and the resulting effects on aquatic habitat would be minimal because of the temporary nature of the activities, timing of activities, and the availability of nearby suitable habitats. In addition, the restoration design of the Riparian Sanctuary project would improve riparian habitat along the upper bank of the river where the spur dikes are installed and in adjacent upland areas, which would benefit both special-status and resident fish species by providing shade; sediment, nutrient, and chemical

regulation; stream bank stability; and input of woody debris and leaves that provide cover and serve as substrates for food-producing invertebrates.

Spawning Habitat Impacts. The Sacramento River in the project area does not provide highly suitable or regularly used spawning habitat for anadromous fishes and does provide suitable adult sturgeon, salmon, and other special-status fish holding habitat. Construction activities would not affect spawning habitat for anadromous fish species such that year-class strength would be substantially reduced, and no long-term adverse impacts on spawning habitat would result from spur dike installation. The spur dikes would result in a temporary reduction in the amount of submerged terrestrial vegetation available for Sacramento splittail, but this habitat is not considered to be limiting in the project area and fish would be expected to successfully spawn in nearby habitats until vegetation regenerates. One or two of the spur dikes would fill an existing scour hole near the upstream end of the proposed revetment; however, this impact would be less than significant because of the presense of suitable deep water habitats with slow water velocities in, upstream, and downstream of the project area.

Migratory Habitat Impacts. The Sacramento River in the project area is migratory habitat for both juvenile and adult special-status fishes. This migratory habitat is a PCE of designated critical habitat for listed anadromous fishes and an element of EFH for Chinook salmon. Construction activities for the spur dikes would extend 75 feet out from the bank, perpendicular or transverse to the flow of the river, and would be about 60 feet wide at the ground level narrowing to 12 feet at the top. The dikes would not extend far enough across the river channel to alter hydraulic conditions such that adverse impacts to migratory habitat for juvenile or adult fishes would occur. The spur dikes would not impede migratory fishes over the long term; however, they could provide predator ambush cover and increase the potential for predators to take juvenile fishes during periods of the year when flows inundate the spur dikes. Riparian vegetation and lower velocity waters between spur dikes would provide cover and habitat for juvenile fishes (Niles and Hartman 2009, Shields et al. 1995), while also providing suitable habitat for predators. Spur dikes have been demonstrated to provide intermediate-quality habitat compared with natural banks, and they provide better quality habitat than traditional riprap that does not include streamside vegetation (Li et al. 1984).

Streamside Habitat Impacts. The extensive riprap bank stabilization along the lower Sacramento River was identified as a primary cause for the decline of salmon in the river (Schmetterling et al. 2001). Stream channels and their associated riparian zones help maintain soil stability and water quality and support important chemical processes and nutrient cycles necessary to perpetuate the long-term health of the physical and biological properties of these areas (Fischenich 2003). Riprap can also create preferential habitat for some organisms (e.g., predators) at the expense of others (Fischenich 2003), and changes in aquatic habitat as a result of bank protection measures may favor exotic fishes (Moyle and Light 1996). The loss of natural fish habitat features such as undercut banks, log snags, and streamside hanging vegetation is detrimental to fish, particularly smaller salmonids (Knudsen and Dilley 1987, Schmetterling et al. 2001).

The removal of riparian vegetation for spur dike construction could adversely affect the quality of rearing habitat used by special-status fishes. SRA habitat generally includes the woody vegetation and cover structures associated with “natural” banks that provide shade; sediment, nutrient, and chemical regulation;

streambank stability; and woody debris and leaves that provide cover and serve as substrates for food-producing invertebrates. Less than 1 acre of moderate- to low-quality SRA habitat along approximately 2,000 feet of the river would be affected by the installation of spur dikes, but most of the existing woody vegetation (i.e., SRA habitat) would be preserved along the bank. In addition, some riparian vegetation would be expected to regenerate between the spur dikes, and the site-specific plantings would restore approximately 400 acres of varying densities of riparian habitat across the Riparian Sanctuary. The limited riparian habitat that would be removed has only recently become established and does not consist of large or extensive mature tracts of riparian trees similar to what is present downstream on the west side of the Riparian Sanctuary. The mature SRA habitat downstream of the proposed spur dikes would be preserved and incorporated into the restoration design. In addition, the 225-foot-wide areas of soft riverbank between the spur dikes would allow for continued natural regeneration of riparian forest. This design would minimize the conversion of natural streambank to riprap, while still providing sufficient protection against further erosion to maintain the existing river alignment, resulting in a less-than-significant impact on SRA habitat.

Floodplain Habitat Impacts. Placement of spur dikes, many of which would not be continually inundated, would not significantly alter the current function of the habitat along the affected stretch of bank, which is mostly shallow seasonally inundated bar habitat. The floodplain (the Riparian Sanctuary) in the project area is not considered a frequently inundated active floodplain as defined by Williams et al. (2009), and it does not provide the quality floodplain habitat that supports better rearing and migration for juvenile Chinook salmon and results in improved growth (Sommer et al. 2001 and 2005). The floodplain in the project area is only periodically inundated at high flows and is not inundated frequently enough or for a sufficient duration to benefit fish like floodplain habitats observed in the Yolo Bypass. The construction of spur dikes would not alter the frequency or period of inundation of the floodplain in the project area and would not affect the floodplain habitat.

Overall Impacts. The protection of the PCGID-PID pumping plant and fish screen facility would provide long-term beneficial effects for juvenile salmonids and other special-status fishes by ensuring the fish screens operate effectively. The consolidation of three unscreened pumping plants on the Sacramento River into the current single facility with a state-of-the-art fish screen was a major improvement to protect endangered fish species in the Sacramento River. Implementation of the Riparian Sanctuary project would help protect investments in the facility and further protect special-status fish over the long term. Minor impacts to juvenile salmon rearing habitat associated with the spur dikes would be more than offset by the beneficial effects of protecting the long-term performance of the pumping plant and fish screen facility, as well as the restoration of riparian habitat and associated SRA habitat at the Riparian Sanctuary. Although riprap and streambank stabilization are implicated as contributing in the decline of anadromous salmonids in the Central Valley, potential impacts on aquatic habitat in the project area, including designated critical habitat and EFH, would be less than significant because of the anticipated net benefits of riparian habitat restoration and fish screen performance to fishes over the long term. In addition, any permit conditions for incidental take of listed species resulting from ESA and CESA consultations and identified in the Streambed Alteration Agreement would further reduce and ensure impacts on aquatic habitat would be less than significant.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Under Alternative 3, impacts on aquatic habitat would be greater than those described for Alternative 2 because traditional riprap would require more excavation and placement of riprap in the Sacramento River and a larger area of SRA habitat would be removed for construction of the traditional riprap. The types of impacts would be similar to those described for Alternative 2.

The lineal extent of the traditional riprap would be 500 to 700 feet longer than the spur dikes, and the temporary loss of SRA habitat would be greater with Alternative 3 (up to about 5 acres). Both the no berm and low berm options would allow revegetation on the soil-filled quarry stone, with more revegetation on the low berm. Bank slope with the no berm option would vary along the revetment being steepest (2.5:1) along the upstream end and flattening out (10:1) longitudinally downstream. Bank slope for the low berm option would be 10 or 15:1 near the water's edge at summer mean water surface elevation and increasing to 2 or 3:1 at the existing cut bank to match the existing ground elevation.

The primary habitat along the existing bank where the revetment would be installed is shallow water bar habitat seasonally inundated during winter and spring and most commonly used as rearing habitat for juvenile fall/late-fall run Chinook salmon and early life stages of non-anadromous special-status fishes. This bank currently lacks significant SRA habitat and associated structure like large woody debris or continuous stretches of overhanging or shade producing vegetation. Much of the bank conversion would be constructed on the existing bar feature and only portions of it would be inundated continuously; thus, the function of the shallow water rearing habitat on this gravel bar would not be significantly altered. The traditional riprap would also not significantly change the local geomorphology or hydraulic habitat (other than the existing scour hole) or change the particle size distribution, such that significant changes or reductions in juvenile rearing habitat occurs in the project area. By planting the soil-filled quarry stone, the function of the seasonally inundated bank would be similar to the existing condition in 3 to 5 years with growth of cottonwoods and willows. A short-term temporary reduction in vegetation along the revetment would result from the construction activities; however, these impacts would be less than significant because this habitat is not considered limiting in this reach of the Sacramento River where alternating bar sequences with natural river banks provide structure and cover during seasonal high flows.

Impacts associated with bank protection measures under Alternative 3 would be minimized to the greatest extent possible by the design, and any impacts to juvenile rearing habitat would be short-term and temporary. The beneficial effects of protecting the pumping plant and fish screen facility, as well as the restoration of riparian habitat and associated SRA habitat at the Riparian Sanctuary, would more than offset the minor impacts on aquatic habitat. In addition, any permit conditions for incidental take of listed species resulting from ESA and CESA consultations and identified in the Streambed Alteration Agreement would further reduce and ensure impacts on aquatic habitat would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, impacts related to the traditional riprap, with or without the low berm, and site-specific planting would be the same as described for Alternative 3.

Removal of rock along the north (right) river bank of the upstream peninsula would modify the river bank by encouraging a natural progression of streambank erosion and is predicted to result in an eventual channel cut off through the peninsula over the long term (50 years), which would further offset minor impacts to rearing habitat that would occur from installation of bank protection on the northwest corner of the Riparian Sanctuary. Mature riparian vegetation along the existing revetment would be avoided during rock removal, although some vegetation may need to be removed for the access road. Over the long term, the cut off would modify habitats on the peninsula, including SRA habitat for fishes as well as aquatic habitat along the former river alignment. As the river cuts through the existing riparian habitat on the peninsula, aquatic habitat along the abandoned channel would become a backwater and eventually be filled in with sediment deposits. The natural meander process would likely result in a more dynamic channel that provides diverse aquatic habitat, including low-lying floodplain habitats, and would include the input of large woody debris and natural maintenance of SRA habitat, all of which could benefit fishes, including critical habitat and EFH over the long term. In addition, the channel cut off, in combination with the bank protection measures, would maintain the required river velocities in front of the pumping plant and fish screen facility to ensure effective operation of the fish screens and protection of listed fish species.

Impact FR-5: Implementation of the Riparian Sanctuary project could result in impacts to anadromous and resident fishes from in-water activities, increased turbidity, or hazardous materials spills.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, ongoing activities associated with operation and maintenance of the PCGID-PID pumping plant and fish screen facility and the Riparian Sanctuary could result in increased turbidity or the potential for hazardous materials spills that could affect fishes in the Sacramento River. Periodic maintenance of the facility includes cleaning the fish screens and replacing or repairing parts of the facility. These activities could result in direct impacts to fishes if the activities require work in the river. PCGID-PID would take necessary precautions to minimize potential adverse impacts on fishes during routine maintenance in accordance with their agreements with the Service and NMFS, and impacts from routine maintenance would be less than significant.

Current management practices at the Riparian Sanctuary would also continue. The Service currently uses herbicides and other treatments to control and inhibit the spread of non-native and invasive plant species. These activities are limited to upland areas and have a low potential to result in the spill of hazardous materials into the Sacramento River that would adversely affect fish. Ongoing activities would have a less-than-significant impact on fishes as a result of hazardous materials spills.

Under the No-Action Alternative, the fish screens at the facility could cease to operate effectively as a result of continued erosion of the northwest bank of the Riparian Sanctuary, which could result in injury to or mortality of fishes. As the bank of the Riparian Sanctuary continues to erode and migrate southward, the angle of flow and the velocity of the water passing the fish screens is predicted to change. Instead of flowing across the screens, the river would begin to flow toward the screens, potentially increasing approach velocities beyond the 0.33 foot-per-second threshold for fry promulgated by NMFS

(1997). Approach and sweeping velocities are an important requirement of the facility's operation to protect fish from injury and mortality, and if these criteria are not met, the facility could trap, injure, or kill special-status and other fish swept into the screens, which would be a significant impact. If the facility ultimately becomes stranded as the river moves further away from it, as predicted in the feasibility study prepared by MBK Engineers (2005), the fish screens would no longer operate and fish would not be affected.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Over the long term, maintenance of the restored riparian habitat would require weed control using herbicides and other treatments to ensure the successful establishment of native plants and improvement of habitat at the Riparian Sanctuary. Roundup® or a generic herbicide brand with glyphosate as the active ingredient would be sprayed to control weeds. The proper utilization of such chemicals is critical in minimizing potential adverse risks to special-status fish. NMFS has identified point-source and nonpoint-source pollution as factors affecting critical habitat for spring-run Chinook salmon and steelhead in the Sacramento River watershed. Glyphosate and permutations of the chemical have been tested for toxicity on numerous aquatic animals, including invertebrate and vertebrate fresh and saltwater species. Results of these studies indicate that glyphosate has very low acute toxicity to aquatic animals (U.S. Environmental Protection Agency 1993, World Health Organization 1994). Adverse effects on fishes would not be expected from use of glyphosate herbicides according to label instructions (Monsanto Company 2002). The improper use or application of herbicides containing glyphosate as the active ingredient could have deleterious impacts to all special-status fish, but implementation of Mitigation Measure WR-3, described in Section 3.4, Water Resources, would ensure proper herbicide use in the project area, and impacts during long-term maintenance of the restored riparian habitat would be less than significant.

Other long-term activities for maintenance and monitoring of the bank protection measures and restoration area are not expected to involve in-water activities and would result in minimal ground disturbance from vehicle traffic and replanting activities. These activities would not adversely affect fishes in the Sacramento River, and long-term impacts would be less than significant.

The protection of the PCGID-PID pumping plant and fish screen facility over the long term would provide long-term beneficial effects for juvenile salmonids and other listed species by ensuring the fish screens operate effectively. The consolidation of three unscreened pumping plants on the Sacramento River into the current single facility with a state-of-the-art fish screen was a major improvement to protect endangered fish species in the Sacramento River. Implementation of the Riparian Sanctuary project would help protect investments in the facility and further protect special-status fish over the long term.

3.6 Vegetation, Wildlife, and Sensitive Biological Resources

This section describes the vegetation, wildlife, and sensitive biological resources in the project area and evaluates the impacts of the alternatives on these resources. The discussion of biological resources is based on a focused literature review, informal consultation with resource agencies, and results of various field surveys. A discussion of fisheries and special-status fish species is provided in Section 3.5.

3.6.1 Regulatory Framework

Federal Laws and Regulations

Endangered Species Act

Section 9 of the ESA defines "take" and generally prohibits the "taking" of animal species listed as endangered or threatened (16 USC 1532, 50 CFR 17.3). Under the ESA, the "take" of a species listed under the federal ESA is deemed to occur when an intentional or negligent act or omission causes the agent of the action "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The term "harm" includes acts that actually kill or injure wildlife. Such acts may include significant habitat modification or degradation when it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Listed plants are not protected from take. However, it is illegal to collect or maliciously harm them on federal lands, and the ESA prohibits interstate or international trade of listed plant and animal species.

Section 7 of the ESA requires federal agencies, in consultation with the Secretary of the Interior, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species (plant or animal) or result in the destruction or adverse modification of designated critical habitat for these species.

For the Riparian Sanctuary project, the Service will be completing an intra-agency consultation to address listed species and their habitat in the project area. A biological assessment will be prepared for the following species: valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (Threatened) and western yellow-billed cuckoo (*Coccyzus americanus*) (Candidate). No critical habitat is designated for these species within the project area.

Clean Water Act

The objective of the CWA of 1977, as amended, is to maintain and restore the chemical, physical, and biological integrity of the nation's waters. Discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands, is regulated by the Corps under Section 404 of the CWA (33 USC 1344), and applicants for a federal permit for activities that result in discharge into navigable waters are required under Section 401 of the CWA to obtain certification from the State that the activities comply with water quality requirements of the CWA (33 USC 1341). Corps regulations implementing Section 404 define waters of the United States to include intrastate waters, including lakes, rivers, streams, wetlands, and natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce. Wetlands are defined for regulatory purposes as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under

normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3, 40 CFR 230.3). To comply with the federal policy that there be no net loss of wetlands, discharge into wetlands must be avoided and minimized to the extent practicable, or compensatory mitigation is required.

The proposed bank protection measures along the Sacramento River would result in placement of fill material (i.e., rock, sand, gravel) within the ordinary high water mark (OHWM) of the river, a Corps jurisdictional water, and possibly in adjacent wetlands. Placement of fill in the Sacramento River and in the adjacent wetlands would require authorization under both Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. The application may request authorization under both statutes. These activities are expected to be permitted under an individual permit because of the nature of the activities and the amount of fill, although the Corps may determine that another permit type is appropriate. In addition, the applicant will be required to obtain a CWA Section 401 Water Quality Certification from the Central Valley Regional Water Board.

Bald and Golden Eagle Act

The Bald and Golden Eagle Act, originally passed in 1940, provides for the protection of bald and golden eagles (as amended in 1962) by prohibiting the take; possession; sale; purchase; barter; offer to sell, purchase, or barter; transport; export; or import of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 USC 668(a), 50 CFR 22). The definition of "take" includes to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb (16 USC 688(c), 50 CFR 22.3). For purposes of these guidelines, "disturb" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagles' return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits and causes injury, death, or nest abandonment.

A violation of the act can result in a fine, imprisonment, or both. Potential impacts to these species are addressed in subsection 3.6.3, Environmental Consequences, and measures are recommended, as appropriate, to ensure compliance with this act.

Migratory Bird Treaty Act

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 CFR Part 10, including feathers or other parts, nests, eggs, or products except as allowed by implementing regulations (50 CFR 21). Most of the birds found in the project area are protected under the MBTA. Effects on migratory birds are discussed in subsection 3.6.3, Environmental Consequences, and measures are recommended, as appropriate, to ensure compliance with this act.

Executive Order 13112 – Invasive Species

Executive Order 13112 directs federal agencies to use relevant programs and authorities to:

- prevent the introduction of invasive species;
- detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner;
- monitor invasive species populations accurately and reliably;
- provide for restoration of native species and habitat conditions in ecosystems that have been invaded;
- conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species;
- promote public education on invasive species and the means to address them; and
- not authorize, fund, or carry out actions that the agency believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

The Sacramento River NWR CCP identifies two control strategies for invasive plant management: (1) manage vegetation and habitat for desired species composition and population levels and annually map and monitor target invasive plants; and (2) conduct and support research to evaluate control techniques for invasive plant species including prescribed fire, grazing, herbicides, mowing, disking, and weed mat tarping (U.S. Fish and Wildlife Service 2005). Currently, most of the Riparian Sanctuary in the project area (approximately 200 acres) is farmed with dryland row crops to help control invasive plant species. Target invasive plant species identified by the Sacramento River NWR are listed in Appendix D, and invasive plants that are found in the project area are identified in subsection 3.6.2, Affected Environment. The analysis of impacts in subsection 3.6.3, Environmental Consequences, addresses concerns with invasive plant species and identifies appropriate measures to minimize the spread of invasive plants.

Executive Order 11990 – Protection of Wetlands

Executive Order 11990 is an overall wetlands policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. It requires federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands. Compliance with conditions of a permit issued pursuant to Section 404 of the CWA would ensure compliance with this federal executive order.

Executive Order 13186 – Migratory Birds

Executive Order 13186 directs executive departments and agencies to take certain actions to further implement the MBTA. It requires that each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations develop and implement a Memorandum of Understanding with the Service to promote the conservation of migratory bird populations. Measures to

protect migratory birds are recommended in subsection 3.6.3, Environmental Consequences, and would ensure compliance with this federal executive order.

Sacramento River National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR CCP describes the desired future conditions on the refuge and provides guidance to achieve these conditions. The wildlife and habitat goal of the Sacramento River NWR is to contribute to the recovery of endangered and threatened species, abundance of migratory birds, and protection of anadromous fish by providing natural diversity through the restoration and management of viable riparian habitats along the Sacramento River. The objective is to restore an additional 3,255 acres of riparian vegetation and habitats and maintain existing and newly restored riparian habitats for riparian species by 2015. Some of the strategies used to achieve the wildlife and habitat goal are:

- develop site assessments and restoration plans for each of the restoration sites;
- modify privately constructed levees to restore or enhance topographical features where appropriate;
- continue to protect and manage Sacramento River NWR lands within the 100-year floodplain to enhance habitat for migratory birds and anadromous fish;
- evaluate the response of federal and state endangered and threatened species to habitat restoration;
- identify, locate, map, and conserve important native plant areas;
- manage vegetation and habitat for desired species composition and population levels of native species; and
- evaluate techniques for controlling target invasive plant species.

The Sacramento River NWR is involved in the development and implementation of conservation plans for migratory bird species, including the Partners in Flight North American Landbird Conservation Plan, North American Waterfowl Management Plan, United States Shorebird Conservation Plan, and the North American Waterbird Conservation Management Plan. Collectively, these plans provide management direction for migratory landbirds, shorebirds, and waterfowl regionally and globally. The restoration of riparian habitat at the Riparian Sanctuary would help the Service achieve its objectives for the Sacramento River NWR and would provide habitat for migratory birds identified in the conservation plans.

State Laws and Regulations

California Endangered Species Act

Under CESA, CDFG is responsible for maintaining a list of endangered and threatened species (California Fish and Game Code 2070). CDFG also maintains a list of “candidate species,” which are species that CDFG formally identifies as being under review for addition to the list of endangered or threatened species, and lists of “species of special concern,” which serve as species “watch lists.” Take of protected species incidental to otherwise lawful management activities may be authorized under California Fish and Game Code Section 2081. Authorization from CDFG is provided in the form of an incidental take permit.

Pursuant to the requirements of CESA, a public agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the project area and determine whether the proposed project could have a significant impact on such species. In addition, CDFG encourages informal consultation on any proposed project that may affect a candidate species. Effects on state-listed species are discussed in subsection 3.6.3, Environmental Consequences, and measures are recommended, as appropriate, to ensure compliance with CESA, including identification of the need for an incidental take permit or other authorization from CDFG.

Sections 1600–1616 of the California Fish and Game Code

CDFG has jurisdictional authority over fish and wildlife resources associated with rivers, streams, and lakes under California Fish and Game Code Sections 1600–1616. CDFG must be notified when any person, business, state or local government agency, or public utility proposes an activity that will:

- divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake;
- use material from a streambed; or
- result in the disposal or deposition of debris, waste, or other material where it can pass into any river, stream, or lake.

The notification requirement applies to any work undertaken in or near a river, stream, or lake that flows at least intermittently through a bed or channel. This includes ephemeral streams, desert washes, and watercourses with a subsurface flow. It may also apply to any work undertaken within the floodplain of a body of water.

If CDFG determines that the proposed project or activity could have substantial adverse effects on fish or wildlife, a Streambed Alteration Agreement is required. As part of this agreement, CDFG may require reasonable modifications to project activities that would allow for the protection of fish and wildlife resources. Because construction activities for the Riparian Sanctuary project would take place within and along the banks of the Sacramento River, a Streambed Alteration Agreement would be requested.

California Fish and Game Code

The following sections of the California Fish and Game Code also apply to project activities:

- Native Plant Protection Act, Sections 1900-1913
- Birds of Prey, Section 3503.5
- Migratory Birds, Section 3513
- Fully Protected Species, Sections 3505, 3511, 4700, 5050, and 5515

The discussion of effects on plants and wildlife in subsection 3.6.3, Environmental Consequences, address impacts to species protected or covered under these sections of the Code, and measures are recommended, as appropriate, to ensure compliance with the Code.

3.6.2 Affected Environment

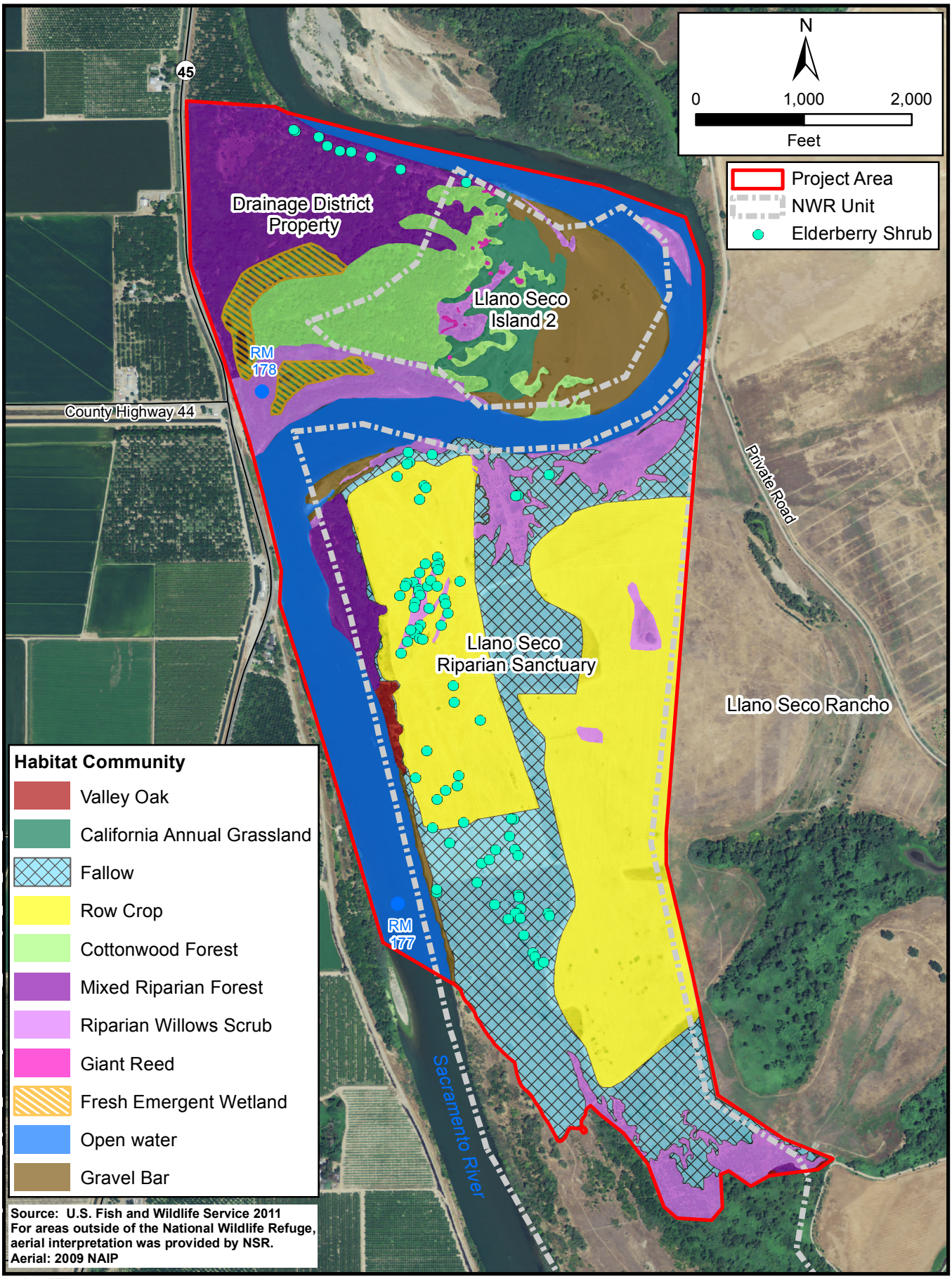
The habitat communities in the project area support a variety of common and special-status plant and animal species, although the Riparian Sanctuary is dominated by invasive plant species and croplands, which provide lower quality wildlife habitat. The Service has planted and manages wheat crops to control the spread of invasive plant species at the Riparian Sanctuary. The nearby Sacramento River and riparian habitat along the river attract migratory birds to the region, and the inclusions of riparian habitat, grasslands, and other open habitats are used by many species of birds as they fly through the area.

The Central Valley is one of the most important regions to migratory and wintering shorebirds and waterfowl in western North America (Gilmer et al. 1982, Shuford et al. 1998). Migratory neotropical birds dependent on riparian woodlands and associated wetlands are known to occur on the adjacent Llano Seco Rancho, including species from nearly every taxonomic group of birds in North America (Silveira 1992). Waterfowl known to occur in abundance near the project area include northern pintails (*Anas acuta*), American wigeons (*Anas americana*), green-winged teal (*Anas crecca*), and northern shovelers (*Anas clypeata*) (Silveira 1992). Dowitchers (*Limnodromus* spp.), sandpipers (*Calidris* spp.), dunlin (*Calidris alpina*), greater yellowlegs (*Tringa melanoleuca*), and long-billed curlews (*Numenius americanus*) have also been documented using wetlands, pastures, and croplands on the Llano Seco Unit of the Sacramento River NWR. In addition to these migrants, mallards (*Anas platyrhynchos*), wood ducks (*Aix sponsa*), great blue herons (*Ardea herodias*), great egrets (*Casmerodius albus*), and double-crested cormorants (*Phalacrocorax auritus*) breed in the vicinity of the project area (Silveira 1992).

