Appendix A

Public Noticing and Scoping Materials

Appendix A-1

Notice of Intent

barrier penetrating oxime. The administration of this oxime initiates the reactivation of the central nervous system cholinesterases (AChE and BChE) for pesticide and OP induced central nervous system (and peripherally) inhibited AChE.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. E9–2034 Filed 1–29–09; 8:45 am]

BILLING CODE 3710–08–P

DEPARTMENT OF DEFENSE

Department of the Army

Army Education Advisory Committee Meeting

AGENCY: Department of the Army, DoD.

ACTION: Notice of open meeting.

SUMMARY: Pursuant to the Federal Advisory Committee Act of 1972 (5 U.S.C., Appendix, as amended), the Sunshine in the Government Act of 1976 (U.S.C. 552b, as amended) and 41 Code of the Federal Regulations (CFR 102–3. 140 through 160, the Department of the Army announces the following committee meeting:

Name of Committee: Army Education Advisory Committee (AEAC).

Date of Meeting: February 25, 2009.

Time of Meeting: 0900–1500.

Place of Meeting: Deputy Chief of Staff G–3/5/7 Conference Room, Building 161, Room 305, Ft. Monroe, VA.

Proposed Agenda: Purpose of the meeting is to allow review, discussions, and deliberations of actions and recommendations from five subcommittees: Defense Language Institute Foreign Language Center, Command and General Staff College Board of Visitors, Army War College Board of Visitors, Distance Learning/Training Technology Applications Subcommittee, and the Reserve Officer Training Corps Subcommittee. Approved recommendations will be forwarded to the Office of the Administrative Assistant, Secretary of the Army, the appropriate Subcommittee's Alternate Designated Federal Official (ADFO), and the Subcommittee's decision maker.

FOR FURTHER INFORMATION CONTACT: For information please contact Mr. Wayne Joyner at *albert.wayne.joyner@us.army.mil* or (757) 788–5890. Written submissions are to be submitted to the following address: Army Education Advisory Committee, ATTN: Designated Federal Officer (DFO) (Joyner), 5 Fenwick Road, building 161, room 217, Fort Monroe, Virginia 23651.

SUPPLEMENTARY INFORMATION: Meeting of the Advisory Committee is open to the public. Attendance will be limited to those persons who have notified the Committee Management Office at least 10 calendar days prior to the meeting of their intention to attend.

Filing Written Statement: Pursuant to 41 CFR 102–3.140d, the Committee is not obligated to allow the public to speak, however, interested persons may submit a written statement for consideration by the Committee. Individuals submitting a written statement must submit their statement to the DFO at the address listed (see **FOR FURTHER INFORMATION CONTACT**). Written statements not received at least 10 calendar days prior to the meeting, may not be provided to or considered by the committee. The DFO will review all timely submissions with the Chairperson, and ensure they are provided to the members of the committee before the meeting. After reviewing written comments, the Chairperson and the DFO may choose to invite the submitter of the comments to orally present their issue during open portion of this meeting or at a future meeting. The DFO, in consultation with the Chairperson, may allot a specific amount of time for the members of the public to present their issues for review and discussion.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. E9–2031 Filed 1–29–09; 8:45 am]

BILLING CODE 3710–08–P

DEPARTMENT OF DEFENSE

Department of the Army; Army Corps of Engineers

Intent To Prepare a Joint Environmental Impact Statement/Environmental Impact Report for the Sacramento River Bank Protection Project Phase II Supplemental Authority providing for implementation of up to 80,000 linear feet of additional bank protection in the Sacramento River Flood Control Project area, Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties, CA

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DOD.

ACTION: Notice of intent.

SUMMARY: The action being taken is the preparation of a joint environmental impact statement/environmental impact report (EIS/EIR) for the Sacramento River Bank Protection Project (SRBPP) Phase II Supplemental Authority. The SRBPP Phase II Supplemental Authority will result in the implementation of an additional 80,000 linear feet of bank protection in the Sacramento River Flood Control Project area, as authorized by the Water Resources Development Act (WRDA) of 2007. The SRBPP Phase II Supplemental Authority is located in the Sacramento River Flood Control Project (SRFCP) area, consisting of the Sacramento River and its Tributaries, CA.

DATES: A series of public scoping meetings will be held as follows:

1. Tuesday, February 17, 2009, 6 to 8 p.m. at Colusa Fairgrounds, Atwood Hall (1303 10th Street, Colusa).
2. Wednesday, February 18, 2009, 6 to 8 p.m. at Jean Harvie Community and Senior Center (14273 River Road, Walnut Grove).
3. Tuesday, February 24, 2009, 4 to 6 p.m. at Library Galleria (828 "I" Street, Sacramento).
4. Wednesday, February 25, 2009, 6 to 8 p.m. at the Chico Masonic Family Center (110 West East Avenue, Chico).

Send written comments by March 16, 2009 to the address below.

ADDRESSES: Written comments and suggestions concerning this project may be submitted to Mr. Matthew Davis, U.S. Army Corps of Engineers, Sacramento District, Attn: CESPK–PD–R, 1325 J Street, Sacramento, CA 95814–2922. Requests to be placed on the mailing list should also be sent to this address.

FOR FURTHER INFORMATION CONTACT: Questions about the proposed action and EIS/EIR should be addressed to Matthew Davis at (916) 557–6708, by e-mail *Matthew.G.Davis@usace.army.mil,* by fax (916) 557–7856, or by mail to (*see* **ADDRESSES**).

SUPPLEMENTARY INFORMATION: The U.S. Army Corps of Engineers, Sacramento District (Corps) is the federal lead agency for compliance with the National Environmental Policy Act (NEPA) for the Proposed Action. The Central Valley Flood Protection Board of the State of California (CVFPB) is the state lead agency for compliance with the California Environmental Quality Act (CEQA) for the Proposed Action.

1. *Proposed Action.* Section 3031 of the Water Resources Development Act (WRDA) of 2007 authorizes the U.S. Army Corps of Engineers and its local sponsors to construct an additional 80,000 linear feet of bank protection in the SRBPP area. The Corps and the CVFPB are preparing an EIS/EIR to analyze the impacts of constructing an additional 80,000 linear feet of bank protection in the SRBPP area in the form

of bank stabilization, employing primarily riprap, and levee setbacks where feasible.

The planning area for the proposed actions is considered to be the entire Sacramento River Flood Control Project, and the Corps' current inventory of critical eroding sites will constitute a representative sample of the sites to eventually be treated. As streambank erosion is episodic and new critical sites can appear each year, the environmental analysis will be programmatic in nature allowing for future environmental impact analysis for specific projects, as needed.

2. *Alternatives.* The EIS/EIR will address the No Action alternative and five action alternatives including four different types of bank protection alternatives and a levee setback alternative. The four types of bank protection alternatives differ from one another in the amount and extent of rock protection placed and the environmental features (e.g., vegetation and instream woody material) incorporated in the design.

3. *Scoping Process.*

a. A series of public scoping meetings will be held in February 2009 to present information to the public and to receive comments from the public. These meetings are intended to initiate the process to involve concerned individuals, and local, State, and Federal agencies.

b. Significant issues to be analyzed in depth in the EIS/EIR include effects on river meander, hydraulics, wetlands and other waters of the U.S., vegetation and wildlife resources, special-status species, aesthetics, cultural resources, recreation, land use, fisheries, water quality, air quality, noise, transportation, visual resources, and socioeconomics; and cumulative effects of related projects in the study area.

c. The Corps will consult with the State Historic Preservation Officer to comply with the National Historic Preservation Act and the U.S. Fish and Wildlife Service and National Marine Fisheries Service to comply with the Endangered Species Act. The Corps is also coordinating with the U.S. Fish and Wildlife Service to comply with the Fish and Wildlife Coordination Act.

d. A 45-day public review period will be provided for individuals and agencies to review and comment on the draft EIS/EIR. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the draft EIS/EIR circulation.

4. *Availability.* The draft EIS/EIR is scheduled to be available for public review and comment in October 2010.

Dated: January 22, 2009.

Thomas C. Chapman,

Colonel, Corps of Engineers, District Engineer.

[FR Doc. E9–2036 Filed 1–29–09; 8:45 am]

BILLING CODE 3720–58–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Record of Decision for Atlantic Fleet Active Sonar Training

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: The Department of the Navy (DON), after carefully weighing the operational and environmental consequences of the proposed action, announces its decision to designate areas along the East Coast of the United States and in the Gulf of Mexico where mid- and high-frequency active (MFA and HFA) sonar and the improved extended echo ranging (IEER) system training; maintenance; and research, development, test, and evaluation (RDT&E) activities will occur, and to conduct these activities. The Navy's decision regarding MFA sonar activities includes the advanced extended echo ranging (AEER) system as a replacement for the IEER system. The Navy considered applicable executive orders, including an analysis of the environmental effects of its actions outside the United States or its territories under Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*, and the requirements of EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.*

The proposed action will be accomplished as set forth in the No-Action Alternative, described in the Final Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) as the preferred alternative. Implementation of the preferred alternative could begin immediately. The preferred alternative represents the active sonar training and RDT&E activities necessary for Navy to meet its Title 10 obligation to organize, train, equip and maintain combat-ready naval forces and to successfully fulfill its current and future global mission of winning wars, deterring aggression, and maintaining freedom of the seas.

SUPPLEMENTARY INFORMATION: The Record of Decision (ROD) has been distributed to all those individuals who requested a copy of the Final EIS/OEIS and agencies and organizations that received a copy of the Final EIS/OEIS. The complete text of the Navy's ROD is available for public viewing on the project Web site at *http://www.afasteis.gcsaic.com*, along with copies of the Final EIS/OEIS and supporting documents. Single copies of the ROD will be made available upon request by contacting Naval Facilities Engineering Command, Atlantic, Attention: Code EV22 (AFAST Project Manager), 6506 Hampton Boulevard, Norfolk, VA 23508–1278.

Dated: January 27, 2009.

A. M. Vallandingham

Lieutenant Commander, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E9–2052 Filed 1–29–09; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Record of Decision for Southern California Range Complex

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: The Department of the Navy (DON), after carefully weighing the operational, and environmental consequences of the proposed action, announces its decision to support and conduct current, emerging, and future military readiness activities in the Southern California (SOCAL) Range Complex, to include San Clemente Island (SCI), as necessary to achieve and sustain Fleet readiness, including Navy training; Department of Defense (DoD) or other federal agency research, development, test, and evaluation (RDT&E) activities; and investment in range resources and range infrastructure, all in furtherance of the Navy's statutory obligations under Title 10 of the United States Code governing the roles and responsibilities of the Navy. In its decision, the Navy considered applicable executive orders, including an analysis of the environmental effects of its actions outside the United States or its territories under the provisions of Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions,* and the requirements of EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.*

The proposed action will be accomplished as set out in Alternative 2, described in the Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/

Appendix A-2

Notice of Preparation

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, GOVERNOR

CENTRAL VALLEY FLOOD PROTECTION BOARD
3310 El Camino Ave., Rm. LL40
SACRAMENTO, CA 95821
(916) 574-0609 FAX: (916) 574-0682
PERMITS: (916) 574-0653 FAX: (916) 574-0682

NOTICE OF PREPARATION

Environmental Impact Statement and Environmental Impact Report for the Sacramento River Bank Protection Project Phase II Supplemental Authority

January 30, 2009

The Central Valley Flood Protection Board (Board) (formerly the Reclamation Board), and the U.S. Army Corps of Engineers, Sacramento District (Corps) are preparing a joint Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Sacramento River Bank Protection Project (SPRBPP) Phase II Supplemental Authority (proposed project) for implementation of up to 80,000 linear feet of additional bank protection in the Sacramento River Flood Control Project (SRFCP) area, as authorized by Section 3031 of the Water Resources Development Act (WRDA) of 2007, in Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba counties, CA. The Corps will serve as the lead agency under the National Environmental Policy Act (NEPA), and the Board, as the local project sponsor, will serve as lead agency under the California Environmental Quality Act (CEQA).

The SRBPP is a continuing construction project, authorized by the Flood Control Act of 1960, to provide erosion protection for the existing levees and flood control facilities of the SRFCP. The SRFCP consists of approximately 980 miles of levees plus overflow weirs, pumping plants, and bypass channels that protect communities and agricultural lands in the Sacramento Valley and Sacramento-San Joaquin Delta (Figure 1). SRBPP authorizes bank protection to maintain the integrity of the SRFCP, through various engineered methods such as bank stabilization and levee setbacks.

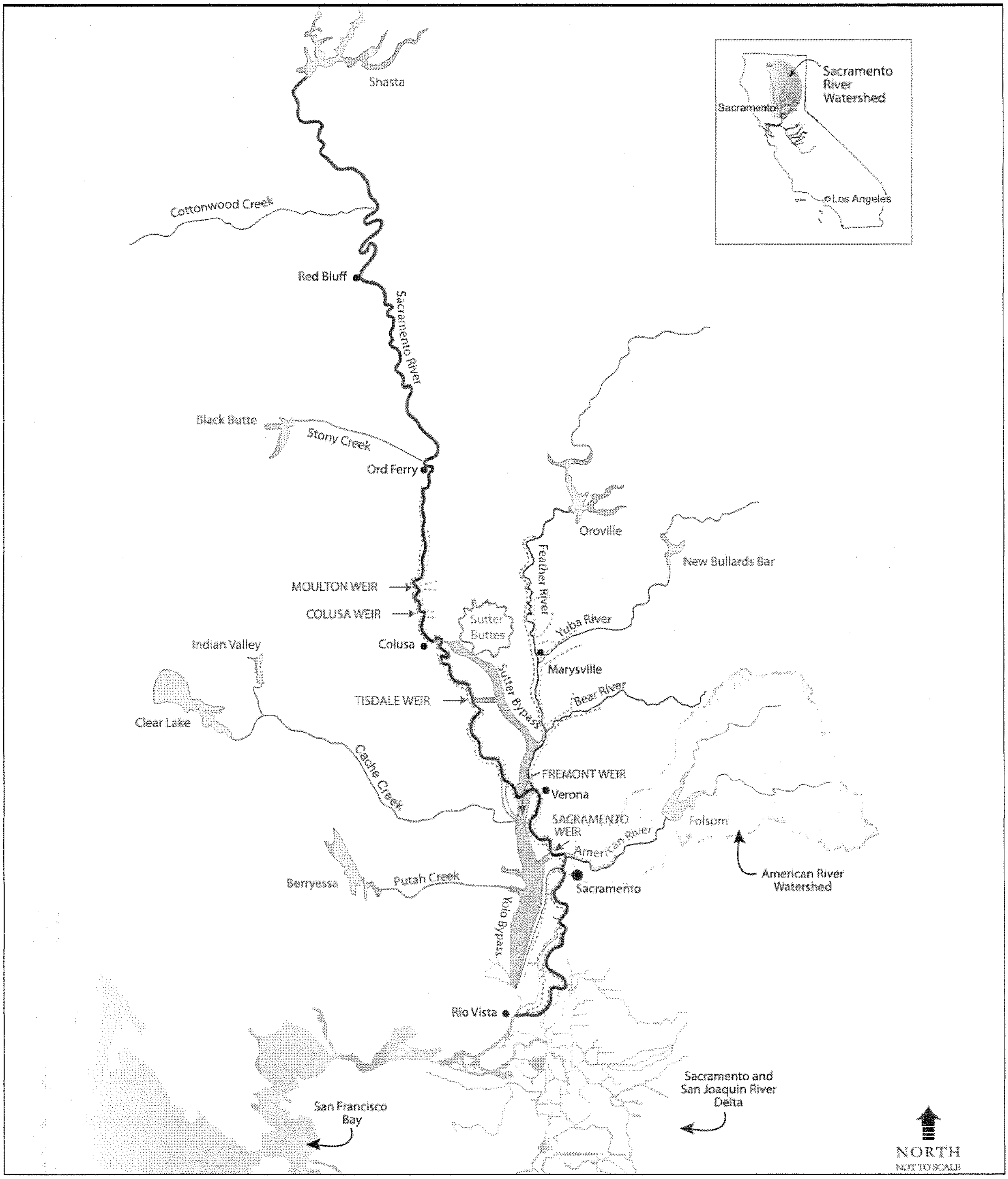

Figure 1. The Sacramento River Bank Protection Project Area

Background

The banks and levees in the Sacramento River watershed have been eroding over time, often resulting in increased flood risk to areas protected by these levees. The SRBPP was originally authorized in 1960 to better manage flood risk by using various engineered methods to protect existing levees and flood control facilities within the SRFCP.

The SRBPP is a long-range program of bank stabilization and erosion control intended to maintain the integrity of the SRFCP. To date, work has been carried out in two phases, with a total of about 820,000 feet of rivers and channels being treated under the project. Current SRBPP work is being carried out under Phase II of its existing federal authorization of 405,000 feet.

The proposed project, construction of the additional 80,000 linear feet of bank protection, was authorized and added to Phase II by Section 3031 of the WRDA of 2007 in order to protect the banks of levees and associated flood risk management infrastructure that is within the SRBPP area from stream erosion. The Corps is responsible for implementation of the SRBPP, including the additional 80,000 linear feet, in conjunction with its non-federal cost-share partner, the Board. Preparation of an EIS/EIR, consistent with Corps engineering regulations for WRDA-NEPA compliance and state regulations will be the vehicle for:

- estimating where bank protection actions will be taken,
- examining alternative methods of bank protection,
- assessing their likely environmental impacts (biophysical and socioeconomic),
- assessing their likely environmental benefits, and
- establishing the framework for determining mitigation for unavoidable significant impacts, including for site-specific future actions.

After decisions for program implementation are made for these items in the final EIS/EIR, individual implementation projects will include further evaluation of site-specific impacts and mitigation requirements through additional environmental impact analysis, under the decision policy established in the final EIS/EIR.

Purpose

The central reaches of the Sacramento River levees in the SRFCP were established close to streambanks to erode vast sediment deposits accumulated from hydraulic mining in the Sierra Nevada in the 1800s and to facilitate use of rich floodplain soils for agriculture. This sediment-removal purpose was met by about 1940, but the rivers, deprived of the natural energy dissipation of floodplains, have continued to erode laterally, often undermining the toe of adjacent levees. This ongoing problem has two potential solutions: setback of levees to reduce floodflow depths and velocities and thus erosion of natural banks, or armoring existing or restored streambanks to resist the erosion. The project purpose and objective is to arrest or avoid streambank erosion that threatens the integrity of the SRFCP levee system.

Study Area

The planning area for the SRBPP Phase II Supplemental Authority is considered to be the entire SRFCP area. The Corps' current inventory of critical eroding sites will constitute a representative sample of the sites to eventually be treated. As streambank erosion is episodic and new critical sites can appear each year, the environmental analysis will be programmatic in nature allowing for future environmental impact analysis for specific projects, as needed.

Project Alternatives

The EIS/EIR will address the No Action alternative and five action alternatives including four different types of bank protection alternatives and a levee setback alternative. The four types of bank protection alternatives differ from one another in the amount and extent of rock protection placed and the environmental features (e.g., vegetation and instream woody material) incorporated in the design.

The EIR will describe the direct and indirect significant environmental effects of the improvements that are proposed project within the study area at a programmatic level. The EIR will also evaluate cumulative effects of the proposed flood control improvements when considered in conjunction with other related past, present, and reasonably foreseeable future projects, including other Corps, Board, and California Department of Water Resources projects.

On the basis of preliminary evaluation, the Board has determined that the proposed alternatives that will be evaluated in the EIR could have the following significant environmental effects:

Appendix A-3

Public Comments and Scoping Meeting Transcript

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Sacramento Area Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4706

March 13, 2009

Mr. Matt Davis
NEPA Compliance Specialist
U.S. Army Corps of Engineers
1325 J Street, Room 1480
Sacramento, California 95814-2922

Dear Mr. Davis:

This is in response to your Public Scoping Meeting on the Sacramento Bank Protection Project for an additional 80,000 linear feet of bank protection authorized by Congress under the Water Resource Development Act 2007, conducted on February 24 and 25, 2009 in the City of Sacramento and Chico, California. The meeting is one of the requirements under National Environmental Protection Act (NEPA) process to obtain comments and recommendations in regards to the proposed project. Your January 26, 200, meeting announcement directed that written comments on the project be mailed to your office. The enclosed comments provided by NOAA's National Marine Fishery Service (NMFS) are preliminary in nature and intended as technical assistance to aid in the U.S. Army Corps of Engineers (Corps) planning process.

As a general recommendation, NMFS suggests that the Corps give priority to consideration of building set back levees and other flood management projects that provide increased regional flood control benefits while restoring natural flood plains and rearing habitats for native fish species that are within the flood control system. For more conventional repairs that may impact fishery resources, NMFS has provided a list of general recommendations and comments (enclosed).

Please contact Madelyn Martinez at (916) 930-3605, or via e-mail at Madelyn.Martinez@noaa.gov, if you have any questions regarding this letter.

Sincerely,

Maria Rea

Maria Rea
Supervisor, Sacramento Area Office

Enclosure
cc: Copy to file – AR# 2009SA00111
NMFS-PRD, Long Beach, CA

Corps: Michael.L.Dietl@usace.army.mil@usace.army.mil ,
Matthew.G.Davis@usace.army.mil
UFWS: Douglas_Weinrich@fws.gov, Jennifer_Hobbs@fws.gov, and
Jeremy.Reding@fws.gov
DFG: ghobgood@dfg.ca.gov
DWR: kyoung@water.ca.gov

ENCLOSURE 1

NOAA'S NATIONAL MARINE FISHERIES SERVICE COMMENTS AND RECOMMENDATIONS FOR THE ADDITIONAL 80,000 LINER FEET BANK PROTECTION ON THESACRAMNTO RIVER BANK PROTECTION PROJECT PUBLIC SCOPING MEETING FEBRUARY 24 AND 25, 2009

Background

The Sacramento River Bank Protection Project (SRBPP) is a continuing construction project that was authorized by the Flood Control Act of 1960, to provide protection for the existing levees and flood control facilities of the Sacramento River Flood Control Project (FCP). The FCP consists of approximately 980 miles of levees plus overflow weirs, pumping plants, and bypass channels that protect communities and agricultural lands in the Sacramento Valley and Sacramento-San Joaquin Delta (Delta).

As authorized by Congress in 1960, the SRBPP is a local cooperation project, with a state-federal cost-share arrangement between the U.S. Army Corps of Engineers (Corps) as the federal participant, and the Reclamation Board as the state participant. The Corps is authorized and funded by the federal government to construct bank stabilization or setback levees that protect the FCP from bank erosion. The Reclamation Board is authorized and funded by the State of California to act as the local cost-sharing sponsor of the SRBPP program.

During the first phase of its implementation from 1960 to 1975, approximately 430,000 linear feet (81.4 miles) of bank revetment was installed. The federal government subsequently authorized a second phase that consists of up to 405,000 linear feet (76.7 miles) of bank protection. Currently, installation of an additional 24,000 feet (3 miles) of bank protection (either rock revetment or levee setback) remains within the authorized 405,000 foot authority for Phase 2 contracts. After the Phase 2 authority has been fulfilled, approximately 80,000+ linear feet of levee bank will need repairs.

Project Description

The project is in the early preliminary planning and project development stages. According to the information provided during the September 16, 2008 meeting, the Corps plans to repair 80,000 linear feet of erosions sites in the Sacramento River Levee System. Since the proposed project would occur in multiple years, the Corps would like to approach the proposed project at a programmatic level. The SRBPP action area extends south-to-north along the Sacramento River from the town of Collinsville from river mile (RM) 0 upstream to Chico at RM 194, including reaches of lower Elder and Deer creeks. The SRBPP includes Cache Creek, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, Elk, and Cache sloughs. The repair design would utilize design templates used from the SRBPP, Phase II repair and use the Standard Assessment Methodology (SAM) to evaluate the types of impacts on listed aquatic species and its habitat.

Biological Resources

Available information indicates that the following listed species and designated critical habitat may occur in the project area:

Sacramento River winter-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)
endangered (June 28, 2005, 70 FR 37160)
Sacramento River winter-run Chinook salmon designated critical habitat
(June 16, 1993, 58 FR 33212)
Central Valley spring-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)
threatened (June 28, 2005, 70 FR 37160)
Central Valley spring-run Chinook salmon designated critical habitat
(September 2, 2005, 70 FR 52488)
Central Valley steelhead DPS (*Oncorhynchus mykiss*)
threatened (December 22, 2005)
Central Valley steelhead designated critical habitat
(September 2, 2005, 70 FR 52488)
Southern DPS of North American green sturgeon (*Acipenser medirostris*)
threatened (April 7, 2006, 70 FR 17386)
Southern DPS of North American green sturgeon proposed designated critical habitat (September 8, 2008, 73 FR 52084)

The proposed project may also affect Essential Fish Habitat for fall/late-fall run Chinook salmon as described in Amendment 14 of the Pacific Salmon Fishery Management Plan pursuant to the Magnuson-Stephens Fishery Conservation and Management Act.

Status of the Species and their Critical Habitat

Sacramento Winter-run Chinook Salmon

Historical winter-run population estimates, which included males and females, were as high as near 100,000 fish in the 1960s, but declined to under 200 fish in the 1990s (Good *et al.* 2005). In recent years, the carcass survey population estimates of winter-run included a high of 17,334 (Table 1) in 2006, followed by a precipitous decline in 2007 that continued in 2008.

Two current methods are utilized to estimate juvenile production of winter-run: the Juvenile Production Estimate (JPE) method, and the Juvenile Production Index (JPI) method (Gaines and Poytress 2004). Gaines and Poytress (2004) estimated the juvenile population of winter-run exiting the upper Sacramento River at Red Bluff Diversion Dam (RBDD) to be 3,707,916 juveniles per year using the JPI method between the years 1995 and 2003 (excluding 2000 and 2001). Using the JPE method, Gaines and Poytress (2004) estimated an average of 3,857,036 juveniles exiting the upper Sacramento River RBDD and entering the Delta between the years of 1996 and 2003. Averaging these two estimates yields an estimated population size of 3,782,476 juveniles during that timeframe.

Table 1. Winter-run population estimates from RBDD counts (1986 to 2001) and carcass counts (2001 to 2008), and corresponding cohort replacement rates for the years since 1986 (CDFG 2004a, CDFG 2007).

Year	Population Estimate[1]	5-Year Moving Average of Population Estimate	Cohort Replacement Rate	5-Year Moving Average of Cohort Replacement Rate	NMFS-Calculated Juvenile Production Estimate (JPE)[2]
1986	2,596	-	-	-	
1987	2,186	-	-	-	
1988	2,885	-	-	-	
1989	696	-	0.27	-	
1990	433	1,759	0.20	-	
1991	211	1,282	0.07	-	40,100
1992	1,240	1,092	1.78	-	273,100
1993	387	593	0.90	0.64	90,500
1994	186	491	0.88	0.77	74,500
1995	1,297	664	1.05	0.94	338,107
1996	1,337	889	3.45	1.61	165,069
1997	880	817	4.73	2.20	138,316
1998	3,002	1,340	2.31	2.48	454,792
1999	3,288	1,961	2.46	2.80	289,724
2000	1,352	1,972	1.54	2.90	370,221
2001	8,224	3,349	2.74	2.76	1,864,802
2002	7,441	4,661	2.26	2.22	2,136,747
2003	8,218	5,705	6.08	3.02	1,896,649
2004	7,701	6,587	0.94	2.71	881,719
2005	15,730	9,463	2.11	2.83	3,556,995
2006	17,205	11,259	2.09	2.70	3,890,534
2007	2,488	10,268	0.32	2.31	1,100,067
2008	2,850[3]	9,195	0.18	1.13	1,100,000[4]
median	**2,186**	**1,759**	**1.94**	**2.59**	**354,164**

[1] Population estimates were based on RBDD counts until 2001. Starting in 2001, population estimates were based on carcass surveys.

[2] JPE estimates were derived from NMFS calculations utilizing RBDD winter-run counts through 2001, and carcass counts thereafter for deriving adult escapement numbers.

[3] CDFG (2008)

[4] NMFS preliminary estimate

Based on a recent reviews and analysis of the current viability of the Sacramento River winter-run Chinook Salmon ESU, NMFS believes that the winter-run Evolutionary Significant Unit (ESU) is currently not viable. An age-structured density-independent model of spawning escapement by Botsford and Brittnacker (1998 *op. cit.* Good *et al.* 2005) assessing the viability of winter-run found the species was certain to fall below the quasi-extinction threshold of 3 consecutive spawning runs with fewer than 50 females (Good *et al.* 2005). Lindley *et al.* (2007) assessed the viability of the population using a Bayesian model based on spawning escapement that allowed for density dependence and a change in population growth rate in response to conservation measures. This analysis found a biologically significant expected quasi-extinction probability of 28 percent. There is only one population, and it depends on cold-water releases from Shasta Dam, which could be vulnerable to a prolonged drought (Good *et al.* 2005).

Lindley *et al.* (2007) determined that the winter-run population, which is confined to spawn below Keswick Dam, is at a moderate extinction risk according to population viability analysis (PVA), and at a low risk according to other criteria (*i.e.*, population size, population decline, and the risk of wide ranging catastrophe). However, concerns of genetic introgression with hatchery populations are increasing. Hatchery-origin winter-run from Livingstone National Fish hatchery (LSNFH) have made up more than 5 percent of the natural spawning run in recent years and in 2005, it exceeded 18 percent of the natural run. If this proportion of hatchery origin fish from the LSNFH exceeds 15 percent in 2006-2007, Lindley *et al.* (2007) recommends reclassifying the winter-run population extinction risk as moderate, rather than low, based on the impacts of the hatchery fish over multiple generations of spawners. In addition, data used for Lindley *et al.* (2007) did not include the significant decline in escapement numbers in 2007 and 2008, which are reflected in the population size and population decline, nor the current drought conditions.

Lindley *et al.* (2007) also states that the winter-run ESU fails the "representation and redundancy rule" because it has only one population, and that population spawns outside of the ecoregion in which it evolved. In order to satisfy the "representation and redundancy rule," at least two populations of winter-run would have to be re-established in the basalt- and porous-lava region of its origin. An ESU represented by only one spawning population at moderate risk of extinction is at a high risk of extinction over an extended period of time (Lindley *et al.* 2007).

Critical habitat for winter-run is composed of physical and biological features that are essential for the conservation of winter-run, including up and downstream access, and the availability of certain habitat conditions necessary to meet the biological requirements of the species. Currently, many of these physical and biological features are impaired, and provide limited conservation value. For example, when the gates are in, RBDD reduces the value of the migratory corridor for upstream and downstream migration. Unscreened diversions throughout the mainstem Sacramento River, and the DCC when the gates are open during winter-run outmigration, do not provide a safe migratory corridor to San Francisco Bay and the Pacific Ocean.

The current condition of riparian habitat for winter-run rearing is degraded by the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento River system. This reduces growth and survival and ultimately affects the abundance and productivity of the populations. The riprap channelizes the river and prevents the natural meander of the river to create floodplains. Floodplains are a source of primary productivity for food and shelter for juvenile salmonids, provides high quality rearing and refugia habitat during high flows. In addition, floosdplain is another source for the recruitment of instream woody material along the river banks, a component needed for salmonid to create refugia, which elevates the conservation value. Most of the levee in the Sacramento River are either devoid of vegetation or sparsely vegetated producing spotted, narrow riparian corridor.

By taking all these existing conditions, NMFS finds that the current condition of winter-run critical habitat is degraded, and does not provide the conservation value necessary for the recovery of the species.

Central Valley Spring-Run Chinook Salmon

Historically, spring-run occupied the upper and middle reaches (1,000 to 6,000 feet) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit Rivers, with smaller populations in most tributaries with sufficient habitat for over-summering adults (Stone 1874, Rutter 1904, Clark 1929). The spring-run was the second most abundant salmon run in the Central Valley (CDFG 1998). The Central Valley drainage as a whole is estimated to have supported spring-run runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). Before the construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River alone (Fry 1961). Construction of other low elevation dams in the foothills of the Sierras on the American, Mokelumne, Stanislaus, Tuolumne, and Merced Rivers extirpated spring-run from these watersheds. Naturally-spawning populations of spring-run currently are restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River.

On the Feather River, significant numbers of spring-run, as identified by run timing, return to the FRFH. In 2002, the FRFH reported 4,189 returning spring-run, which is below the 10-year average of 4,727 fish. However, coded wire tagged (CWT) information from these hatchery returns indicates substantial introgression has occurred between spring-run and fall-run populations within the Feather River system due to hatchery practices. Because Chinook salmon have not always been temporally separated in the hatchery, spring-run and fall-run have been spawned together, thus compromising the genetic integrity of the spring-run and early fall-run stocks. The number of naturally spawning spring-run Chinook salmon in the Feather River has been estimated only periodically since the 1960s, with estimates ranging from 2 fish in 1978 to 2,908 in 1964. However, the genetic integrity of this population is questionable because of the significant temporal and spatial overlap between spawning populations of spring-run and fall-run (Good *et al.* 2005). For the reasons discussed above, and the importance of genetic diversity as one of the VSP parameters, the Feather River spring-run population numbers are not included in the following discussion of ESU abundance.