This section describes the existing habitat communities in the project area and the special-status plants and wildlife that have potential to occur in these habitats. Appendix D provides supporting information for the discussion of special-status species and invasive plants.

Habitat Communities

The following habitat communities were identified in the project area: valley oak woodland, California annual grassland/fallow, row crop, cottonwood forest/mixed riparian forest, riparian willows scrub/giant reed, fresh emergent wetland, and open water/gravel bar (Figure 3.6-1). Habitat communities on the Riparian Sanctuary and Llano Seco Island 2 were mapped during preparation of the Sacramento River NWR CCP, and data updated in 2011 were provided by the Service to use in this document. Areas not covered by the vegetation data provided by the Service (e.g., land adjacent to Llano Seco Island 2 on the peninsula) were interpreted from aerial photography by North State Resources. Wildlife species expected to use each habitat community are based on the California Wildlife Habitat Relationships system, observations made during field surveys, and wildlife lists from the Sacramento River NWR.



Source: U.S. Fish and Wildlife Service 2011
For areas outside of the National Wildlife Refuge, aerial interpretation was provided by NSR.
Aerial: 2009 NAIP

Path: E:\Projects\51043_Riparian_Sanctuary\GIS\Working_Mxds\Figure_3-6-1_Habitat_11-11.mxd

North State Resources, Inc.

Riparian Sanctuary Project

Figure 3.6-1
Habitat Communities

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Valley Oak Woodland

Valley oak woodland occurs in a small stand (2 acres) south of the mixed riparian forest along the Sacramento River on the Riparian Sanctuary. The canopy, dominated by valley oak (*Quercus lobata*), is more open than in the mixed riparian forest habitat, allowing for a dense herbaceous layer to develop. The understory is dominated by ripgut brome (*Bromus diandrus*) and blessed milkthistle (*Silybum marianum*). Poison oak (*Toxicodendron diversilobum*), California pipevine (*Aristolochia californica*), and wild cucumber (*Marah fabaceus*) also occur in the understory.

The valley oak woodland provides habitat for many wildlife species that forage in nearby agricultural or grassland habitat and that find cover or even nest in the large oaks. The acorns produced are also used as forage by a variety of species, including acorn woodpeckers (*Melanerpes formicivorus*), western scrub-jays (*Aphelocoma californica*), and black-tailed deer (*Odocoileus hemionus hemionus*). Amphibians and reptiles that make use of the downed tree branches under these oaks include the western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleucus*), and common kingsnake (*Lampropeltis getulus*). Common birds of this habitat include house finches (*Carpodacus americanus*), western bluebirds (*Sialia mexicana*), and northern flickers (*Colaptes auratus*). Raptors such as the red-tailed hawk (*Buteo jamaicensis*) also forage and nest here. California ground squirrels (*Spermophilus beecheyi*) are also common in this habitat.

California Annual Grassland/Fallow

Approximately 21 acres of areas mapped as California annual grassland are located on the peninsula. This area is within the floodplain of the Sacramento River and is likely frequently flooded. The area is densely covered with herbaceous species. Dominant plants in this grassland include ripgut brome, soft chess (*Bromus hordeaceus*), and rattail fescue (*Vulpia myuros*). In swales and low-lying areas, yellow star-thistle (*Centaurea solstitialis*) and blessed milk-thistle dominate the annual grassland habitat community. Yellow star-thistle is an invasive plant species actively managed by the Sacramento River NWR.

Approximately 138 acres of fallow land are located primarily in the central and southern portions of the Riparian Sanctuary. This habitat is characterized as a dense herbaceous layer and, depending on its location, is more often dominated by forbs than grasses, sometimes forming pure stands. Dominant plant species include blessed milk-thistle, bur-chervil (*Anthriscus caucalis*), yellow star-thistle, mugwort (*Artemisia douglasiana*), wild radish (*Raphanus raphanistrum*), ripgut brome, soft chess, and rattail fescue.

Grassland bird species such as the mourning dove (*Zenaida macroura*), savannah sparrow (*Passerculus sandwichensis*), and white-crowned sparrow (*Zonotrichia leucophrys*), as well as rodents such as the California ground squirrel, Botta's pocket gopher (*Thomomys bottae*), and deer mouse (*Peromyscus maniculatus*), may forage on the seed crop this community provides. These species, in turn, attract predators such as the gopher snake, American kestrel (*Falco sparverius*), red-tailed hawk, and coyote (*Canis latrans*). Reptile species expected to occupy this habitat include the western fence lizard, western skink (*Eumeces skiltonianus*), western rattlesnake (*Crotalus viridis*), and yellow-bellied racer (*Coluber constrictor*).

Row Crop

Approximately 206 acres of the Riparian Sanctuary are under cultivation to preclude the establishment of invasive plants. Wheat (*Triticum* sp.) is planted annually in these areas, avoiding blue elderberry (*Sambucus mexicana*) and coyote brush (*Baccharis pilularis*), which are interspersed sparsely throughout the cultivated areas.

Active and fallow fields differ from the annual grasslands described above in that they have been recently plowed or disked. They provide wildlife habitat that is similar to that found in annual grassland. The primary difference is that the periodic disking associated with these areas disrupts burrows and other refugia for reptiles, rodents, and other small animals. When a field is seeded with a cover crop, such as wheat, the monotypic vegetation reduces the variability of forage and cover types, which effectively reduces the quality of habitat for many wildlife species. However, cropland habitat can be productive for burrowing mammals (e.g., California vole (*Microtus californicus*) and pocket gophers) and often provides preferred foraging grounds for raptors, including great horned owls (*Bubo virginianus*) and Swainson's hawks (*Buteo swainsoni*).

Cottonwood Forest/Mixed Riparian Forest

Cottonwood forest (49 acres) and mixed riparian forest (82 acres) dominate the peninsula and the banks of the Sacramento River bounding the Riparian Sactuary. A stand of mature mixed riparian forest occupies the northwestern portion of the Riparian Sanctuary, and smaller inclusions of riparian habitat are present in the central portion of the Riparian Sanctuary. The riparian habitat is characterized by a dense overstory with few shrubs and a dense understory of California rose (*Rosa californica*) and Himalayan blackberry (*Rubus discolor*). Dominant tree and shrub species include valley oak, northern California walnut (*Juglans hindsii*), Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), blue elderberry, California boxelder (*Acer negundo* var. *californicum*), coyote brush, poison oak, red willow (*Salix laevigata*), arroyo willow (*S. lasiolepis*), and narrow leaved willow (*S. exigua*). Understory forbs and grasses include blessed milk-thistle, ripgut brome, catchweed bedstraw (*Galium aparine*), hare wall barley (*Hordeum murinum* ssp. *leporinum*), and mugwort. Lianas of California grape (*Vitis californica*) also grow into the canopy. California walnut and perennial pepperweed (*Lepidium latifolium*), an invasive plant species managed by the Sacramento River NWR, grows intermittently throughout the valley foothill riparian habitat community at the Riparian Sanctuary.

Riparian communities are among the most important habitats for wildlife because of their high floristic and structural diversity, food abundance, and water availability. In addition to providing breeding, foraging, and roosting habitat for a diverse array of animals, riparian communities provide movement corridors for wildlife, connecting various habitats throughout the region. Movement corridors function as avenues along which wide-ranging regional and migratory animals can travel, plants can propagate, genetic interchange can occur, and populations can move in response to environmental changes and natural disasters.

The leaf litter, fallen tree branches, and logs associated with the riparian communities in the project area provide cover for amphibians such as the western toad (*Buto boreas*) and Pacific chorus frog (*Pseudacris regilla*). The western fence lizard, western skink, and southern alligator lizard (*Elgaria multicarinata*) are

also expected to be present here, as are several snake species, including the yellow-bellied racer, common garter snake (*Thamnophis sirtalis*), western rattle snake (*Crotalus viridis*), and common kingsnake.

Common bird species nesting and foraging in this habitat, primarily in the riparian tree canopy, include the bushtit (*Psaltriparus minimus*), white-breasted nuthatch (*Sitta carolinensis*), and Nuttall's and downy woodpeckers (*Picoides nuttallii* and *P. pubescens*, respectively). Other resident species, such as the spotted towhee (*Pipilo maculatus*) and Bewick's wren (*Thryomanes bewickii*), nest and forage on or very close to the ground, usually in dense vegetation. Several species of raptors, including the red-shouldered hawk (*Buteo lineaus*), Cooper's hawk (*Accipiter cooperii*), and western screech-owl (*Otus kennicottii*), are also year-round residents of riparian communities. In addition to the permanent residents, numerous species of neotropical migrants are found in this community from spring through fall, with many potentially breeding in the project area.

A variety of mammals also occur in riparian communities. Small mammals, such as the Botta's pocket gopher, North American porcupine (*Erethizon dorsatum*), ringtail (*Bassariscus astutus*), and deer mouse, may burrow or find refuge in dense grass or brushy thickets. Black-tailed deer frequently use riparian habitats, and predators, such as the raccoon (*Procyon lotor*) and long-tailed weasel (*Mustela frenata*), are attracted by the abundance of prey and cover. In addition, the taller trees provide daytime roosts for nocturnal species such as the raccoon and Virginia opossum (*Didelphis virginiana*).

Riparian Willows Scrub/Giant Reed

Approximately 68 acres of riparian willows scrub are present on the southern and eastern portions of the peninsula and the north-central and extreme southern portions of the Riparian Sanctuary. Riparian willows scrub habitat on the peninsula is typical of scrub habitats along the Sacramento River and is characterized as a dense thicket of narrow leaved willow and arroyo willow. Giant reed (*Arundo donax*) (1 acre) inclusions occur within this scrub habitat.

At the Riparian Sanctuary, canopy cover of riparian willows scrub habitat ranges from sparse to dense. It varies from that on the peninsula in that coyote brush dominates the habitat with blue elderberry, northern California walnut, mugwort, and California rose occasionally found in the overstory. The understory is dominated by forbs and grasses and includes blessed milk-thistle, bur-chervil, yellow star-thistle, mugwort, wild radish, ripgut brome, and poison hemlock (*Conium maculatum*). The northern California black walnut, giant reed, and yellow star-thistle are invasive plant species actively managed by the Sacramento River NWR.

Wildlife found in the riparian willows scrub habitat is similar to species found in cottonwood forest and mixed riparian habitats. The riparian willows scrub habitat mapped at the Riparian Sanctuary is more arid and provides habitat for a broader assemblage of wildlife species. This habitat provides seeds, fruit, and protection from predators and harsh weather. The shrubs also provide singing, roosting, and nesting sites for many species of birds, including the California quail (*Callipepla californica*), wrentit (*Chameae fasciata*), and Bewick's wren (*Thryomanes bewickii*). Mammals common in this habitat include the black-tailed hare (*Lepus californicus*), gray fox (*Urocyon cinereoargenteus*), coyote, and deer mouse. Reptiles that make use of this habitat include the western fence lizard and southern alligator lizard.

Elderberry shrubs in this and other riparian habitat are the primary host for the federally listed valley elderberry longhorn beetle. More than 100 elderberry shrubs have been recorded at the Riparian Sanctuary and on the peninsula during surveys of the project area, and many of these have indicators of beetle use (River Partners 2011).

Fresh Emergent Wetland

Fresh emergent wetland habitat (13 acres) is found on the western portion of the peninsula. These wetlands are located in the floodplain of the Sacramento River. Areas of open water are variable due to seasonal fluctuations of the river elevation, which allows these features to become densely vegetated. Plants that typically dominate fresh emergent wetlands include broad-leaved cattail (*Typha latifolia*), hardstem bulrush (*Schoenoplectus acutus*), and verbain (*Verbena bonariensis*).

As with riparian habitats, fresh emergent wetlands are among the most productive wildlife habitats. They provide abundant breeding, foraging, and roosting habitat for a diverse array of animals. Emergent plants and quiet water within the wetland provide safe harbors for breeding amphibians such as western toad, bullfrog (*Rana catesbiana*), and Pacific chorus frog. The western pond turtle (*Actinemys marmorata*) and western aquatic garter snake (*Thamnophis couchii*) also require wetlands to forage and breed. Many bird and mammal species use or require the fresh emergent wetland for foraging and nesting. Birds using this wetland type include great blue heron, green heron (*Butorides virescens*), black-crowned night heron (*Nycticorax nycticorax*), common yellowthroat (*Geothlypis trichas*), song sparrow, common snipe (*Gallinago gallinago*), mallard, northern pintail, red-winged blackbird (*Agelaius phoeniceus*), and American bittern (*Botaurus lentiginosus*), among many others.

Open Water/Gravel Bar

The Sacramento River, described as open water and gravel bar in Figure 3.6-1 (121 and 44 acres, respectively), provides riverine habitat through the project area, on the north and west sides of the Riparian Sanctuary and the north, east, and south sides of the peninsula. This stream is characterized as a perennial bed and bank feature with cobble, gravel, and sand, which dominates the stream substrate. It also includes a large gravel bar on the peninsula that is inundated during high flows. The river is approximately 400 feet wide, on average, during summer flows in this location, but under high water conditions, it floods the adjacent lands and influences the habitat types that occur in the Sacramento River floodplain.

The Sacramento River provides aquatic habitat for various fish species, as discussed in Section 3.5, and the open water habitat provides foraging, cover, reproductive sites, and drinking water for a variety of wildlife species. Western toads and Pacific chorus frogs use open water and emergent vegetation along riverbanks for reproduction and foraging. Western pond turtles and western aquatic garter snakes use instream wood and boulders for basking and refuge. Many species of birds, including herons, waterfowl, and insectivorous birds, use open water habitats for foraging and resting. Common bird species include the great blue heron, great egret, common merganser (*Mergus merganser*), double-crested cormorant, mallard, cinnamon teal (*Anas cyanoptera*), Canada goose (*Branta canadensis*), belted kingfisher (*Megaceryle alcyon*), black phoebe (*Sayornis nigricans*), and osprey (*Pandion haliaetus*). Spotted sandpiper (*Actitis macularius*) and killdeer (*Charadrius vociferus*) use gravel bar habitat. The banks of

the Sacramento River provide habitat for bank swallow (*Riparia riparia*), a state-listed species. Bank swallows nest in colonies and prefer exposed or recently eroded vertical banks or cliffs with fine-textured soils near water. Swallows have not been documented nesting at RM 178.2 on the northwest bank of the Riparian Sanctuary since 1997; however, nesting activity (64 active burrows) was documented downstream at RM 177 in 2010 and has been documented in the vicinity of the project reach over the past 25 years (River Partners 2011).

Open water habitat also provides resources for many species of mammals. Several species of bats forage for insects over open water, black-tailed deer and other terrestrial wildlife drink from rivers and streams, and raccoons forage and wash food in nearshore areas. Aquatic and semi-aquatic mammals that use open water habitats include beaver (*Castor canadensis*), river otter (*Lutra canadensis*), mink (*Mustela vison*), and muskrat (*Ondatra zibethicus*).

Special-Status Species

All special-status species considered for analysis are evaluated in Appendix D, which provides descriptions of the habitat requirements for each species and an analysis of the potential for each species to occur in the project area. Species that are found in habitat communities that are not present in the project area or that are not likely to breed in the project area, but may forage in regionally available habitat nearby, were eliminated from further consideration. The special-status species listed in Table 3.6-1 were determined to have potential to use the habitats in the project area and, thus, could be affected by the Riparian Sanctuary project. Table 3.6-1 also identifies where the species are likely to occur in the project area, and species accounts for these species are included in Appendix D.

Table 3.6-1. Special-Status Plant and Wildlife Species with Potential to Occur in the Project Area

Common Name *Scientific Name*	Listing Status[1] (Fed/State)	General Habitat	Comments
Plants			
Watershield *Brasenia schreberi*	—/RPR 2.3	Freshwater swamps and marshes; blooms June–September; elevation 100–7,220 feet.	Fresh emergent wetlands on the peninsula provide suitable habitat for this species. Nearest documented occurrence is 3.4 miles southeast of the project area (California Department of Fish and Game 2011).
Wooly rose-mallow *Hibiscus lasiocarpus var. occidentalis*	—/RPR 1B.2	Freshwater marshes and swamps; blooms June–September; elevation 0–400 feet.	Fresh emergent wetlands on the peninsula provide suitable habitat for this species. Nearest documented occurrence is 1.1 miles southeast of the project area (California Department of Fish and Game 2011).
Brazilian watermeal *Wolffia brasiliensis*	—/RPR 2.3	Shallow freshwater marshes and swamps; blooms April–December; elevation 100–330 feet.	Fresh emergent wetlands on the peninsula provide suitable habitat for this species. Nearest documented occurrence is 4.6 miles southeast of the project area (California Department of Fish and Game 2011).

Table 3.6-1. Special-Status Plant and Wildlife Species with Potential to Occur in the Project Area

Common Name *Scientific Name*	Listing Status[1] (Fed/State)	General Habitat	Comments
Animals			
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/—	Elderberry shrubs associated with riparian forests that occur along rivers and streams.	Elderberry shrubs with exit holes have been recorded throughout the project area (River Partners 2011; Rogner pers. comm.), and the species has been recorded within the project boundary (California Department of Fish and Game 2011).
Bald eagle *Haliaeetus leucocephalus*	D/E, FP	Requires large bodies of water or free-flowing rivers with abundant fish and adjacent snags and large trees for perching and nesting.	Bird monitoring was conducted at the Riparian Sanctuary in 2004, 2005, 2008, and 2009. Bald eagles or their nests have not been detected during these survey efforts (Young and Howell 2009; River Partners 2011). No nests are known to occur near the project area; however, wintering and foraging habitats are present.
Swainson's hawk *Buteo swainsoni*	—/T	Breeds in stands with few trees in juniper-sage flats, riparian areas and oak savannah; forages in adjacent livestock pasture, grassland or grain fields.	Species was observed foraging at the Riparian Sanctuary in 2008 and 2009 (Young and Howell 2009), and suitable nesting and foraging habitat is present in the project area. Species was reported nesting along the Sacramento River less than 1 mile north of the project area in 1988 and 1990 (California Department of Fish and Game 2011).
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	C/E	Nesting habitat is cottonwood/willow riparian forest. Occurs only along the upper Sacramento Valley portion of the Sacramento River, the Feather River in Sutter County, south of the Kern River in Kern County, and along the Santa Ana, Amargosa, and lower Colorado rivers.	Suitable habitat is present at the Riparian Sanctuary along the banks of the Sacramento River and on the peninsula north of the Riparian Sanctuary. Surveys at the Riparian Sanctuary in 2008 and 2010 did not detect this species (River Partners 2011). The species was recorded immediately south of the project area in 1985 (California Department of Fish and Game 2011).
Bank swallow *Riparia riparia*	—/T	Colonial nester on vertical banks or cliffs with fine-textured soils near water.	Bank swallows have been documented in the project area historically (California Department of Fish and Game 2011; River Partners 2011). This species was not observed in the project area during surveys conducted in 2007, 2008, and 2009. However, 64 active burrows were observed at RM 177.0 in 2010 (River Partners 2011).

Table 3.6-1. Special-Status Plant and Wildlife Species with Potential to Occur in the Project Area

Common Name *Scientific Name*	Listing Status[1] (Fed/State)	General Habitat	Comments
Western pond turtle *Actinemys marmorata*	—/SC	Slow-water aquatic habitat with available basking sites. Hatchlings require shallow water with dense submergent or short emergent vegetation. Require an upland oviposition site in the vicinity of the aquatic site.	Suitable foraging, cover, and breeding habitat is present in slow backwaters along the northwestern banks of the Riparian Sanctuary and fresh emergent wetlands on the peninsula.
Short-eared owl *Asio flammeus*	—/SC	Open, treeless areas with elevated sites for perches and dense grassland vegetation for roosting and nesting.	Suitable breeding and foraging habitat is present within annual grasslands in the project area.
Northern harrier *Circus cyaneus*	—/SC	Forages in marshes, grasslands, and ruderal habitats; nests in tall, dense vegetation in extensive marshes and wet fields.	Annual grassland provides suitable nesting and foraging habitat in the project area.
White-tailed kite *Elanus leucurus*	—/FP	Nests in lowlands with dense oak or riparian stands near open areas; forages over grassland, meadows, cropland and marshes.	Suitable breeding and foraging habitat is present within riparian forest and annual grasslands in the project area.
Yellow warbler *Dendroica petechia*	—/SC	Breeds in riparian woodlands, particularly those dominated by willows and cottonwoods.	Observed in the project area in 2008 and 2009 (Young and Howell 2009). Breeding habitat is present in the riparian wetlands occurring in and adjacent to the project area.
Yellow-breasted chat *Icteria virens*	—/SC	Breeds in riparian habitats having dense understory vegetation, such as willow and blackberry.	Observed in the project area in 2004, 2008, and 2009 (Young and Howell 2009). Breeding habitat is present in the riparian wetlands occurring in and adjacent to the project area.
Loggerhead shrike *Lanius ludovicianus*	—/SC	Forages in open grassland habitats throughout the Central Valley of California. Nests in shrubs and trees.	Annual grassland and shrub habitats provide suitable nesting and foraging habitat in the project area.

Table 3.6-1. Special-Status Plant and Wildlife Species with Potential to Occur in the Project Area

Common Name *Scientific Name*	Listing Status[1] (Fed/State)	General Habitat	Comments
Grasshopper sparrow *Ammodramus savannarum*	—/SC	In general, prefer short to middle-height, moderately open, dry grasslands with scattered shrubs.	Annual grassland provides suitable nesting and foraging habitat in the project area. A grasshopper sparrow was observed near the southern boundary of the Riparian Sanctuary during surveys in June 2010 (Rogner pers. comm.).
Tricolored blackbird *Agelaius tricolor*	–/SC	Breeds near fresh water in dense emergent vegetation.	Fresh emergent wetlands on the peninsula provide suitable breeding habitat, and annual grasslands and cultivated fields at the Riparian Sanctuary provide suitable foraging habitat for this species. Observed in the project area during the 2008 monitoring surveys (Young and Howell 2009).
Western red bat *Lasiurus blossevillii*	—/SC	Prefers sites with a mosaic of habitats that includes trees for roosting and open areas for foraging. Strongly associated with riparian habitats.	Riparian forest in the project area provides suitable habitat for this species.
Ring-tailed cat *Bassariscus astutus*	—/FP	Riparian habitats and in brush stands of most forest and shrub habitats. Nests in rock recesses, hollow trees, logs, snags, abandoned burrows or woodrat nests.	Suitable riparian habitat is present in the project area.

[1] Status Codes:

E Endangered

T Threatened

C Candidate for listing

D De-listed

FP Fully protected

SC California species of special concern

California Rare Plant Rank Listing:

List 1B Plants rare, threatened, or endangered in California and elsewhere.

List 2 Plants rare, threatened, or endangered in California but more common elsewhere.

Extensions

.3 Not very endangered in California

.2 Fairly endangered in California

.1 Seriously endangered in California

Natural Communities

Three natural communities in the project area are ranked as threatened or very threatened: Great Valley mixed riparian forest, Great Valley willow scrub, and coastal and freshwater marsh. These natural communities encompass the cottonwood forest, mixed riparian forest, fresh emergent wetland, and riparian willows scrub habitats described above. Descriptions of these natural community types, based on Holland (1986), are provided below.

Great Valley mixed riparian forest is present in the southern portion of the peninsula and along the western edge of the Riparian Sanctuary. This habitat community is a tall, dense, winter-deciduous broadleafed riparian forest found on fine-textured alluvium set back from active river channels. Characteristic species include California boxelder, common buttonbush (*Cephalanthus occidentalis*), black walnut, California sycamore, Fremont cottonwood, willows, and California wild grape. According to Holland (1986), Great Valley mixed riparian forest was formerly very extensive in the Sacramento and northern San Joaquin valleys, but has largely been cleared for agriculture, flood control, and urban expansion.

Great Valley willow scrub is present in the central portion of the peninsula and along the northwest corner of the Riparian Sanctuary. It is a dense, broadleafed, winter-deciduous streamside shrub thicket dominated by several willow species. In addition to willows, characteristic species include California wild rose, Fremont cottonwood, California wild grape, and Bermuda grass (*Cynodon dactylon*). The community is distributed along major rivers and most of the smaller streams throughout the Great Valley watershed, usually below 1,000 feet.

Coastal and freshwater marsh is present on the southern portion of the peninsula. This habitat community is found on quiet sites permanently flooded by freshwater and is dominated by perennial, emergent monocots up to 13–16 feet tall. Characteristic species include sedge (*Carex* spp.), nutsedge (*Cyperus* spp.), spikerush (*Eleocharis* spp.), hardstem bulrush, broad-leaved cattail, verbain, and common reed (*Phragmites australis*).

Waters of the United States

In April 2010, NSR conducted a delineation of wetlands and “other waters” on the Riparian Sanctuary, and in November 2011, NSR conducted a delineation of the upstream peninsula (North State Resources, Inc. 2011). The delineations were based on field observations of positive indicators for wetland vegetation, hydrology, and soils and indicators of “other waters.” This methodology is consistent with the approach outlined in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (U.S. Army Corps of Engineers 2008).

Three types of jurisdictional features were mapped in the project area: riparian wetland, freshwater emergent/riparian wetland, and perennial stream (Table 3.6-2, Figure 3.6-2). Potential Corps jurisdictional riparian wetlands on the Riparian Sanctuary portion of the project area encompass approximately 7.39 acres.

The wetlands are dominated by narrow leaved willow, red willow, and boxelder in the overstory with Italian ryegrass (*Lolium multiflorum*) and sedges dominating the understory. Wetland hydrology is provided by frequent flooding and long-duration inundation. Potential Corps jurisdictional freshwater emergent/riparian wetlands and riparian wetlands on the peninsula encompass approximately 40.13 acres and 48.37 acres, respectively. The fresh emergent wetlands support water primrose (*Ludwigia peploides*) and smartweed (*Polygonum* sp.) in the ponded areas. Hydrology is provided by frequent flooding and long-duration inundation as indicated by watermarks and sediment deposits.

The Sacramento River follows the north and west sides of the Riparian Sanctuary and north, east, and south sides of the peninsula. This stream is characterized as a perennial bed and bank feature with an OHWM that ranges from approximately 300–2,000 feet wide through the project area. Cobble, gravel, and sand dominate the stream substrate. The reach in the project area is approximately 13,500 linear feet.

Table 3.6-2. Delineated Waters of the United States in the Project Area

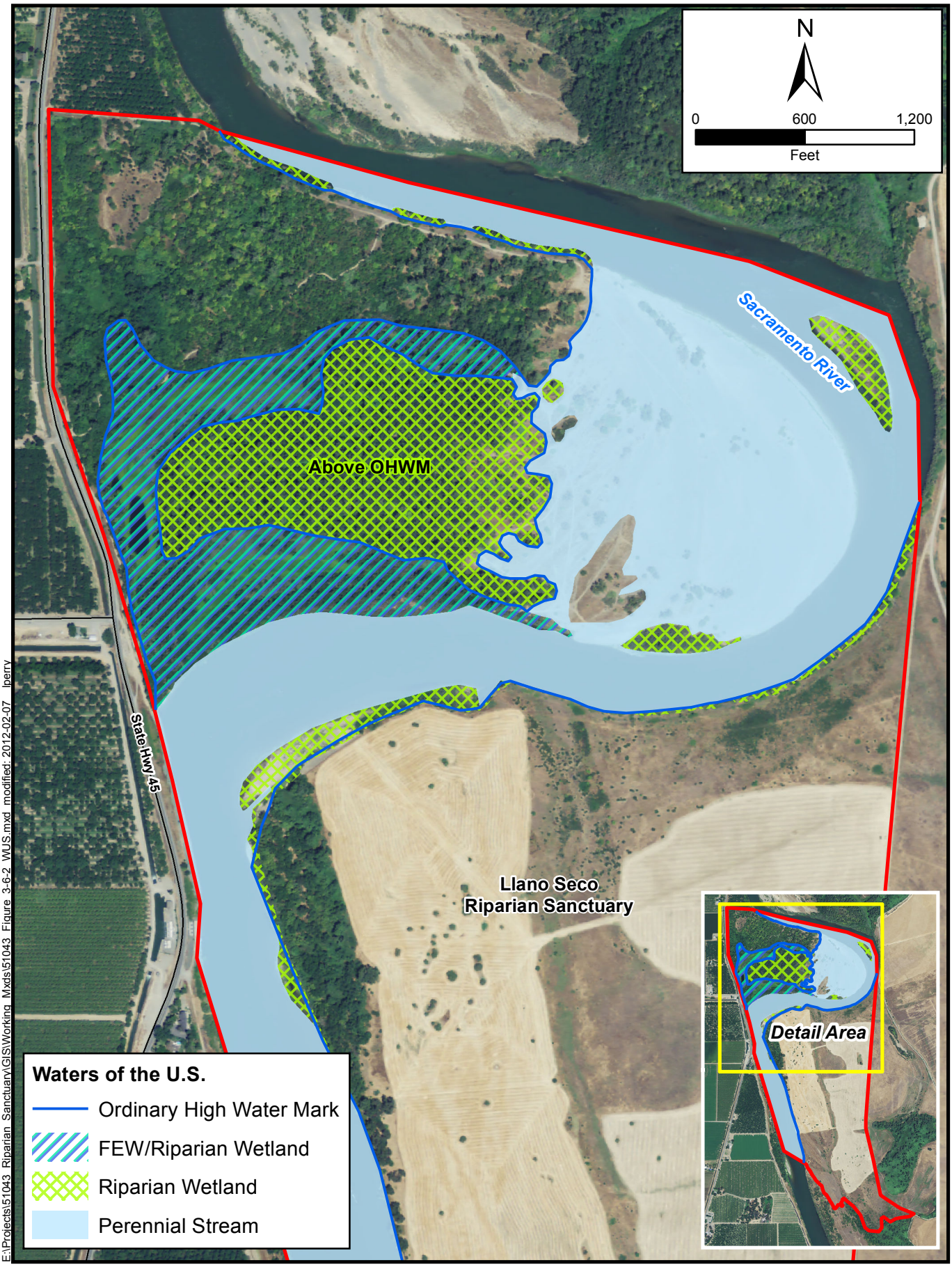
Feature Type	Total Acreage	Total Linear Feet
Riparian wetland	55.76	n/a
Fresh emergent/riparian wetland	40.13	n/a
Perennial stream	183.02	13,500

3.6.3 Environmental Consequences

Methodology

The following surveys were conducted to support the planning and feasibility studies for the Riparian Sanctuary project and to provide baseline information:

- PRBO Conservation Science conducted bird monitoring surveys within the northernmost 500 acres of the Riparian Sanctuary (including the portion of the Riparian Sanctuary within the project area) in 2004 and 2005 and again in 2008 and 2009 (Young and Howell 2009).
- River Partners surveyed for western yellow-billed cuckoo in 2008 and expanded the survey to include the upstream peninsula in 2010 (River Partners 2011).
- The Service and CDFG have conducted annual bank swallow surveys since 1986 (with the exception of 1994, 1995, and 2006) in and near the Riparian Sanctuary (River Partners 2011).
- River Partners monitored 85 elderberry shrubs at the Riparian Sanctuary in 2008 and expanded the survey to include an additional 34 elderberry shrubs at the Riparian Sanctuary in 2010 (River Partners 2011).