The spring-run ESU has displayed broad fluctuations in adult abundance, ranging from 1,403 in 1993 to 25,890 in 1982 (Table 2, Figure 1). Sacramento River tributary populations in Mill, Deer, and Butte Creeks are probably the best trend indicators for the spring-run ESU as a whole because these streams contain the primary independent populations within the ESU. Generally, these streams have shown a positive escapement trend since 1991. Escapement numbers are dominated by Butte Creek returns, which have averaged over 7,000 fish since 1995. During this same period, adult returns on Mill Creek have averaged 778 fish, and 1,463 fish on Deer Creek. Although recent trends are positive, annual abundance estimates display a high level of fluctuation, and the overall number of spring-run remains well below estimates of historic abundance. Additionally, in 2002 and 2003, mean water temperatures in Butte Creek exceeded 21°C for 10 or more days in July (Williams 2006). These persistent high water temperatures, coupled with high fish densities, precipitated an outbreak of columnaris disease (*Flexibacter columnaris*) and ichthyophthiriasis (*Ichthyophthirius multifiis*) in the adult spring-run over-summering in Butte Creek. In 2002, this contributed to the pre-spawning mortality of approximately 20 to 30 percent of the adults. In 2003, approximately 65 percent of the adults succumbed, resulting in a loss of an estimated 11,231 adult spring-run in Butte Creek.

Lindley *et al.* (2004) identified 26 historical populations within the spring-run ESU; 19 were independent populations, and 7 were dependent populations. In addition, there are two additional extant populations, in the Feather River below Oroville Dam, and in the mainstem

Sacramento River below Keswick Dam. These two populations likely established themselves following the construction of Oroville Dam and Keswick Dam, respectively. Of the 19 independent populations of spring-run that occurred historically, only three independent populations remain, in Deer, Mill, and Butte Creeks. Dependent populations of spring-run continue to occur in Big Chico, Antelope, Clear, Thomes, and Beegum Creeks, but rely on the three extant independent populations for their continued survival.

The Butte, Deer, and Mill Creek populations of spring-run are in the Northern Sierra Nevada diversity group. Lindley *et al.* (2007) indicated that spring-run populations in Butte and Deer Creeks had a low risk of extinction in Butte and Deer Creek, according to their PVA model and the other population viability criteria (*i.e.*, population size, population decline, catastrophic events, and hatchery influence). The Mill Creek population of spring-run Chinook salmon is at moderate extinction risk according to the PVA model, but appears to satisfy the other viability criteria for low-risk status. However, the spring-run ESU fails to meet the "representation and redundancy rule," since the Northern Sierra Nevada is the only diversity group in the spring-run ESU that contains demonstrably viable populations out of at least 3 diversity groups that historically contained them. Independent populations of spring-run only occur within the Northern Sierra Nevada diversity group. The Northwestern California diversity group contains a few ephemeral populations of spring-run that are likely dependent on the Northern Sierra Nevada populations for their continued existence. The spring-run populations that historically occurred in the Basalt and Porous Lava, and Southern Sierra Nevada, diversity groups have been extirpated. Over the long term, the three remaining independent populations are considered to be vulnerable to catastrophic events, such as volcanic eruptions from Mount Lassen or large forest fires due to the close proximity of their headwaters to each other. Drought is also considered to pose a significant threat to the viability of the spring-run populations in the Deer, Mill, and Butte Creek watersheds due to their close proximity to each other. One large event could eliminate all three populations.

Table 2. Central Valley spring-run Chinook salmon population estimates with corresponding cohort replacement rates for years since 1986 (CDFG 2007).

Year	Sacramento River Basin Escapement Run Size	5-Year Moving Average of Population Estimate	Cohort Replacement Rate	5-Year Moving Average of Cohort Replacement Rate	NMFS-Calculated JPE[1]
1986	24,263	-	-	-	**4,396,998**
1987	12,675	-	-	-	**2,296,993**
1988	12,100	-	-	-	**2,192,790**
1989	7,085	-	0.29	-	**1,283,960**
1990	5,790	12,383	0.46	-	**1,049,277**
1991	1,623	7,855	0.13	-	**294,124**
1992	1,547	5,629	0.22	-	**280,351**
1993	1,403	3,490	0.24	0.27	**254,255**
1994	2,546	2,582	1.57	0.52	**461,392**
1995	9,824	3,389	6.35	1.70	**1,780,328**

1996	2,701	3,604	1.93	2.06	**489,482**
1997	1,431	3,581	0.56	2.13	**259,329**
1998	24,725	8,245	2.52	2.58	**4,480,722**
1999	6,069	8,950	2.25	2.72	**1,099,838**
2000	5,457	8,077	3.81	2.21	**988,930**
2001	13,326	10,202	0.54	1.94	**2,414,969**
2002	13,218	12,559	2.18	2.26	**2,395,397**
2003	8,902	9,394	1.63	2.08	**1,613,241**
2004	9,872	10,155	0.74	1.78	**1,789,027**
2005	14,312	11,926	1.08	1.23	**2,593,654**
2006	8,716	11,004	0.98	1.32	**1,579,534**
2007	Still being processed	Still being processed	Still being processed	Still being processed	Still being processed
2008	Still being processed	Still being processed	Still being processed	Still being processed	Still being processed
median	8,716	9,394	1.08	1.70	1,579,534

[1]NMFS calculated the spring-run JPE using returning adult escapement numbers to the Sacramento River basin prior to the opening of the RBDD for spring-run migration, and then escapement to Mill, Deer, and Butte Creeks for the remaining period, assuming a female to male ratio of 6:4, and pre-spawning mortality of 25 percent. NMFS utilized the female fecundity value of 4,900 eggs/femals in Fisher (1994) for spring-run Chinook salmon. The remaining survival estimates used the winter-run values for calculating JPE.

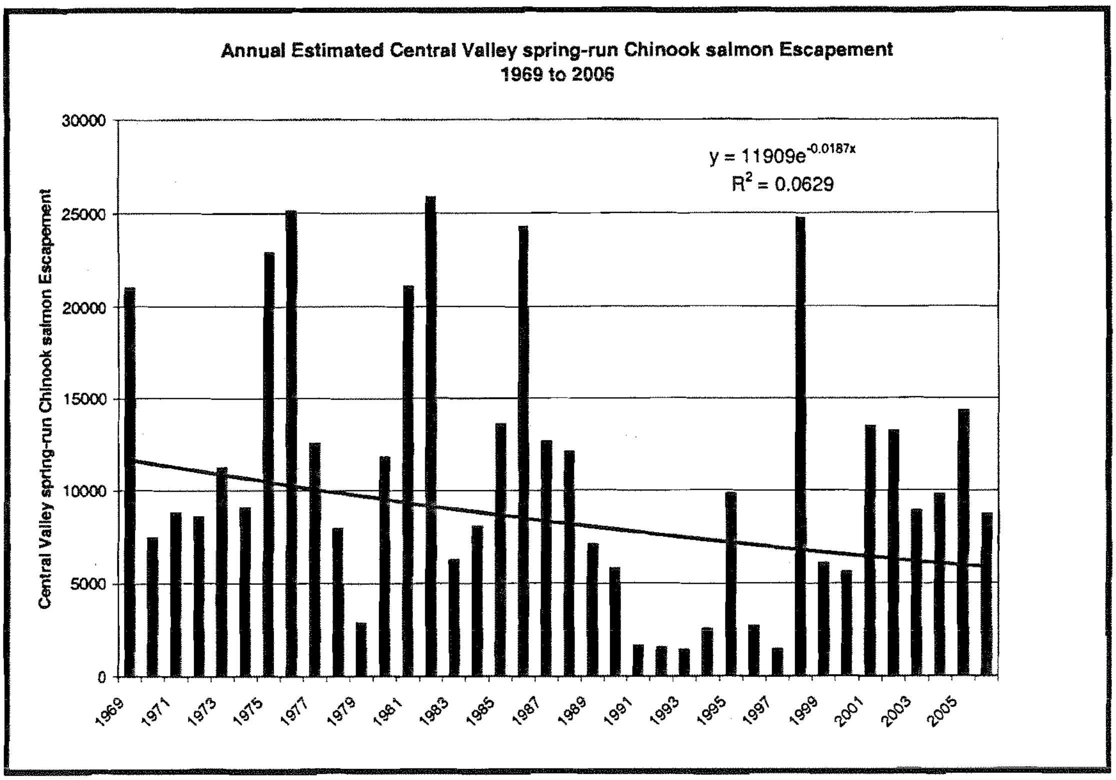

Figure 1. Annual estimated Central Valley spring-run Chinook salmon escapement population for the Sacramento River watershed for years 1969 through 2006 (PFMC 2002, 2004, CDFG 2004b, Yoshiyama 1998, GrandTab 2006).

Based on the Viable Salmonid Population (VSP) parameters of population size, population growth rate, spatial structure, and diversity, Butte Creek and Deer Creek spring-run are at low risk of extinction, satisfying both the population viability analysis (PVA) and other viability criteria. Mill Creek is at moderate extinction risk according to the PVA, but appear to satisfy the other viability criteria for low-risk status (Lindley *et al.* 2007). Since the Spring-run fail the representation and redundancy rule for ESU viability, as their current distribution has been severely constricted; therefore, spring-run are at moderate risk of extinction over an extended period of time.

Since the spring-run critical habitat has suffered similar types of degradation as winter-run critical habitat, the current condition of spring-run critical habitat is degraded, and does not provide the conservation value necessary for the survival and recovery of the species.

Central Valley Steelhead

Over the past 30 years, the naturally-spawned steelhead populations in the upper Sacramento River have declined substantially (Figure 2). Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River, upstream of the Feather River. Steelhead counts at the RBDD declined from about 8,000 fish for the period of 1967 to 1977, to an average of approximately 2,000 through the early 1990s, with an estimated total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults (McEwan and Jackson 1996, McEwan 2001). Steelhead escapement surveys at RBDD ended in 1993 due to changes in dam operations.

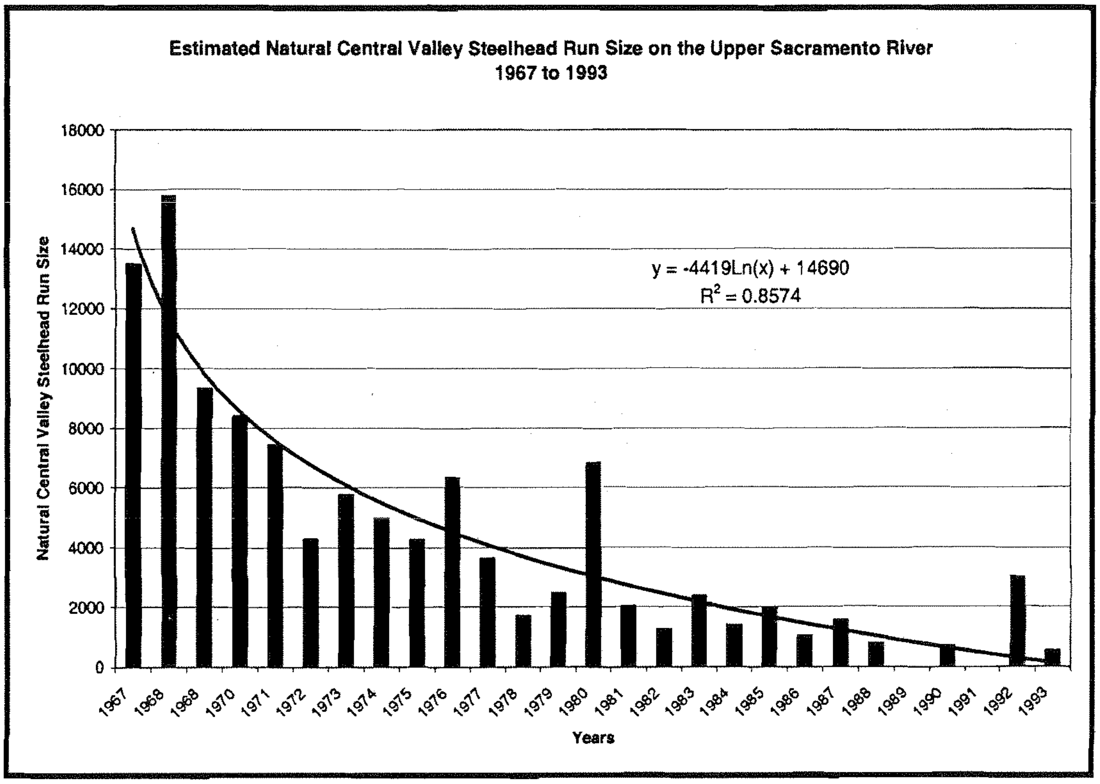

Figure 2. Estimated natural Central Valley steelhead escapement in the upper Sacramento River based on RBDD counts. Note: Steelhead escapement surveys at RBDD ended in 1993 (from McEwan and Jackson 1996).

Nobriga and Cadrett (2003) compared CWT and untagged (wild) steelhead smolt catch ratios at Chipps Island trawl from 1998 through 2001 to estimate that about 100,000 to 300,000 steelhead juveniles are produced naturally each year in the Central Valley. Good *et al.* (2005) made the following conclusion based on the Chipps Island data:

> "If we make the fairly generous assumptions (in the sense of generating large estimates of spawners) that average fecundity is 5,000 eggs per female, 1 percent of eggs survive to reach Chipps Island, and 181,000 smolts are produced (the 1998-2000 average), about 3,628 female steelhead spawn naturally in the entire Central Valley. This can be compared with McEwan's (2001) estimate of 1 million to 2 million spawners before 1850, and 40,000 spawners in the 1960s."

Existing wild steelhead stocks in the Central Valley are mostly confined to the upper Sacramento River and its tributaries, including Antelope, Deer, and Mill Creeks and the Yuba River. Populations may exist in Big Chico and Butte Creeks and a few wild steelhead are produced in the American and Feather Rivers (McEwan and Jackson 1996). Snorkel surveys from 1999 to 2002 indicate that steelhead are present in Clear Creek (Newton 2002 *op. cit.* Good *et al.* 2005). Because of the large resident *O. mykiss* population in Clear Creek, steelhead spawner abundance has not been estimated.

Recent monitoring has detected small self-sustaining populations of steelhead in the Stanislaus, Mokelumne, and Calaveras Rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001). On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995 (S.P. Cramer and Associates Inc. 2000, 2001). Zimmerman *et al.* (2008) has documented CV steelhead in the Stanislaus, Tuolumne and Merced Rivers based on otilith microchemistry.

It is possible that naturally-spawning populations exist in many other streams but are undetected due to lack of monitoring programs (IEP Steelhead Project Work Team 1999). Incidental catches and observations of juvenile steelhead also have occurred on the Tuolumne and Merced Rivers during fall-run Chinook salmon monitoring activities, indicating that steelhead are widespread throughout accessible streams and rivers in the Central Valley (Good *et al.* 2005). CDFG staff has prepared catch summaries for juvenile migrant CV steelhead on the San Joaquin River near Mossdale, which represents migrants from the Stanislaus, Tuolumne, and Merced Rivers. Based on trawl recoveries at Mossdale between 1988 and 2002, as well as rotary screw trap efforts in all three tributaries, CDFG (2003) stated that it is "clear from this data that rainbow trout do occur in all the tributaries as migrants and that the vast majority of them occur on the Stanislaus River." The documented returns on the order of single fish in these tributaries suggest that existing populations of CV steelhead on the Tuolumne, Merced, and lower San Joaquin Rivers are severely depressed (Figure 3).

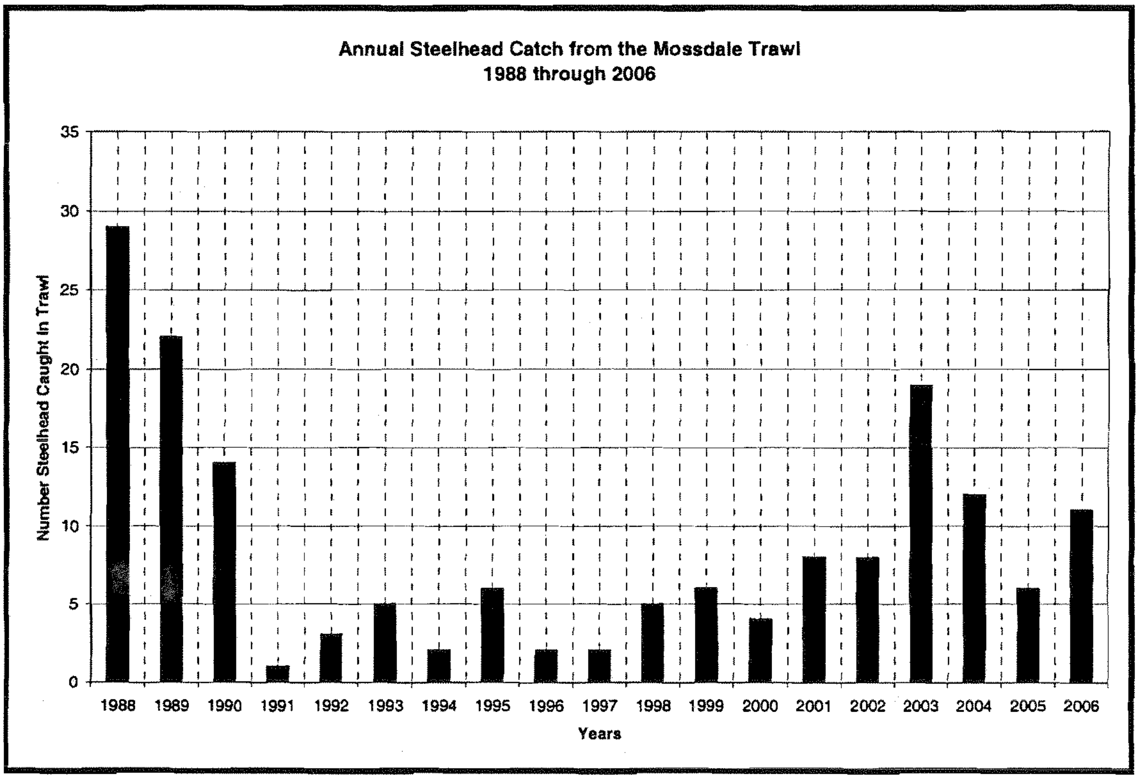

Figure 3. Annual number of Central Valley steelhead caught while Kodiak trawling at the Mossdale monitoring location on the San Joaquin River (Marston 2004, SJRG 2007).

Lindley *et al.* (2007) indicated that prior population census estimates completed in the 1990s found the CV steelhead spawning population above RBDD had a fairly strong negative population growth rate and small population size. Good *et al.* (2005) indicated the decline was continuing as evidenced by new information (Chipps Island trawl data). CV steelhead populations generally show a continuing decline, an overall low abundance, and fluctuating return rates. The future of CV steelhead is uncertain due to limited data concerning their status. However, Lindley *et al.* (2007) concluded that there is sufficient evidence to suggest that the DPS is at moderate to high risk of extinction.

The current condition of CV steelhead critical habitat is degraded, and does not provide the conservation value necessary for the survival and recovery of the species. CV steelhead critical habitat has suffered similar types of degradation as winter-run critical habitat. In addition, the Sacramento-San Joaquin River Delta, as part of CV steelhead designated critical habitat, provides very little function necessary for juvenile CV steelhead rearing and physiological transition to salt water.

Green Sturgeon

Limited population abundance information comes from incidental captures of North American green sturgeon from the white sturgeon monitoring program by the CDFG sturgeon tagging program (CDFG 2002). By comparing ratios of white sturgeon to green sturgeon captures, CDFG provides estimates of adult and sub-adult North American green sturgeon abundance. Estimated abundance between 1954 and 2001 ranged from 175 fish to more than 8,000 per year and averaged 1,509 fish per year. Unfortunately, there are many biases and errors associated with these data, and CDFG does not consider these estimates reliable. Fish monitoring efforts at RBDD and GCID on the upper Sacramento River have captured between 0 and 2,068 juvenile Southern DPS of green sturgeon per year (Adams *et al.* 2002). The only existing information regarding changes in the abundance of the Southern DPS of green sturgeon includes changes in abundance at the John E. Skinner Fish Collection Facility between 1968 and 2006 (Table 3, Figures 4 and 5). The average number of Southern DPS of green sturgeon taken per year at the State Facility prior to 1986 was 732; from 1986 on, the average per year was 47 (April 5, 2005, 70 FR 17386). For the Harvey O. Banks Pumping Plant, the average number prior to 1986 was 889; from 1986 to 2001 the average was 32 (April 5, 2005, 70 FR 17386). In light of the increased exports, particularly during the previous 10 years, it is clear that the abundance of the Southern DPS of green sturgeon is declining. Additional analysis of North American green and white sturgeon taken at the Fish Facilities indicates that take of both North American green and white sturgeon per acre-foot of water exported has decreased substantially since the 1960s (April 5, 2005, 70 FR 17386). Catches of sub-adult and adult Northern and Southern DPS of green sturgeon, primarily in San Pablo Bay, by the IEP ranged from 1 to 212 green sturgeon per year between 1996 and 2004 (212 occurred in 2001). However, the portion of the Southern DPS of green sturgeon is unknown. Recent spawning population estimates using sibling-based genetics by Israel (2006b) indicate spawning populations of 32 spawners in 2002, 64 in 2003, 44 in 2004, 92 in 2005, and 124 in 2006 above RBDD (with an average of 71).

Based on the length and estimated age of post-larvae captured at RBDD (approximately 2 weeks of age) and GCID (downstream, approximately 3 weeks of age), it appears the majority of

Southern DPS of green sturgeon are spawning above RBDD. Available information on green sturgeon indicates that, as with winter-run, the mainstem Sacramento River may be the last viable spawning habitat (Good *et al.* 2005) for the Southern DPS of green sturgeon. Lindley *et al.* (2007) pointed out that an ESU represented by a single population at moderate risk is at a high risk of extinction over the long term. Although the extinction risk of the Southern DPS of green sturgeon has not been assessed, NMFS believes that the extinction risk has increased because there is only one known population, within the mainstem Sacramento River.

Table 3. The annual occurrence of juvenile Southern DPS of North American green sturgeon at the CVP and SWP fish collection facilities in the South Delta. (Adams *et al.* 2002, CDFG 2002)

Year	State Facilities		Federal Facilities	
	Salvage Numbers	Numbers per 1000 acre feet	Salvage Numbers	Numbers per 1000 acre feet
1968	12	0.0162		
1969	0	0		
1970	13	0.0254		
1971	168	0.2281		
1972	122	0.0798		
1973	140	0.1112		
1974	7313	3.9805		
1975	2885	1.2033		
1976	240	0.1787		
1977	14	0.0168		
1978	768	0.3482		
1979	423	0.1665		
1980	47	0.0217		
1981	411	0.1825	274	0.1278
1982	523	0.2005	570	0.2553
1983	1	0.0008	1475	0.653
1984	94	0.043	750	0.2881
1985	3	0.0011	1374	0.4917
1985	0	0	49	0.0189
1987	37	0.0168	91	0.0328
1988	50	0.0188	0	0
1989	0	0	0	0
1990	124	0.0514	0	0
1991	45	0.0265	0	0
1992	50	0.0332	114	0.0963
1993	27	0.0084	12	0.0045
1994	5	0.003	12	0.0068
1995	101	0.0478	60	0.0211
1996	40	0.0123	36	0.0139
1997	19	0.0075	60	0.0239
1998	136	0.0806	24	0.0115
1999	36	0.0133	24	0.0095
2000	30	0.008	0	0
2001	54	0.0233	24	0.0106
2002	12	0.0042	0	0
2003	18	0.0052	0	0
2004	0	0	0	0
2005	16	0.0044	12	0.0045
2006	39	0.0078	324	0.1235

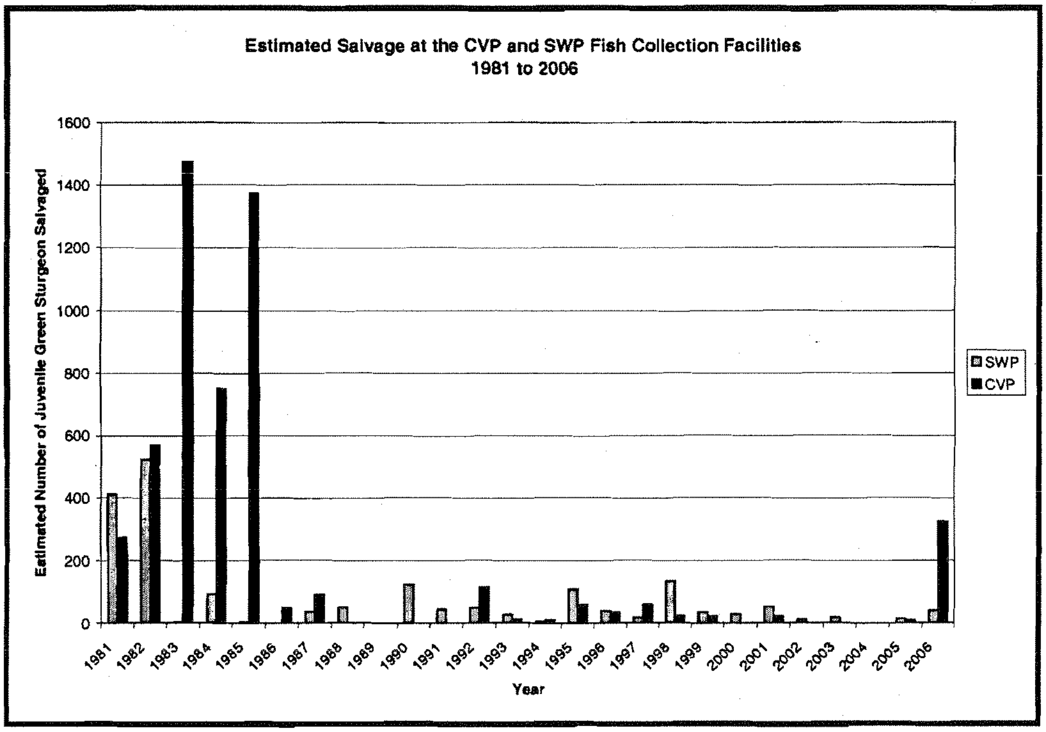

Figure 4 Estimated number of juvenile Southern DPS of North American green sturgeon salvaged from the SWP and the CVP fish collection facilities (Beamesderfer *et al.* 2007, CDFG 2002, Adams *et al.* 2007).

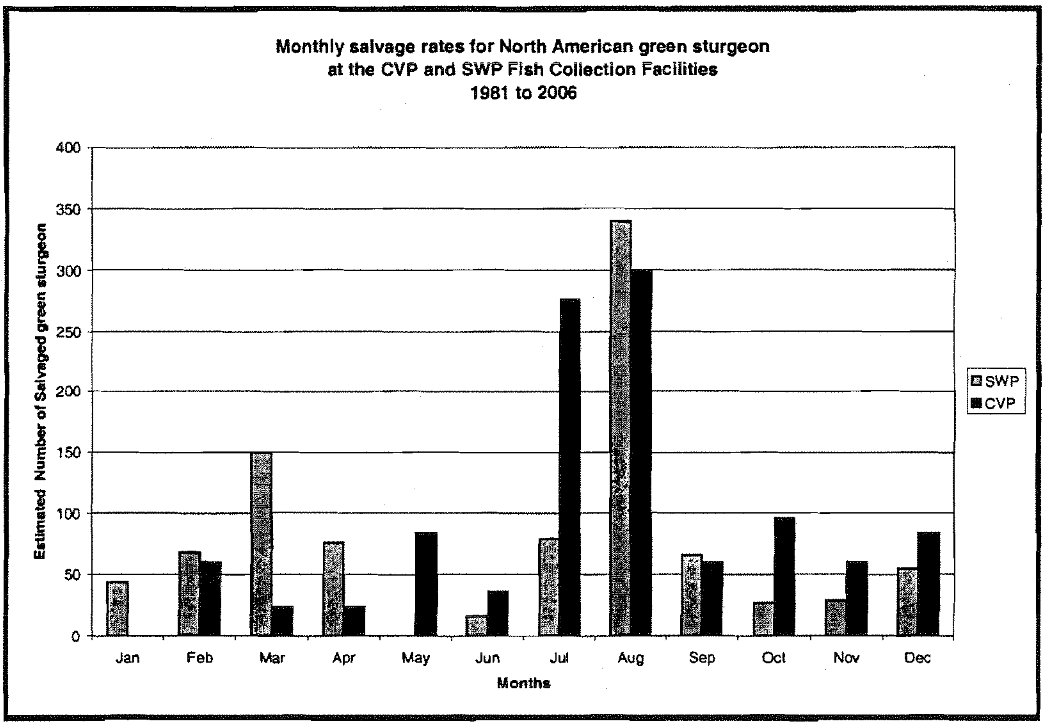

Figure 5. Monthly estimated number of Southern DPS of North American green sturgeon salvaged monthly from the SWP and the CVP fish collection facilities (CDFG 2002, unpublished CDFG records).

Preliminary Analysis

Based on the most recent studies and information provided, we find the current status of Sacramento winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, and North American green sturgeon ranges from a moderate to a high risk of extinction. The population size and abundance are not viable towards the recovery of the species. Conditions of their habitat are highly degraded and do not provide the conservation value necessary for the survival and recovery of the species. Given the current status and condition of the listed species and evaluating them to the proposed activities, NMFS believes the Corps proposed activities for the 80,000 linear feet of bank repair in the Sacramento Bank Protection Project have significant potential to degrade the condition and status of listed species. Prior to finalizing the SRBPP plans, we believe further investigations, studies, and reevaluation should be conducted by the Corps to address concerns related to aquatic species listed under the Endangered Species Act and minimize impacts to listed species and their habitat. The studies should approach each repair site from either a watershed approach or a systemwide perspective than an individual repair site. A watershed or systemwide approach would provide alternative approaches and designs in repairing the erosion sites (*i.e.,* building a setback levee for multiple repairs sites at close proximity and allowing the river to meander at its natural process). In addition, the systemwide approach would allow the opportunity to look into levee repair designs with ecological benefits while minimizing impacts to natural resources, listed species, and their habitat while creating a regional flood control management benefits (*i.e.*, increased conveyance capacity).

Specific Concerns

1. ***Program of SRBPP***

   Based on the presentation given on February 24 and 25, 2009, NMFS is concerned that the SRBPP would not reevaluate a series of repair sites from a watershed approach and provide alternatives for different types of design repair (*i.e.* allowing the river to naturally meander. This would provide listed species a floodplain habitat for rearing and refugia during high flows, instream woody material (IWM) recruitment for shelter along the streambanks, vegetation recruitment for future shaded riverine habitat, etc.

   Since the program is a maintenance program of the existing flood control system of the Sacramento Basin, we are concern opportunities for setback levees would not be considered. Because the repair sites would be newly built, future opportunities to repair the levee system under various programs and plans (FloodSafe, Central Valley Flood Control Board, etc.) would not consider alternative approaches that would be beneficial for natural resources particularly listed species due to "Newly" built repair site.

2. ***Corps No Vegetation Policy***

   NMFS is aware that lots of efforts are being made among various state, federal, and local agencies regarding this policy to meet all need of interested parties. However, based on the proposed design template, operation and maintenance plan (O&M) for repair sites, it appears that O&M for the levee repair sites is going to the direction of degrading the existing riparian and eventually eliminating the riparian corridor of vegetation. The template suggests that eight feet from the toe of the levee should be cleared of vegetation. Vegetation below 4 inch in diameter would be removed. We find eliminating newly growth vegetation would not allow existing vegetation/trees to be replaced, thus eventually eliminating a riparian corridor with shaded riverine habitat, which is utilized as a migratory corridor by listed species and is designated as critical habitat. In addition, this policy would prevent newly built levee sites to meet the expected Standard Assessment Methodology model (SAM) results and terms and conditions listed in previous biological opinions. IWM would not be able to recruit IWM due to the lack of resources, planted vegetation would not be able to reach the target height and coverage as listed in the SAM results.

3. *Designs*

Several designs presented in the public meeting showed some degree of impacts to listed species from pure riprap face without vegetation to benches with some vegetation. The least impact to listed species is the design with a bench /lower berm with vegetation. However, the least impact design does not appear to fit some existing designs such as the levees in the delta and Deer Creek that are very low levee and small with no berms to plant vegetation or not enough room to plant vegetation. In addition, some areas especially at the outer bend of a river meander, the levee is steep. Thus, we find that the fifteen foot buffer from the toe to the berm does not provide room for potential habitat restoration for listed species. Various design and buffer measurements should be considered to accommodate different levee profile.