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North State Resources, Inc.

Riparian Sanctuary Project

Figure 3.6-2
Waters of the United States

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The analysis of impacts on vegetation, wildlife, and sensitive biological resources is based on a review of applicable management plans, informal consultation with resource agencies, review of existing documentation that addresses biological resources in or near the project area, and observations from multiple field surveys of the project area. Project-specific studies and analytical reports referenced in this document are available for download on the River Partners website: http://riverpartners.org/where-we-work/sanctuary/documents.html. Impacts on habitats have been quantified. All other impacts are discussed qualitatively.

Significance criteria used to analyze the potential impacts of the Riparian Sanctuary project on vegetation, wildlife, and other sensitive biological resources include factual and scientific information and regulatory standards of county, state, and federal agencies, including the CEQA Guidelines. These criteria have been developed to establish thresholds to determine the significance of impacts pursuant to CEQA (Section 15064.7) and the intensity of impacts pursuant to NEPA and should not be confused with a "take" or adverse effect determination under the ESA. The biological assessment for the project will provide the necessary analysis of effects on federally listed species in compliance with the ESA.

Significance Thresholds

Vegetation, wildlife, and sensitive biological resources impacts would be considered significant if the Riparian Sanctuary project would:

- substantially adversely affect, either directly or through habitat modifications, any species identified as a candidate, sensitive, or special-status species by CDFG or the Service;
- substantially adversely affect any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by CDFG or the Service;
- substantially adversely affect federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, fill, hydrological interruption, or other means;
- substantially interfere or disrupt major terrestrial wildlife migration or travel corridors or impede the use of native wildlife nursery sites;
- substantially adversely affect, either directly or through habitat modifications, any non-special-status wildlife species;
- eliminate a native plant or animal community; or
- introduce or proliferate the spread of non-native and invasive plants.

Impacts and Mitigation Measures

Impact VW-1: Construction and implementation of the Riparian Sanctuary project could modify habitats in the project area and increase the spread of invasive plant species.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, bank protection measures and restoration activities would not be implemented. The existing habitat communities would continue to be affected by natural processes (e.g., flooding), and the restoration of riparian habitat would rely on natural recruitment of native vegetation. The Riparian Sanctuary would continue to provide low-quality habitat for many wildlife species that were likely historically present in riparian forests that dominated the lands along the Sacramento River.

The Sacramento River is predicted to continue eroding the northwest corner of the Riparian Sanctuary, and the mature valley foothill riparian habitat along the bank could be lost due to this erosion process (Larsen et al. 2004). The other habitats at the Riparian Sanctuary may also experience changes as the floodplain is modified by river meander, which is a natural process typical of large river systems. The Service would continue to manage invasive plants by using current management techniques, including planting and managing row crops and spraying herbicides. Competition from invasive plants and the Service's current management practices would limit the potential for natural recruitment of native species, and natural recruitment would likely consist of non-native plant species. The dominance of invasive plants and the low potential for historic native habitat to be restored reduce the ability of the Service to achieve management goals and objectives, which are intended to return the Riparian Sanctuary to historic riparian forest conditions. Conditions in the project area under the No-Action Alternative would be similar to current conditions, and the continued presence of invasive and other non-native plant species would prevent the natural recruitment of riparian habitats, resulting in a significant impact. (It should be noted, however, that restoration of the Riparian Sanctuary as described under Alternatives 2, 3, and 4 would eradicate current invasive plant populations, restore native riparian habitat, and improve conditions for native plant populations.)

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction activities associated with the spur dikes and site-specific plantings would result in disturbance to upland habitats, primarily row crops and fallow lands, and removal of low-growing vegetation and small trees and shrubs. Large trees and sensitive habitats (i.e., elderberry shrubs and riparian woodland stands) would be protected to the extent feasible and flagged or fenced for avoidance during construction of the spur dikes and site preparation for the restoration. Access roads and staging areas would be limited to previously disturbed areas (i.e., within existing two-track roads, cultivated areas, or areas dominated by non-native and invasive plant species). Invasive plants would be removed in preparation for the site-specific plantings, which would reduce the potential for their reintroduction or spread over the long term, once the native habitat becomes established. Standard construction practices to prevent the spread of invasive plants would also be implemented during all construction activities.

Construction of the spur dikes would involve equipment access and ground disturbance on the northwestern portion of the Riparian Sanctuary (mostly cropland and some riparian willows scrub habitat) for one or two construction seasons (4 months to 1 year of work). The spur dikes would extend into the river and would result in a loss of small amounts of riparian willows scrub and gravel bar habitat. Temporary access for construction activities would disturb upland (fallow and cropland habitat) and some riparian wetland habitats on the bank and gravel bar of the northwestern portion of the Riparian Sanctuary (see Impact VW-2 for additional discussion on riparian wetland impacts). Large trees in riparian and valley oak habitats and elderberry shrubs would be avoided to the extent feasible. Disturbed areas associated with construction of the spur dikes would be revegetated as part of the planting design, excluding the main access road across the northern part of the Riparian Sanctuary, which would be maintained over the long term to provide maintenance and monitoring access. The spur dikes would result in a loss of bank-side habitat along approximately 2,000 feet of the Sacramento River, although some riparian vegetation is expected to regenerate naturally between the dikes where the bank is not covered with rock. This loss of habitat would be minimal compared with the extent of available bank-

side habitat in the region. The loss of bank-side habitat suitable for nesting bank swallows is discussed below in Impact VW-5.

The restoration activities would involve vegetation removal, herbicide spraying, and ground disturbance on approximately 400 acres of the Riparian Sanctuary over approximately 5 years (2 years of site preparation and 3 years of monitoring and watering). Site preparation would involve removal of the row crops and fallow lands, as well as invasive plants in riparian and valley oak habitats. The existing cottonwood/mixed riparian forest, riparian willows scrub, and valley oak habitat communities would be preserved in place and incorporated into the restoration design. Most of the Riparian Sanctuary would be modified from the existing row crops, fallow lands, and small stands or inclusions of riparian and valley oak habitats to varying densities of riparian habitat over the long term, offsetting the temporary, construction-related impacts to habitat in the project area. The site-specific plantings would result in an approximately 400-acre increase of low-, medium-, and high-density riparian habitat in the project area over the long term.

The desired future condition of the restored habitat is a multi-layered riparian forest that provides complex and diverse habitats to support a variety of wildlife, including valley elderberry longhorn beetle and western yellow-billed cuckoo (U.S. Fish and Wildlife Service 2005). Monitoring and weed-control efforts over the long term would help produce higher quality habitat by controlling invasive plants and allowing native species to dominate. Although the restoration would result in a reduction of habitat for shrub, grassland, and open habitat dwelling wildlife, similar upland habitats are abundant locally and regionally, and approximately 95 acres of lower density shrub and grassland habitat would be established along the central portion of the Riparian Sanctuary (a reduction of approximately 340 acres from current shrub and open habitats). The newly restored habitat would be of higher quality than current habitats. The establishment of mature riparian forest would contribute to the Great Valley mixed riparian forest and Great Valley willow scrub communities monitored by CDFG and would extend the linkage of riparian habitat along the Sacramento River. Additionally, the restoration of 305 acres of medium- and high-density riparian habitat at the Riparian Sanctuary would provide reproductive and refugia habitat for a more diverse community of wildlife and contribute to the Service's management goals for the Riparian Sanctuary, which would be a beneficial effect.

Despite temporary disturbance to upland and low-quality habitats in the project area during construction, the net gain of riparian habitat at the Riparian Sanctuary would greatly improve wildlife habitat and help the Service achieve its goals for restoring historic riparian forests along the Sacramento River. Impacts on habitat would be less than significant.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Under Alternative 3, construction-related impacts on the Riparian Sanctuary would be greater than those described for Alternative 2. Installation of revetment along the northwestern bank of the Riparian Sanctuary would not result in additional impacts on upland habitats, but could remove additional riparian willows scrub habitat and riparian wetlands. Additional impacts on riparian wetlands are discussed in Impact VW-2. Overall, impacts on habitat communities would be less than significant because of the restoration of higher quality riparian habitats in the project area.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, construction-related impacts would be greater than those described for Alternatives 2 and 3. Additional impacts on habitat communities would result from the removal of rock along the north river bank of the peninsula, which could require the removal of mixed riparian forest to provide an access road and disturbance to upland and riparian vegetation growing in the existing revetment, and the placement of rock along the private property on the peninsula. Improvement of an existing access road would be required to truck the riprap off-site, which would result in some vegetation removal and tree trimming in a 20-foot-wide corridor from SR 45 to the edge of the existing revetment (see Figure 2-5). Less than 6 acres of mixed riparian forest would be affected. Movement of materials or the use of the same equipment between rock removal on the northern side of the peninsula and the Riparian Sanctuary could increase the potential to spread invasive plant species between sites. Incorporation of standard practices to prevent the spread of invasive plants and removal of invasive plants during site preparation activities, as described in Chapter 2, would result in a less-than-significant impact.

Based on hydraulic modeling for the Riparian Sanctuary project, rock removal would expedite expansion of existing scour holes, and the Sacramento River would eventually cut off the peninsula, pass through the existing fresh emergent and riparian habitats on the peninsula, and create an abandoned oxbow (or "oxbow lake") (Ayres Associates 2010). The cut off of the peninsula is predicted to occur within 50 years, but could occur sooner if major flood events take place (Larsen et al. 2004). The resulting change in the Sacramento River channel would result in a temporary loss of fresh emergent and riparian habitat until new habitat establishes on the oxbow. Over time, sediment would likely fill in portions of the created oxbow lake on the north and east sides of the peninsula, and fresh emergent and/or riparian habitat is expected to develop in these areas, which would increase available riparian and fresh emergent habitat. Habitat on the oxbow lake would be expected to take at least 25 years to become established, and a temporal loss of mature habitat would be experienced until the habitat fully matures. A net loss of habitat is not expected or would be minimal and a result of natural processes; therefore, the temporary loss of riparian habitat due to the change in the Sacramento River channel would be less than significant.

Impact VW-2: Construction of the Riparian Sanctuary project could result in placement of fill material into waters of the United States and disturbance of wetlands.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, bank protection measures and restoration activities would not be implemented, and no construction-related impacts on waters of the United States would take place. The existing riparian wetlands would be retained, and fill material would not be placed in the Sacramento River. The natural meander process of the Sacramento River would continue to erode the northwestern corner of the Riparian Sanctuary and could modify the existing wetlands, which may become re-established along the bank in other areas. Longer term impacts on riparian wetlands would be part of natural processes.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction of the spur dikes would result in the temporary and permanent loss of riparian wetlands on the gravel bar within the OHWM of the Sacramento River in the northwestern portion of the Riparian Sanctuary, as well as the permanent placement of fill material (quarry stone, gravel, and sand) into the Sacramento River. Construction of access roads and staging areas, site clearing and preparation, and site-specific plantings at the Riparian Sanctuary would not affect jurisdictional wetlands or other waters of the United States.

Approximately 9,000 cubic yards of riprap (rock, sand, and gravel) would be needed to construct the eight spur dikes, and a portion of this material would be placed along a 2,000-foot reach in the OHWM of the Sacramento River (the total discharged amount will be identified during final design and as part of the permit application). Approximately 1 acre of riparian wetlands along the gravel bar would be affected by spur dike placement; additional temporary impacts on riparian wetlands may occur during construction, but some vegetation would be expected to regenerate between the spur dikes following construction. The discharge of fill into the Sacramento River could result in water quality impacts, such as sedimentation, erosion, and chemical spills, which are discussed in Section 3.4, Water Resources. These activities would require compliance with the permitting requirements of the CWA for discharge of fill material into navigable waters, and PCGID-PID would need to submit an application for a permit to the Corps and a request for water quality certification to the Central Valley Regional Water Board. In addition, CDFG may require a Streambed Alteration Agreement, and PCGID-PID would be required to submit a notification to CDFG. All construction activities would be required to comply with the terms of the permits received.

As described in Impact VW-1, restoration of the Riparian Sanctuary would provide approximately 400 acres of native riparian habitat that would include various densities of plantings and a multi-layered riparian forest. The restoration may include some wetland species that are found in the existing riparian wetlands (e.g., narrow leaved and arroyo willows), but the current design does not specifically incorporate riparian wetlands similar to those that exist where the spur dikes would be installed. Some riparian wetlands temporarily disturbed by the construction of spur dikes would be expected to regenerate naturally between spur dikes. However, the spur dikes would result in a permanent loss of riparian wetlands because wetlands are not expected to regenerate on the spur dikes themselves (estimated loss of 1 acre, but specific amount of loss to be determined as part of final design and identified in the permit application). As a result, the removal of riparian wetlands for spur dike construction could result in a net loss of wetlands, which would be a significant impact. Implementation of Mitigation Measure VW-2 would ensure that the design incorporates similar riparian wetlands, and the restoration would compensate for the permanent loss of jurisdictional wetlands, resulting in a less-than-significant impact.

Mitigation Measure VW-2: Compensate for the loss of jurisdictional wetlands in the riparian restoration designs.

The Service will be responsible for ensuring that the riparian restoration plan for the site-specific plantings at the Riparian Sanctuary incorporates measures to protect riparian wetlands in place, where feasible, and to restore similar quality riparian wetlands on-site if avoidance is not feasible. On-site

mitigation is encouraged by the Corps and CDFG, and the restoration activities would restore riparian habitat on 400 acres of the Riparian Sanctuary. A wetlands mitigation and monitoring plan would need to be prepared and submitted to the Corps and CDFG for review and approval as part of their permitting processes; the riparian restoration plan prepared by River Partners may be submitted in place of a separate wetlands plan if the information required by the agencies is included in it. The plan will need to discuss the restoration plans to compensate for the loss of riparian wetlands and identify monitoring parameters and performance criteria for each parameter to ensure the success of the restored wetlands.

The riparian restoration or wetlands plan will include the following measures:

- The total acreage of impacts to jurisdictional wetlands will be calculated based on the final design of the bank protection measure and the delineation of waters of the United States, once verified by the Corps. This acreage will be used to determine the total acreage of replacement wetlands needed.

- All replacement wetlands will be restored on-site, which may include areas at the Riparian Sanctuary, particularly along the river, or on Llano Seco Island 2 (Service-managed lands). Riparian wetlands lost will be replaced to provide similar function (e.g., planted within the OHWM to provide instream cover for fish and other aquatic wildlife).

- Jurisdictional wetlands affected by the bank protection measures will be replaced at a 1:1 ratio of acres permanently lost to acres of on-site replacement wetlands. This ratio is subject to the final recommendations made by the Corps and CDFG. It is based on the assumption that the overall restoration design provides a substantial benefit by restoring approximately 400 acres of mixed density riparian habitat.

- Planted species will consist of the same species as those removed (e.g., red willow, narrow leaved willow). Stems will be planted at three (3) stems per planting to help ensure successful establishment of at least one vigorous plant for each plant removed.

- Impacts to herbaceous cover in the jurisdictional wetlands will be offset by reseeding any unvegetated and disturbed areas with a suitable seed mixture after construction; by using plugs of rushes, sedges, or other native vegetation taken by hand from plants in adjacent riparian wetland habitat; or from CDFG-approved nursery sources.

- The restored wetlands will be monitored according to performance criteria identified in the plan and per the conditions of the Corps permit. Typical performance criteria may include ensuring species diversity is equal to or greater than that for selected reference areas (e.g., existing riparian woodlands located in or adjacent to the project area) and that density (stems per acre) of woody riparian species is equal to or greater than that for selected reference areas (e.g., existing riparian woodlands located in or adjacent to the project area).

- Construction fencing will be erected along the outer edges of the construction zone where needed to prevent accidental entry into existing riparian habitat.

- Equipment and materials will be stockpiled or stored outside of existing or restored riparian habitat.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Under Alternative 3, construction-related impacts on jurisdictional wetlands and waters of the United States would be greater than those described for Alternative 2 because a larger volume of fill material would be placed in the Sacramento River and a greater amount of riparian wetlands would be removed for construction of traditional riprap. The types of impacts would be similar to those described for Alternative 2.

Installation of the traditional riprap, with or without a low berm, would result in disturbance to 2,500 to 2,700 linear feet of the bank of the Sacramento River on the northwest side of the Riparian Sanctuary and would result in the permanent loss of approximately 4.5 acres of riparian wetlands along this reach. The no berm option would require excavation of approximately 89,100 tons of material along the river bank to establish a slope suitable for the placement of riprap and for a toe trench; these activities would remove existing riparian wetland present on the river bank and gravel bar. The excavated slope and toe trench would be backfilled with the appropriate mix of soil and rock to support woody vegetation on the slope and a mix of sand and gravel to protect scouring in the toe trench, totaling approximately 36,000 tons of quarry stone and 20,000 tons of soil-filled quarry stone. The low berm option would not require bank excavation, but would require placement of material into the river to form the berm and place riprap, totaling approximately 44,400 tons of quarry stone and 24,750 tons of soil-filled quarry stone.

Both options would result in a permanent loss of riparian wetlands and discharge of fill material below the OHWM of the Sacramento River (estimated loss of 4.5 acres of wetlands, but specific amount to be determined as part of final design and identified in the permit application), which would be a significant impact. The low berm option would provide an opportunity for riparian vegetation to establish on the low berm, and restoration of riparian vegetation on the bank and low berm would occur naturally after construction or would be incorporated into the restoration design as appropriate. This restored vegetation may sufficiently offset the loss of riparian wetlands and would result in a smaller net loss of wetlands than the no berm option; the specific estimate of restored wetlands will be calculated as part of the final design and permit application process. As described for Alternative 2, the restoration plan has the opportunity to incorporate similar riparian wetlands into the design to offset the loss of riparian wetlands. Implementation of Mitigation Measure VW-2 would ensure the restoration design incorporates similar riparian wetlands, and the restoration would compensate for the permanent loss of jurisdictional wetlands, resulting in a less-than-significant impact.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, impacts related to the construction of traditional riprap, with or without the low berm, and site-specific planting would be the same as described for Alternatives 2 and 3. The traditional riprap would result in an estimated loss of 4.5 acres of riparian wetlands. Implementation of Mitigation Measure VW-2 would ensure the restoration design incorporates similar riparian wetlands, and the restoration would compensate for the permanent loss of jurisdictional wetlands, resulting in a less-than-significant impact.

Removal of rock along the north riverbank of the peninsula would require the removal of potentially Corps jurisdictional riparian wetland growing in the existing revetment (up to about 1.5 acres), but would

not result in a discharge of fill into the Sacramento River or impacts on fresh emergent wetlands. Removal of rock would allow scour holes to expand, and the Sacramento River is predicted to eventually cut off the peninsula (Ayres Associates 2010). As described under Impact VW-1, this cut off is expected to result in the establishment of new riparian wetlands and fresh emergent wetlands on the abandoned oxbow. Impacts on waters of the United States, including wetlands, as a result of the cut off would be the result of natural processes and would not require additional Section 404 permitting.

Impact VW-3: Construction and implementation of the Riparian Sanctuary project could affect special-status plant and animal species in fresh emergent wetland habitat on the upstream peninsula.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, bank protection measures and restoration activities would not be implemented. No activities would take place in or near the fresh emergent wetland on the peninsula, and the special-status plant and wildlife species that may occupy fresh emergent wetland habitat would not be affected.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of the bank protection measures and restoration of the Riparian Sanctuary would not result in direct or indirect impacts on special-status plant and wildlife species (e.g., tricolored blackbird, western pond turtle) that may occupy fresh emergent wetland habitat on the peninsula. No suitable fresh emergent wetland habitat is present at the Riparian Sanctuary, and activities at the Riparian Sanctuary would not be expected to disturb wildlife on the peninsula. Construction and restoration activities would be more than 800 feet away from fresh emergent wetland habitat, which would minimize effects from noise and other disturbance. Additionally, the riparian habitat restoration design does not include fresh emergent wetlands and would not provide a beneficial effect for these special-status species. Therefore, Alternatives 2 and 3 would have no adverse or beneficial effect on special-status plant and wildlife species that use fresh emergent wetland habitat.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Under Alternative 4, activities at the Riparian Sanctuary would result in the same effects as described for Alternatives 2 and 3; however, Alternative 4 also includes activities on the peninsula to remove existing riprap. Removal of the riprap would not directly affect fresh emergent wetland habitat. The construction equipment used to remove rock would be more than 1,000 feet away from the fresh emergent wetland habitat and would be separated by dense riparian habitat. Noise and other construction-related activities would not be expected to disturb nesting tricolored blackbirds in the fresh emergent wetland habitats, and such impacts would be less than significant.

Temporal impacts caused by the change in the Sacramento River channel would be the same as described for Alternative 4 in Impact VW-1. This change could result in a net increase of fresh emergent wetland habitat with the predicted development of the oxbow lake, which would result in beneficial effects for the western pond turtle and tricolored blackbird. The natural processes that modify the river channel and

remove existing fresh emergent wetland could result in a loss of populations of special-status plant species (e.g., wooly rose-mallow, watershield, and Brazilian watermeal) if they occupy the fresh emergent wetland. However, newly created wetlands on the oxbow would provide similar habitat for the plants, resulting in a less-than-significant impact.

Impact VW-4: Construction and implementation of the Riparian Sanctuary project could remove or disturb elderberry shrubs and adversely affect the federally listed valley elderberry longhorn beetle.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, bank protection measures and restoration activities would not be implemented. This alternative would not result in construction-related impacts on the valley elderberry longhorn beetle. The Service would continue to maintain the Riparian Sanctuary under current management practices, which preserves established elderberry shrubs. Currently, elderberry shrubs in the cultivated areas are protected from disking (up to the dripline), and herbicide treatments are used to control the spread of selected non-native and invasive plants, such as perennial pepperweed. Row crops, such as winter wheat, are cultivated to control the spread of other invasive plant species, primarily by reducing the abundance of seeds. The invasive plant populations preclude the establishment of new elderberry shrubs and the associated riparian habitat, an essential element of contiguous valley elderberry longhorn beetle habitat. This alternative would not result in additional effects on elderberry shrubs or the beetle.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction of the spur dikes and site preparation for restoration activities at the Riparian Sanctuary could result in the loss or damage of elderberry shrubs that may support the valley elderberry longhorn beetle (i.e., stems with basal diameter greater than 1 inch). Direct impacts could occur if suitable elderberry shrubs are removed and transplanted as part of the restoration activities, which may result in mortality of individual beetles. Additionally, ground disturbance within 20 feet of the dripline of elderberry shrubs constitutes a direct impact (U.S. Fish and Wildlife Service 1999). Further, reproduction and foraging may be impaired because valley elderberry longhorn beetles rely on elderberry foliage for food and lay their eggs on elderberry stems. Indirect impacts could result from construction activities within 100 feet of the dripline of an elderberry shrub if the activities result in changes that could affect the long-term viability of the elderberry shrubs, such as alteration of drainage patterns, sedimentation, erosion, and chemical spills. Hydrology and water quality impacts are discussed in Section 3.4, Water Resources, and dust effects are discussed in Section 3.9, Air Quality.

The riparian habitat restoration design includes conservation measures to avoid and minimize impacts on elderberry shrubs during site preparation, and it incorporates the existing elderberry shrubs at the Riparian Sanctuary into the design and includes plantings of new elderberry shrubs within the elderberry savannah and other communities (see Figure 3.6-1 for locations of known elderberry shrubs and Figure 2-2 for the restoration plan). The conservation measures include protecting elderberry shrubs along the river from removal or disturbance during construction; erecting fencing and signs around protected areas; planting elderberry shrubs away from long-term maintenance areas to minimize long-term effects; and developing

a mitigation and monitoring plan for elderberry shrubs that must be removed or transplanted. Existing and new elderberry shrubs would be incorporated into the restoration planting design, which would provide the complete habitat requirements to support valley elderberry longhorn beetle and benefit the species. Currently, 17 acres of riparian and elderberry savannah habitat are present at the Riparian Sanctuary. Elderberry shrubs would be planted in each density designation, and elderberry savanna would be part of the medium-density habitat, which would result in a net increase of more than 350 acres of elderberry/riparian habitat across the Riparian Sanctuary.

Only two elderberry shrubs are located close to the river where the spur dikes would be located, and one or both of these shrubs may need to be removed and transplanted elsewhere on the Riparian Sanctuary to accommodate the spur dikes. Other elderberry shrubs on the Riparian Sanctuary could likely be avoided during site preparation and restoration activities, but some disturbance would take place around the shrubs, resulting in potential direct (if within 20 feet of the shrubs) and indirect (if within 100 feet of the shrubs) impacts. Direct and indirect effects could injure or kill the beetle, if present in the shrub, and the removal of elderberry shrubs, although expected to be minimal, would reduce available habitat at least in the short term. The newly restored habitat would eventually offset the initial impacts to habitat, but elderberry shrubs generally take more than 5 years to become large enough to support valley elderberry longhorn beetles, and riparian habitat requires about 25 years to reach its full value. The impacts on the beetle and its habitat would be significant. In addition to the conservation measures outlined above, implementation of Mitigation Measures VW-4a and VW-4b would avoid and minimize direct and indirect impacts on valley elderberry longhorn beetle, resulting in a less-than-significant impact.

Because of the potential impacts on the valley elderberry longhorn beetle, a federally listed species, and its habitat, a biological assessment will be prepared to comply with the ESA and to provide sufficient detail to allow the Service to render a biological opinion. The specific number of elderberry shrubs that would need to be removed will be identified during final design and addressed in the biological assessment.

Maintenance of site-specific plantings would not differ substantially from current management practices at the Riparian Sanctuary. Currently, disking and mowing take place up to the driplines of elderberry shrubs. Chemical herbicides are also used on invasive plants. Additional operational activities associated with restoration of the Riparian Sanctuary would include the continued use of the access road and established long-term maintenance areas; the operation and maintenance of irrigation systems (for 3 years after plantings); and disking, mowing, and herbicide application to control non-native and invasive plants. These actions could result in damage to elderberry shrubs while riparian vegetation is establishing; however, precautions would be taken to avoid elderberry shrubs similar to current management practices. Impacts from management of site-specific plantings would not result in additional impacts on the valley elderberry longhorn beetle or its habitat and would be less than significant.

Mitigation Measure VW-4a: Protect preserved elderberry shrubs during construction.