4. *Timeline*

Know project schedule may change. NMFS would like a tentative timeline of the project from planning to implementation as the project develops, Having the timeline in the brochure would have been helpful during the scoping meeting because the timeline would help prepare interested parties for future comments and participation.

Recommendations

In the preparation of the programmatic biological assessment, NMFS recommends the following:

1. Provide a detailed comprehensive evaluation on the characteristics of the Environmental baseline. This should include the following:
    - Types of shade and percentage of shade along the projects area/Sacramento River and its
    - Type of riparian vegetation
    - Density of vegetation along the Sacramento River and its tributary,
    - Characterization of riprap
    - Cumulative effects of riprap within reach subregion for the past 50 years.

- Implementation of the Corps vegetation management policy

2. Evaluate the repair sites from a watershed or systemwide approach that considers setback levees to restore and enhance the natural geomorphologic process. This would encourage alternative levee repair designs which would have ecological benefits while increasing flood control benefits.

3. Conduct a study on existing erosion sites and a cost benefit analysis of whether creating a setback levee would be least expensive compared to the continued maintenance of adding riprap on erosion sites with self-mitigating levee designs. The study should analyze the rate of erosion and amount of riprap to be replaced through the coming years, adjusting to the inflation of cost.

4. Coordinate with California Department of Water Resource's FloodSafe program, which has a direction of repairing levees from a corridor perspective, similar to a watershed approach.

5. Coordinate an outreach program with landowners and non-profit environmental organizations (*i.e.*, The Nature Conservancy, River Partners, etc.) to identify opportunities to purchase land from willing sellers to construct setback levees.

6. Coordinate with the multiagency Bank Swallow Working Group to determine whether the repair sites contain present and past bank swallow.

7. Develop a process of purchasing setback levees to demonstrate the level of efforts being conducted to encourage setback levees, enhance and restore ecological process and natural geomorphologic process.

8. Analyze the effects of the program in regards to the following:
   - Viability of listed species using concepts described in our "Viability Salmon Populations and the Recovery of Evolution Significant Units" report (NOAA Technical Memorandum NMFS-NWFSC-42, 2000), "Recovery Planning Guidance for Technical Recovery Teams" (NMFS-SWFSC, 2000), "Population Structure of Threatened and Endangered Chinook Salmon ESUs in California's Central Valley Basin" (Lindley *et al.* 2004. NOAA Technical Memorandum NMFS. NOAA-TM-NMFS-SWFSC-360), "Historical Population Structure of Central Valley Steelhead and its Alteration by Dams" (Lindley *et al.* 2006. *San Francisco Estuary and Watershed Science,* 4(1): 1-19), "Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin" (Lindley *et al.* 2007. *San Francisco Estuary and Watershed Science,* 5(1): 1-26)
   - Critical habitat particularly the Primary Constituent Elements (*i.e.*, spawning, freshwater rearing habitat, freshwater migration corridor, and estuarine areas)
   - Recovery of the species in the Central Valley Mulit-Species Salmon and Steelhead Recovery Plan

- A list of recovery action items that parallels to the NMFS' Recovery Plan for Chinook salmon and steelhead.
- The status of the species affected by the addition of riprap as well as the affects to the value of the threats assessments in the recovery plan such as the loss of riparian habitat, geomorphologic functions, loss of flood plain habitat in the Sacramento River and Delta.

9. Develop and conduct a comprehensive fish research program with the collaborative and support of NMFS' Southwest Fisheries Science Center and the Corps Environmental Research Development Center (ERDC). The Corps's ERDC should coordinate and collaborate with NMFS' Southwest Science Center during the development of the fish monitoring plan. We highly recommend that the Corps pursue a research funding agreement to ensure and secure participation from our science center. We believe the Science Center can provide expertise, comments, knowledge, skills, and background experience to immediately address the needs of the Corps.

   This would entail developing and conducting a green sturgeon study in terms of distribution, location, population size, density, and abundance.

   Suggested studies from our Green Sturgeon Lead:
   - Acoustic Tagging
   - Use of Didson Camera to find the holding locations at several sites.
   - Habitat Classification *(i.e.*, loss of mudflats in the delta and habitat diversity), erosion sites, depth, clarity of the water and temperature, etc.
   - Hydrology study of future riprap as a function in loss of GS habitat
   - Loss of macroinvertebrates, organic input and nutrient when new riprap are in placed.
   - River bathymetric GIS layer.

10. Reevaluate the Standard Assessment Methodology (SAM) model and develop a procedure to integrate Green Sturgeon in the model. The Corps should request NMFS Southwest Fisheries Science Center for their review.

11. Develop/Update the Operation and Maintenance Manual (vegetation) on levee repair sites.

12. Require a conservation easement on future levee repair projects. This would provide the right to construct with vegetation and continually maintain the site according to the project descriptions and levee design alternatives of the biological assessment, terms and conditions of the biological opinion, etc.

13. Develop a conservation strategy for the SRBPP that includes the following:
    - Measurable goals and objectives
    - Process/procedure in mitigation/purchase of a conservation bank
    - Guidelines on the different types of conservation banking credits

- Map Geographical Information System (GIS) Layer of potential conservation banking sites (preferably at least 2 per reach) and setback levees.

14. Develop a training manual of the SAM model that includes the following:
    - Procedure in collecting data
    - Procedure in the input of data
    - Types of preferred summary data, templates, and graphs (*i.e.* pre- and post construction conditions)
    - Guidelines in implementing the SAM and sample alternatives to compensate the negative values of the SAM (*i.e.*, how much wood to be constructed for the loss of SRA)
    - Guidelines in placing riparian vegetation and IWM
    - Guidelines in installing, and maintaining the sites to meet the results of SAM values.

15. Develop a hydraulic model on the effects of the Flood Control System in regards to climate change.

16. Create a new website specifically of all the levee repairs. The website should have current, past, and future levee repairs, links to their biological opinion, download feature of maps, information, Environmental Assessment/Environmental Impact Statement (EA/EIS), research studies, location of mitigation and compensation sites and their status, etc.

17. Follow-up on previous terms and conditions that were provided in our previous biological opinions for the SRBPP such as the following:

    - A manual of different types of fish-friendly levee repair designs. The manual should list which designs works or does not work for certain situation.
    - A manual or guidance document on different types of vegetation that could be used along the levee at different elevation.
    - Soil/rock composition study. The study should demonstrate whether the vegetation growth rate increases or decreases on the types of soil/rock composition (*i.e.*, burrito style (Sacramento Area Flood Control Agency's (SAFCA) levee repair design) vs. rock-soil-rock/soil combination vs. 70:30 mixture vs. jetting soil in the voids vs. shooting soil on the riprap modified conveyor belt.

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Flex your power!
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March 2, 2009

Kip Young
Central Valley Flood Protection Board (CVFPB)
2825 Watt Avenue, Suite 100
Sacramento, CA 95821-0000

Sacramento River Bank Protection Phase II Supplemental Authority (SCH No. 2009012081)

Dear Mr. Young:

The California Department of Transportation (Caltrans) appreciates the opportunity to comment on the subject Notice of Preparation (NOP) for the Sacramento River Bank Protection Phase II Supplemental Authority Draft Environmental Impact Report (DEIR). Per our telephone conversation on the date of this letter, I understand that your project's NOP comment period has been extended to March 17, 2009.

The project entails the addition of up to 80,000 linear feet of bank protection in the existing Sacramento River Flood Control Project (SRFCP) area, pursuant to Section 3031 of the Water Resources Development Act (WRDA) of 2007. It is a continuing construction project to provide erosion protection for the existing levees and flood control facilities of the SRFCP. The U.S. Army Corps of Engineers (USACE) is the lead agency for purposes of the National Environmental Policy Act (NEPA), and the CVFPB is the lead agency for purposes of the California Environmental Quality Act (CEQA).

The Caltrans Local Development-Intergovernmental Review (LD-IGR) Program is your partner in stewardship of the public interest, our part of which entails the State Highway System (SHS) including over 12,000 state highway bridges. Caltrans is also tasked by Federal regulation with oversight of approximately 12,200 bridges owned by local government agencies. Much of the SRFCP including the proposed project bears potential effects to county and city bridges under our oversight. We are particularly interested in having potential scour conditions addressed in your analysis. In further consideration of our responsibilities under CEQA and identified in 40 CFR 1508.15 and 40 CFR 1508.26 for NEPA purposes, we have the following specific comments:

1. If a change in water level is expected to result from the project, a complete hydraulic evaluation of bridges in the affected area must be performed.
2. At bridge locations, a seepage analysis will be required. Seepage identified in this analysis should be mitigated to zero beyond the bridge embankment.
3. A sediment analysis and report will be required.
4. For work occurring within the State right of way, an encroachment permit from Caltrans will be required.
5. Heavy and oversized loads using State highway facilities are subject to transportation permit requirements.

In addition, we request that you forward all calculations, reports and analysis to our office for further review as project-specific details become available.

Please let us know if we can be of assistance or guidance, for example, direction to the appropriate office for your permitting needs. My telephone number is 916.651.8201, and I can be reached via e-mail at: gary.arnold@dot.ca.gov.

Sincerely,

Gary S. Arnold
Statewide Local Development-Intergovernmental Review Coordinator
Office of Community Planning

c: State Clearinghouse, Governor's Office of Planning and Research (OPR)
B. De Terra, District 3
D. El Nakhal, HQ Encroachment Permits
R. Hunt, HQ Underwater Investigations

The Nature Conservancy
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March 16, 2009

Matt Davis
US Army Corps of Engineers
CESPK-PD
1325 J Street
Sacramento, CA 95814-2922

Subject: Scoping Comments for the Joint EIS/EIR for the Sacramento River Bank Protection Project Phase II Supplemental Authority

Dear Mr. Davis,

Thank you for the opportunity to provide comments on the Sacramento River Bank Protection Project Phase II Supplemental Authority (Project) The Nature Conservancy is concerned about the placement of revetment on the Sacramento River and its tributaries because of the well documented adverse impacts that it has on the health of the river and its natural communities While we recognize that in certain instances it is absolutely necessary to halt erosion, we know that past bank protection projects that have gone far beyond what was needed to protect the critical public infrastructure.

Earlier Sacramento River Bank Protection Project activities included the installation of miles of revetment that does not protect flood protection levees but instead stops the meander of the river. This revetment blocks the natural creation of terrestrial and aquatic habitats and the succession of vegetation that is absolutely essential to healthy natural communities and viable populations of special status species. While we hope that the Project will only result in protecting levees in areas that are subject to erosion, we are concerned that the project description and the entire EIS/EIR needs to be clear about what is and is not included in the Project.

We believe that, through a collaborative approach that incorporates input from relevant constituencies and experts early in the process, it is possible to achieve both public safety and ecosystem restoration goals, consistent with the Corps' own "Environmental Operating Principles." To that end we are providing scoping comments on the EIS/EIR, comments on the proposed Project and recommended public process steps.

Scoping Comments:

1. The Nature Conservancy is particularly concerned that the bank protection is proposed to be evaluated with a *programmatic* EIR that will not analyze the specific changes that will occur as part of the Project. Although it is stated that a range of different solutions (e.g., riprap of existing bank, levee setback) will be considered for individual repairs, the scoping information contains no listing of sites and no discussion of what is to be done at any particular problem site. As such, the EIS/EIR will not provide an adequate analysis of the impacts of the Project. To rectify this problem, the document should incorporate the exact locations of the sites (with GPS coordinates and photographs) and analyze the proposed changes at these sites. This will permit interested parties to evaluate both the effects of the Project and the adequacy of the draft EIS/EIR. We understand that a list of one hundred and ten bank protection sites, based on the 2008 inventory of bank erosion sites, has been

reviewed by regulatory agencies in conjunction with their initial comments on the Project. We recommend that this listing be incorporated and evaluated in the EIS/EIR.

If those specific sites are not specifically a part of the Project they should, at a minimum, be used as examples of the type of erosion sites that will included in the Project. The EIS/EIR should provide clear documentation of the type of sites and physical changes that may be included within the Project and specify the limits of the NEPA/CEQA coverage to be provided by the proposed EIS/EIR. This will permit an adequate analysis of the impacts of the Project consistent with NEPA and CEQA. The EIS/EIR should also clearly provide that any bank protection improvements that do not fall within the parameters of these examples and the document's analysis are not a part of the proposed Project and not a part of the NEPA/CEQA coverage it provides.

2. It is completely insufficient to consider impacts only in terms of loss of Shaded Riverine Aquatic habitat. Loss of river meander also results in great impacts to the river ecosystem for many aquatic and terrestrial species. These impacts are most obvious with regard to bank swallows, which require actively eroding banks for nesting. However bank erosion and the resultant processes of sediment transport and deposition are also important for a broad suite of terrestrial and aquatic species. For example, cottonwoods require newly deposited sediments for seed germination, and salmon rely on invertebrate prey items that reside in well aerated gravels. If the Project will result in the limitation of river meander then this full range if impacts must be analyzed.

3. In addition to considering the full range of impacts (as called for above), there should be an assessment of the *cumulative* impacts of all the revetment that has been installed to date in addition to the 80,000 feet proposed under this EIS/EIR (the Corps' "project overview" states that "about 820,000 feet" have been stabilized under SRBPP since its initial authorization in 1960). Some incremental repair projects may not individually cause great harm to the environment, but in combination with all of the past revetment, the impacts are very significant.

4. In response to comment 83 made by J. Hobbs (USFWS) the Corps states that "the [site - specific] alternatives were to be selected based on best professional judgment." This response suggests that the Corps feels it is sufficient to consider only the best judgment of their staff when selecting alternatives. The Nature Conservancy believes that the outcome of these projects would be improved by including the perspectives of a wider collection of experts who work on the Sacramento River (e.g., DFG, USFWS, DWR, and TNC).

Project Comments

1. This Project should only include the repair of erosion sites where the flood protection improvements are imminently threatened. For all repair sites a determination must be made as to whether or not allowing continued meander is possible. Levees that do not protect critical infrastructure should be setback where possible. Flood easements and/or setback levees should be given primary consideration when seeking long-term, cost effective solutions. Placing new rock should be the last resort. Purchasing highly erodible lands for long-term conservation ownership may be considerably less expensive over the long run than continuing to repair erosion sites through traditional placement of riprap.

2. Trees are needed along the levees where space exists or can be created. Although the presentation at the public scoping meeting in Chico on February 25, 2009, showed several Corps-approved vegetation designs, the design that is proposed for this project (levees

devoid of trees and shrubs) is the most ecologically damaging. At a minimum, riparian plantings of the sort included in recent erosion repairs on the Sacramento River at River Mile 178R should be provided.

3. Give full consideration to the recommendations made by NOAA/NMFS on what sites should be considered for levee setbacks.

Process Recommendations

1. Develop a project timeline for all phases of Sacramento Bank Protection work that details the various phases of planning and the opportunities for stakeholder input.

2. Contact all groups that focus on the watersheds where projects are proposed, and invite their participation in the planning process. It is not sufficient to seek stakeholder input when the projects are already at the 60% design phase (as has been done in the past). The Nature Conservancy and other entities have a great deal of experience working with the Corps to achieve creative solutions to flood management problems in a way that does not unduly damage river ecosystems.

3. Work with the Sacramento River Conservation Area Forum to facilitate public outreach for this project.

This additional increment of the Sacramento River Bank Protection Project has the potential to provide important flood control benefits but it also has the potential to cause great ecological damage. We also understand from a recent presentation given by Frank Piccola that there is discussion of a Phase III of the Sacramento River Bank Protection Project that could include an additional 400,000 lineal feet of bank protection. The Nature Conservancy is very concerned that the subject Project and this possible future Phase III could, if directed to stop river meander in the middle portion of the Sacramento River, negate all of the ecological gains that we and our partner agencies have achieved over the past twenty plus years. We would like to meet with your staff in the near future to discuss our comments to this EIS/EIR scoping as well as our concerns regarding this and future phases of the Sacramento River Bank Protection Project.

The Nature Conservancy looks forward to working with you on this important Project.

Sincerely,

Gregg Werner

Gregg Werner
Project Director, Sacramento River

Cc: Frank Piccola
Mike Dietl
Beverley Anderson-Abbs
Kent Smith
Kevin Foerster
Kelly Moroney
Madelyn Martinez
Glen Pearson

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, Governor

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March 16, 2009

Mr. Matt Davis
U.S. Army Corps of Engineers
Sacramento District, ATTN: CESPK-PD-R
1325 J Street
Sacramento, California 95814

Dear Mr. Davis:

SUBJECT: Sacramento River Bank Protection Project

Staff of the Delta Protection Commission (Commission) has reviewed the proposed project. Based on the information provided, a determination has been made that the project area involves lands in the Primary and Secondary Zones of the Legal Delta.

The Delta Protection Act (Act) was enacted in 1992 in recognition of the increasing threats to the resources of the Primary Zone of the Delta from urban and suburban encroachment having the potential to impact agriculture, wildlife habitat, and recreation. Pursuant to the Act, a Land Use and Resource Management Plan (Management Plan) for the Primary Zone was completed and adopted by the Commission in 1995.

The Management Plan sets out findings, policies, and recommendations resulting from background studies in the areas of environment, utilities and infrastructure, land use, agriculture, water, recreation and access, levees, and marine patrol/boater education/safety programs. As mandated by the Act, the policies of the Management Plan are incorporated in the General Plans of local entities having jurisdiction within the Primary Zone, including Contra Costa, Sacramento, San Joaquin, Solano and Yolo Counties.

The policies and recommendations from the Management Plan that are relevant to this project include, but are not limited to, the following:

Levees

- Policy 1: Local governments shall ensure that Delta levees are maintained to protect human life, to provide flood protection, to protect private and public property, to protect historic structures and communities, to protect riparian and upland habitat, to promote interstate and intrastate commerce, to protect water quality in the State and federal water projects, and to protect recreational use of the Delta area. Delta levee maintenance and rehabilitation shall be given priority over other uses of the levee areas. To the extent levee integrity is not jeopardized, other uses, including support of vegetation for wildlife habitat, shall be allowed.

- Recommendation 1: Levee maintenance, rehabilitation, and upgrading should be established as the first and highest priority of use of the levee. No other use whether for habitat, trails, recreational facilities, or roads should be allowed to unreasonably adversely impact levee integrity or maintenance.
- Recommendation 6: A "clearinghouse" for material suitable for levee maintenance should be created to assist in distributing appropriate materials to sites slated for maintenance work. Materials which have value for levee maintenance work, such as materials routinely dredged from Delta channels or materials otherwise excavated from within the Delta area, should be reserved first for levee maintenance work. Other uses should be considered only if the material is not needed or is unsuitable for levee maintenance work. Regulations should establish priorities for in-Delta use of soil excavated from within the Delta.

Thank you for the opportunity to provide input into the proposed project. Please contact me at (916) 776-2290 if you have any questions or need clarification regarding the comments provided herein.

Sincerely,

Linda Fiack

Linda Fiack
Executive Director

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, *Governor*

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February 19, 2009

File Ref: SCH# 2009012081

The Central Valley Flood Protection Board
Attn: Kip Young
2825 Watt Avenue, Suite 100
Sacramento, Ca 95821

Subject: Sacramento Riverbank Protection Phase II Supplemental Authority Notice of Preparation

Dear Mr. Young:

The purpose of this letter is to provide you with comments on the Central Valley Flood Protection Board (CVFPB) Notice of Preparation (NOP) for the joint Draft Environmental Impact Statement/ Environmental Impact Report (Draft EIS/EIR) for the Sacramento River Bank Protection Project (SRBPP) Phase II Supplemental Authority. For this project, the California State Lands Commission (Commission) is both a trustee agency and a responsible agency under the California Environmental Quality Act (CEQA).

The State acquired sovereign ownership of all tidelands and submerged lands and beds of navigable waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all the people of the State for statewide Public Trust purposes which include waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. The landward boundaries of the State's sovereign interests in areas that are subject to tidal action are generally based upon the ordinary high water marks of these waterways as they last naturally existed. In non-tidal navigable waterways, the State holds a fee ownership in the bed of the waterway between the two ordinary low water marks as they last naturally existed. The entire non-tidal navigable waterway between the ordinary high water marks is subject to the Public Trust Easement. Both the easement and fee-owned lands are under the jurisdiction of the Commission. The locations of the ordinary high and low water marks are often related to the last natural conditions of the river, and may not be apparent from a present day site inspection.

To the extent the project involves State-owned sovereign lands owned in fee by the State and under the jurisdiction of the Commission, such as the Sacramento River, the current lease will need to be modified as required. A detailed site location and description will need to be submitted to the Commission to determine the exact extent of the Commission's leasing jurisdiction.

The current project is to authorize an additional 80,000 linear feet of bank protection (and other measures), in addition to the previously authorized 820,000 linear feet of improvements on the Sacramento River. The cumulative loss of associated riparian vegetation and shaded riverine aquatic habitat along 820,000 linear feet of river bank will be difficult to mitigate, as will the resulting impacts to the listed runs of salmonids and listed avian species. The Commission recommends that the Central Valley Flood Protection Board work very closely with the fisheries agencies (i.e., California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service (USFWS), and NOAA Fisheries) and with local representatives of adjoining landowners (such as the Sacramento River Conservation Area Forum) to addresses these cumulative impacts and to design appropriate mitigation/conservation areas. Other types of mitigation, such as avoidance, both in time and space (such as construction work windows), will also need to be considered.

Queries of the Natural Diversity Database (CNDDB) and the USFWS Special Status Species Database should be conducted to identify any special-status plant or wildlife species that may occur in the region. Their potential for occurrence on the project site or in the project area should be included in the DEIS/ DEIR.

One of the major stressors of the Sacramento River system is introduced species. Therefore, the DEIS/DEIR should consider a range of alternatives for prevention programs for terrestrial and aquatic invasive species (including quarantine, early detection, and early response) to slow the introduction of invasive species, such as the Quagga mussel, into high demand and sensitive areas. As part of the alternative analysis, the design of the proposed project should take into consideration the current and proposed aquatic invasive species prevention programs. In addition, in light of the recent decline of pelagic organisms and in order to protect at-risk fish species, the DEIR/DEIS should examine the objectives of the project and determine if the project would favor non-native fisheries within the Sacramento River.

An evaluation of the noise and vibration impacts on fish and birds from construction activities in the water, as well as construction on the levees and land-side supporting structures of the Sacramento River and flood control facilities, should be included in the DEIS/DEIR. Mitigation measures may be needed that would include species-specific work windows as defined by CDFG, USFWS, and NOAA Fisheries.

Any construction activities along the water-side bank should consider water quality issues, such as increased turbidity and sedimentation, and make all the necessary arrangements to reduce or mitigate for these concerns.

An evaluation of potential submerged cultural resources in the project area will need to be undertaken. Any submerged archaeological site or submerged historic resource remaining in state waters for more than 50 years is presumed to be significant. The title to all abandoned shipwrecks and all archaeological sites and historic or cultural resources on or in the tide and submerged lands of California is vested in the state and under the jurisdiction of the Commission. The Commission maintains a shipwrecks database of known and potential vessels located on the state's tide and submerged lands; however, the location of many shipwrecks remains unknown. The recovery of objects from any submerged archaeological site or shipwreck requires a salvage permit under Public Resources Code (PRC) section 6309. On statutorily granted tide and submerged lands, a permit may be issued only after consultation with the local grantee and a determination by the Commission that the proposed salvage operation is not inconsistent with the purposes of the legislative grant. A Code of Federal Regulations section 106 evaluation should be made, as well, to determine any potential terrestrial cultural resources in the project areas where construction can occur.

Greenhouse gas emissions information consistent with the California Global Warming Solutions Act (AB 32) should be included in the DEIS/DEIR. This would include a determination of the greenhouse gases that will be emitted as a result of construction and ongoing maintenance of the levee system, a determination of the significance of those impacts, and mitigation measures to reduce any impacts found to be significant.

An evaluation of the temporary and permanent loss of recreation resources in the specific areas during the construction of the Sacramento River levee and flood control facilities improvements should be included in the DEIS/DEIR. These impacts should include mitigation measures, which might include alternative public access points, for the residents and tourists for the area.

The DEIS/DEIR should discuss the potential changes and impacts to current transportation routes into and out of areas during the construction of the proposed Sacramento River levee improvements and flood control facilities. Once again, these impacts should include mitigation measures for the residents and tourists of the area.

As a responsible agency, the Commission will need to rely on this document for the issuance of a lease, and therefore, we hope that you consider our comments prior to adoption of the final EIS/EIR. Please contact Diane Jones, Public Land Manager, at 916-574-1843 or by email at jonesd@slc.ca.gov for information about our leasing requirements. For questions and comments related to the environmental review, please contact Christopher Huitt at (916) 574-1938 or by e-mail at huittc@slc.ca.gov.

If you have any questions involving the Shipwreck and Historic Maritime Resources Program please contact Staff Counsel Pam Griggs at (916) 574-1854 or by email at griggsp@slc.ca.gov.

Sincerely,

Gail Newton, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
State Clearinghouse
D. Jones, CSLC
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February 23, 2009

Jay Punia
Executive Officer
Central Valley Flood Protection Project
3310 El Camino Ave, Rm LL40
Sacramento, CA 95821

Subject: **Notice of Preparation of an Environmental Impact Statement and Environmental Impact Report for the Sacramento River Bank Protection Project Phase II Supplemental Authority**

Dear Mr. Punia:

The Sacramento Regional County Sanitation District (SRCSD) and Sacramento Area Sewer District (SASD) have reviewed the Notice of Preparation for the Sacramento River Bank Protection Project Phase II and have the following comments:

SRCSD and SASD currently have several essential facilities in operation that are located in the proposed project area. It is important that SRCSD retains the ability to maintain and/or rehabilitate these facilities, including the possibility of adding future structures, in order to meet the needs of the community. There needs to be close coordination with SRCSD during the design phase for projects that are within the vicinity of the SRCSD interceptors to ensure that this project does not adversely affect SRCSD and/or SASD facilities..

SRCSD's Lower Northwest Interceptor (LNWI) crosses the Sacramento River in two locations. The Northern Sacramento River Crossing consists of two 60-inch diameter pipelines that cross under the Sacramento River near the Interstate 80 Bridge in northern Sacramento County. This section of pipe extends 2,000 feet under the riverbed at a depth of approximately 45 feet. The Southern Sacramento River Crossing is located north of the Freeport Bridge. This section of pipe extends 2,100 feet under the riverbed at a depth of approximately 45 feet.

The Arden Force Main and the Arden Parallel Force Main are two 60-inch diameter force mains that cross under the American River near the California State University of Sacramento and the Fairbain Water Treatment Plant.

The Sump 82 force main crosses under the American River east of Richards Blvd. This pump station and force main were originally part of the Mode 2 operating scenario which allows for the City of Sacramento wastewater flows to be diverted from their collection system to these dual force mains.

The Northeast Siphons also cross under the American River. Possible future improvements to these facilities may include either replacing the current pipeline or constructing a second siphon parallel to the original one. SRCSD also requests to retain the right to construct above ground facilities in this area, such as a Water Recycling Facility, on a portion of the old Northeast Treatment Plant site.

SRCSD operates the Sacramento Regional Wastewater Treatment Plant (SRWTP) which treats wastewater from the Sacramento metropolitan area and discharges approximately 130 million gallons per day of treated wastewater into the Sacramento River. The SRWTP outfall is located in the lower Sacramento River near the town of Freeport.

SASD has two force main lines that may be affected by the levee restoration project. SASD should be involved during the preliminary design phase if any of their levee restoration efforts or transportation routes encroaches within 200 feet of either side of the following sewer force main lines:

- Shallow sewer force main crossing perpendicularly underneath the Sacramento River in Walnut Grove from the east shore at River Road and C Street (near 14125 River Road) to the west shore at 4th Avenue and California State Highway 160.
- Sewer force main crossing perpendicularly from north to south underneath the Delta Cross Channel between the towns of Locke and Walnut Grove.

If you have any questions regarding these comments, please contact me at (916) 876-9994.

Sincerely,

Sarenna Deeble

Sarenna Deeble
SRCSD/SASD
Policy and Planning

cc: Ruben Robles
Michael Meyer
My Huynh
SRCSD Development Services
SASD Development Services

June 4, 2009

Altacal Audubon Society
PO Box 3671 Chico, California 95927-3671
http://www.altacal.org/

Matt Davis
Army Corps of Engineers
CESPK-PD
1325 J Street
Sacramento, CA 95814-2922
Email: Matthew.g.Davis@usace.army.mil

Subject: Sacramento River Bank Protection Project

Dear Mr. Davis:

The Altacal chapter of the National Audubon Society would like to express our general concern for the bank rocking projects that will be taking place over the next several years as part of the Sacramento River Bank Protection Project Phase II Supplemental Authorization. With the significant amount of rock that is already armoring the river, the addition of approximately 16 miles of river and tributary rock will have further cumulative impact to the Sacramento River's natural processes.

We are actively engaged in the management of the state threatened Bank Swallow and aware of the status of other species use of Sacramento River habitats, including the state endangered Western Yellow-billed cuckoo. Because bank rocking removes existing and potential nesting habitat for swallows, new rock installed on eroding banks will most directly impact them as well as processes at and proximate to the armored site. But as noted, cumulative impacts will occur and assessment should also be considered on a system-wide level. As proponents for species conservation we recommend 1) re-evaluation of the necessity of rock for each area that has been identified, 2) avoidance where appropriate 3) alternatives such as conservation easements and set back levees where appropriate and 4) holistic mitigation for species and habitats that will be impacted.

We look forward to working with you during this process.

Thank you,

Dawn Garcia
Conservation Chairperson
conservation@altacal.org

cc: Board of Directors,
Altacal Audubon Society
Audubon California
River Partners
The Nature Conservancy
Sacramento River Preservation Trust
PRBO Conservation Science
Bank Swallow Working Group

March 13, 2009

Matt Davis
Army Corps of Engineers
CESPK-PD
1325 J Street
Sacramento, CA 95814-2922

Dear Mr. Davis,

Thank you for the opportunity to provide comments on this project. As a public citizen, I am concerned about the placement of riprap on the Sacramento River and its tributaries because of the well documented adverse impacts that it has on the health of the river and its natural communities. While I recognize that in certain instances it is absolutely necessary to halt erosion in order to protect critical infrastructure, alternatives need to be more adequately pursued prior to applying practices that are being used because that is what always has been done. In an effort to avoid similar outcomes in the future, I would like to provide the following comments/suggestions:

1. I am particularly concerned that the proposed rock work is being evaluated with a *programmatic* Environmental Impact Statement/Report (EIS/R). Although it is stated that a range of different solutions (e.g., riprap of existing bank, levee setback) will be considered for individual repairs, there is no discussion of what is to be done at the particular problem sites—nor is there any listing of these sites. It is therefore impossible to provide meaningful feedback on the project. To rectify this problem, the Army Corps of Engineers (Corps) should provide a listing of the exact locations of the sites (with GPS coordinates and photographs if available).

2. This project should not include the repair of erosion sites where no critical infrastructure is imminently threatened. For all repair sites determinations must be made as to whether or not it is possible to allow continued meander. In general, a wider range of alternatives should be feasible on the reaches of the Sacramento River above Colusa, where levees do not directly align the channel on both sides. Levees should be allowed to erode when possible. Flood easements and/or setback levees should be given primary consideration when seeking long-term, cost effective solutions.

3. Although each erosion site must be considered individually, there should be consideration given to reach and watershed effects. Issues of temporal and spatial scale must be considered to characterize likely impacts on natural river processes such as erosion and sediment deposition, as well as important human considerations such as flood protection.

4. Placing new rock should always be the last resort. Purchasing highly erodible lands for long-term conservation ownership may be considerably less expensive over the long run than continuing to repair erosion sites through traditional placement of revetment.

5. It is insufficient to consider impacts only in terms of loss of Shaded Riverine Aquatic habitat. Loss of river meander also poses large impacts on the river ecosystem for a suite of aquatic and terrestrial species, including several which are federally or state-listed under the federal Endangered Species Act and the state California Endangered Species Act. These are most obvious in terms of the impacts to bank swallows (*Riparia riparia*), a State-listed species, which require actively eroding banks for nesting. However, bank erosion and the resultant processes of sediment transport and deposition are also important for a broad suite of terrestrial and aquatic species. For example, cottonwoods require newly deposited sediments for seed germination, and Chinook salmon (*Oncorhynchus tshawytscha*), two runs of which are federally and/or state-listed, rely on invertebrate prey items that reside in well aerated gravels.

6. In addition to considering the full range of impacts (as called for above), there should be an assessment of the *cumulative* impacts of all the rocking that has been done to date in addition to the 80,000 feet proposed under this EIS/R, as per the requirements for addressing cumulative impacts in the National Environmental Policy Act (NEPA), and California Environmental Quality Act (CEQA). Incremental repair projects may not pose great risks to the environment, but in combination with all the past work that has been done, as well as projects in the adjacent area of the proposed project, the impacts are likely substantial.