The construction contractor retained by PCGID-PID or the Service will be required to implement protection measures around elderberry shrubs that are to be preserved in the project area during

construction activities. These measures will be verified and refined, as necessary, by the Service during ESA consultation and may include the following:

- The locations of elderberry shrubs to be preserved will be clearly identified on construction plans.
- Plywood boxes will be constructed around all preserved elderberry shrubs in areas where bank protection measures would be installed. A biological monitor will be present during construction of the plywood boxes to ensure that all elderberry shrubs intended for preservation are identified and adequately protected prior to vegetation clearing or any ground disturbing activities.
- Exclusionary fencing will be installed 20 feet from the dripline of elderberry shrubs that are not protected by plywood boxes and that will be preservered elsewhere in the project area during construction and restoration activities. This buffer may be modified at the discretion of the Service for site-specific plantings near existing elderberry shrubs.
- Signs and fencing will be erected in accordance with the Service's *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (U.S. Fish and Wildlife Service 1999).
- A qualified biologist will conduct worker environmental awareness training to ensure that construction workers are able to identify and appropriately avoid elderberry shrubs.

Mitigation Measure VW-4b: Implement a mitigation plan for elderberry shrubs that must be removed.

The Service (Sacramento River NWR) will be responsible for preparing a mitigation plan to identify measures to replace or replant elderberry shrubs that must be removed during construction. This plan may be incorporated into the riparian restoration plan and will be reviewed and approved by the Service as part of the ESA consultation process. The measures identified in the mitigation plan may include, but are not limited to, the following:

- The locations of elderberry shrubs to be removed or transplanted will be clearly identified on construction plans.
- As part of the restoration design, elderberry stems removed will be mitigated in accordance with the Service's *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (U.S. Fish and Wildlife Service 1999). A qualified biologist will record the number of stems to be removed so that the design can incorporate appropriate replacement ratios of elderberries and associated riparian plants.
- All transplant and replacement shrubs will be planted within the restoration area of the Riparian Sanctuary and will be incorporated into the restoration design.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of traditional riprap, with or without a low berm, and restoration of the Riparian Sanctuary under Alternative 3 would involve similar activities as Alternative 2 and would result in the same types of impacts on the valley elderberry longhorn beetle. The traditional riprap would extend between 2,500 and 2,700 feet along the river bank, slightly longer than the spur dikes, but elderberry shrubs along the top of the bank would be avoided to the extent feasible or transplanted (potential direct impact) during

construction activities as described for Alternative 2. No additional impacts on elderberry shrubs are anticipated with Alternative 3 beyond those described for Alternative 2.

Direct and indirect impacts could result from activities near elderberry shrubs, which would be significant. Implementation of Mitigation Measures VW-4a and VW-4b, described for Alternative 2, would reduce impacts on the valley elderberry longhorn beetle to a less-than-significant level.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap, with or without a low berm, and restoration of the Riparian Sanctuary under Alternative 4 would involve similar activities as Alternatives 2 and 3 and would result in the same types of impacts on the valley elderberry longhorn beetle. Additional impacts could also result from removal of rock along the north riverbank of the peninsula if elderberry shrubs are located in or near the work area. Rock removal would require the removal of some established vegetation along the access road and growing in the existing revetment; however, such removal would avoid large trees and shrubs and preserve elderberry shrubs to the extent feasible. Elderberry shrubs are known to be present in the vegetated portions of the existing revetment and along the proposed access road, and approximately four shrubs could require removal because of their location between the existing dirt road and river. Five other shrubs could be subject to indirect effects during road widening and ground disturbance from equipment access. Direct and indirect impacts could result from activities near elderberry shrubs and removal of elderberry shrubs, as described for Alternative 2, which would be significant. Implementation of Mitigation Measures VW-4a and VW-4b, described for Alternative 2, would reduce impacts on the valley elderberry longhorn beetle to a less-than-significant level.

Impact VW-5: Construction and implementation of the Riparian Sanctuary project could adversely affect nesting bank swallows and their habitat.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, bank protection measures and restoration activities would not be implemented. This alternative would not result in construction-related impacts on bank swallows nesting or breeding in or near the project area. The Service would continue to maintain the Riparian Sanctuary under current management practices, which includes the disking and planting of dryland crops and disking and spraying of non-native and invasive plant species to eradicate and inhibit the spread of these species.

The Sacramento River would continue to erode the northwest corner of the Riparian Sanctuary. Potential bank swallow habitat would change over time as erosion forces alter bank structure and make the banks more or less suitable for swallows, depending on soil conditions of the resulting cut-bank. Conditions in the project area would be similar to current conditions or would be the subject of natural processes.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Three spur dikes would be placed along the northwest bank of the Riparian Sanctuary where potential bank swallow habitat has been delineated (River Partners 2011). The spur dikes would allow erosional forces to remain constant across the Riparian Sanctuary and would reduce the suitability of the bank for

nesting bank swallows. Although bank swallows have historically nested in the area proposed for spur dike placement (RM 178.2), no colonies have been documented since 1997 (River Partners 2011), and the habitat is not assumed to be currently occupied. The lack of use by bank swallows may indicate that this segment of river is not currently suitable for nesting. However, suitable nesting habitat is present along approximately 1,560 linear feet of the river at RM 177 at the southwest end of the project area, and this habitat was documented to support a bank swallow colony in 2010. Changes in bank swallow habitat are dynamic along the Sacramento River, where flooding and natural meandering processes regularly alter available bank swallow nesting habitat. A natural reduction of bank suitability for nesting is often affected by changes in habitat, such as vegetation regrowth, parasite load, or slumping of the bank (Garrison 1999). Man-made changes to river banks, such as from bank protection or armoring, have resulted in a loss of bank swallow habitat along the Sacramento and Feather rivers and contributed to the decline of swallow populations in California (Garcia et al. 2008, Garrison et al. 1987, Garrison et al. 1989, Girvetz 2010, Moffatt et al. 2005, Schlorff 1997). Some studies have determined that removal of bank protection would benefit bank swallow by restoring habitat along the rivers, while conservation easements and land acquisitions would help protect existing habitat and known colony sites (Garcia et al. 2008, Garrison et al. 1989, Girvetz 2010, Moffatt et al. 2005).

Construction of the spur dikes could disturb nesting bank swallows if the habitat at RM 178.2 becomes suitable prior to construction and if the swallows occupy the habitat. Construction is expected between April 1 and November 30, which overlaps with the nesting period for bank swallows (April 1 to July 31) and could have a significant impact on nesting swallows, if they occupy the habitat. Bank swallows nesting downstream of the project area near RM 177 are not expected to be affected by construction activities because of the distance between the proposed spur dike locations and the bank swallow habitat. Some disturbance may occur during restoration activities, particularly site preparation if it takes place during the nesting period. The spur dikes would also result in a loss of up to 2,000 feet of potential bank swallow habitat, which could result in a net loss of bank swallow habitat along the Sacramento River. These impacts would be significant. Mitigation Measure VW-5a would avoid potential impacts on nesting swallows, resulting in a less-than-significant impact, but the loss of potential habitat along the Sacramento River could still be significant if compensatory mitigation (Mitigation Measure VW-5b) is not adequate to create the same amount of habitat elsewhere along the Sacramento River (i.e., a net loss of habitat results). Direct impacts on the state-listed bank swallow would not be expected with the mitigation measures, and an incidental take permit is not expected to be required.

Mitigation Measure VW-5a: Conduct pre-construction surveys for nesting bank swallows and install netting along the bank.

All construction and restoration activities that involve ground disturbance and use of equipment near the banks of the Sacramento River between RM 177 and RM 178.2 will be scheduled outside of the nesting period for bank swallows (i.e., schedule these activities between August 1 and March 31), to the extent possible. If these activities must take place during the nesting period, PCGID-PID, the Service, or the construction contractors retained by PCGID-PID and the Service will be responsible for retaining a qualified biologist to conduct a pre-construction survey in potential bank swallow habitat along the banks of the Sacramento River adjacent to the Riparian Sanctuary at about RM 178.2 (for bank protection

measures) and at about RM 177 (for restoration activities) prior to bank swallows arriving in the area (see River Partners 2011 for map of potential habitat locations). The survey will be conducted in February of the same year that construction is scheduled for the bank protection measure and site preparation is scheduled for restoration activities; multiple surveys may be necessary if these activities are scheduled in different years. The biologist will assess the suitability of the habitat for nesting bank swallows and determine if bank swallows could occupy the habitat during the nesting period. If the habitat is determined to be unsuitable for bank swallow nesting, no additional construction measures are necessary. However, if the habitat has become suitable, the contractor will be responsible for installing netting along the bank prior to bank swallows arriving in the area (i.e., during the first week of March) and under the supervision of a qualified biologist. The netting will consist of a plastic net or poultry wire with a mesh size of about 3/4 to 1 inch. The netting will remain in place until construction activities commence for the bank protection measure, and it can be removed once construction of the bank protection starts. For restoration activities, the netting will remain in place until the end of the nesting period. A qualified biologist will monitor the netting weekly between the time it is installed and construction commences and conduct a survey the day prior to the start of construction to ensure no bank swallows have occupied the habitat.

Mitigation Measure VW-5b: Compensate for the loss of bank swallow habitat.

PCGID-PID will retain a qualified biologist to survey the bank where the bank protection measure will be installed to quantify the amount of suitable bank swallow habitat. If the pre-construction survey identified for Mitigation Measure VW-5a is conducted, the results can be used to quantify the compensation amount in lieu of a separate survey. Once the amount is quantified, PCGID-PID will coordinate with CDFG to identify adequate compensatory mitigation to offset the loss of bank swallow habitat as a result of construction of the bank protection measure. The compensatory mitigation may consist of purchasing mitigation credits at a qualified mitigation bank, preserving bank swallow habitat in perpetuity along the Sacramento River (possibly within the Sacramento River NWR), removing rock or other revetment elsewhere along the Sacramento River in coordination with the landowner or entity that manages the revetment, or a combination of these measures. These measures may require agreements between PCGID and landowners along the river or other entities.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of traditional riprap, with or without a low berm, and restoration of the Riparian Sanctuary under Alternative 3 would involve similar activities as Alternative 2 and would result in the same types of impacts on bank swallows and their habitat. The traditional riprap, with or without the berm, could result in the loss of up to 2,700 feet of potential bank swallow habitat. As described for Alternative 2, this habitat is not currently occupied, although it may become occupied if soil conditions become favorable. Because of the potential for the habitat to become suitable and for bank swallows to nest in the project area during construction, impacts would be significant. Mitigation Measure VW-5a would avoid potential impacts on nesting swallows, resulting in a less-than-significant impact, but the loss of potential habitat along the Sacramento River could still be significant if compensatory mitigation (Mitigation Measure VW-5b) is not adequate to create the same amount of habitat elsewhere along the Sacramento River (i.e., a net loss of habitat results).

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap, with or without a low berm, restoration of the Riparian Sanctuary, and upstream rock removal under Alternative 4 would involve similar activities as Alternatives 2 and 3 and would result in the same types of impacts on bank swallows and their habitat. Construction and restoration activities could disturb nesting bank swallows if they occupy the bank-side habitat along the river adjacent to the Riparian Sanctuary, which would be a significant impact. Implementation of Mitigation Measure VW-5a would reduce the potential for effects on nesting bank swallows, resulting in a less-than-significant impact.

Removal of the rock revetment along the northern side of the peninsula could provide up to 2,200 linear feet of suitable bank habitat for the bank swallow. Rock removal has proven successful for bank swallows and has been the subject of a number of studies along the Sacramento River. In 1999, bank swallow habitat created by rock removal along a private levee at RM 233 provided habitat the following spring for an estimated 2,770 burrows (~1,250 pairs) (Golet et al. 2001). Potential bank swallow habitat would be initially created by the removal of the rock revetment, although some of that habitat may be lost once the river cuts through the peninsula as predicted by hydraulic modeling (Ayres Associates 2010). Additional suitable habitat would also likely be created along the new channel of the river, and a net beneficial effect on bank swallow nesting habitat would be expected because more habitat would be created than the amount lost by the traditional riprap. The placement of traditional riprap would result in the loss of up to 2,700 feet of potential bank swallow habitat, although not all of this habitat is likely suitable for bank swallow nesting. The removal of more than 2,000 feet of existing revetment plus the newly exposed banks along the new channel of the river once it cuts through the peninsula would provide more suitable habitat, ensuring this alternative does not result in a net loss of bank swallow habitat along the river. Impacts on bank swallow habitat would be less than significant.

Impact VW-6: Construction and implementation of the Riparian Sanctuary project could adversely affect other special-status species that nest or breed in the project area and their habitat.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, bank protection measures and restoration activities would not be implemented. This alternative would not result in construction-related impacts on special-status species nesting or breeding in the project area. The Service would continue to maintain the Riparian Sanctuary under current management practices, which include disking and planting dryland crops and disking and spraying non-native and invasive plants species to eradicate and inhibit the spread of these species.

The Sacramento River would continue to erode the northwest corner of the Riparian Sanctuary, resulting in a small loss of nesting and foraging habitat for special-status species over the long term. Conditions in the project area would be similar to current conditions or would be the subject of natural processes.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of bank protection measures and restoration-related activities (i.e., site preparation, planting, irrigation installation and operation, and non-native and invasive plant control) could have direct and indirect impacts on special-status species nesting or breeding in the project area and could modify or remove suitable habitat for these species. Species that may be affected include those that nest in grasslands or shrublands (e.g., northern harriers, Swainson's hawks, loggerhead shrikes, grasshopper sparrows, and short-eared owls) and that nest or breed in riparian habitat (e.g., western pond turtles, bald eagles, western yellow-billed cuckoos, white-tailed kites, yellow warblers, yellow-breasted chats, western red bats, and ring-tailed cats). The activities could also affect other common raptors and migratory birds nesting in the project area.

Construction of the bank protection measures and restoration activities could result in disturbance to or mortality of nesting or breeding special-status species, raptors, and migratory birds in grasslands, shrublands, riparian habitat, or along the river bank. Removal of understory vegetation in grassland and riparian habitats during site preparation for restoration could disturb nesting activity or injure individuals; ground-nesting birds and mammals that den by burrowing underground would be most likely to be affected. Additionally, noise generated by heavy equipment used to remove vegetation, transport rock, place rock, and remove rock (Alternative 4 only) could result in nest abandonment, which could result in mortality of young if they are unable to move from the area during these activities. Construction activities would take place between April 1 and November 30, and restoration activities may take place year-round, although vegetation removal may be scheduled to avoid the nesting/breeding season for most species. Impacts would be most pronounced during the nesting/breeding season for birds because of the potential effects on reproductive success and young. In Butte County, the nesting season for most special-status migratory birds (e.g., yellow warbler and yellow-breasted chat) extends from March 15 through August 31, and the typical nesting period for raptor species is between February 15 and August 15. For Swainson's hawks, this period is between March 1 and September 15. Because activities would overlap with the nesting/breeding season and local populations of special-status species could be affected if nesting activity is disrupted, construction-related impacts on nesting and breeding birds would be significant. Implementation of Mitigation Measure VW-6 would reduce impacts on individual special-status species to less than significant.

Western pond turtles may be present in or adjacent to the proposed locations of the bank protection measures; upland nesting habitat is present throughout the site 660 feet from suitable aquatic habitat (slow, backwater areas). Mortality of western pond turtles or destruction of their nests or eggs could occur during the installation of the bank protection measures and during restoration activities (i.e., site preparation, planting, irrigation installation and operation, and non-native and invasive plant control). Additionally, indirect impacts may occur if water quality is compromised by petroleum or chemical spills or turbidity and sedimentation. Water quality measures would be implemented during construction to minimize water quality impacts, as discussed in Section 3.4, Water Resources. Because of the potential for impacts on individuals during construction and restoration activities, impacts on western pond turtles would be significant. Implementation of Mitigation Measure VW-6 would reduce impacts on individual pond turtles to less than significant.

Mature riparian trees more than 3 feet tall would be retained during construction and restoration activities, so roosting bats or ring-tailed cats with maternity dens in this habitat would not be lost as a result of tree removal. However, noise and other disturbance during construction and restoration activities could cause roosting bats and ring-tailed cats to relocate or move their young. When disturbed, many bats, including western red bats, transport their young while the young are non-volant (Davis 1970). Additionally, ring-tailed cats commonly move their young from den to den or when they are disturbed or threatened (Poglayen-Neuwall and Toweill 1988). Because western red bats and ring-tailed cats are able to move their young to alternate roosts or maternity dens and roosting or denning habitat is readily available along the Sacramento River near the project area, disturbance caused by construction and restoration activities would have a less-than-significant impact on the species.

The bank protection measures would alter 2,000–2,700 feet of bank-side habitat along the Sacramento River at RM 178, and the restoration activities would restore historic riparian habitat at the Riparian Sanctuary in place of the existing croplands and grasslands. These habitat modifications could affect species that prefer grasslands or open habitat such as Swainson's hawks and riparian dwellers. Effects of the restored riparian habitat are discussed under Impact VW-1 and would result in mostly beneficial effects on habitat for special-status species and other common wildlife.

Longer term maintenance activities in the restored area would be similar to current management practices at the Riparian Sanctuary and could result in periodic disturbances to species using the restored habitat. These activities could affect ground-nesting birds (e.g., short-eared owls) and other nesting species near the maintenance activity in the restored habitats of the Riparian Sanctuary. The activities would be periodic and would likely be scheduled outside the peak nesting/breeding period; therefore, they would not be expected to result in substantial adverse effects on species using the restored habitat. Maintenance-related impacts would be less than significant.

In summary, construction and restoration activities could adversely affect nesting and breeding birds, including special-status species and raptors, and western pond turtle, which would result in significant impacts. Impacts on other special-status species during construction and restoration activities and longer term maintenance activities would be less than significant. Implementation of Mitigation Measure VW-6 would reduce impacts on individual special-status species to less than significant. This measure would sufficiently reduce impacts on the state-listed Swainson's hawk, and an incidental take permit is not expected to be needed for this species.

Mitigation Measure VW-6: Conduct pre-construction surveys for nesting special-status bird species, raptors, special-status mammals, and special-status reptiles.

PCGID-PID or the construction contractor retained by PCGID-PID or the Service will be responsible for retaining a qualified biologist to conduct pre-construction surveys prior to any activities scheduled during the nesting season (February 15 through September 15) and implementing measures to avoid activities near active nest sites. Surveys will be repeated each year if activities would commence in subsequent years during the nesting period.

The following specific measures will be implemented:

- All construction activities (e.g., construction of spur dikes, site-specific planting preparation), including pruning and trimming of vegetation, will be supervised by a qualified biologist.

- For Swainson's hawk, a qualified biologist will conduct a pre-construction survey of accessible areas within a 0.5-mile radius of the area where activities would be implemented on the Riparian Sanctuary and upstream peninsula between March 1 and September 15; the required survey radius may be reduced (on a case-by-case basis) if approved in advance by CDFG, but in no case will be less than 500 feet. At least one survey will be conducted no more than 1 week prior to the initiation of the activities. If no active nests are located, no further measures are necessary to avoid impacts to active Swainson's hawk nests. If active nests are identified, the following measures will be implemented:

    - A no-disturbance buffer zone will be established around the nest site. The width of the buffer zone will be determined by a qualified biologist in coordination with CDFG. Determination of the required width of the buffer zone will consider the distance of the nest site from construction activities, the line of sight from the nest site to construction activities, the existing level of disturbance, and other factors established with CDFG on a case-by-case basis.
    - A qualified biologist will monitor active nests within 500 feet (or the width of the buffer zone) of construction activities. The first monitoring event will coincide with the initial implementation of construction activities and monitoring will continue a minimum of once a week until the young have fledged. If the biologist determines that construction activities are disturbing the birds and nest failure is possible, CDFG will be immediately notified. Measures to avoid nest failure will be implemented in coordination with CDFG and may include halting some or all construction activities until the young have fledged. For monitored nest sites, a monitoring report will be submitted to CDFG within 2 weeks after termination of monitoring activities.

- For special-status migratory birds, a qualified biologist will conduct a pre-construction survey no more than 2 weeks prior to commencement of construction or restoration activities scheduled between March 1 and August 31. The pre-construction survey will be used to determine if active nests of these species are present in or within 250 feet of where construction activities would take place. If an active nest is found, a qualified biologist in consultation with CDFG will determine the extent of a construction-free buffer zone to be established around the nest. If no active nests are identified, no further mitigation is necessary.

- For common raptors, a qualified biologist will conduct a pre-construction survey in all suitable upland and riparian habitat no more than 2 weeks prior to commencement of construction or restoration activities scheduled between February 15 and August 31. If an active nest is found, a qualified biologist, in consultation with CDFG, will determine a construction-free buffer zone to be established around the nest until the young have fledged. In consultation with CDFG, a plan will be developed to monitor whether construction activity is disturbing the reproductive process and to determine when the young have fledged. If no active nests are identified, no further mitigation is necessary.

- If a western pond turtle is observed in the project area during construction activities, the contractor will temporarily halt construction until the turtle has moved itself to a safe location outside of the construction limits. If construction is to occur during the nesting season (late June–July), a pre-construction survey will be conducted by a qualified biologist to locate any western pond turtles or their nests. This survey will be conducted within 660 feet of the northwestern portion of the Riparian Sanctuary no more than 2 days prior to the start of construction or restoration activities in suitable habitat. If a pond turtle nest is found, the biologist will flag the site and determine whether construction activities can avoid affecting the nest. If the nest cannot be avoided, in consultation with CDFG, a no-disturbance buffer zone may be established around the nest until the young have left the nest.

Impact VW-7: Implementation of the Riparian Sanctuary project could restrict terrestrial wildlife movement through the project area.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, bank protection measures and restoration activities would not be implemented. The restoration of the Riparian Sanctuary would not occur and would not provide additional cover and refuge for movement of wildlife species. The northwestern corner of the Riparian Sanctuary would continue to erode; however, this would not impede continued use of the river or riparian habitats as movement corridors.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings

The bank protection measures and restoration of the Riparian Sanctuary would not physically impede migration of wildlife species through the project area. The development of complex riparian habitats on the Riparian Sanctuary would provide additional linkage of riparian habitat along the Sacramento River. This would result in beneficial effects on the available migration corridors and contribute to the management goals of the Sacramento River NWR. No adverse impacts on movement corridors would result from implementation of the bank protection measures and restoration.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap, with or without a low berm, and restoration of the Riparian Sanctuary under Alternative 4, including the removal of upstream rock revetment and the subsequent cut off of the peninsula, would result in similar changes to the project area as described for Alternatives 2 and 3 and would not result in adverse effects on movement corridors. The eventual cut off of the peninsula as described under Impact VW-1 would shift riverine and riparian habitats within the floodplain as typically occurs in large river systems and would not result in adverse effects on riverine or riparian migration corridors.

3.7 Cultural Resources

This section discusses the prehistoric, ethnographic, and historic contexts of the region and describes cultural resources in the project area. It analyzes the effects of the alternatives on important cultural resources in the project area, including potential historical resources. Cultural resources include prehistoric and historic archaeological sites, historic buildings and structures, historic districts with multiple buildings or structures, districts of archaeological sites, cultural landscapes, traditional cultural properties, and resources of interest to Native American groups.

3.7.1 Regulatory Framework

Federal Laws and Regulations

National Historic Preservation Act of 1966

The National Historic Preservation Act (NHPA, 16 USC 470 et seq.) created the National Register of Historic Places, which includes districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture. These resources are referred to as "historic properties." The criteria for evaluating resources to determine whether they are eligible for listing in the National Register are codified in 36 CFR 60.4:

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

The act also established a system for state historic preservation programs under State Historic Preservation Officers and established the Advisory Council on Historic Preservation (ACHP), an independent agency that is responsible for implementing Section 106 of the NHPA through the development of procedures to protect cultural properties included in, or eligible for inclusion in, the National Register. Regulations are published in 36 CFR Parts 60 and 63 and 36 CFR Part 800.

36 CFR Part 800, Protection of Historic Properties

The Implementing Regulations for Section 106 of the National Historic Preservation Act (36 CFR Part 800) direct all federal agencies to take into account the effects of the agency's undertakings on National Register listed or eligible properties and to coordinate compliance efforts. Federal agencies must follow the process described in this set of regulations. Section 106 requires the lead federal agency to "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register" and afford the ACHP "a reasonable opportunity to comment with regard to such undertaking." Included in the regulations are methods federal agencies can use to coordinate the compliance requirements of NEPA, NHPA, and other federal historic preservation laws. The Service will evaluate the effects of the preferred alternative on historic properties in accordance with Section 106 of the NHPA and consult with the State Historic Preservation Officer if adverse effects are anticipated.

National Environmental Policy Act

NEPA (42 USC 4321-4347) mandates the protection of cultural resources within its general policy for environmental protection. It requires the preservation of "important historic, cultural, and natural aspects of our national heritage" and the maintenance, "wherever possible, of an environment that supports diversity and a variety of individual choice." Regulations issued by the ACHP provide for the coordination of NEPA and NHPA compliance under 36 CFR Part 800.14(a). Regulations for implementing the procedural provisions of NEPA are available at 40 CFR Parts 1500–1508.

Abandoned Shipwreck Act of 1987

With the Abandoned Shipwreck Act (P.L. 100-298; 43 USC 2101-2106), states have the responsibility to manage a broad range of living and non-living resources in state waters and submerged lands. Included in the range of resources are certain abandoned shipwrecks, which have been deserted and to which the owner has relinquished ownership rights with no retention.

Native American Graves Protection and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act (25 USC 3001 et seq.) requires federal agencies and museums receiving federal funds to inventory and repatriate human remains and associated funerary objects, including items of cultural patrimony. The agencies and museums must offer to return these remains and objects to the Native American groups who are judged to be the most likely descendants or most closely culturally affiliated. The law also protects Native American graves and other cultural items located within archaeological sites on federal and tribal lands.

State Laws and Regulations

Sacramento River National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR CCP provides management direction for cultural resources on the refuge to ensure they are managed according to the NHPA, Archaeological Resources Preservation Act, and Native American Graves Protection and Repatriation Act (U.S. Fish and Wildlife Service 2005). Cultural resources are also managed in accordance with the treatment measures identified in the CCP and in the *Cultural Resource Overview and Management Plan for the Sacramento River Conservation Area* (White

2003). These documents define treatment methods for inadvertent discoveries of historic properties and human remains.

California Public Resources Code (Historical Resources)

California Public Resources Code sections 21083.2 and 21084.1 require public agencies to consider the effects of their actions on historical resources and unique archaeological resources. Historical resources are defined as any cultural resource listed in, or determined eligible for listing in, the California Register of Historical Resources (CRHR) (Pub. Res. Code Section 21084.1 and CEQA Guidelines Section 15064.5, subds. (a) and (b)). The CRHR includes cultural resources listed, or formally determined eligible for listing, in the National Register of Historic Places as well as some California State Landmarks and Points of Historical Interest. A unique archaeological resource is defined as an artifact, object, or site that meets the criteria for listing in the CRHR and the National Register (Pub. Res. Code Section 21083.2, subd. (g)).

Each public agency has a responsibility to assess whether its actions will cause a substantial adverse change in the significance of a historical resource or unique archaeological resource pursuant to California Public Resources Code Section 21084.1. CEQA Guidelines Section 15064.5 defines a substantial adverse change in significance as "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired" (CEQA Guidelines Section 15064.5, subd. (b)(1)).

CEQA Guidelines Section 15064.5, subdivision (b)(2), defines "materially impaired" (for purposes of the definition of "substantial adverse change") as follows:

- Demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in, the CRHR; or

- Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical resources pursuant to section 5020.1(k) of the Public Resources Code or its identification in a historical resources survey meeting the requirements of Section 5024.1(g) of the Public Resources Code, unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or

- Demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its eligibility for inclusion in the CRHR as determined by a lead agency for purposes of CEQA (CEQA Guidelines Section 15064.5, subd. (b)(2)).

If a project will adversely affect historical resources or unique archaeological resources, the lead agency is responsible for consulting with the Office of Historic Preservation to identify appropriate mitigation measures.

Section 5097.5 of the California Public Code – Disturbance of an Archeological Site

Section 5097.5 of the California Public Code makes it a misdemeanor for anyone to knowingly disturb any archaeological, paleontological, or historical feature on public lands.

State of California Health and Safety Code 8010-8011 – California Native American Graves Protection and Repatriation Act

The California Native American Graves Protection and Repatriation Act establishes a state repatriation policy that is consistent with and facilitates implementation of the federal Native American Graves Protection and Repatriation Act. The act strives to ensure that all California Native American human remains and cultural items are treated with dignity and respect. It encourages voluntary disclosure and return of remains and cultural items by publicly funded agencies and museums in California and states an intent for the state to provide mechanisms for aiding California Native American tribes, including non-federally recognized tribes, in filing repatriation claims and getting responses to those claims.