7. Trees are needed along the levees. Recent flume experiments conducted at the University of California Davis suggest that trees do not necessarily increase erosion potential on levees. I recommend alternative designs, such as those authorized for use by the Army Corps of Engineers in 1974, are used for these projects.

8. In response to comment 83 made by J. Hobbs (U.S. Fish and Wildlife Service, or FWS) the Corps states that "the [site -specific] alternatives were to be selected based on best professional judgment." This response suggests that the Corps feels it is sufficient to consider only the best judgment of their staff when selecting alternatives. I believe that the outcome of these projects would be improved by including the perspectives of a wider collection of experts who work on the Sacramento River and affected tributaries (e.g., California Department of Fish and Game, FWS, California Department of Conservation, National Marine Fisheries Service, the Nature Conservancy, Sacramento River Watershed Program, and Sacramento River Conservation Area Forum, as well as affected watershed groups, such as Deer Creek Watershed Conservancy).

9. I am particularly concerned about the proposed work in Deer Creek, which is a spring-run Chinook stream. Little to no detail was provided on the project elements proposed for the Deer Creek levee, other than a map, which was inadequate in scale and detail. A 2002 CALFED Ecosystem Restoration Program grant (over $1 million dollars) was awarded to the Deer Creek Watershed Conservancy to complete a Lower Deer Creek Restoration and Flood Management Feasibility Study, in part as a response to the disastrous effects of the 1997 flood. The levee has been documented to fail prior to reaching design flows. Highly qualified and respected consultants/geomorphologists, including Dr. Matthew Kondolf, University of California Berkeley, and McBain and Trush, Inc., were hired to develop a solution to flood management in the lower watershed. This project determined that a setback levee, along with several other project elements, is the best solution to manage flood flows while also taking landowner's interest into account. Each proposal element, including a setback levee, has been fully vetted with landowners in the watershed. I believe that Army Corps of Engineers staff were involved as technical advisors throughout the time in which the study was conducted. Comments by Ms. Madelyn Martinez (National Marine Fisheries Service) on your Phase II project also captured the need to consider a setback levee at this site. I strongly encourage you to contact Ms. Holly Savage, Deer Creek Watershed Conservancy watershed coordinator (deercreekwatershed@gmail.com) or Brenda Olson (FWS, 530-527-3043) to obtain this critical information on the Study.

Suggested Steps to Improve the Project:

1. Release the list of repair sites with exact GPS locations and photographs.
2. Develop a project timeline for all phases of the work that details the various phases of planning and the opportunities for stakeholder input.
3. Contact all groups that focus on the watersheds where projects are proposed, and invite their participation in the planning process. It is not sufficient to seek stakeholder input when the projects are already at the 60% design phase (as has been done in the past).
4. Utilize the Sacramento River Conservation Area Forum to facilitate project outreach.
5. Give full consideration to the recommendations made by the National Marine Fisheries Service on what sites should be considered for levee setbacks.
6. Contact Holly Savage with the Deer Creek Watershed Conservancy regarding the Lower Deer Creek Restoration and Flood Management Feasibility Study.

Sincerely,

Patricia Bratcher

Patricia Bratcher
P.O. Box 159, Whitmore, CA 96096

Sacramento River Bank Protection Project
Phase II Supplemental Authorization

Name: Diane Fales Date: 2/24/09

Telephone: 530-656-2318 Email: rd1001@syix.com

Affiliation: RD 1001 Title (if applicable): Manager

Street Address: 1959 Cornelius Ave

City: Rio Oso State: CA Zip: 95674

Thank you for your interest in the Sacramento River Bank Protection Project Phase II Supplemental Authorization. Please provide us with your comments regarding the proposed project in the space below. We value your comments; please write legibly.

For your convenience, feel free to take this card with you, fill it out at your opportunity, and mail it to the U.S. Army Corps of Engineers. **Send all written comments by Monday, March 16, 2009.**

Would appreciate information on sites noted along the Bear River. Looking forward to Sac Bank Protection going forward

Please submit your comments to a project representative or fold this form in half, seal with tape and mail to the U.S. Army Corps of Engineers.

Sacramento River Bank Protection Project
Phase II Supplemental Authorization

Name: John Powderly Date: 24 Feb 09

Telephone: (916) 617-4645 Email: JohnP@CityofWestSacramento.org

Affiliation: West Sacramento Flood Control Agency
City of West Sacramento Title (if applicable): Associate Planner

Street Address: 1110 West Capitol Avenue 2nd Floor

City: West Sacramento State: CA Zip: ~~95605~~ 95691

Thank you for your interest in the Sacramento River Bank Protection Project Phase II Supplemental Authorization. Please provide us with your comments regarding the proposed project in the space below. We value your comments; please write legibly.

For your convenience, feel free to take this card with you, fill it out at your opportunity, and mail it to the U.S. Army Corps of Engineers. **Send all written comments by Monday, March 16, 2009.**

- In addition to fishes, bugs, & bunnies, please include the impacts to recreation and openspace caused by this project. Better yet, incorporate recreation & openspace features (or, at least, opportunities for local jurisdictions to provide those features) into the project. Work w/ local jurisdictions to coordinate what the recreation & openspace opportunities.
- When considering environmental mitigations, please ~~priorit~~ ~~consider~~ give local mitigation opportunities higher priority than non-local mitigation opportunities. Perhaps create a rating system for assessing & ranking mitigation opportunities & include in the Program EIR/EIS
- Reach out to locals! Work w/ local jurisdictions to coordinate this program with local levee improvement efforts - better to work on the levee once, instead of twice (if the programs can coordinate w/ time, $, et cetera.) REACH OUT in an effort to coordinate with the local levee authorities.

Please submit your comments to a project representative or fold this form in half, seal with tape and mail to the U.S. Army Corps of Engineers.

Sacramento River Bank Protection Project
Phase II Supplemental Authorization

Name: DENISE REICHENBERG Date: 2/25/09

Telephone: 530 895-4304 Email: dreichenberg@parks.ca.gov

Affiliation: STATE PARKS Title (if applicable): STATE PARK SUPERINTENDENT

Street Address: 525 ESPLANADE

City: CHICO State: CA Zip: 95926

Thank you for your interest in the Sacramento River Bank Protection Project Phase II Supplemental Authorization. Please provide us with your comments regarding the proposed project in the space below. We value your comments; please write legibly.

For your convenience, feel free to take this card with you, fill it out at your opportunity, and mail it to the U.S. Army Corps of Engineers. **Send all written comments by Monday, March 16, 2009.**

Please provide State Parks a list of each site's location. A list of the river and the river mile of each site would work. This will help us determine if any of the project sites will affect specific State Parks.

Please submit your comments to a project representative or fold this form in half, seal with tape and mail to the U.S. Army Corps of Engineers.

Sacramento River Bank Protection Project
Phase II Supplemental Authorization

Name: STUART EDELL P.E. Date: 02/25/2009

Telephone: 530-538-7266 Email: sedell@buttecounty.net

Affiliation: BUTTE COUNTY PW. Title (if applicable): DEPUTY DIRECTOR

Street Address: 7 COUNTY CENTER DRIVE

City: OROVILLE State: CA Zip: 95965

Thank you for your interest in the Sacramento River Bank Protection Project Phase II Supplemental Authorization. Please provide us with your comments regarding the proposed project in the space below. We value your comments; please write legibly.

For your convenience, feel free to take this card with you, fill it out at your opportunity, and mail it to the U.S. Army Corps of Engineers. **Send all written comments by Monday, March 16, 2009.**

THE BUTTE BASIN IS CRITICAL TO THE STATE PLAN OF FLOOD CONTROL. UNFORTUNATELY A CRITICAL WEIR (3B'S) WAS NEVER CONSTRUCTED TO CORPS STANDARDS, UNLIKE THE M&T AND GOOSE LAKE WEIRS. THE RESULT IS THAT FLOOD FLOWS THROUGH THE 3B'S CAUSE HEAD CUTS IN THIS SILT WEIR. THE HEAD CUTS ALLOW WATER TO FLOW FROM THE SACRAMENTO RIVER INTO BUTTE BASIN WHEN THE RIVER IS BELOW WARNING STAGE. THIS FLOW CAUSES PROPERTY DAMAGES, CLOSES ROADS FOR LONG PERIODS AFTER THE FLOOD EVENT AND MOST IMPORTANTLY REDUCES THE FLOOD STORAGE CAPACITY OF THE BUTTE BASIN. WITH THE ELEVATED WATER SURFACE IN BUTTE BASIN, DOWN STREAM WEIRS CANNOT FUNCTION AS DESIGNED AND MORE WATER IS FORCED DOWN THE SACRAMENTO RIVER

Please submit your comments to a project representative or fold this form in half, seal with tape and mail to the U.S. Army Corps of Engineers.

Sacramento River Bank Protection Project
Phase II Supplemental Authorization

Name: Albert Medvitz Date: 2-18-09

Telephone: 707-374-2957 Email: amedvitz@frontiernet.net

Affiliation: Title (if applicable): Dr.

Street Address: P.O. Box 565

City: Rio Vista State: Ca Zip: 94571

Thank you for your interest in the Sacramento River Bank Protection Project Phase II Supplemental Authorization. Please provide us with your comments regarding the proposed project in the space below. We value your comments; please write legibly.

For your convenience, feel free to take this card with you, fill it out at your opportunity, and mail it to the U.S. Army Corps of Engineers. **Send all written comments by Monday, March 16, 2009.**

The current description of the project does not show the relationship of other programs/projects in the Delta system. Specifically how & why site location chosen in relation to BDCP and alternative conveyance and proposals to replace farmlands in central Delta.

Other Comments recorded.

Please submit your comments to a project representative or fold this form in half, seal with tape and mail to the U.S. Army Corps of Engineers.

Sacramento River Bank Protection Project
Phase II Supplemental Authorization

Name: Jeffery Tardaguila Date: 2-24-

Telephone: 916-[illegible] Email:

Affiliation: Title (if applicable):

Street Address: 2201 Home Ave Apt #115

City: Sac State: CA Zip: 95825

Thank you for your interest in the Sacramento River Bank Protection Project Phase II Supplemental Authorization. Please provide us with your comments regarding the proposed project in the space below. We value your comments; please write legibly.

For your convenience, feel free to take this card with you, fill it out at your opportunity, and mail it to the U.S. Army Corps of Engineers. **Send all written comments by Monday, March 16, 2009.**

CD and web address Please
Future Meeting in Saca - This is 2010
Why not Increase where weakness - Since I
See 5x the amount in Future with no
upgrades provided for - Is this minimum
effort or max protection?

Please submit your comments to a project representative or fold this form in half, seal with tape and mail to the U.S. Army Corps of Engineers.

Sacramento River Bank Protection Project
Phase II Supplemental Authorization

Name: Karla Childers Date: 2/18/09

Telephone: 530-696-2804 Email:

Affiliation: land owner 136.6L Title (if applicable):

Street Address: 32078 N Meridian Rd

City: Meridian State: CA Zip: 95957

Thank you for your interest in the Sacramento River Bank Protection Project Phase II Supplemental Authorization. Please provide us with your comments regarding the proposed project in the space below. We value your comments; please write legibly.

For your convenience, feel free to take this card with you, fill it out at your opportunity, and mail it to the U.S. Army Corps of Engineers. **Send all written comments by Monday, March 16, 2009.**

We attended the meeting for the specific reason of obtaining information regarding proposed actions for the levee directly adjacent to our home and farm; Our main concern and question was are setback levees being planned for our specific area. This question was not answered so we found this meeting to be a waste of our time. In our case if this is needed we will not willingly sell our property. We also feel this is not a cost effective solution to the problem. Personally I am frustrated over the amount of money being spent for these meetings to adhere to a "process". At least provide landowners with information regarding what

Please submit your comments to a project representative or fold this form in half, seal with tape and mail to the U.S. Army Corps of Engineers.

proposed actions you are considering instead of

--o0o--

U.S. Army Corps of Engineers

Scoping Meeting - Colusa, California

Tuesday, February 17, 2009

--o0o--

Reported by: LINDSEY R. PERRY

(Meeting commenced at 6:31 p.m.)

MS. BARBIERI: All right, folks. We're going to go ahead and get started. My name's Janet Barbieri, and I'm going to help facilitate the meeting tonight.

Hopefully -- can you hear okay over that noise? All right.

So we're going to have a brief presentation, and then we'll get into the comment session. And, as you know, this is a scoping meeting, and objective of the night is to hear and solicit your comments on scoping for the EIR/EIS. And just to let you know, we have a couple of ways that you can do that. We'll, obviously, have the comment period where you can step up to the mic after the presentation and make your comments there. We also have comment cards, if you want to make written comments, and we have a station over here to your left. If you want to sit down and just speak your comments, our court reporter, she'll take those down, and we're also recording everything tonight as well, so we'll get everything that way.

So to start things off, though, I'd like to introduce Ben Carter. He's the president of the Central Valley Flood Protection Board, and he's going say a few words.

MR. CARTER: Thank you, Janet. I guess I have to use this for the court reporter; is that right? I'm sorry. Well, in any case, I wanted to welcome you all here to this first of four public scoping meetings for the Sacramento River Bank Protection Project. On behalf of the Central Valley Flood Protection Board, the state, we really thank you for taking time out and coming.

I wanted to, first off, recognize a couple people. Ladybug Doherty (phonetic) is also on the Central Valley Flood Protection Board. She's serving as secretary of the board, and then Kim Davis is here tonight representing Senator Sam Aanestad. So if you want to get a message back to the -- either the board or the legislature, talk to -- talk to those two beautiful young ladies.

I wanted to make a note about the Central Valley Flood Protection Board. Some of you may know about the board. We were formerly called the State Reclamation Board, and we are comprised of seven members that are voting members that are private citizens within the central valley, and then there are two ex officio members that are nonvoting that are mem- -- one is a member of the state assembly and one is a member of the state senate.

And our charge, we are really the custodians of the state plan of flood control within the Sacramento

and San Joaquin valley, or the central valley of the state. We -- we're involved in the Sac Bank Protection Project because we are the custodians of the -- of the -- the system up here, and we partner with the -- our -- the federal government, which is administered through the U.S. Army Corps of Engineers in this -- in this effort.

If you've had a chance to look at some of the -- the storyboards that are arrayed around the room, you'll find that the scope of the project is quite large. The project is designed to protect public safety and, in partic- -- and specifically, address erosion sites that occur along the Sacramento River due to high flows.

I just, in closing, wanted to again thank you for coming, and I really do look forward to your comments. Please do not be shy. Colusa has never been known to be shy, actually, but be sure and offer some good comments, some good feedbacks, ask any questions you want and, hopefully, the staff here from the Corps, the Department of Water Resources, the board and their consultants will be able to answer you appropriately. So thanks for coming.

MS. BARBIERI: Thank you. Okay. So now we're going to get into the presentation. I'd like to

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introduce Mike Dietl. He's the project manager with the Army Corps of Engineers. Mike.

MR. DIETL: Thank you, everybody, for coming tonight, and thank you for those kind, kind words from President Carter.

Can you -- can every- -- can everybody hear me now? No. All right. I'll have to do this impromptu.

I'm the project manager for the Sacramento River Bank Protection Project and, specifically, the authorization that we were just granted in 2007 for an additional 80,000 linear feet of bank protection on this project.

Please, again, submit your comments. The purpose of this meeting is really to make sure that we can get all the -- get comments to cover the bases in our environmental documents so that we can deliver a successful project in two years to continue participation in the -- in the bank protection project, so this evening I'm going to give you a little bit of an outline of the program, overview, the history of the project, the supplemental authority and its scope, what we're going to do for environmental review and how the public can participate.

The program is a long-term program in cooperation with the State of California to provide bank

protection in the form of either setback levees or bank protection. And really, it's a program to maintain the integrity of the project that was constructed from 1970 into the '40s (sic) to its present -- into its present form from injuring -- injuring the public or destroying prop- -- property damage. It is a long-term project that the Corps has been involved with the State of California, and we'd like to continue our mission of public safety first and foremost.

It's a project that's cost shared by the federal government and the State of California for all activities that are associated with construction, including any mitigation features that are planted onsite. Long-term O & M is responsible in the State of California at a hundred percent cost, but that does not include the initial planting or maintenance of vegetation.

Often, these -- often, or in most cases, the local maintaining agency signed an agreement with the State of California and the Central Valley Flood Protection Board, but that -- the federal government is not party to that agreement, and we hold the Central Valley Flood Control Board -- protection board responsible.