3.7.2 Affected Environment

Prehistoric, Ethnographic, and Historic Context

Prehistoric human occupation of California stretches back over 10,000 years to the late Pleistocene Era. It is likely, however, that alluvial deposits of recent origin have buried most of the early prehistoric sites in the Sacramento Valley. It is estimated that as much as 33 feet of sediment have accumulated along the lower stretch of the Sacramento River drainage system during the last 5,000 to 6,000 years (Moratto 1984).

The project area lies within a region historically occupied by three Native American groups (Kroeber 1932; Goldschmidt 1978; Johnson 1978; Riddell 1978). These groups were the River Nomlaki, who occupied both banks of the Sacramento River from Cottonwood Creek in present-day Tehama County south to Toomes Creek and possibly farther; the River Patwin, who occupied the lower western half of the Sacramento Valley west of the Sacramento River from above Princeton in the north to near the confluence of the Sacramento and Feather rivers in the south (Kroeber 1932); and the Konkow Maidu (and Mechoopda), who occupied a territory along the Sacramento River from just above modern-day Princeton on the south to Toomes Creek on the north and east from the river to the Sierra Nevada Mountains (Riddell 1978). A 7-mile by 5-mile land area from just below Ord Bend in the north to just above Princeton in the south was likely occupied concurrently by the Maidu and the Patwin.

The Nomlaki generally placed their villages on ridges and high spots near major waterways, including major tributaries to the Sacramento River, whereas River Patwin villages were generally established along the natural levee of the Sacramento River (Goldschmidt 1978; Johnson 1978). The Konkow generally established semi-permanent settlements or winter villages on low, natural rises along streams and rivers. Two ethnographically noted Konkow villages, Soo' noos and Sunusi, were located on the east side of the Sacramento River in the general area between Ord Bend and Glenn, most likely on current Llano Seco land (Riddell 1978). Luis Arguello, during his 1821 military expedition into the Sacramento Valley, made observations of several Patwin and possibly Maidu villages along the river. Expedition notes

discuss a village near modern-day Knights Landing that was located on a high mound and surrounded by a defensive stockade (Ordaz 1821, cited in Heizer and Hester 1970).

A wide variety of tools, implements, and enclosures were used to hunt, collect, and process natural resources, including bows and arrows, spears, traps, slings, blinds, bone harpoons, hooks, nets, and weirs. Woven tools—seed beaters, burden baskets, rope, and carrying nets—and sharpened digging sticks were used to collect plant resources. For processing food, a variety of tools were used, including bedrock mortars, portable mortars (predominantly basket hopper mortars) and pestles, stone knives, mussel shell knives, stone scrapers, and a variety of bone tools.

Early historic contact between the Native Americans in the Sacramento Valley and Euro-Americans came with the occasional expeditions of the Spanish and later Mexican governments into the valley in search of escaped neophytes (baptized Indians) from the missions or new peoples to convert or for other military purposes. In general, the Spanish influence in California was confined to the coastal area from present-day San Francisco in the north to present-day San Diego in the south; however, ripples of contact were felt into the interior valleys including the Central Valley (Lightfoot 2005). The founding of Mission San José in 1797 began a period of initial or indirect contact with the inland tribal groups east and north of the Bay Area, including the Southern Patwin, Plains Miwok, and possibly the Nisenan and River Patwin around present-day Sacramento.

The earliest recorded contact with the River Patwin and possibly the Nomlaki and Konkow occurred in 1821 when Luis Arguello and a small military expedition moved through the Sacramento Valley following the western bank of the Sacramento River (Wilson and Towne 1978, White 2003). In the early 19th century, the Hudson's Bay Company's Southern Brigade trappers and traders, led by Alexander Roderick McLeod, John Work, Michael Laframboise, Thomas Mckay, Peter Skene Ogden, and others, worked their way through much of northern California (Mackie 1997). Between 1826 and 1845, twelve Hudson's Bay Company expeditions trapped in the watersheds of the Sacramento, Pit, and Feather rivers and in the delta of the Sacramento and San Joaquin rivers (Mackie 1997).

During the Mexican Era, the Sacramento Valley was parceled out in large land grants, often to naturalized citizens of American or other European origin, as an attempt by the Mexican government to maintain control of Alta California and prevent the incursion of the Americans and Russians. The Llano Seco grant was awarded in 1845 to Sebastian Kayser, who then sold the grant to Edward Farwell for the price of 15 heifers (Lemke 1961). The Jacinto grant was awarded to Jacinto Rodríguez in 1844 and was eventually purchased by William H. McKee. Both grants changed hands several times during the years between the end of the Mexican-American War and the final United States government land patent awards. The Jacinto grant was officially patented to McKee in 1852 and was purchased parcel by parcel by Dr. Hugh Glenn (for whom Glenn County is named) for inclusion in his wheat empire. Llano Seco was officially patented in 1860 to seven people with land interests in the rancho. The land eventually was mortgaged and the mortgages were purchased by John Parrott in 1861. Following his death, his widow and son gained interest in the land, and in 1909, the Parrott Investment Company was formed to maintain the ranch (Lemke 1961). Llano Seco has maintained its total area without subdivision and has continued as a working ranch into the 21st century.

Largely as a result of the Gold Rush, California became the 31st state in 1850. By 1853, the population of the state exceeded 300,000, and in 1854 Sacramento became the state capital. Butte County is one of the original 27 counties created when California achieved statehood. Glenn County was formed in 1891 from the northern portion of Colusa County (Gudde 1969; Hoover et al. 2002). The Gold Rush promoted the growth of settlement and economic development of the region, with the river systems, particularly the Sacramento River, providing a main route for supplies. The demands of the mining and agricultural industries on California's streams and rivers caused a massive reworking of the entire water system. Mining activities moved and rerouted stream channels, caused severe changes in water flow, and deposited massive amounts of debris into the water system of California. The debris deposition between the years 1849 and 1888 was so severe that it raised the Sacramento riverbed 6.5 feet (Mitchell 1994).

With the need for supplies in the mines came the beginnings of intensive agriculture in California. Many settlers, after a brief stay in the mines, returned to agricultural pursuits with which they were familiar. Farms were located near water sources, in particular along the perennial streams such as the Feather, American, and Sacramento rivers.

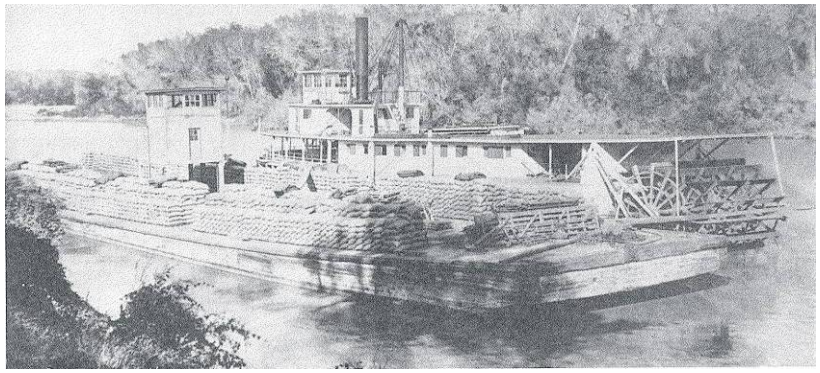

Figure 3.7-1. Sidds Landing on the Sacramento River

To move the produce grown at these farms, small and large landings were built by the landowners along the riverbanks. Figure 3.7-1 depicts a river landing used to load rice bags for shipping on the barge *Alabama* at Sidds Landing, with the riverboat *Jacinto* located next to the *Alabama* (Davis 1984). The riparian vegetation on the riverbank in the background of the figure is depicted as mature trees along the north riverbank. The small landings were ephemeral in nature and not built to handle large amounts of traffic; however, the larger landings were built to be ports of traffic and were often more substantial (California State Lands Commission 1988). These large landings were most often located at major towns along the river (California State Lands Commission 1988). By the early 20th century, river travel became less a means of cargo transport and more a recreational pursuit. The railroad and the automobile provided a quicker, cheaper, and often more reliable means to move produce to markets. Although many of the river landings fell into disuse after the expanded availability of railroads and automobiles, some of the landings took on a different purpose as recreational boat launches.

Historical maps from 1911 and 1917 indicate that Sidds Landing, located on the west bank of the Sacramento River near the project area, was a substantial landing (U.S. Army Corps of Engineers 1911a, 1911b; U.S. Geological Survey 1917). A long structure, possibly a wharf or warehouse, is located on these maps west of the Central Irrigation Canal and the levee and immediately east of the Sacramento River bank. Later topographic maps from 1951 and 1969 and aerial photographs (Google Earth imagery dated 2007) do not show this long structure. These maps instead indicate that the river has moved west

and is located immediately east of the levee with no land between the levee and river channel. Likely the structure was destroyed by the movement of the river.

Irrigation of lands away from the major river and stream channels in the Sacramento Valley became a major concern of agriculturalists in the latter half of the 19th century. Earlier agriculture had relied on crops such as wheat and barley, grasses sown in the spring and harvested in late summer (Street 2004). These crops were intensely farmed during the 1860s and 1870s, after which declining soil quality and economic downturns reduced the market. Improvements in transportation, including the Transcontinental Railroad and local rail lines, led many farmers to diversify their crops and to experiment with specialty crops such as fruits that have limited shelf life. With diversification came the need for water to reach land farther and farther from the main surface sources.

Irrigation districts formed in the 1890s and throughout the early decades of the 20th century in an effort to move water to arable land away from the main sources. The Central Irrigation District, formed in 1887, began the long process of acquiring water rights and constructing canals and pumping facilities that would eventually become the Glenn-Colusa Canal and auxiliary canals and facilities (Davis 1984). Figure 3.7-2 depicts an undated early 20th century photograph of the River Branch Canal, constructed by the Central Irrigation District near Sidds Landing, with the approximate alignment of the current SR 45 along the right side (Davis 1984). The Central Irrigation District eventually became insolvent, and smaller irrigation districts were formed using some of the infrastructure, while a single large company, the Sacramento Valley Irrigation District, took on most of the infrastructure and operation. Later, in 1920, the Glenn-Colusa Irrigation District was formed and began operation of the irrigation system (Davis 1984). The Princeton-Codora Irrigation District, formed in 1916, was one of the smaller irrigation districts to acquire facilities and water rights from the earlier Central Canal and Irrigation Company.

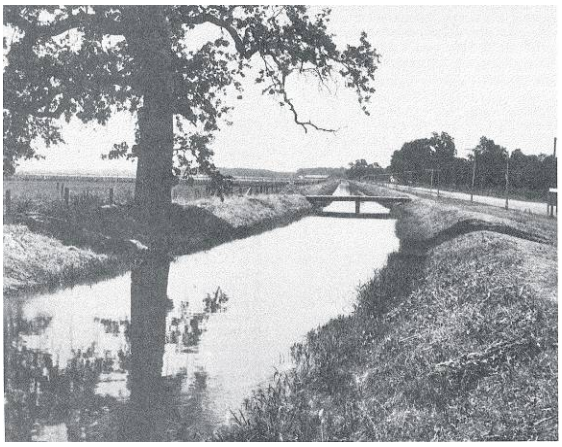

Figure 3.7-2. River Branch Canal near Sidds Landing

Archaeological Context

Archaeological investigations along the Sacramento River have been conducted sporadically throughout the 20th century. A total of 95 prehistoric sites have been recorded between Red Bluff and Colusa, and 29 of those sites have been scientifically excavated (White 2003). Most of the recorded sites were reported to be mounds, middens, or village sites. Village sites would have been locations of prolonged occupation. These sites often contain the remains of a variety of daily activities, including food procurement, processing, and consumption; residential, special use, and storage structures; ritual, sacred, and secular items; and burials. Most of the excavations occurred in the 1960s and 1970s, and several of the larger excavations were conducted by a cooperative research program between California State

University, Chico and the University of California, Los Angeles (CA-BUT- 12, BUT-233, BUT-288, BUT-294, BUT-300, GLE-18, GLE-101, GLE-105, and TEH-248). Most of the sites are poorly recorded, with only brief overviews and no substantial reports. One of these early excavated sites, BUT-233, is known as the Llano Seco site and is located 3.5 miles northeast of the project area on part of the Llano Seco Rancho. This site yielded five radiocarbon dates between 4,947±140 calibrated years Before Present (B.P.) and 989±90 calibrated years B.P. (3000 B.C. and A.D. 1000).

The Sacramento River is known to contain shipwrecks dating from as early as the mid-19th century; however, the probability of abandoned shipwrecks in the project area is very low, in large part because the current stream channel was formed after 1969. Also, although Sidds Landing was known to be an important river landing near the project area, changes in river channel configuration (specifically the westward migration of the channel) and the construction of the pumping plant have likely removed any remaining structural components.

At least two archaeological surveys have been conducted on Llano Seco Rancho lands and along the SR 45 corridor, including portions of the project area (Peak and Associates 1996, White 2003). These two surveys covered 85 percent of the project area (not including the current river channel or upstream peninsula). The peninsula, including Llano Seco Island 2, has not received any archaeological survey coverage; however, the probability of cultural resources in that portion of the project area is considered low for several reasons. The peninsula has been affected by the shifting river alignment throughout the 20th century. Historic maps have shown the channel to have migrated east and south to its current location. The movement of the river would have removed resources deposited before the 20th century. Additionally, considering the unstable nature of river movement in this area, any resources deposited after the channel moved are likely related to agriculture (e.g., orchard trees, equipment fragments), recreation (e.g., beer can scatters, temporary fish camps), or other ephemeral deposits that are generally not considered eligible for listing in the National Register.

Three historic-era sites related to irrigation (P-11-000575 -000576, and -000577) and one historic-era site related to reclamation and flood control (CA-GLE-689H) have been recorded immediately adjacent to the project area (White 2003). These historic sites, located on the western side of the river, are the PID pumping plant structure, an unaffiliated pumphouse with associated irrigation and agricultural developments, the River Branch Canal, and the Sacramento River levee. These resources are located outside of the project area and are therefore not considered further in this section.

One prehistoric site (CA-BUT-2658) and nine isolated finds (three historic and six prehistoric isolates) have been recorded at the Riparian Sanctuary (White 2003). The prehistoric site and the nine isolated finds are located on the eastern side of the river. Isolated finds are generally not considered eligible for listing in the National Register and are not considered important resources for the analysis in this document; therefore, these isolated resources are not considered further.

The prehistoric site CA-BUT-2658, referred to as the Sanctuary Mound, is a “large mound rising above the valley floor and surrounded by a perimeter artifact scatter” (White 2003: 83). This site is unique in the Sacramento Valley, as most mound sites of a similar nature have been destroyed by urban development, levee construction, river channel migration, and agriculture. The presence of human

remains at CA-BUT-2658 adds another level of importance to the site. Due to the location of the site on the former Llano Seco Rancho and current Sacramento River NWR (Service lands), access to the site by the general public has been very limited throughout history. This lack of access and the lack of extensive agriculture and other disturbances have preserved the site. The continued protection of the site by the Service by not opening the Riparian Sanctuary to the public has further maintained the integrity of the site. White (2003) suggested that this site is eligible for listing in the National Register in the *Cultural Resource Overview and Management Plan for the Sacramento River Conservation Area*. For purposes of the analysis, the site is assumed to be eligible for listing in the National Register and, therefore, also eligible for listing in the CRHR.

3.7.3 Environmental Consequences

Methodology

The analysis of impacts to cultural resources is based on an assessment of archaeological sensitivity for the project area and the potential for the Riparian Sanctuary project to affect important cultural resources. Archaeological sensitivity (the possibility of unknown cultural resources to exist in an area) is determined by a review of historical maps, historical documents, previous archaeological survey coverage, presence of known cultural resources, and environmental information (e.g., soils, geology, vegetation regime, river conditions). Additionally, the Cultural Resource Overview and Management Plan prepared for the Sacramento River Conservation Area includes the Riparian Sanctuary (White 2003). That plan presents the findings of a previous survey of a portion of the project area and provides management recommendations for the isolated finds and the historic properties at the Riparian Sanctuary. It is important to note that isolated finds are generally not considered eligible for listing in the National Register and are not considered important resources for purposes of this analysis.

The analysis in this document is not intended to provide a determination of effects on historic properties pursuant to Section 106 of the NHPA. The Service will be responsible for conducting a separate analysis of the potential for the Riparian Sanctuary project to have an adverse effect on historic properties.

Significance Thresholds

Impacts to cultural resources would be considered significant if the Riparian Sanctuary project would:

- cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5 of the CEQA Guidelines;
- cause a substantial adverse change in the significance of a unique archaeological resource pursuant to Section 15064.5;
- disturb any human remains, including those interred outside of formal cemeteries;
- reduce the integrity of known or unknown historic properties; or
- conflict with the applicable goals, objectives, or strategies of the Sacramento River NWR relating to cultural resources.

Impacts and Mitigation Measures

Impact CR-1: Construction and implementation of the Riparian Sanctuary project could affect the integrity of site CA-BUT-2658.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in any construction-related impacts on site CA-BUT-2658. The site would continue to be avoided during periodic maintenance activities and agriculture-related activities on the Riparian Sanctuary, and the Riparian Sanctuary would not be open to the public to avoid potential impacts to the site.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of the bank protection measures would not be expected to affect CA-BUT-2658 because the site is not in the areas proposed for disturbance during construction of the spur dikes, including staging and access areas. The additional rock removal on the upstream peninsula under Alternative 4 would also not affect site CA-BUT-2658.

Restoration activities at the Riparian Sanctuary, including site preparation, plantings, installation of the irrigation system, monitoring activities, and herbicide application, could disturb site CA-BUT-2658 and result in a loss of integrity that could make the site ineligible for listing in the National Register or result in an adverse change in the significance of the resource that could make it ineligible for listing in the CRHR. Specifically during the construction phase, vegetation and debris removal during preparation for restoration, disking to smooth the ground surface for irrigation and tractor operations, and planting activities that involve digging to install plants would cause ground disturbance in the location of the site, which could destroy or damage artifacts and human remains that contribute to the site's integrity. Installation of the irrigation system could also disturb the site if any of the irrigation lines cross through the site. The presence of people performing the restoration activities introduces the possibility of casual or active artifact collection activities during construction, which could result in the loss of important components of the site and greatly reduce its integrity. Because of the potential loss of integrity of the site, construction-related impacts on site CA-BUT-2658 would be significant.

In addition to construction-related effects, longer term maintenance and potential effects from planted vegetation could adversely affect site CA-BUT-2658. Maintenance activities such as mowing could also cause further ground disturbance and damage artifacts if implemented in the site boundary. Spraying herbicides on or near CA-BUT-2658 to control invasive plants could affect the ability of the site to yield important information. The artifacts found on the site include items made of stone that may have trace amounts of animal or plant materials, as well as items made of shell and bone. The herbicides may cause alterations in the individual artifacts on the site by reacting with the materials or masking or destroying trace evidence and the artifacts themselves. In addition, application of herbicides on or near the site could affect human remains known to be on the site and result in intangible and unquantifiable effects to Native American values associated with their ancestors.

Several existing dirt roads that may be used for access throughout the construction and implementation phases are located along the boundaries of CA-BUT-2658. Use of these roads may also damage the site due to accidental or intentional off-road driving.

The restoration design includes low-, medium-, and high-density riparian habitat, which includes a mixture of trees, shrubs, and grasses, in the location of the site. Although beneficial for a variety of reasons, the restored habitat would further disturb both buried and surface deposits associated with the site after the initial plantings. The root systems of trees and shrubs can cause significant alterations to the matrix of an archaeological site as they develop and extend farther into the earth.

Disturbances, including but not limited to those listed above, could collectively reduce the integrity of site CA-BUT-2658 and destroy resources associated with the site. Because cultural resources are nonrenewable resources and artifacts and human remains associated with the site could be permanently destroyed or damaged, the integrity and significance of the site could be affected, which would make it ineligible for listing in the National Register or CRHR. These impacts would be significant. Implementation of Mitigation Measures CR-1a and CR-1b would reduce the potential for disturbances to the site and help protect its integrity and significance, which would ensure impacts are less than significant.

Mitigation Measure CR-1a: Provide an archaeological monitor during all activities at the Riparian Sanctuary near site CA-BUT-2658.

The Service will be responsible for retaining a qualified professional archaeologist to monitor all activities near site CA-BUT-2658 during all phases of the project. Daily monitoring of the site will take place during the initial restoration activities, especially during preparation and planting activities. Periodic monitoring will take place during maintenance and monitoring activities, such as mowing and herbicide application, over the long term to ensure resources at the site are adequately protected and no alterations to the site take place. A representative from the Mechoopda Tribe may monitor any activities that could disturb the site, including maintenance activities, in order to help prevent any unnecessary disturbance or impacts to the resources, and a cultural resource member of the tribe will be present during restoration activities in order to collect and re-bury any culturally significant materials that are brought to the surface during this activity. Monitoring will help reduce accidental damage due to project activities and prevent movement of individual artifacts from the site though casual or purposeful collection.

Mitigation Measure CR-1b: Allow only native grass restoration and minimal maintenance within the boundaries of site CA-BUT-2658.

The Service will modify the restoration plans to only include native grass restoration within the boundaries of site CA-BUT-2658 and to restrict maintenance activities at the site. If the effects of native grass seeding and maintenance can be shown to have no effect on site CA-BUT-2658, the restoration plans will allow for limited application of native grasses on the site. In consultation with the Mechoopda Tribe, the following activities will be allowed for site preparation and application of seeds: prescribed burn, herbicide application, and use of a no-till drill for seed application. Other treatment methods, such as hand pulling of invasive species, will be allowed at the discretion of the Service archaeologist. The

following activities will not be allowed: disking for site preparation, mechanical mowing for maintenance over the long term, and other ground disturbance that might damage resources at the site. The site will be fenced or marked off during restoration activities, and an archaeological monitor will be present during seeding and maintenance activities. Any fencing or other boundary markings will be removed at completion of the restoration plantings.

Impact CR-2: Construction activities could disturb or damage previously undiscovered historical or archaeological resources or human remains.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in any construction-related impacts on previously undiscovered cultural resources.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

The project area and vicinity have an extensive cultural history, and many prehistoric and historic cultural resources have been documented at Llano Seco Rancho, along the Sacramento River, and in the project area. Based on the area's history and the extent of cultural resource discoveries, it is possible that previously undiscovered historical and archaeological resources, such as lithic scatters, prehistoric habitations, or historic resources, may be discovered in the project area during construction activities. Buried or previously undiscovered resources, including new features of previously recorded sites, could be encountered during ground-disturbing activities associated with the restoration activities. If resources are discovered, impacts on the resources could be significant if they are determined eligible for listing in the National Register or CRHR and if the impact would affect their eligibility. The Service would implement treatment measures in accordance with the Sacramento River NWR CCP and Cultural Resources Overview and Management Plan to ensure consistency with these plans and minimize adverse impacts. In addition, implementation of Mitigation Measures CR-2a and CR-2b would further ensure that previously undiscovered cultural resources or human remains are not adversely affected by construction and restoration activities, resulting in a less-than-significant impact.

In-water construction associated with the bank protection measures would not likely affect undiscovered inundated cultural resources because inundated resources are not expected in the affected reach of the river based on the frequent and recency of changes to the river alignment. Access and staging for construction and restoration of the Riparian Sanctuary would result in minimal ground disturbance and are not likely to result in effects to undiscovered resources.

Mitigation Measure CR-2a: Implement treatment measures and record previously undiscovered resources.

The construction contractor will comply with relevant measures in the Sacramento River NWR CCP and Cultural Resources Overview and Management Plan if potential cultural resources are discovered during construction or restoration activities. If a discovery is made, the Service archaeologist will be notified immediately, and the resource will be examined by a qualified professional archaeologist to determine if it is a cultural resource. Any cultural resources discovered during construction will be recorded according

to accepted contemporary standards and evaluated to determine their eligibility for listing in the National Register and CRHR. Impacts on the resources, if any, will be evaluated, and specific treatment measures will be identified in consultation with the State Historic Preservation Officer and the Service to determine the appropriate course of action if eligible resources would be adversely affected. Specific measures may be implemented to reduce adverse impacts, such as data recovery and curation of recovered materials or protection in place by avoiding the resource.

Mitigation Measure CR-2b: Implement treatment measures for human remains.

The construction contractor will comply with appropriate measures in the Sacramento River NWR CCP and Cultural Resources Overview and Management Plan if human remains are discovered during construction or restoration activities. Regarding human remains, "any individual who has knowingly and inadvertently discovered human remains on Federal lands must provide immediate telephone notification of the inadvertent discovery, with written confirmation, to the responsible Federal agency official" (White 2003: 125). In addition, all activity in the area must stop. The appropriate steps are laid out in the *Cultural Resource Overview and Management Plan for the Sacramento River Conservation Area* (White 2003: 124-127). If a discovery is made, the Service archaeologist and County coroner will be notified immediately, and the Service will notify local Native American tribes and the Native American Heritage Commission, as appropriate. Discoveries on federal lands are subject to the Native American Graves Protection and Repatriation Act. The ancestry of the remains will be determined if feasible and with minimal disturbance of the remains. All human remains and associated burial artifacts encountered will be protected and assessed in a respectful and dignified manner. If removal is necessary, it will be undertaken with a Native American representative present (if appropriate), and the remains will be treated according to the provisions set forth in Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the California Public Resources Code.

3.8 Transportation and Traffic

This section describes the transportation network in the vicinity of the project area and the traffic conditions on nearby roadways, and it analyzes the effects of the alternatives on the transportation network and traffic. The project area does not support alternative forms of transportation, such as bicycles, bus systems, or pedestrian travel; therefore, this topic is not discussed further.

3.8.1 Regulatory Framework

Sacramento River National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR CCP identifies strategies to maintain access to refuge lands currently open to the public and provide access in the future to lands as they become open to the public (U.S. Fish and Wildlife Service 2005). Lands that remain closed to the public are monitored by law enforcement. The Riparian Sanctuary is currently closed to the public and does not currently offer public use opportunities. The Llano Seco Island 2 is open to the public via boat, but not from the land.

California Vehicle Code

The California Department of Transportation has the discretionary authority to issue special permits for the movement of vehicles and loads exceeding the statutory limitations on the size, weight, and loading contained in Division 15 of the California Vehicle Code. If oversize vehicles or loads need to access the project area using the state highway system, a transportation permit may be required. Activities in the right-of-way of a state highway may also require an encroachment permit pursuant to Section 660 of the Streets and Highways Code.

County General Plans

The Butte and Gleen County General Plans provide goals and policies emphasize the provision of a safe and efficient transportation system (Butte County 2010, Glenn County 1993). The Counties encourage interagency coordination when planning roadways to meet the needs of multiple land uses. Butte County also promotes reductions in vehicle emissions, provides for and encourages the use of alternative forms of transportation, and establishes and manages the road and highway system in the county to serve travelers.

3.8.2 Affected Environment

The transportation network in the vicinity of the project area includes two major routes, Interstate 5 (I-5) approximately 10 miles to the west and State Route (SR) 99 approximately 15 miles to the east, as well as several state highways and local roads in the immediate vicinity (refer to Figure 1-1 in Chapter 1). The project area does not support any housing or a population center and is not served by any alternative forms of transportation or paved roads. Access to the Riparian Sanctuary is via private roads on the Llano Seco Rancho, and access to the Llano Seco Island 2 and rest of the peninsula is via boat from the Sacramento River and private and State lands from SR 45. Public access to both refuge units is restricted on private roads and lands. Access to the PCGID-PID pumping plant and fish screen facility and west bank of the river across from the Riparian Sanctuary is via SR 45 and County Road 44.

I-5 is a major freeway through California and is part of the National Highway System and Interregional Road System. It spans the entire length of California from Tijuana, Mexico, to the Oregon border and continues north to Washington. Within Glenn County, I-5 is a four-lane freeway that operates at a level of service (LOS) of A (free flow) (Fehr and Peers 2009). It carries approximately 26,000 average daily vehicle trips with a substantial amount of truck traffic. Average annual daily traffic (AADT) on I-5 in Glenn County (between the Colusa and Tehama County lines) ranged from 24,000 to 25,000 trips in 2008 (California Department of Transportation 2009a). Truck traffic on I-5 in Glenn County accounted for approximately 30 percent of the AADT in 2008 (California Department of Transportation 2009b).

SR 99 is a major two- to four-lane highway in California that connects the northern part of the state to the southern part of the Central Valley near Bakersfield. It passes through Chico, northeast of the project area, and continues north through Tehama County to I-5. SR 99 between SR 149 and SR 162 operates at LOS D (high-density, but stable flow) with peak-hour traffic volumes of approximately 1,000 vehicle trips (Butte County 2007). SR 99 traffic ranged from 14,900 trips near the Sutter/Butte County line to 24,000 trips at the junction with SR 149 in 2008 (California Department of Transportation 2009a). Approximately 10 percent of the AADT was truck traffic.

SR 45 and 162 are local highways that provide access to the Riparian Sanctuary from I-5 and SR 99 via Butte City. SR 45 is a local two-lane highway that follows the Sacramento River from Hamilton City south through Colusa County. It generally parallels I-5 in Glenn County. Because of its proximity to the Sacramento River and rice crops adjacent to the river, SR 45 occasionally floods and may be closed to traffic during periods of high flow in the river or when nearby crop fields are flooded (Glenn County 1993). Primary traffic along SR 45 is agricultural traffic with a small percentage of truck traffic (less than 20 percent). In Glenn County, SR 45 operates at LOS B and carries approximately 1,700–2,300 average daily vehicle trips (Fehr and Peers 2009).

SR 162 is a rural highway that travels west to east from the mountains in Glenn County through Butte County to the foothills east of Oroville. It serves local and through traffic and provides access to the Oroville Dam recreation area. SR 162 west of SR 99 in Butte County operates at LOS C (stable flow, but beginning to become congested) or better with peak-hour traffic volumes of approximately 150 vehicle trips (Butte County 2007). Traffic estimates on SR 162 between the junction with I-5 in Willows and the junction with SR 45 in Glenn County ranged from 8,800 trips near I-5 to 2,150 trips near SR 45 in 2008 (California Department of Transportation 2009a). SR 162 east of SR 45 to the Glenn/Butte County line received an estimated 1,500–2,700 trips in 2008. Truck traffic on SR 162 ranged from 4 percent near I-5 to 20 percent near SR 45.

3.8.3 Environmental Consequences

Methodology

The analysis of transportation and traffic impacts is based on a review of applicable management plans, traffic data for major highways in the vicinity, and road conditions in and near the project area and an evaluation of the Riparian Sanctuary project's potential to increase traffic or affect circulation on nearby

roads and highways. The analysis includes an estimate of the number of trips expected during construction, but the resulting impacts on the road network and circulation are discussed qualitatively.

Significance Thresholds

Transportation and traffic impacts would be considered significant if the Riparian Sanctuary project would:

- substantially increase traffic on local roads or highways, resulting in unacceptable levels of service or increased congestion;
- substantially increase traffic hazards due to incompatible uses;
- substantially degrade unpaved local or private roads; or
- result in inadequate emergency access.

Impacts and Mitigation Measures

Impact TT-1: Construction activities could increase traffic or affect circulation on nearby roads or highways.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in construction-related traffic or circulation impacts.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction of spur dikes and restoration of the Riparian Sanctuary under Alternative 2 would involve the transportation of materials, equipment, and workers to the project area and would result in increased weekday traffic on local roads and nearby highways during the construction period. Trucks and vehicles would access the project area via SR 162 or SR 45 from Interstate 5 or SR 99 and via local private roads on the east side of the Sacramento River, including on the Llano Seco Rancho. Access to the project area could degrade unpaved roads, particularly on adjacent private lands, and could create unsafe driving conditions.

Equipment needed during construction would be hauled to the project area at the beginning of the construction period, stored on-site in designated staging areas, and removed from the project area when it is no longer needed. Trips associated with equipment transport would be minimal and would not substantially increase traffic on local roads. Material for the spur dikes would be hauled to the project area from nearby commercial sources (within 100 miles), and approximately 600 trips by 20-ton trucks are anticipated to be needed to haul approximately 12,160 tons of material. Up to six trucks would be expected per hour, resulting in about 25–30 trucks per day accessing the project area. For restoration activities, plants would need to be hauled to the site from nursery stock or nearby sites where plants can be removed for transplanting, resulting in less than 10 additional trips after the spur dikes are constructed. Daily traffic from construction workers would also increase traffic on local roads, and the workers are expected to commute from nearby communities. Traffic from material transport and construction workers would substantially increase traffic on local roads, including at Llano Seco Rancho, and on highways near the project area. Traffic on highways would be less noticeable and would blend in with daily traffic from

commuters, travelers, and truck drivers, whereas traffic on the local roads would be noticeable and could disrupt daily activities, particularly on Llano Seco Rancho. Construction traffic would not impede emergency access on nearby lands because no road closures would be needed during the construction period.

Traffic control measures, such as signs and flaggers, would be used as needed on access roads to inform travelers of potential delays and use of large trucks and equipment in the area. The Llano Seco Rancho landowner would be notified prior to access across the private land east of the Riparian Sanctuary, and the necessary authorizations (e.g., access easement agreement, road maintenance agreement) would be obtained to ensure minimal disruptions to the land and daily activities. These agreements would include measures to maintain access roads in good conditions, such as by watering the roads, laying gravel, or grading the roads, and safe roadway conditions would be maintained throughout the construction phase. The number of trips on private roads during the construction period would be substantial compared with current traffic, which is limited to agricultural operations traffic, but implementation of and compliance with agreements with the landowner would minimize adverse effects, resulting in a less-than-significant impact.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of traditional riprap and restoration of the Riparian Sanctuary under Alternative 3 would result in similar traffic conditions as described for Alternative 2. Construction activities would require about the same number of weekday trips over a similar construction period, but about four to six times as many haul trips would be expected for transporting materials for the riprap (approximately 2,300 trips for 46,000 tons of material without a low berm; approximately 3,460 trips for 69,150 tons of material with a low berm). Access to the project area would be the same via local roads, highways, and the Llano Seco Rancho. Traffic control measures, proper notification, and agreements with the landowner would help minimize adverse effects from increased construction traffic. Construction-related traffic impacts would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap, removal of upstream rock, and restoration of the Riparian Sanctuary under Alternative 4 would result in similar traffic conditions as described for Alternatives 2 and 3. Construction activities would require about the same number of weekday trips over a similar construction period as for Alternative 3, but access would be needed to both the Riparian Sanctuary and the upstream peninsula. Construction traffic would need to use SR 45 and other local roads west of the river to access the peninsula, and an existing access road from SR 45 onto the peninsula would need to be improved, which could require an encroachment permit from the California Department of Transportation. The total number of haul trips for materials would be similar to Alternative 3 (worst-case), but it may be reduced by about 1,225 long-distance trips if removed upstream rock can be used downstream (approximately 24,500 tons expected to be available). Local trips from the upstream peninsula would be necessary via SR 45, local roads, and private roads on Llano Seco Rancho, so trips on these roads would be about the same as described for Alternative 3. Traffic control measures, proper notification, and agreements with the landowner would help minimize adverse effects from increased construction traffic, and terms of an

encroachment permit, if required, would be adhered to. Construction-related traffic impacts would, therefore, be less than significant.

Impact TT-2: Implementation of the Riparian Sanctuary project could affect long-term traffic or circulation on nearby roads or highways.

Alternative 1 – No-Action Alternative

None of the bank protection measures or restoration activities would be implemented under the No-Action Alternative. Traffic conditions and access to the project area would be similar to current conditions. No increases in traffic on local roads or highways would be experienced over the long term.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Maintenance of the bank protection measures over the long term would require periodic trips to the project area to check their condition and determine if any actions are needed to improve them (e.g., adding more riprap). Maintenance trips would be expected to result in approximately 150 trips per year to the project area, inclusive of potential trips for construction equipment, workers, and trucks to haul materials should maintenance actions be necessary. Access for maintenance may be via private lands on Llano Seco Rancho, under an agreement with the landowner, or by boat along the Sacramento River. The new road established at the Riparian Sanctuary would provide long-term access through the refuge unit from the private lands to the bank of the river. It would also serve as the main access route for maintenance of the riparian habitat during the first 3 years and for periodic assessments of the condition of the riparian habitat; approximately 15 trips per year are anticipated for monitoring. Increased traffic after the initial construction period would be most frequent during the first 3 years and would lessen after that to periodic maintenance trips with occasional peaks if actions are needed. Similar measures identified for the construction period would be implemented during maintenance activities to minimize adverse traffic-related effects. Long-term traffic impacts would be less than significant.

3.9 Air Quality

This section describes air quality in Butte and Glenn counties, including greenhouse gas (GHG) emissions, and analyzes the effects of the alternatives on air quality.

3.9.1 Regulatory Framework

Clean Air Act and Amendments

The federal Clean Air Act (CAA), originally passed in 1970 and amended twice thereafter, established the framework for modern air pollution control. The act mandates the U.S. Environmental Protection Agency (EPA) to develop rules and regulations to preserve and improve air quality, and it delegates specific responsibilities to state and local agencies. Specifically, the CAA directs EPA to establish National Ambient Air Quality Standards (NAAQS) for the following "criteria pollutants": ozone, carbon monoxide (CO), nitrogen dioxide (NO2), particulate matter (PM2.5 and PM10), and sulfur dioxide (SO2). The NAAQS 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. Table 3.9-1 identifies the NAAQS for the six criteria pollutants.

Table 3.9-1. National and State Criteria Pollutant Ambient Air Quality Standards

Pollutant	Averaging Time	Federal Standard	State Standard
Ozone	1-hour 8-hour	n/a 0.075 ppm	0.09 ppm 0.07 ppm
CO	8-hour 1-hour	9 ppm 35 ppm	9 ppm 20 ppm
NO2	Annual arithmetic mean 1-hour	0.053 ppm 0.1 ppm	0.03 ppm 0.18 ppm
SO2	24-hour 1-hour	n/a 0.075 ppm	0.04 ppm 0.25 ppm
Fine particulate matter (PM2.5)	24-hour Annual arithmetic mean	35 $\mu g/m^3$ 15 $\mu g/m^3$	35 $\mu g/m^3$ 12 $\mu g/m^3$
Respirable particulate matter (PM10)	24-hour Annual arithmetic mean	150 $\mu g/m^3$ n/a	50 $\mu g/m^3$ 20 $\mu g/m^3$
Lead	30-day average Calendar quarter	— 1.5 $\mu g/m^3$	1.5 $\mu g/m^3$ —

Notes: ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

Source: California Air Resources Board 2011a

The CAA requires states to submit a state implementation plan (SIP) for areas designated nonattainment for any NAAQS. SIPs require approval by EPA prior to being adopted by the State. SIPs must demonstrate how the NAAQS will be achieved and may contain narrative objectives, rules, and future commitments associated with attaining the NAAQS. California has SIPs for ozone, PM10, and PM2.5 for the entire state and several regional plans for counties or air districts that have been designated as nonattainment areas (i.e., areas that fail to attain the NAAQS or CAAQS) for the criteria pollutants.

Federal Conformity Requirements

The purpose of EPA's General Conformity Rule is to ensure that federal projects conform to applicable SIPs so that they do not interfere with strategies employed to attain the NAAQS. The rule applies to federal projects in areas designated as nonattainment areas for any of the six criteria pollutants and in some areas designated as maintenance areas. The rule applies to all federal projects except the following:

- programs specifically included in a transportation plan or program that is found to conform under the federal Transportation Conformity Rule,
- projects with associated emissions below specified de minimis threshold levels (i.e., levels too small to be concerned with), and
- certain other projects that are exempt or presumed to conform.

If a project would result in total direct and indirect emissions in excess of the *de minimis* emission rates, the emissions must be demonstrated to conform to the applicable SIP for each affected pollutant. If emissions would not exceed the *de minimis* levels and are not regionally significant, then the project is presumed to conform and no further analysis or determination is required. The Riparian Sanctuary project is assumed to conform because it is not expected to result in annual emissions above the *de minimis* rates of pollutants for which Butte or Glenn County is in nonattainment status (described in Section 3.9.2, Affected Environment).

California Clean Air Act

The California Clean Air Act of 1988 was adopted to attain California Ambient Air Quality Standards (CAAQS) in a timely manner for the protection of public health. The California Air Resources Board (ARB) has the primary regulatory authority and responsibility for implementing the act. ARB was established prior to the California Clean Air Act to establish state air quality standards (see Table 3.9-1), maintain oversight authority for air quality planning, develop programs for reducing emissions from motor vehicles, develop air emission inventories, collect air quality and meteorological data, and approve SIPs.

The California Clean Air Act requires designation of "attainment" and "nonattainment" areas with respect to CAAQS. Under the act, air quality management districts that are in nonattainment for CO, SO2, NO2, or ozone are required to prepare and adopt air quality attainment plans. Attainment plans are designed to reduce districtwide pollutant levels and/or reduce the pollutant precursor(s) by 5 percent annually. Air quality management districts that are in nonattainment for state PM standards are not required to prepare attainment plans for this criteria pollutant (California Health and Safety Code Sections 40911 and 40926).

California Environmental Quality Act

As of August 2007, CEQA lead agencies are required to analyze the potential for a proposed project to produce GHG emissions, which consist primarily of carbon dioxide (CO2), nitrous oxide (N2O), and methane (CH4) (PRC Section 21083.05). This legislation also required the Governor's Office of Planning and Research to prepare and submit to the Resources Agency proposed amendments to the CEQA Guidelines to provide direction on analysis of GHGs. Amendments to the CEQA Guidelines became effective on March 18, 2010, to provide guidance to public agencies regarding the analysis and mitigation of GHG emissions and the effects of GHG emissions in draft CEQA documents.

The following GHGs are now regulated by the state: CO2, CH4, N2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (Health and Safety Code 38505(g)). ARB has also adopted vehicle emission standards to reduce GHGs that result from gas combustions (e.g., CO2), but EPA must also approve the standards before they become effective. Implementation of these new standards is set to become effective for vehicles, allowing stricter air quality standards than the CAA requires. In addition to regulating GHGs via vehicle emissions, the state's Climate Action Team, headed by the California Environmental Protection Agency, set statewide targets for reductions in CO2 emissions. By 2020, the state aims to reduce current CO2 emissions by 59 million tons.

California Global Warming Solutions Act of 2006

The California Global Warming Solutions Act (Assembly Bill 32) was enacted in 2006 to regulate emissions of GHGs that contribute to global climate change. ARB is charged with monitoring and regulating sources of GHG that cause global warming. The act directs ARB to consult with the California Public Utilities Commission in the development of emissions reduction measures, including limits on emissions of GHGs applied to electricity and natural gas providers that are regulated by the California Public Utilities Commission. Consultation between these agencies is meant to prevent duplicative or inconsistent GHG regulatory requirements. A companion bill was enacted by the California legislature in 2007 to provide CEQA analysis of GHG emissions and to ensure that projects subject to CEQA review would comply with the California Global Warming Solutions Act (Senate Bill 92 incorporated into Section 38505(g) of the Health and Safety Code).

Northern Sacramento Valley Area Air Quality Attainment Plan

Air districts in the northern Sacramento Valley prepared the *Northern Sacramento Valley Planning Area Air Quality Attainment Plan* in 1994 and have completed updates every 3 years since, with 2009 being the most recent update (Sacramento Valley Air Quality Engineering and Enforcement Professionals 2009). Their goal was to prepare a uniform air quality attainment plan that identifies programs for achieving and maintaining healthful air quality throughout the air basin and presents the latest monitoring data and issues with air quality in the valley. The plan discusses compliance with the 1994 SIP for ozone and addresses basic requirements identified by the State to achieve healthful air quality.

Local Air District Rules and Regulations

At the local level, air quality is managed through air quality management districts, which consist of one or more counties within a particular air basin. Like ARB, local air quality management districts were established before the 1988 California Clean Air Act was enacted. The original responsibilities of the

local air districts consisted primarily of implementing nondiscretionary duties, including overseeing stationary source emissions, approving air quality permits, maintaining emission inventories, maintaining air quality monitoring stations, and overseeing agricultural burn permits. Other duties included reviewing the air quality sections of CEQA documents.

In 1988, the California Clean Air Act substantially added to the authority and responsibilities of local air quality management districts. The act designated local air districts as the lead agencies for air quality planning, required air districts to prepare air quality plans, and granted authority to regulate indirect sources of air pollution and implement transportation control measures. Additionally, the authority to prepare SIPs, originally delegated to ARB by EPA, was delegated to the local air quality management districts.

The Butte County Air Quality Management District and Glenn County Air Pollution Control District have established local rules and regulations that require air quality permits for various activities in each county and that provide a means to manage and regulate air emissions in the counties. Permits that may apply to the Riparian Sanctuary project are Authority to Construct for certain activities that may produce air contaminants and Permit to Operate for use of equipment that may emit pollutants. Butte County also developed an Air Quality Handbook for providing direction on air quality analyses in CEQA documents (Butte County Air Quality Management District 2008). The handbook identifies measures that may be applicable to projects to reduce emissions and pollutants during construction and operation.

3.9.2 Affected Environment

Ambient Air Quality

The project area is in the northern part of the Sacramento Valley Air Basin. The air basin encompasses the northern portion of the Central Valley around the Sacramento metropolitan area and is bounded by the Coast Ranges to the west, the Cascade Range to the north, and the Sierra Nevada to the east. These mountain ranges provide substantial physical barriers to wind and dispersion of locally generated air pollution. The predominant wind pattern in the air basin is from the Pacific Ocean into the Sacramento Valley through the Carquinez Strait, southwest of Sacramento, which brings cool winds into the valley during most of the year. During winter months, northerly winds (i.e., winds from the north) are more common. The seasonal wind patterns influence the dispersion of pollutants, and southerly winds tend to prevent air pollutants from being transported north out of the Sacramento Valley.

Air quality in the project area and vicinity is monitored and regulated by the Butte County Air Quality Management District and Glenn County Air Pollution Control District. Each district maintains air quality monitoring stations to monitor concentrations of air pollutants and report air quality conditions. The nearest monitoring stations to the project area are the Gridley station on Cowee Avenue in Butte County and the Willows station at 720 N. Colusa Street in Glenn County. The Gridley station currently only monitors PM2.5, so data from the Chico station on Manzanita Avenue were compiled to provide baseline conditions for other criteria pollutants in Butte County. The Chico and Willows stations monitor ozone, PM10, PM2.5, and other pollutants. The Chico station monitors carbon monoxide, but the Willows station does not. Air quality at the Chico station may not accurately represent air quality in the project

area because of influences from urban activities in Chico, but it demonstrates the quality of air in the region. Table 3.9-2 summarizes air quality conditions for criteria pollutants at the monitoring stations in Butte and Glenn counties.

Table 3.9-2. Summary Statistics for Air Quality Data in Butte and Glenn Counties

		No. of Days Exceeding Federal Standards		No. of Days Exceeding State Standards	
Year	**Pollutant (averaging time)***	**Butte****	**Glenn****	**Butte**	**Glenn**
2010	Ozone (1 hour)	n/a	n/a	0	0
	Ozone (8 hour)	0	0	1	0
	CO (8 hour)	0	ND	0	ND
	PM_{10} (daily)	0	0	0	0
2009	Ozone (1 hour)	n/a	n/a	0	0
	Ozone (8 hour)	0	0	2	4
	CO (8 hour)	0	ND	0	ND
	PM_{10} (daily)	0	0	0	12
2008	Ozone (1 hour)	n/a	n/a	0	0
	Ozone (8 hour)	0	2	14	2
	CO (8 hour)	0	ND	0	ND
	PM_{10} (daily)	0	0	37	4

*See Table 3.9-1 for standards.

**Butte County data reported from the Chico Manzanita Avenue station. Glenn County data reported from the Willows station at 720 N. Colusa Street.

Notes: n/a = not applicable (no national standard for 1-hour ozone). ND = no data available.

Source: California Air Resources Board 2011b

Butte County is in attainment status for national and state standards for CO, NO2, and SO2 and for the national standard for PM10 (California Air Resources Board 2010). The county is in nonattainment status for national and state standards for ozone (8-hour) and PM2.5, state standard for ozone (1-hour), and state standard for PM10. Glenn County is in attainment status for national and state standards for NO2 and SO2 and national standards for ozone (8-hour), PM10, PM2.5, and CO. The county is in nonattainment status for state standards for ozone (8-hour), ozone (1-hour), and PM10. Glenn County is unclassified for state standards for PM2.5 and CO.

Air Pollutants and Sources

Ozone is an invisible pollutant formed when sunlight triggers chemical reactions between nitrogen oxides and hydrocarbons. The primary contributors to the formation of ozone are vehicle emissions, industrial plant emissions, fossil fuel combustion, and evaporation of paints and solvents. Vehicle emissions are the primary contributors to ozone formation in the vicinity of the project area.

Particulate matter consists of fine mineral, metal, soot, smoke, and dust particles suspended in the air. For health reasons, PM10 is monitored throughout the state. The following pollutant sources contribute to PM10: wood stoves, wind-blown dust from dirt roads and agricultural activities, open burning from backyard burn piles, and wildland fires. Some of these sources contribute to increases in local PM10 concentrations, while others, such as vehicle traffic and periodic wildland fires, affect regional PM10 concentrations. Dust and vehicle emissions are the primary contributors of PM10 in the vicinity of the project area.

CO results from the incomplete combustion of carbon-containing fuels, such as gasoline or wood, and is emitted by a wide variety of combustion sources. It is a public health concern because it combines readily with hemoglobin and thus reduces the amount of oxygen transported in the bloodstream. CO has little effect on plants and materials, but it can significantly affect human health. Effects on humans range from slight headaches to nausea to death. High CO levels are of greatest concern during the fall and winter months, when periods of light winds combine with the formation of ground-level temperature inversions from evening through early morning. These conditions trap pollutants near the ground, reducing the dispersion of vehicle emissions. Moreover, motor vehicles produce more CO emissions at lower air temperatures.

The accumulation of GHG emissions in the atmosphere has been attributed to global warming because GHGs tend to trap heat in the atmosphere, which in turn heats the surface of the Earth. The combustion of fossil fuels (i.e., fuels containing carbon, such as wood, coal, gasoline, and diesel) is the primary human activity that contributes GHGs (California Office of Planning and Research 2008). The most common GHG that results from human activity is CO2, followed by CH4 and NO2. According to the California Environmental Protection Agency Climate Action Team, transportation accounts for 38 percent of human-caused GHGs in California, industrial activities account for 20 percent, electricity accounts for 23 percent, commercial and residential activities account for 9 percent, agriculture and forestry practice contribute 6 percent, and the remainder comes from other miscellaneous sources (California Environmental Protection Agency 2006). In 2004, fossil fuel combustion accounted for 98 percent of the CO2 emissions in California and measured 398 million metric tons. ARB reports that California is the 15th largest source of GHG emissions in the world, exceeding most nations (California Air Resources Board 2008). State efforts to minimize GHG emissions have not yet translated into monitoring for these gases in Butte and Glenn counties.

Sensitive Receptors

A sensitive receptor is a location where human populations, particularly children, seniors, and sick individuals, are present and where there is a reasonable expectation of continuous human exposure to pollutants. The project area is not near a heavily populated area, although rural residents and

recreationists in the vicinity are considered sensitive receptors. The nearest residences are on the west side of the Sacramento River, more than 700 feet from the edge of the project area. Several residences are scattered along the local highways and county and private roads that provide access to the project area; many of these homes are associated with the agricultural uses in the vicinity.

3.9.3 Environmental Consequences

Methodology

The analysis of air quality impacts is based on a review of applicable management plans, air quality data for Butte and Glenn counties, and information on sources of pollutants and land uses in and near the project area and an evaluation of the Riparian Sanctuary project's potential to result in air emissions that could affect local or regional air quality. Impacts are discussed qualitatively and are considered in the context of the current attainment status for the region and potential for emissions generated by the project to exceed air quality standards.

Significance Thresholds

Air quality impacts would be considered significant if the Riparian Sanctuary project would:

- violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors);
- expose sensitive receptors to substantial pollutant concentrations;
- create objectionable odors affecting a substantial number of people;
- generate GHG emissions, either directly or indirectly, that could have a substantial impact on the environment; or
- conflict with or obstruct implementation of an applicable air quality plan or plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Impacts and Mitigation Measures

Impact AQ-1: Construction activities could generate short-term vehicle or equipment emissions or air pollutants that could affect local or regional air quality.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in construction-related air quality impacts.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Construction of spur dikes and restoration of the Riparian Sanctuary under Alternative 2 would involve activities that generate dust, vehicle and equipment emissions, and other air pollutants that would contribute to existing violations of standards for ozone and particulate matter. Truck traffic to haul materials and equipment and worker traffic would generate CO and other pollutants from exhaust that

would contribute to ozone and GHG emissions in the region. Construction activities in the project area would also result in exhaust and other emissions, as well as fugitive dust from ground-disturbing activities and movement of rock and other materials for the spur dikes. Access on dirt roads on the Llano Seco Rancho could also generate dust, but compliance with agreements with the landowner would ensure dust is minimal, specifically by maintaining low vehicle speeds through the private property and watering the roads as needed. Odors from emissions generated during construction would not likely be noticeable to nearby sensitive receptors because of the distance between the project area and residences or recreational areas (typically more than 700 feet).

Dust and emissions in the project area could disperse to nearby residences and recreation areas, but few people would be affected. The air quality impacts would also be temporary and limited to the construction period, although construction traffic could contribute substantially to CO and ozone emissions in the region based on the estimated number of trips (see Section 3.8, Transportation and Traffic). Fugitive dust would be more localized and would have a less substantial effect on regional air quality. Because of the existing nonattainment status, however, the increase in particulate matter and ozone emissions, as well as potential GHG emissions, during construction would be considered significant.

Implementation of Mitigation Measure AQ-1 would reduce the project's contribution to local and regional air quality impacts and minimize fugitive dust and emissions during construction, effectively reducing impacts to a less-than-significant level. The mitigation measure would also ensure the Riparian Sanctuary project is consistent with the Northern Sacramento Valley Area Air Quality Attainment Plan.

Mitigation Measure AQ-1: Implement a fugitive dust and emissions reduction plan.

The construction contractor will be responsible for preparing and implementing a fugitive dust and emissions reduction plan to limit fugitive dust, particulate matter, and GHG emissions. The plan will identify measures to be implemented during construction activities and will be reviewed and approved by the local air districts, the Service, and PCGID-PID. The Service and PCGID-PID will be responsible for ensuring the contractor implements the measures during construction activities. Applicable measures will also be implemented during longer term maintenance activities, as appropriate. Measures identified in the plan may include, but are not limited to, the following from the Butte County Air Quality Handbook (Butte County Air Quality Management District 2008):

- A water truck will be on-site at all times. Water will be applied to disturbed areas a minimum of two times per day or more as necessary, and all visibly dry disturbed areas and unpaved roads will be watered to minimize dust emission.
- Soil pile surfaces will be moistened if dust is being emitted from the pile(s). Adequately secured tarps, plastic, or other material may be required to further reduce dust emissions.
- Water will be applied by means of truck(s), hoses, and/or sprinklers as needed prior to any land clearing or earth movement to minimize dust emission.
- Unpaved roads may be graveled to reduce dust emissions at the discretion of the Service.
- Haul roads will be sprayed down at the end of the work shift to form a thin crust. This application of water will be in addition to the minimum rate of application.

- Haul vehicles transporting soil into or out of the property will be covered pursuant to California Vehicle Code Section 23114.
- On-site vehicles will be limited to a speed that minimizes dust emissions on unpaved roads.
- Vehicles entering or exiting the construction area will travel at a speed that minimizes dust emissions.
- Construction workers will park in designated parking area(s) to help reduce dust emissions.
- A publicly visible sign with the telephone number and person to contact regarding dust complaints will be posted in a publicly accessible area near the project area (such as along SR 45). This person will respond to complaints and take corrective action within 24 hours. The telephone number of the Butte and Glenn County air districts will also be visible.
- Unnecessary vehicle idling will be limited to 5 minutes.
- All construction equipment will be maintained in proper tune according to manufacturer's specifications.
- The use of diesel construction equipment meeting ARB's 1996 or newer certification standard for off-road heavy-duty diesel engines will be maximized to the extent feasible. Equipment may be electrified if feasible, and gasoline-powered equipment should be substituted for diesel-powered equipment where feasible, unless alternatively fueled construction equipment can be used.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of traditional riprap and restoration of the Riparian Sanctuary under Alternative 3 would involve similar activities as Alternative 2 and would result in the same types of air quality impacts. Dust impacts would be primarily localized, but exhaust-related emissions would be more regional and would affect air quality in a larger area because of the need to haul materials and rock from sources up to 100 miles away. Few sensitive receptors would be affected by emissions and dust. Construction-related impacts on air quality would be temporary, but would contribute to the existing violations of fugitive dust and ozone in the area, as well as contributing to GHG emissions, resulting in a significant impact. Implementation of Mitigation Measure AQ-1, described for Alternative 2, would reduce air quality impacts during construction to a less-than-significant level.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap, removal of upstream rock, and restoration of the Riparian Sanctuary under Alternative 4 would involve similar activities as Alternatives 2 and 3 and would result in the same types of air quality impacts. A slight increase in pollutants would be expected for Alternative 4 because of the additional activity of removing upstream rock, but the re-use of the removed rock as part of the downstream riprap would reduce the number of long-distance haul trips, if authorized. Dust impacts would be primarily localized, but exhaust-related emissions would be more regional and would affect air quality in a larger area similar to Alternative 3. Few sensitive receptors would be affected by emissions and dust. Construction-related impacts on air quality would be temporary, but would contribute to the existing violations of fugitive dust and ozone in the area, as well as contribute to GHG emissions, resulting in a significant impact. Implementation of Mitigation Measure AQ-1, described for Alternative 2, would reduce air quality impacts during construction to a less-than-significant level.

Impact AQ-2: Implementation of the Riparian Sanctuary project could affect air quality over the long term.

Alternative 1 – No-Action Alternative

None of the bank protection measures or restoration activities would be implemented under the No-Action Alternative. Minimal ongoing maintenance activities would take place, resulting in periodic emissions or dust from vehicles and equipment accessing or working in the project area. These air quality impacts are part of the current conditions, and an increase in emissions or dust would not be anticipated.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Routine maintenance and inspections of the bank protection measures and restored riparian habitat would involve periodic trips to the project area and potential maintenance activities for the bank protection measures, which would result in periodic dust and emissions over the long term. The types of air quality impacts would be similar to the construction-related impacts, but they would be on a smaller scale and infrequent. Air quality impacts would be slightly higher than current conditions, but they would not be considered substantial given the nature and timing of the maintenance activities and inspections. If maintenance activities are necessary, applicable components of Mitigation Measure AQ-1 would apply and would help reduce these air quality impacts.

The restored riparian habitat would help offset temporary construction emissions as well as ongoing long-term emissions by increasing tree cover at the Riparian Sanctuary. Each planted tree and the native grasses would help absorb several tons of CO2 in its lifetime to offset the emissions generated by the project. With an estimated 55,500 woody plants being planted at the Riparian Sanctuary, the reduction in CO2 emissions over the long term would improve air quality in and around the project area and offset the project's contribution to GHG effects. As a result, long-term air quality impacts from implementation of Alternatives 2, 3, or 4 would be less than significant.

3.10 Noise

This section describes the noise environment and sensitive receptors in the vicinity of the project area and analyzes the effects of the alternatives on the noise environment. The project area is not near an airport or private airstrip; therefore, these topics are not discussed further.

3.10.1 Regulatory Framework

Noise Control Act of 1972

The Noise Control Act of 1972 (PL 92-574) requires the federal government to set and enforce uniform noise standards for aircraft, vehicles, workplace activities, portable air compressors, federal highway projects, and federal housing projects. The Noise Control Act also requires federal agencies to comply with all federal, state, and local noise requirements. Most federal noise standards focus on preventing hearing loss by limiting exposure to sounds of 90 A-weighted decibels (dBA) and higher.

California Noise Control Act

The California Noise Control Act, Division 28 of the California Health and Safety Code, is based on the understanding that all Californians are entitled to a peaceful and quiet environment, free from the intrusion of noise that may be hazardous to their health or welfare. The act established the Office of Noise Control to develop criteria and otherwise aid local agencies in preparing noise elements for their general plans.

Butte County Noise Standards

The Butte County General Plan identifies acceptable noise exposure levels for transportation and non-transportation sources (Butte County 2007). Table 3.10-1 identifies the acceptable non-transportation exposure levels for urban and non-urban areas. Urban areas are considered built-up and tend to be more likely to contain sensitive receptors in denser populations, but have higher existing ambient noise levels. Non-urban areas are agricultural, timber mountain, resource conservation, foothill residential, and rural residential land uses that have smaller populations and fewer sensitive receptors, but have lower existing ambient noise levels. Butte County can impose noise level standards up to 5 decibels less than those specified in the table based on the presence of existing low ambient noise levels in the vicinity of a project area. In rural areas, the exterior noise level standard is applied at a point 100 feet away from a residence.

Table 3.10-1. Maximum Allowable Noise Exposure to Non-Transportation Sources

	Daytime 7 a.m. – 7 p.m.		Evening 7 p.m. – 10 p.m.		Night 10 p.m. – 7 a.m.	
Noise Level (dB)	***Urban***	***Non-Urban***	***Urban***	***Non-Urban***	***Urban***	***Non-Urban***
Hourly Leq	55	50	50	45	45	40
Maximum Level	70	60	60	55	55	50

Note: Equivalent Continuous Sound Pressure Level, or Leq, is the constant noise level that would result in the same total sound energy being produced over a given period (hourly average).

Source: Butte County 2007

Glenn County Noise Control Ordinance

Glenn County has a Noise Control Ordinance (Section 15.560.100 of the County Code) that identifies acceptable noise levels for residential-, commercial-, and industrial-zoned properties and specifies additional requirements for certain sensitive uses (e.g., schools, hospitals) within those zoning districts. Table 3.10-2 identifies the acceptable noise levels for those land uses. The Noise Control Ordinance also identifies exceptions to the local noise standards provided standard, reasonable practices are being followed. These exceptions include construction activities during normal operating periods (i.e., between 7 a.m. and 7 p.m.).

Table 3.10-2. Maximum One-hour Equivalent Sound Pressure Levels

Time of Day	Residential Areas	Commercial Areas	Industrial Areas
7:00 a.m. - 10:00 p.m.	55	60	65
10:00 p.m. - 7:00 a.m.	45	55	60

Note: The residential category also includes all resource zoning districts. Measurements are in A-weighted decibels (dBA).

Source: Glenn County Code Section 15.560.100

3.10.2 Affected Environment

Existing Noise Levels

Noise is generally defined as excessive and unwanted sound emanating from noise-producing objects. Noise levels are commonly measured with a dBA scale. This scale is based on the range of sound audible to the human ear, where 10 dBA is at the low threshold of hearing and 120–140 dBA is the threshold of pain. Human responses to noise are subjective and can vary, but constant exposure to high levels of noise (generally over 90 dBA) can cause hearing damage or loss and have other health effects. Intensity, duration, frequency, time pattern of noise, and existing background noises are some factors that can influence individual responses to noise. Table 3.10-3 identifies noise levels for various common sources and activities.

Table 3.10-3. Noise Levels and Associated Effects for a Variety of Noise Types

Noise Source at a Given Distance	A-Weighted Sound Level in Decibels	Subjective Impression
Jet takeoff (50 feet)	140	Pain threshold
Civil defense siren (100 feet)	130	
Rock concert near stage	120	Uncomfortably loud
Train warning horn (90 feet)	110	
Heavy truck or motorcycle (25 feet)	90	Very loud

Table 3.10-3. Noise Levels and Associated Effects for a Variety of Noise Types

Noise Source at a Given Distance	A-Weighted Sound Level in Decibels	Subjective Impression
Garbage disposal (2 feet)	80	Moderately loud
Passenger car at 65 mph (25 feet)	70	
Vacuum cleaner (100 feet)	60	
Light traffic (100 feet)	50	Quiet
Bird calls	40	
Soft whisper (15 feet)	30	Very quiet
High-quality recording studio	20	
Acoustic test chamber	10	Just audible
	0	Threshold of hearing

Sources: Beranek 1988 and U.S. Environmental Protection Agency 1971

Major transportation-related noise sources in Butte County include roads, railroads, and airport operations (Butte County 2007). Major sources of stationary noise in Butte County include industrial, commercial, and public facilities, such as stationary noise generators, landfill operations, mining operations, and parks. Although areas adjacent to major noise sources, such as highways and railroads, are considered to be fairly noisy, most of Butte County can be subjectively characterized as fairly quiet to moderately noisy. Most noise-sensitive areas in Glenn County are relatively quiet, with typical noise levels ranging from 48 to 60 dB Ldn (day-night average noise level) (Glenn County 1993). Noise sources in Glenn County include traffic on local roadways, neighborhood activities, some industrial operations, and agricultural operations, which can take place during the late evening and early morning hours. Sensitive receptors tend to be more sensitive to noise during the evening and nighttime hours, particularly during sleep or resting periods.

Few major noise sources exist in the vicinity of the project area. Most of the land uses are agricultural or rural residential with some recreational uses. No airports, industrial facilities, or urban areas are present near the project area. The primary sources of noise are vehicle noise along nearby roads, recreational activities, operation of the PCGID-PID pumping plant facility, and agricultural operations. Noise measurements were recorded in September 2000 at the M&T Chico Ranch about 5 miles north of the project area (Butte County 2007); noise levels at that ranch are likely very similar to noise levels in the project area because of the similar land uses and activities (primarily agricultural). Daytime noise levels ranged from 37.6 to 71.7 dB Leq with a high (Lmax) of 67.5 dB. Average 24-hour noise levels (Leq) ranged from 41.4 to 69.7 dB. Leq (energy-equivalent noise level) is an hourly average, while Ldn is a 24-hour weighted average (with evening and nighttime noise weighted more heavily than daytime noise).

Sensitive Receptors

A sensitive receptor is a specific location, such as a school, residence, commercial area, or park, where people could be exposed to unacceptable levels of noise that could affect health or safety. The project area is not near a heavily populated area, although rural residents and recreationists in the vicinity are considered sensitive receptors. The nearest residences are on the west side of the Sacramento River, more than 700 feet from the edge of the project area. Several residences are scattered along the local highways and county and private roads that provide access to the project area; many of these homes are associated with the agricultural uses in the vicinity. Noise tolerance levels for these groups are subjective, varying widely between individuals. Wildlife also uses the habitats in the project area and would be considered a sensitive receptor to noise.

3.10.3 Environmental Consequences

Methodology

The analysis of noise impacts is based on a review of applicable management plans, ambient noise levels in Butte and Glenn counties, and information on sources of noise and land uses in and near the project area and an evaluation of the Riparian Sanctuary project's potential to increase noise levels to a degree that could affect nearby sensitive receptors. Impacts are discussed qualitatively with presentation of typical noise levels for equipment that may be used during construction activities.

Significance Thresholds

Noise impacts would be considered significant if the Riparian Sanctuary project would:

- expose persons to or generate noise levels in excess of standards established by Butte or Glenn County or the Service;
- expose persons to or generate excessive groundborne vibration or groundborne noise levels;
- result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project; or
- result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

Impacts and Mitigation Measures

Impact NO-1: Construction activities could generate noise above acceptable standards and expose sensitive receptors to substantial noise levels.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in construction-related noise impacts.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of the bank protection measures and restoration of the Riparian Sanctuary under Alternatives 2 and 3 would involve activities that generate noise from construction equipment, vehicles,

and the placement of rock along the river. Equipment used for spur dike construction and vegetation removal would include excavator(s), loader(s), a crane, dump trucks, crawler tractor(s), pickup trucks, water truck(s), generator(s), air compressor(s), winch(es), and chainsaws. Typical noise levels for these types of equipment are identified in Table 3.10-4. Rock placement may generate the highest noise level, possibly reaching 100 dB at 50 feet. Truck and other construction-related traffic on roads in the vicinity would also generate noise, which in some areas may be substantially higher than current noise levels (e.g., on the Llano Seco Rancho). Construction noise would be short term, limited to the construction period, and would be limited to daytime hours during weekdays.

Table 3.10-4. Typical Construction-Related Noise Levels

Construction Equipment	Typical Noise Level (dB) 50 Feet from Source
Crane	82
Excavator	82
Dump truck	80
Front end loader	80
Crawler tractor	80
Pickup truck	65
Generator	75
Air compressor	75
Winch	75
Chainsaw	75

Source: Federal Transit Administration 1995, Sincero and Sincero 1996

Current noise levels are relatively low in the project area, and noise standards established by Butte and Glenn counties identify maximum noise levels in non-urban or residential areas to be 55–60 dBA. Most of the construction activities would generate noise above these standards, resulting in a temporary increase in ambient noise levels in the project area; however, the activities would be more than 50 feet from the nearest residence or sensitive receptor. Construction noise would attenuate (reduce) by the time it reaches nearby residential and recreational receptors, which are more than 700 feet from the project boundary. Recreationists on the river may notice noise from construction activities, but signs along the reach upstream and downstream of the Riparian Sanctuary would inform boaters of the activities and discourage them from accessing the affected reach to avoid impacts. Existing vegetation along the west side of the Riparian Sanctuary would also help mask noise levels.

Haul truck traffic would also result in noise along access routes, but truck noise would blend in with existing noise along major highways. Receptors along the highways would be exposed to noise from project-related truck traffic during normal working hours (7 a.m.–7 p.m.), and the noise would be brief, as the trucks pass by on the highways. The increase in truck noise associated with this alternative would not substantially affect receptors along the access routes.

Some groundborne vibrations may result from construction activities as heavy equipment is used in the project area and large rocks are placed along the river. These vibrations would be distant from nearby sensitive receptors and would not result in adverse effects.

Although construction activities would increase noise levels in the project area and along haul routes, nearby sensitive receptors would not be adversely affected. Construction-related noise impacts would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap, removal of upstream rock, and restoration of the Riparian Sanctuary under Alternative 4 would involve similar activities as Alternatives 2 and 3 and would result in the same types of noise impacts. Noise levels would increase in the project area during construction, but nearby sensitive receptors would not be adversely affected. Removal of rock from the north side of the upstream peninsula would result in additional noise impacts beyond Alternatives 2 and 3, but sensitive receptors are still more than 700 feet from the peninsula and would not be adversely affected. Construction-related impacts on noise would be less than significant.

Impact NO-2: Implementation of the Riparian Sanctuary project could increase ambient noise levels in the project area over the long term.

Alternative 1 – No-Action Alternative

None of the bank protection measures or restoration activities would be implemented under the No-Action Alternative. Minimal ongoing maintenance activities would take place, resulting in periodic noise from vehicles and equipment accessing or working in the project area. These noise impacts are part of the current conditions, and an increase in noise levels would not be anticipated.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings/Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Routine maintenance and inspections of the bank protection measures and restored riparian habitat would involve periodic trips to the project area and potential activities in the project area to maintain the bank protection measures, which would result in periodic noise over the long term. The types of noise impacts would be similar to the construction-related impacts, but they would be on a smaller scale and infrequent. Noise impacts would be slightly higher than current conditions, but they would not be considered substantial given the nature and timing of the maintenance activities and inspections and distance to sensitive receptors. Long-term noise impacts from implementation of Alternative 2 would be less than significant.

3.11 Aesthetics

This section describes the aesthetic or visual setting and character of the project area and analyzes the effects of the alternatives on the aesthetic or visual resources of the project area. No scenic highways have been designated near the project area, and the Sacramento River near the project area is not a designated wild and scenic river; these topics are not discussed further.

3.11.1 Regulatory Framework

Sacramento River National Wildlife Refuge Comprehensive Conservation Plan

The Sacramento River NWR CCP identifies a visitor services goal for the refuge to encourage visitors to "experience, appreciate, and understand the Refuge history, riparian ecosystem, fish, and wildlife" (U.S. Fish and Wildlife Service 2005). One of the objectives of the CCP is to provide quality wildlife observation and photography opportunities, which would foster a connection between visitors and natural resources. The visual setting and character of the Riparian Sanctuary and Llano Seco Island 2 are important components of the refuge that provide opportunities for visitors to enjoy and experience the scenic quality of the area.

Butte and Glenn County General Plans

The Butte County and Glenn County General Plans identify objectives and policies to protect and enhance the quality of scenic resources in both counties. Butte County policies apply mostly to scenic highways and ridgelines, which are not located in or near the project area, but the general plan also requires views of scenic resources, including the Sacramento River NWR, to be maintained (Butte County 2010). Glenn County policies relate to avoiding light and glare impacts and preparing a scenic highways plan to preserve scenic resources; policies related to protecting biological resources, such as preserving natural riparian habitat along the Sacramento River, also help protect and enhance scenic resources (Glenn County 1993).

3.11.2 Affected Environment

Aesthetic resources are described in terms of visual features and attributes, and the aesthetic value of an area is a measure of its visual or "scenic" character and quality combined with a viewer's response to these conditions. The methods used to describe the aesthetic value of the project area include: (1) objectively characterizing the existing visual features, (2) assessing their visual quality relative to the larger regional character, and (3) determining the importance of the view to people (i.e., the sensitivity of the landscape). Visual features in the project area include the Sacramento River, riparian habitat, and the banks and floodplain of the river (Photographs 1–4).

The visual character of an area is influenced by a number of factors, including landforms, hydrology, vegetation, wildlife presence, recreation potential, and constructed elements of the built environment. Both natural and artificial landscape features contribute to the visual character of an area and its quality relative to the larger regional character. Waterways, including rivers, are generally a visually dominant element in characterizing a viewshed. The importance of a view is related to its visibility, number of viewers, frequency and duration of views, types of viewers, and viewers' expectations.

Photograph 1: Downstream east and west banks of Sacramento River from just upstream of the PCGID-PID pumping plant and fish screen facility.

Photograph 2: Sacramento River and northwest bank of Riparian Sanctuary from upstream of the PCGID-PID pumping plant and fish screen facility.

Photograph 3: South side of upstream peninsula from just upstream of PCGID-PID pumping plant and fish screen facility.

Photograph 4: North side of upstream peninsula looking east.

The Sacramento River is a prominent feature in the project area and is an important visual resource in the Sacramento Valley as it meanders along a broad alluvial floodplain. Lands along the Sacramento River in the vicinity of the project area contain stands of mature riparian vegetation, agricultural fields, riprap or other forms of revetment, or eroded banks with sparse vegetation. Some buildings and other structures exist along the river, including residences, the PCGID-PID pumping plant and fish screen facility, and power lines. Units of the Sacramento River NWR extend along 77 miles of the Sacramento River and preserve the natural habitat and landscape of the river with few built facilities.

The visual character of the Riparian Sanctuary is dominated by low-growing non-native vegetation, with small patches of native woody plants and a narrow, dense valley oak–dominated forest along the west bank (Photograph 1). The north side of the Riparian Sanctuary along the Sacramento River contains riprap with a few riparian trees and shrubs and patches of native herbaceous plants and a large gravel bar at lower water levels (Photograph 2). The visual character of the upstream peninsula is a combination of dense riparian woodlands (Photograph 3) and open, sparsely vegetated floodplain. The northern bank of the upstream peninsula contains riparian vegetation and revetment (Photograph 4). Flood flow along the Sacramento River has penetrated the riprap along the north side of the peninsula, created scour holes, and removed vegetation in some areas. Land surrounding the project area is dominated by agricultural fields with rural residences and associated structures. The native riparian habitat in the project area provides an important visual feature in the landscape because of the extensive amount of surrounding land that was converted from native habitats to agricultural and other uses.

The banks and floodplain of the Sacramento River in the vicinity of the project area contain varying amounts of riprap, riparian vegetation, and exposed soil and geologic features (Photograph 3). The visual character of the river in the project area is typical of other reaches up- and downstream of the project area where banks have eroded, bank protection or stabilization measures have been installed, and the river meanders across its broad floodplain.

Public views of the project area are primarily from travelers on SR 45 along the west side of the Sacramento River and water recreationists on the river. Traffic along SR 45 is typical of a rural area, consisting mostly of local commuters, landowners, residents, and occasional recreationists. Riparian vegetation along the west side of the Riparian Sanctuary and the peninsula partially obstructs views of the remainder of the project area from SR 45 and lands to the west of the project area. Motorists also have only brief views of the project area as they pass by, but local travelers who use the road frequently are likely to notice changes in the landscape over time. Boaters along the Sacramento River also have brief views of the project area through the riparian vegetation and likely see less of the project area because of their lower vantage point, although they have more prominent views of the riverbanks. Recreationists are likely to notice changes in the landscape if they visit the area frequently or recreate nearby for the purpose of enjoying the scenery.

Surrounding private lands restrict public access to most of the project area, and most views of the project area are from nearby residences and private lands. Riparian vegetation and topography limit views of the project area from some residences and nearby private lands. Local residences are likely to notice changes in the landscape of the project area because of their familiarity with the current views and past changes.

Riparian vegetation and the Sacramento River in the project area are prominent visual features and contribute to scenic views of the local area, whereas the non-native vegetation and riprap along the river detract somewhat from the scenic quality of the area. Views of the project area are limited to local travelers, occasional recreationists, and people on private lands, and some portions of the project area are visually obstructed by the tall-growing vegetation and topography. Overall, changes in the landscape of the project area would likely be noticeable by the viewing groups because of their familiarity with the area and sensitivity to changes.

3.11.3 Environmental Consequences

Methodology

The analysis of aesthetic and visual resource impacts is based on a review of applicable management plans, photographs taken during field visits, and aerial photographs of the project area and vicinity and an evaluation of the Riparian Sanctuary project's potential to modify aesthetic or visual resources in the project area. The Sacramento NWR CCP guides management of the federally managed land in the project area, and the County general plans guide management of adjacent private lands. These plans provide guidance on preserving scenic views and areas and were used to assess compatibility of the Riparian Sanctuary project with visual objectives for the project area.

Significance Criteria

Aesthetic or visual resource impacts would be considered significant if the Riparian Sanctuary project would:

- have a substantial adverse effect on a scenic vista;
- substantially degrade the existing visual character or quality of the site and its surroundings; or
- create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

Impacts and Mitigation Measures

Impact AE-1: Construction activities could degrade the visual character of the project area or modify scenic views of the vicinity.

Alternative 1 – No-Action Alternative

Under the No-Action Alternative, no construction activities would take place. This alternative would not result in construction-related visual resource impacts.

Alternative 2 – Spur Dikes and Site-Specific Plantings/Alternative 3 – Traditional Riprap and Site-Specific Plantings

Construction of bank protection measures and restoration of the Riparian Sanctuary under Alternatives 2 and 3 would involve a variety of temporary activities that would disturb soils, remove vegetation, and introduce construction equipment and human activity in the project area, which would temporarily degrade the scenic quality of the area. Public views of the project area are limited to short-duration views for travelers on SR 45 west of the project area and for infrequent recreationists on the Sacramento River

near the project area. Construction would be limited to daytime activities and would not introduce a new source of light or glare to the project area.

Restoration activities in the central and southern portions of the Riparian Sanctuary would be partially masked from views along SR 45 by existing riparian vegetation in the project area, which would be preserved during construction. Construction equipment would be most noticeable in the northern portion of the Riparian Sanctuary from the limited views along the highway and river, whereas vegetation removal and soil disturbance would be less noticeable because of the disturbed nature of much of the project area. Existing non-native vegetation at the Riparian Sanctuary and revetment along some of the river in the project area have already somewhat degraded the scenic quality of the project area. The temporary construction activities would not be highly visible from public viewpoints, and they would not substantially degrade the visual character or scenic quality of the project area. Construction-related impacts on visual resources would be less than significant.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Construction of traditional riprap and restoration of the Riparian Sanctuary under Alternative 4 would result in similar activities and disturbances as described for Alternatives 2 and 3. Removal of upstream rock would, however, result in additional disturbances on the upstream peninsula and along more of the Sacramento River, up to about RM 179. These areas are also only visible from SR 45 (briefly) and by recreationists on the river or across the river to the north. The peninsula is more densely vegetated, which limits views from SR 45, but activities along the north side would be exposed along the river, where recreationists would have better views. Few recreationists would be affected by the temporary visual changes in the project area during removal of the upstream rock and other activities, as described for Alternative 2. The temporary activities would not be highly visible from public viewpoints nor would they substantially degrade the visual character or scenic quality of the project area. Visual resource impacts during construction would be less than significant.

Impact AE-2: Implementation of the Riparian Sanctuary project could modify the visual character of the project area over the long term.

Alternative 1 – No-Action Alternative

None of the bank protection measures or restoration activities would be implemented under the No-Action Alternative. The visual character of the project area could change at the Riparian Sanctuary as the river continues to erode the northwest bank, resulting in changes in vegetative cover and the alignment of the Sacramento River. Generally, conditions would be similar to current conditions and typical of a river channel, with riparian habitat in some areas, grasslands and invasive plants dominating areas affected by periodic floods, and a meandering river channel. Non-native vegetation would be expected to continue to dominate, but the croplands may have to be abandoned if the river floods more of the area. The specific changes cannot be predicted, but the visual character would be expected to be fairly similar to current conditions with the river continuing to modify its course.

Alternative 2 – Spur Dikes and Site-Specific Plantings

Installation of spur dikes along the Sacramento River bank on the north side of the Riparian Sanctuary would modify the visual character of the river bank, but would be consistent with existing revetment in the vicinity although they would extend further into the river than the traditional riprap. No changes in visual character would be expected on the peninsula, assuming upstream revetment is maintained and the river does not cut off the peninsula. As long as the spur dikes are effective, the visual character of the river channel would be similar to current conditions.

The visual character of the Riparian Sanctuary would change from the current croplands and low-quality wildlife habitat to more diverse and higher quality riparian habitat. The restoration of riparian habitat would greatly improve the visual character and scenic quality of the project area by providing more natural and lush habitat, which would result in enhanced wildlife viewing and photography opportunities. Although limited public views are available, the restored riparian habitat would improve views of the Riparian Sanctuary from SR 45, the river, and nearby recreational areas. Visual resource-related impacts from implementation of Alternative 2 would be less than significant and mostly beneficial.

Alternative 3 – Traditional Riprap and Site-Specific Plantings

Installation of traditional riprap along the Sacramento River bank on the north side of the Riparian Sanctuary would modify the visual character of the river bank, but would be consistent with existing revetment in the vicinity. The traditional riprap would maintain the current visual character of the area. The low berm would be under the water much of the year and not visible from nearby public viewpoints. The restoration benefits would be the same as for Alternative 2 because the same level of restoration is included for Alternative 3. Visual resource-related impacts from implementation of Alternative 3 would be less than significant and mostly beneficial.

Alternative 4 – Traditional Riprap with Upstream Rock Removal and Site-Specific Plantings

Installation of traditional riprap along the Sacramento River bank on the north side of the Riparian Sanctuary would modify the visual character of the river bank as described for Alternative 3, but the removal of upstream rock with Alternative 4 would encourage a cut off of the peninsula and change the visual character of the peninsula. The east side of the peninsula where Llano Seco Island 2 is located could become an island on the river or become part of the east side of the river, but much of the existing riparian vegetation would likely remain in place along the new river alignment. The banks of the river would also be more natural appearing without the riprap on the north side of the peninsula, although some riprap would remain along the private property near SR 45. With the cut off, the traditional riprap downstream would stabilize the river at the Riparian Sanctuary and prevent visual changes in that area, other than the benefits of the restored vegetation discussed for Alternative 2. Visual resource–related impacts from implementation of Alternative 4 would be less than significant and mostly beneficial.

Chapter 4 Other Statutory Considerations

This chapter addresses the following statutory considerations that are required under the National Environmental Policy Act (NEPA) and/or the California Environmental Quality Act (CEQA):

- Cumulative Impacts (NEPA and CEQA)
- Growth-Inducing Effects (CEQA)
- Relationship between Short-Term Uses and Long-Term Productivity (NEPA)
- Irreversible and Irretrievable Commitments of Resources (NEPA and CEQA)
- Significant Unavoidable Adverse Impacts (CEQA)
- Mitigation Monitoring and Reporting Program (CEQA)

4.1 Cumulative Impacts

Cumulative impacts are the impacts on the environment that result from the incremental impacts of a proposed action when added to the impacts of other past, present, and reasonably foreseeable future actions (14 CCR 15355(b), 40 CFR 1508.7), regardless of what agency (federal or non-federal) or entity undertakes such other actions. These impacts can result from individually minor but collectively significant actions taking place over time. The President's Council on Environmental Quality NEPA regulations and the State of California's CEQA Guidelines require that the cumulative impacts of a proposed action be addressed in an environmental document when the cumulative impacts are expected to be significant (40 CFR 1508.25(a)(2),14 CCR 15130(a)). When a lead agency is examining a project with an incremental effect that is not "cumulatively considerable," the lead agency need not consider that effect significant, but shall briefly describe its basis for concluding that the incremental effect is not cumulatively considerable.

The Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project (Riparian Sanctuary project) (i.e., implementation of one of the action alternatives), in combination with other projects along the Sacramento River, on the Sacramento River National Wildlife Refuge (NWR), at the M&T Chico Ranch north of the project area, and on the Llano Seco Rancho, could result in cumulative impacts on the resources analyzed in Chapter 3 of this environmental impact statement/environmental impact report (EIS/EIR). The Riparian Sanctuary project is expected to be implemented within the next 5 years, but its effects are projected to last at least 50 years to protect the pumping plant and fish screen facility and allow time for the restored vegetation to reach maturity. As a result, the timeframe for the cumulative impact analysis is 50 years, although most reasonably foreseeable projects in the vicinity of the project area are expected to be implemented within approximately 15 years. Most effects of the Riparian Sanctuary project would be localized in and around the project area, but the combined effects of reasonably foreseeable future projects along the river and on the refuge and nearby private lands could result in regional cumulative impacts. As a result, the spatial extent of the cumulative impact analysis encompasses the reach of the Sacramento River from Shasta Dam to the Sacramento-San

Joaquin Delta, all refuge units on the Sacramento River NWR, and lands adjacent to or near the project area, specifically the M&T Chico Ranch and Llano Seco Rancho.

Table 4-1 lists other projects that have been implemented or will be implemented over the next 15 years in the vicinity of the project area and that could contribute to cumulative impacts. Past and present projects are considered to be part of the baseline or affected environment described in Chapter 3 because their effects have already influenced the existing environmental setting. Future projects are considered to be reasonably foreseeable. A discussion of the potential for and extent of cumulative impacts is presented below for the resources analyzed in Chapter 3.

Table 4-1. Other Past, Present, and Reasonably Foreseeable Future Projects

Project Name	Location	Past, Present, or Future
Sacramento River Bank Protection Project ▪ Ongoing bank stabilization and levee repair projects ▪ Approximately 920,000 linear feet of river stabilization in Phases I and II ▪ 80,000 linear feet undergoing environmental review	Entire Sacramento River	Past, Present, Future
Sacramento River NWR Comprehensive Conservation Plan (CCP) Implementation (see U.S. Fish and Wildlife Service 2005) ▪ Restoration and enhancement of refuge units ▪ Visitor service projects, such as trails and kiosks ▪ Hunting and fishing program ▪ Wildlife research	Sacramento River NWR Units	Present, Future
Restoration Activities on the Sacramento River NWR ▪ Focus on riparian habitat restoration along the river	Segments of Sacramento River	Past, Present, Future
Princeton-Codora-Glenn and Provident Irrigation Districts (PCGID-PID) Pumping Plant and Fish Screen Facility	West bank of Sacramento River, across from Riparian Sanctuary	Past
M&T Chico Ranch/Llano Seco Rancho Pumping Facility and Maintenance	Sacramento River Mile 192.5	Past, Present
M&T Chico Ranch Water Conveyance System Improvements	M&T Chico Ranch	Future

For purposes of the analysis of cumulative impacts, the effects of installation of revetment (either traditional riprap or spur dikes) and site-specific plantings under Alternatives 2 and 3 are not differentiated for all resource topics because of the similarities between the effects of both alternatives. Effects of Alternative 4, particularly the removal of upstream rock, are specifically called out in the analysis if additional cumulative effects may be expected because of the rock removal. The term "Riparian Sanctuary project" is used to collectively refer to any of the action alternatives where the cumulative impacts would be similar under each alternative, and references to individual alternatives are included where the differences need to be discussed.

4.1.1 Land Use

The Riparian Sanctuary project would not change land uses in the project area other than to restore riparian habitat in place of current cropland and low quality habitat. Temporary construction activities would result in minimal disruptions to adjacent lands and uses. The project would be consistent with the restoration objectives and strategies for the Sacramento River NWR CCP, although bank protection under Alternatives 2 and 3 would further restrict natural river processes and conflict with Objective 1.2 of the CCP. Alternative 4 would be consistent with the CCP. Land use impacts associated with the Riparian Sanctuary project would be localized and mostly beneficial and would not be cumulatively considerable.

Other projects on the Sacramento River NWR, such as restoration and visitor service projects, would contribute to implementation of the CCP and would not be expected to change land uses on the refuge. Other projects in the area, such as a water conveyance system and bank protection measures, would be expected to result in minimal changes in land uses based on the nature of the projects. None of the other projects would be expected to result in substantial losses of agricultural lands, and some of the projects (e.g., water conveyance system, pumping facility protection) would benefit agricultural uses in the region. No cumulatively significant land use changes would be expected along the Sacramento River, and cumulative land use impacts would be less than significant.

4.1.2 Geology, Fluvial Geomorphology, and Soils

The Riparian Sanctuary project would modify the reach of the Sacramento River in the project area through stabilization of the bank across from the PCGID-PID pumping plant and fish screen facility and removal of upstream rock revetment (Alternative 4 only). In addition, construction activities would result in temporary soil disturbance across approximately 400 acres of the Riparian Sanctuary as well as additional soil disturbance along the north side of the upstream peninsula (Alternative 4 only), but restoration activities would help stabilize the soils over the long term and minimize erosion. Alternatives 2 and 3 would stabilize the Sacramento River through the project area, maintaining a similar channel as current conditions, while Alternative 4 would encourage a cut off of the upstream peninsula and restore natural processes, resulting in substantial modification to the channel alignment. Changes in the Sacramento River alignment could be cumulatively considerable, but soil disturbance would be localized and temporary and would not be cumulatively considerable.

Other bank protection projects along the Sacramento River could have similar effects on the morphology of the river as Alternatives 2 and 3 by stabilizing its banks and restricting river meander, and restoration projects on the Sacramento River NWR could help protect the banks and upland areas from soil erosion. Soil disturbance would take place for each of the projects, but it would be localized in each project area. Cumulative changes to the Sacramento River that restrict natural processes, particularly in combination with Alternatives 2 and 3, could be significant as a result of indirect effects on other resources (e.g., fishery resources, water quality), but cumulative restoration projects would result in a net benefit to riparian habitats along the river and help stabilize soils over the long term. In addition, measures could be implemented to minimize adverse effects of bank stabilization, such as through use of setback levees and plantings along revetment. Cumulative changes to the river as a result of Alternative 4 and other bank protection projects would be less intense across the river system because of the restoration of natural

processes through the project area that would, to some extent, offset stabilization efforts elsewhere along the river.

4.1.3 Water Resources

The Riparian Sanctuary project could result in construction-related impacts on water quality in the Sacramento River, including increased turbidity, potential for hazardous materials spills, and potential releases of mercury, and would modify flood flows through the project area (moreso under Alternative 4). Measures have been identified to reduce most of the adverse impacts on water quality to less-than-significant levels, but the impacts could be cumulatively considerable. Restoration activities would require the temporary use of ground water for irrigation, which would be a less-than-significant impact on the Sacramento Valley groundwater basin, but could be cumulatively considerable.

Bank protection and restoration projects along the Sacramento River, particularly those that require in-water activities, could result in similar water quality impacts as the Riparian Sanctuary project, which could be cumulatively significant if multiple projects are implemented near each other at the same time. Mitigation measures similar to those identified for the Riparian Sanctuary project would likely be needed for individual projects to minimize adverse impacts and ensure cumulative impacts are less than significant. Compliance with a Stormwater Pollution Prevention Plan and applicable permitting would also help minimize adverse water quality impacts.

Localized changes in flood flows may also occur along the river due to other bank protection projects, and a cumulative increase in flood flows may occur in downstream reaches as more of the river becomes riprapped. Depending on the specific changes to flood flows along the river, cumulative impacts could be significant, especially if flood zones change or properties outside of existing flood zones are subject to flooding.

Other projects on the Sacramento River NWR may require the use of ground water for restoration activities or visitor uses, which could cumulatively increase the amount of ground water withdrawn from the groundwater basin. Use of ground water for restoration would be similar to the Riparian Sanctuary project, and the use would be temporary until vegetation becomes established. This temporary use would result in less ground water use than for typical agricultural uses along the river. Depending on the quantity and timing of the groundwater withdrawals, cumulative impacts could result in a temporary depletion of groundwater supplies in the basin, but long-term cumulative impacts are not expected to be significant. More detailed groundwater studies or analyses may be needed to evaluate the cumulative effects on the groundwater basin if substantial sources of supply are needed.

4.1.4 Fishery Resources

The Riparian Sanctuary project could result in construction and implementation impacts on special-status and resident fishes in the Sacramento River in and near the project area. Direct injury or mortality could result from in-water activities, and increased turbidity and hazardous material spills in the river could affect individuals as well as aquatic habitat. The changes to the river as a result of bank protection measures would modify aquatic habitat, but the loss of streamside riverine aquatic habitat would be

minimal and vegetation plantings and regeneration along the riprap would help offset the loss in addition to the overall restoration of the Riparian Sanctuary. Rock removal under Alternative 4 would modify aquatic habitat the most in the project area as a result of re-establishing natural river processes, which could result in short-term adverse changes as the river channel adjusts and an increase in habitat for predatory fishes when an oxbow forms. Measures have been identified to reduce adverse construction-related impacts on fishes and their habitat to less-than-significant levels, but the impacts could be cumulatively considerable.

Bank protection and restoration projects along the Sacramento River could result in similar impacts to special-status and resident fishes and their habitats from construction activities and loss of aquatic habitat, and mitigation measures would likely be needed for individual projects to minimize adverse impacts. Significant cumulative impacts could occur if multiple projects are conducted simultaneously along a short reach of the river, and long-term cumulative impacts could be significant if substantial aquatic habitat, particularly high quality spawning or rearing habitat, is degraded or lost. Other projects that have potential to affect federally listed fish species would be subject to consultation requirements under the Endangered Species Act and would need to incorporate appropriate conservation measures to minimize adverse effects on the fishes and their habitat, which could include improving or restoring low quality habitat along the Sacramento River if habitat would be degraded or lost by a proposed project. With implementation of appropriate conservation measures to reduce impacts to minimal levels, cumulative impacts on special-status and resident fishes and their habitat would be less than significant.

4.1.5 Vegetation, Wildlife, and Sensitive Biological Resources

The Riparian Sanctuary project could result in construction and implementation impacts on special-status wildlife, such as valley elderberry longhorn beetle, western pond turtle, and bank swallow, and would modify habitats in the project area. Construction-related impacts would result from temporary disturbance during the construction period, which could affect nesting or breeding wildlife in the project area. Measures have been identified to reduce or avoid potential disturbance impacts during construction, specifically for the beetle, pond turtle, bank swallows, and migratory birds. Habitat modifications would primarily be beneficial with the restoration of riparian habitat at the Riparian Sanctuary, although a temporal loss would occur until the habitat is mature and a minor amount of riparian wetlands would be lost where bank protection measures are proposed. For valley elderberry longhorn beetle, the restored riparian habitat would benefit the species, and any elderberry shrubs removed or disturbed during construction would be replaced as part of the restoration design. For Alternatives 2 and 3, a net loss of potential bank swallow habitat along the river could result from the placement of revetment along open river bank, but for Alternative 4, the river cut off would offset the loss of bank swallow habitat where riprap is installed by creating additional open river bank habitat along the new alignment that could be used by swallows in the future. Impacts on special-status species and habitats in the project area could be cumulatively considerable.

Other restoration and visitor service projects on the Sacramento River NWR would contribute to implementation of the CCP and would improve riparian and other habitats on the refuge and along the Sacramento River. These projects could have temporary disturbance-related impacts to nesting or breeding wildlife, similar to the Riparian Sanctuary project. Other bank protection projects in the area

could result in modifications to or losses of habitat for special-status species, particularly bank swallow, and impacts to wetlands as well as construction-related impacts on the species. Other projects would be expected to implement similar measures as the Riparian Sanctuary project to avoid or minimize adverse impacts on special-status wildlife during construction activities and to offset losses of wetlands and other sensitive habitats, and the restoration activities along the Sacramento River would likely result in a net gain in riparian and other native habitats, despite the potential for minor losses from other projects. Cumulative impacts on special-status wildlife and their habitat would be less than significant, with the exception of bank swallow habitat, which could experience a net loss due to the increased bank protection along the Sacramento River, regardless of the alternative selected for the Riparian Sanctuary project. Cumulative impacts on bank swallow would be more pronounced under Alternatives 2 and 3 than under Alternative 4 because of the potential for a net loss, despite the mitigation measure identified for Alternatives 2 and 3; Alternative 4 would be self-mitigating with regard to bank swallow habitat impacts.

4.1.6 Cultural Resources

Restoration activities associated with the Riparian Sanctuary project could affect an important cultural resources site and other previously undiscovered cultural resources. The bank protection measures are not expected to affect inundated cultural resources in the Sacramento River or other previously undiscovered resources because of the constant erosion of the bank where the revetment would be installed. Measures have been identified to reduce or avoid potential effects on cultural resources. Project-related impacts would be localized and would not be cumulatively considerable.

Bank protection projects along the Sacramento River, restoration and visitor services projects on the Sacramento River NWR, and the water conveyance project in the vicinity of the project area could affect other cultural resources found in their respective project areas, and measures would be expected, similar to those identified for the Riparian Sanctuary project, to reduce or avoid adverse impacts and comply with applicable regulations (e.g., National Historic Preservation Act, CEQA). Cumulative impacts on the cultural resources in the project area would not be expected as the other projects would be implemented in different locations, and a cumulative loss of important prehistoric or historic cultural resources would not be expected if adequate measures are implemented for each project. Cumulative impacts on cultural resources would be less than significant.

4.1.7 Transportation and Traffic

Construction vehicles, trucks, and equipment associated with the Riparian Sanctuary would temporarily increase traffic on nearby state and local highways and private roads, and longer term maintenance traffic would be minimal and infrequent. Traffic on private roads would be a concern to local landowners, but agreements and construction measures would be implemented to minimize effects on the private roads. Regional traffic associated with the Riparian Sanctuary project would result in a less-than-significant impact, but it could be cumulatively considerable if other projects result in similar traffic on the same roads. Other projects are not expected to use the same private roads as the Riparian Sanctuary project, and the local traffic generated by the project would not be cumulatively considerable.

Bank protection projects along the Sacramento River, restoration and visitor services projects on the Sacramento River NWR, and the water conveyance project in the vicinity of the project area would involve varying levels of construction and maintenance traffic that would contribute to increases in regional traffic on state and local highways in the area. The largest volume of traffic from other projects would likely come from haul trucks transporting materials and equipment to and from project areas, which are also the largest source of traffic for the Riparian Sanctuary project. Cumulatively, the increase in traffic could affect roadway conditions (e.g., congestion, levels of service) if traffic from other projects is using the same roads at the same time as the Riparian Sanctuary project. Many routes are available for transporting materials and equipment in Butte and Glenn counties, and state and local highways would be expected to have capacity to handle the temporary increase in traffic. Cumulative traffic impacts would be less than significant.

4.1.8 Air Quality

The Riparian Sanctuary project would result in temporary construction emissions and periodic longer term emissions associated with maintenance activities. The emissions would contribute to existing violations of particulate matter and ozone and contribute to greenhouse gas emissions in the region. Measures have been identified to reduce project-related air quality impacts to less than significant, but the emissions could be cumulatively considerable. Restoration of the Riparian Sanctuary would help offset emissions, including greenhouse gas emissions, from project activities by increasing plant density in the project area.

Bank protection projects along the Sacramento River, restoration and visitor services projects on the Sacramento River NWR, and the water conveyance project in the vicinity of the project area would also result in varying levels of short- and long-term emissions and would contribute to existing violations of pollutants and greenhouse gas emissions. Each project would be expected to incorporate appropriate measures to minimize emissions to the extent feasible and comply with local air district rules and regulations, which would help reduce cumulative impacts on air quality. The combined effects of the Riparian Sanctuary project and other projects in the area could result in significant cumulative air quality impacts, but measures, such as those identified for the Riparian Sanctuary project, and restored woody and other vegetation would reduce each project’s contribution to air quality impacts to acceptable levels and ensure cumulative impacts are less than significant.

4.1.9 Noise

The Riparian Sanctuary project would result in temporary construction noise and periodic longer-term noise from maintenance activities for the bank protection measure and the restored habitat. Most project-generated noise would be localized in the project area and would not affect nearby receptors, but traffic noise would extend beyond the project area and affect private properties and others along access roads. Although project-related noise impacts would be less than significant, the increase in traffic noise on state and local highways could be cumulatively considerable, similar to traffic impacts. Localized noise generated by the project would not be cumulatively considerable.

Other projects in the area, such as bank protection and restoration projects, would generate traffic noise that, in combination with the Riparian Sanctuary project, could be noticeable to residents and others along the access roads. Acceptable noise levels along highways tend to be higher than in more rural areas, and the increased traffic noise would likely blend in with the existing traffic noise along the highways. The cumulative increase in traffic noise would be less than significant.

4.1.10 Aesthetics

The Riparian Sanctuary project would result in minimal changes to the visual character of the project area from the bank protection measures, and the restoration of riparian habitat would improve the visual quality of the area by converting open land to a riparian forest. The spur dikes (Alternative 2) and traditional riprap without a berm (Alternatives 3 and 4) would create a less visually appealing bank than traditional riprap with a low berm, which includes plantings on the berm (Alternatives 3 and 4), but few viewer groups would be affected by the changes. The visual changes associated with the Riparian Sanctuary project would be localized and mostly beneficial and would not be cumulatively considerable.

Other bank protection and restoration projects along the Sacramento River could result in similar changes to the visual setting by installing bank protection measures, removing riparian vegetation, and restoring riparian vegetation. Overall, the visual quality of the Sacramento River in the vicinity of the project area would remain similar to current conditions with a combination of revetment, floodplain features, and riparian vegetation. Cumulative visual quality impacts would be less than significant.

4.2 Growth-Inducing Effects

Growth-inducing effects can result from a proposed action if it would foster or encourage economic or population growth in an area, such as by resulting in construction of additional housing or removing obstacles to population growth. Growth itself is not assumed to be beneficial, detrimental, or insignificant to the environment, except when a physical environmental impact would occur (CEQA Guidelines Section 15126.2(d)).

The Riparian Sanctuary project is in a rural area and is intended to enhance wildlife habitat and to ensure continued operation of the PCGID-PID pumping plant and fish screen facility. None of the activities associated with the project would directly or indirectly result in increased economic or population growth. Continued operation of the PCGID-PID facility would ensure the obligated water supply can be delivered to PCGID-PID customers, which are primarily agriculture-based. The project would also not change the use of the water supply or provide a new water supply for other uses such as development. Continued delivery of water by PCGID-PID would sustain existing uses and would not trigger new development or encourage growth in the area.

4.3 Relationship Between Short-Term Uses and Long-Term Productivity

Short-term uses in the project area, such as during construction activities, could affect maintenance and enhancement of long-term productivity of resources in the project area. Short-term uses associated with the Riparian Sanctuary project would include ground disturbance, installation of rock, planting of riparian vegetation, and other activities during the construction phase. These uses would result in a number of temporary impacts that would cease upon completion of the construction phase, and they would result in new riparian habitat at the Riparian Sanctuary, which would result in a beneficial long-term change in the project area. Temporary impacts during the construction phase include the temporary exposure of disturbed areas to the effects of wind, rain, and runoff, which could cause erosion and sedimentation; water quality impacts from stormwater run-off and from potential spills, leaks, or accidental releases of hazardous substances; biological resource impacts from disturbance in the river and removal of vegetation before new vegetation is established; and air quality impacts from increased emissions of criteria pollutants. These temporary impacts would have minimal effects on long-term productivity of the project area because the affected resources (e.g., soil, wildlife, vegetation, water quality) would recover over time. In addition, the establishment of riparian vegetation at the Riparian Sanctuary would enhance the quality of riparian habitat along the Sacramento River and improve environmental conditions over the long term, increasing productivity. The protection measures along the bank of the Sacramento River would also help stabilize the bank and maintain the channel alignment to ensure long-term productivity of the PCGID-PID pumping plant and fish screen facility.

4.4 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable environmental changes are defined as uses of nonrenewable resources that may be irreversible due to a long-term commitment of these resources that makes future removal or nonuse unlikely. The Riparian Sanctuary project would require the use of fossil fuels and other nonrenewable materials during construction and, to a lesser extent, during long-term maintenance, which would be an irreversible and irretrievable commitment of these resources. A substantial quantity of rock and fill material would be required to construct the bank protection measures, and this material would be committed to the project with little to no potential for future re-use or removal. Water used for irrigation of the planted vegetation would also be committed to the project, although some water would be expected to percolate into the ground or evaporate and return to the ground water over time. If important cultural resources are damaged during project activities, such impacts would be irreversible and would result in an irretrievable commitment of the cultural resource, which is a nonrenewable resource.

4.5 Significant Unavoidable Adverse Impacts

Significant unavoidable impacts are adverse effects that were determined to be significant in the environmental analysis, but for which mitigation measures would not adequately reduce the impacts to less-than-significant levels based on the thresholds identified. Several significant impacts were identified in the environmental analysis in Chapter 3, and mitigation measures were identified for impacts associated with the action alternatives to reduce the level of the impact to less than significant, to the

extent feasible. Two impacts were identified that may not be sufficiently reduced with the available mitigation measures: construction-related water quality impacts associated with the low berm option of Alternatives 3 and 4 and the net loss of bank swallow habitat associated with the spur dikes or traditional riprap for Alternatives 2 and 3. Because other options are available to alleviate these significant impacts, they could be avoided by implementation of one of the other options. However, if the lead agencies elect to implement an alternative that would result in these significant impacts despite the availability of other options, significant and unavoidable impacts could result and would need to be justified. A statement of overriding considerations would need to be prepared by California Department of Fish and Game (CDFG).

4.6 Mitigation Monitoring and Reporting Program

Several mitigation measures have been identified in Chapter 3 of this EIS/EIR and are included in a mitigation monitoring and reporting program (MMRP) for the preferred alternative (Alternative 4). The draft MMRP is included as Appendix E to this document, and the final MMRP will be included as an appendix to the Final EIS/EIR. The approval of such a program will be part of any action taken by the CDFG with respect to the project. The mitigation measures may also be identified as environmental commitments in the Record of Decision prepared by the U.S. Fish and Wildlife Service (Service).

The MMRP will be used by the CDFG in conjunction with Service staff, PCGID-PID, project contractors, cooperating and participating agencies, and monitoring personnel during project implementation. The intent of the MMRP is to ensure the effective implementation and enforcement of adopted mitigation measures and permit conditions. The MMRP will provide for monitoring of construction activities as necessary, on-site identification of environmental problems, and proper reporting to agency staff.

Chapter 5 Consultation and Coordination

5.1 Agency Consultation and Coordination

5.1.1 List of Agencies and Organizations Contacted

A number of agencies and organizations were contacted during development of the alternatives and throughout the environmental review process. River Partners coordinated a Technical Advisory Committee that met periodically to discuss the project, alternatives, and environmental review process. Members of the Technical Advisory Committee include representatives from:

- U.S. Fish and Wildlife Service (Service)
- California Department of Fish and Game (CDFG)
- U.S. Army Corps of Engineers
- California Department of Water Resources
- Central Valley Flood Protection Board
- California Bay-Delta Authority
- Princeton, Codora, Glenn and Provident Irrigation Districts (PCGID-PID)
- The Nature Conservancy
- Ayres Associates
- MBK Engineers
- California Universities

5.1.2 Compliance with Applicable Environmental Laws

National Environmental Policy Act

This environmental impact statement/environmental impact report (EIS/EIR) was prepared pursuant to National Environmental Policy Act (NEPA) and the regulations implementing that statute. NEPA provides a commitment that federal agencies will consider the environmental effects of their actions and disclose their environmental effects. This EIS/EIR provides detailed information regarding a reasonable range of alternatives, the effects of these alternatives on the environment, and potential mitigation measures. It was prepared to comply with federal and state laws while reducing redundancy and providing the necessary documentation for both processes.

California Environmental Quality Act

This EIS/EIR was prepared to comply with California Environmental Quality Act (CEQA) and the regulations implementing the statute. Key among the CEQA provisions is the requirement to identify all significant impacts. Significance thresholds are identified for each issue area to allow the reader to clearly understand when an environmental impact is considered significant.

Clean Water Act

The Llano Seco Riparian Sanctuary Unit Restoration and Pumping Plant/Fish Screen Facility Protection Project (Riparian Sanctuary project) will need to comply with the Clean Water Act via multiple permitting mechanisms. Discharge of dredged or fill material into waters of the United States (e.g.,

placement of riprap along the Sacramento River) will require a Section 404 permit from the U.S. Army Corps of Engineers, which will also require a Section 401 water quality certification from the Central Valley Regional Water Quality Board. Ground disturbance activities will require authorization under the State General Construction Activity Stormwater Permit (General Permit) adopted by the State Water Resources Control Board, which also requires implementation of appropriate best management practices to ensure water quality impacts are minimized. The Service and CDFG attended a pre-application meeting with the U.S. Army Corps of Engineers and other agencies in January 2012 to initiate discussions on the appropriate Section 404 permit for the project.

Rivers and Harbors Act

In addition to the CWA Section 404 permit, PCGID-PID will need to obtain a Section 10 permit from the Corps for placement of riprap into the Sacramento River, a navigable water. The permit application for a Section 404 permit is expected to be used to obtain a Section 10 permit.

Endangered Species Act

The Riparian Sanctuary project will need to comply with Section 7 of the Endangered Species Act. The Service (Sacramento River National Wildlife Refuge) will initiate intra-Service (with the Ecological Services division) and inter-agency (with National Marine Fisheries Service) consultation for federally listed species that may be affected by the project. A biological assessment will be prepared to discuss and evaluate impacts on federally listed fish and terrestrial species. The Service and CDFG have initiated discussions with the Service–Ecological Services division and with the National Marine Fisheries Service to discuss the project and options for mitigation or conservation measures.

Magnuson-Stevens Fishery Conservation and Management Act

The Riparian Sanctuary project will need to comply with the Magnuson-Stevens Fishery Conservation and Management Act. An Essential Fish Habitat assessment will be prepared as part of the biological assessment and be submitted to the National Marine Fisheries Service.

National Historic Preservation Act

The Riparian Sanctuary project will need to comply with Section 106 of the National Historic Preservation Act. The Service will initiate consultation with the State Historic Preservation Officer for potential impacts on historic properties. The Service re-initiated a 2002 consultation regarding the Riparian Sanctuary Unit with three local tribes in June 2011 in the form of a letter requesting consultation/coordination. Michael DeSpain, Director and Coordinator for the Mechoopda Indian Tribe responded and requested a site visit, which took place in June 2011. The Mechoopda Tribe requested to be included on the mailing list for the project and that a restoration plan be developed and reviewed by the tribe prior to any activities on the site.

California Endangered Species Act

The Riparian Sanctuary project will need to comply with the California Endangered Species Act because of the potential for incidental take of federally listed fish species. The lead agencies and PCGID-PID will consult with the CDFG–Habitat Conservation Planning Branch to comply with Section 2081

requirements. CDFG may adopt the conditions identified through the Endangered Species Act consultation with the National Marine Fisheries Service for state-listed fish. The need for an incidental take permit for bank swallow will be determined based on the selected alternative and presence of bank swallows in the project area at the time of construction.

Fish and Game Code Section 1602

The Riparian Sanctuary project would modify the banks of the Sacramento River, and PCGID-PID, as the responsible party for the revetment, will need to submit a request to CDFG for a Streambed Alteration Agreement. Terms of the agreement will be incorporated into the project and will likely include the mitigation measures identified in this EIS/EIR.

Executive Order 11988—Floodplain Management

The Service considered short- and long-term effects associated with modifications to the Sacramento River floodplain from construction of bank protection measures. The Riparian Sanctuary project would not increase the risk of flood loss or result in flood-related effects on human health, safety, or welfare. The project would comply with the requirements of Executive Order 11988.

Executive Order 11990—Protection of Wetlands

The Service evaluated the effects of the Riparian Sanctuary project on wetlands in the project area and identified measures to minimize the loss of wetlands. The Riparian Sanctuary project would involve restoration activities that would restore native riparian habitat, including wetlands, on 400 acres of federal lands along the Sacramento River. Any loss of wetlands associated with construction activities would be replaced through the restoration activities. The project would comply with the requirements of Executive Order 11990.

Executive Order 12898—Environmental Justice

The Service provided opportunities for public involvement during the environmental review process for the Riparian Sanctuary project without discriminating against a person's minority or income status. The Riparian Sanctuary project would not be conducted in a manner that would disproportionately affect minority or low-income populations. The project would comply with the requirements of Executive Order 12898.

5.2 Preparers and Contributors

5.2.1 U.S. Fish and Wildlife Service

Kelly Moroney, Sacramento River National Wildlife Refuge Assistant Refuge Manager

Dan Frisk, Sacramento National Wildlife Refuge Complex Manager

Joe Silveira, Refuge Biologist

Nick Valentine, Archaeologist

Anan Raymond, Regional Archaeologist

Patricia Roberson, Refuge Operations Office

5.2.2 California Department of Fish and Game

Tracy McReynolds, Staff Environmental Scientist

5.2.3 Princeton-Codora-Glenn Irrigation District-Provident Irrigation District

Lance Boyd, Manager, Provident Irrigation District

John Garner, Director, Princeton-Codora-Glenn Irrigation District

5.2.4 North State Resources, Inc.

Wirt Lanning, Project Director

Leslie Perry, Project Manager/Environmental Analyst

Heather Kelly, Biologist

Keith Marine, Aquatic Resources Program Manager

Mike Gorman, Fishery Biologist

Duncan Drummond, Hydrologist/Geologist

Kristina Crawford, Archaeologist

Sylvia Cantu, Graphics Specialist

Kathryn McDonald, Technical Editor

5.2.5 River Partners

John Carlon

Helen Swagerty, Project Manager

Michael Rogner, Associate Restoration Biologist

5.2.6 Engineering/Design Team

Lyle W. Zevenbergen, Ayres Associates

Joe Countryman, MBK Engineers

Tom Smith, Riversmith Engineering

Eric Larsen, U.C. Davis

Mussetter Engineering, Inc.

Taber Consultants

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