It's a project that is wide in geographic

scope, going all the way from Elder Creek in the north down to Collinsville in the south in the bay delta. Mainly, it at starts at river mile 192 at Hamilton City at the levee portion of the project.

Original authorization for the project was in 1960. The federal government authorized 400,000 linear feet of bank protection, which was completed in 1975. There was no mitigation for this project in terms of fish and wildlife values.

As the authorization was nearing its end, the Corps and the Flood Protection Board sought new authorization to continue the project in its second phase. In 1974, it was authorized for an additional 405,000 linear feet with mitigation authorized. I point this out because, at that point, between the phase one and phase two, there was huge consternation on the environmental impacts of phase one.

We only have 13,000 linear feet remaining out of the 405,000 linear feet, so that really puts us into a bind over the next couple years. We may run out of the ability to place bank protection, as the federal government, if we do not have a successful environmental document and post authorization decision document to move forward.

Status: What we do is the Corps and the Flood

Protection Board make yearly inspections of the entire flood control project. And in 2008, we had over -- we had approximately 154 sites that needed er- -- identified for erosion repair. Eight sites were constructed in 2008. We've planned to construct 9,000 linear feet in 2009. Prior to the '90s, we had a production rate of about 10,000 linear feet a year. We've just gotten back to that at -- when Governor Schwarzenegger declared a state of emergency. Prior to that, we were -- we were in a spot where there was either -- there was either no construction during a year or there was very limited construction. So it's -- the strides we've made in the last few years we want to keep continuing making to maintain public safety.

This is the location of the 2008 erosion sites. As you can see, they're spread out all up and down the Sacramento valley. There's no real area that is immune from erosion or lacking erosion sites in their area.

Typically, we get involved when we see a deficiency of one sort of -- another, and that really is the focus on the standard levee template, where you see erosion into the bank that's being caused by high sheer stresses from waters going down the Sacramento River or its tributaries. Existing vegetation often plays a role in contributing to this, when it falls out, taking

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out a lot of soil and other material from the levee or the berm.

Well, we've got a new authority. In 2007, 80,000 feet was simply added in what was called the Water Resources Development Act of 2007 to grow from 405,000 linear feet to 485,000 linear feet. What's required to implement that 80,000 feet is a new environmental impact statement and a post authorization decision document, and that's why we're here tonight.

I just want to go back to that. I want to stress that, in 2011, we will be out of authority again, and we have two years to make this happen, and we have that authority, so it is imperative that we move quick- -- the Corps moves quickly along with the Flood Protection Board so there's a role of the federal government to support the state.

Without this project, there would only be the Public Law 8499 out there to respond during an emergency event. This authority allows us to proactively prioritize repair fixes on a planned basis.

The purpose of the environmental review is to study and evaluate a range of alternatives and potential impacts and follow the legal guidelines that are put out under the California Environmental Quality Act and the National Environmental Policy Act.

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The purpose of the scoping is to inform the public about the project, identify the interested parties, what are the significant issues, what are potential alternatives and then really focus where we need to then go out as the project team, the Army Corps of Engineers and the Flood Protection Board to determine what do we really need to analyze to make this project move forward.

Well, we've identified six alternatives. One is the standard "no action," one is a setback levee and then various combinations of different types of rock (inaudible). And why do we have that? That is to capture the entire range of effects on -- of the project and disclose that to the public.

The environmental factors that we're considering are on the board. A number of them where we want to look here is if you have any questions or any ideas under -- specifically under these areas or any areas that are not covered on this slide, we'd like to hear about those and how we may be able to address those or your suggestions therefore.

We have a number of special status species in the area that compound the planning process. Delta smelt is not necessarily in -- not in this area of the valley, but we have steelhead, Chinook salmon, green

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sturgeon, the elderberry beetle, Swainson's Hawk and banks swallows, and we can potentially deal with each one of these species at any given site location.

I want to specifically point those out because, in 2001, we received a draft jeopardy opinion from Fish and Wildlife and National Marine Fisheries Service, and that's why we have designs, as you see today, that have allowed us to move forward and prevent that backlog from -- try to remove some of that backlog we had in the '90s.

Issues identified to date. There's the potential for effects to historic or archaeological resources during construction, such as houses, shipwrecks, potential effects on fish and wildlife, effects of noise during construction when we're working close to urban areas or someone's house, effects for recreation during construction, the effects of -- on riparian vegetation, wetlands and other communities, and other effects to land use and then the visual character or aesthetic nature of the -- of the river.

We have the U.S. Army Corps of Engineers' vegetation policy that is being emphasized following post-Katrina efforts. I point this out simply that -- it's very simple. Essentially, no vegetation on the levee itself and a 15-foot clearance zone on each side.

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I am being vague. There are a lot of nuances to this policy, but we'd spend the rest of the night discussing that if we went into detail on that.

I'll show you what the slide is from the 1974 authorization. Obviously, there are some differences in what that slide is. We do plan on making the U.S. Army Corps' policy in general with the 15-foot buffer zone part of the 80,000 feet study process initially.

The timeline here is, we're in 2009 or -- 2009. On top, we have a phase two supplemental authorization for the 80,000 linear feet with the public scoping period handling (sic) now, with release of the draft EIS/EIR happening in late 2010 and the final ESI -- EIS and EIR being released in 2011 being followed immediately with site-specific reviews and construction anticipated for that summer.

At the same time, we're going to begin scoping for phase three this summer, and we'd like to complete that project planning by 2013 and be finished and be in construction in 2015. If possible, we'd like to even push that more forward, where we may not even have to use the 80,000 linear feet, but time will tell and the public participation process will -- will inform that.

This program is being coordinated between the Corps and the state and consistent with the FloodSAFE

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Program. It's being consist- -- it is being coordinated with the Central Valley Flood Management Planning and the Levee Evaluation Program, and to the extent possible, we will be taking public comment throughout the process with -- during the development of the Central Valley Flood Protection Project. Because, essentially, this will be one of those programs that may fit under the Central Valley Flood Protection Project. Since we deal with many of the same issues, we will have to coordinate closely so that we're not duplicating efforts and wasting money.

This is just a slide of the various different projects that are going out -- going on in the valley right now and the complicated nature of the planning process. We have, of course, the Public Law 8499 project that responds after flood events; we have the Bank Protection Project that we're talking about now to maintain the integrity of the system over the long-term; we have the American River Common Features Project, Three Rivers Levee Improvement Projects, Yuba Basin, the FloodSAFE, the state's plan; we have another plan called The Comprehensive Study formally; we have the Sutter Basin Project, the Natomas Levee Improvement Program, West Sacramento Improvement Project, the West Sacramento Project and, of course, the Central Valley Flood

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Protection Plan. With all those elements, it's going to be a bear to coordinate.

For more information, please contact myself or Matt Davis in the back of the room for the -- for information on -- specifically, for federal-related issues. And please contact Dave Wheeldon. Dave, please raise -- project manager for the State of California, and then Kip Young as well, also in the back of the room.

And if you'd like to make any comments or short questions, I'd be happy to take them.

MS. DAVIS: (Inaudible.)

MS. BARBIERI: Just a second. Yeah, we're going to record, so if you wouldn't mind using the microphone, that would be great.

MS. DAVIS: (Inaudible.)

MS. BARBIERI: Yeah.

THE REPORTER: State your name too, please.

MS. DAVIS: Hi, my name is --

AUDIO OPERATOR: Go ahead.

MS. DAVIS: I think I should give up.

My name is Kim Davis, and I had a question about vegetation. Since the Corps' policy is no more vegetation, that, I'm assuming, means from this project forward, there won't be vegetation, but will there be

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mitigation? Because typically, there will be mitigation. The environmental community is going to want vegetation or something, so what I'm curious is, the cost difference between maybe having to buy land somewhere else and plant vegetation versus just planting the vegetation on the levees and how much more that's going to be and the cost factor of what that does to the -- to the ratio. And when that happens, will those figures be available to the public as well as the legislature before the projects are turning dirt?

MR. DIETL: There's a coup- -- you asked a couple questions in that. There's always going to be mitigation associated with these projects. I'd like to give an example.

Like this year, the vegetation policy does not affect what we're going to build this year, so it's going to be on a site-by-site basis where the policy comes into effect.

MS. DAVIS: Okay.

MR. DIETL: And that mainly has to do with that 15-foot buffer zone and how proactive we (inaudible).

In terms of the planning process on the future projects, we're going to open that up, because there's a number of issues that go with that, and that will become public and we'll have to do that. Whether that's tied

into this 80,000 feet, it may not be. It may be more tied into that phase three portion of the project.

I hope that answers...

MS. DAVIS: Okay. Yeah, I just think it would be real important to see those numbers in advance.

MR. DIETL: Yes.

MS. BARBIERI: And I wanted to mention, that's why I went back to this slide, just as a reminder about sort of scoping and what we're looking for in terms of scoping comments, these are the types of things we're looking for. Mike said it earlier. We're trying to, you know, scope out the breadth and depth of the environmental review process, and so if you want to try to think in those terms about your comments, certainly try to do that.

And if you can't think of that right now and you think of something later that falls into that category, certainly, you know, feel free. I don't know if we said what the deadline is for scoping comments, but we have the comment cards and you can do those at a later time. So just as a reminder of sort of what we're looking for in terms of comments for scoping.

MR. DIETL: March 17th.

MS. BARBIERI: March 17th.

MS. ANDRERI: I just have one.

MS. BARBIERI: And your name too.

MS. ANDRERI: Sorry.

AUDIO OPERATOR: Talk right into the mic.

MS. ANDRERI: Ashley Andreri (phonetic) from Family Water Alliance.

Since -- one of the alternatives of setback levees, I didn't see anything in there where they'd be taking the economic impacts to the rural communities into consideration, the land going off the tax roles, most likely it's ag land and the -- if eminent domain would be used also.

MR. DIETL: In this -- in this document, in the EIS/EIR, it's going to be in a programatic nature. So to specifically talk about individual project sites, we're going to do that and follow that up into a document, but what we're supposed to do is at least identify how we're going to address that proj- -- that process, like we do for any other resource consideration, and what we say in terms of the effects to that, it's going to be noted, and it's going to have to be discussed and the ideal's going to be, how do we lay out that process on what we do at a site-specific basis to determine that?

MS. ANDRERI: So there'll be cumulative impacts, then --

MR. DIETL: Yes.

MS. ANDRERI: -- for all the projects to --

MR. DIETL: Yes. However, there's something -- there's something difficult. You can say 80,000 linear feet of setback levee or you can say 80,000 linear feet of rock. At this point, we don't have, necessarily, an identified alternative for any one of those sites.

THE WITNESS: Correct.

MR. DIETL: We'd just like to be able to do that on a site-specific basis, so we have to get the range of impacts.

MS. ANDRERI: So after this EIS/EIR is done, what's the next step so that that -- you know, that the public is involved in that process?

MR. DIETL: The public will be involved in this process at the release -- at a minimum, at the release of the draft EIS. So what we have now is to take your comments, digest what those comments are and go forward and detail how we're going to address those. Until we get the scope of those comments, we can't really make sure because we can go into detail on a number of those items.

MS. ANDRERI: Okay.

MR. DIETL: And we're going to have to really work some groups out.

MR. CARTER: I just wanted to add that the -- there's another opportunity for the public to participate in the project -- or in the process and give feedback in that each of these sites (first man) come before the Central Valley Flood Protection Board in a public meeting to be reviewed and approved by the board. And at that time, there's opportunity for the public to provide comment to the -- both the board and the corps, our partner, on these projects.

So beyond the environmental review process and these scoping meetings, there are -- there will be additional opportunities as the projects are designed and alternatives are considered and recommended, the public can come and comment on those as well.

MR. DIETL: Yeah, I would just like to add that we want to be as transparent as possible in this process because we have differing interests from all sides of the spectrum and if we -- we can't cater to one.

MS. BARBIERI: Other comments? If you could use the mic, that would be great. We could get it all recorded. Thank you. And tell us your name.

MR. YOUNG: My name's Pat Young. Our family farms property about three miles north of Butte City, which is one of the marked zones, and what I was wondering, do you consider rate of erosion when you're locating which sites go in order? Because I -- I'm sure you guys are familiar with -- the river has "S'd" itself up there and, basically, we're losing earth towards the levee. It will -- you know, and high water here is over a hundred feet a year. And I know the Army corps came out there about four years ago and put a row of stakes to see how fast it was eroding, and they all went in the first year that they put them out there. It burned back about 110 feet, 120 feet. So my ques- -- is the rate of erosion a consideration as far as the sites that you approach first?

MR. DIETL: The rate of erosion is a consideration, but what we're dealing with and in terms of what we see about the 80,000 feet of erosion sites that are identified right now, that is really that there is -- that it's within 30 feet of the levee or into the itself, so we don't really look at rate of erosion where there is, you know, a significant amount of berm area out there right now. Historically, we have, but at this point, we're focusing on those areas that are going to become critical within the next few years if any more of that levee is lost.

MR. YOUNG: Well, that's -- was my point. The river's about 60 feet from the levee now, which, about 10 years ago, it was about 300 feet away from the levee.

MS. BARBIERI: Make sure you put that in your comment card or -- yeah.

Other comments? I should have mentioned that we're going to say, too, you know, if you want to talk more with folks, look at any of the boards or get into some more detailed discussion about things, these guys are going to stay for a little while after the meeting, so you can certainly do that too.

Other comments, though, now?

MS. DAVIS: Kim Davis. I just had another question about the comp study, the old comp study, which kind of got shelved for several years, and there were a lot of concerns in the Nor state on the comp study. I know things are very different today. And you kind of made a reference to it as the comp study, and I know it's not really being -- or my impression is it's not being used as a whole study.

What parts of that and how do we find out, is it being revised? Does it have a new name? Are you just kind of taking parts of it? How's it being used?

MR. DIETL: I'm going to defer this one to the State of California because really what -- what we do is we act as an agent to our sponsors. If the sponsor comes and wants to revive the comp study, we can go do that. Until we have that interest, we don't -- we don't

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really work on our own. We're always looking for a cost share partner.

MS. DAVIS: Okay. I wasn't referring to it being revised and brought back. You had mentioned that it's on that page 11, which we can't see because I -- I'm going to pull it up tomorrow, but it's being referenced, and I was just wondering at -- how that's being used.

MR. DIETL: Well, the comp study had a lot of goals and developed a lot of information, so there's information that's being used in there from the scientific aspects of it, from the hydrology and the hydraulic models and some of the principals of cooperation that were developed in there. So in -- that -- in an aggregate sense, that's how it's being used, and we will be developing information based on what they developed and improving it further in going forward. So that's how the comp study is being used, if I answered your question at all.

MS. DAVIS: Yeah. Do you know if it's something that -- I've heard that they're -- actually want to kind of, like, make the comp study happen again, whether they rename it, so will -- the work that you guys do, is that part of it or is that just something that might happen later and really isn't a factor in

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this?

MR. DIETL: No, they're -- they're wholly separate. You have to think about -- the bank protection project is a project that does not increase the level of flood protection. It maintains the system as it was -- as it was authorized.

MS. DAVIS: Okay. Thank you.

MS. BARBIERI: Other comments?

Okay. Well, unless there are any others, I guess we'll wrap up this piece of the meeting. And again, we're going to stay for a little while, be available to have some more discussions, answer some more questions. Be sure to take a comment card with you, fill one out tonight, fill one in later. Be sure to get your comments in before that deadline rolls around.

And thank you all very much for coming.

(Meeting adjourned at 7:02 p.m.)

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U.S. Army Corps of Engineers

Scoping Meeting - Walnut Grove, California

Wednesday, February 18, 2009

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Reported by: LINDSEY R. PERRY

(Meeting commenced at 6:32 p.m.)

MS. BARBIERI: Good evening, everyone. We're going to go ahead and get started, so if you'd come up and find a seat.

Thanks for being here, everybody. So we're going to go ahead and get started. We've got a brief presentation.

My name's Janet Barbieri. I'm going to help facilitate the meeting tonight, and this is Mike Dietl. He's the Corps' project manager for the Sacramento River Bank Protection Project, and Mike is going to give a presentation. And then after that, we'll have an opportunity for your public comment for this scoping meeting.

And before we get started, though, I did want to just introduce Robert Yeadon. He is the Department of Water Resources delta regional coordinator. And -- where are you? Oh, he's right there in the back. So -- Robert serves as a liaison of sorts, so if you have any questions or you're trying to get some information or find people, he'd be the guy to go to, so you can track him down after the meeting.

So we'll go ahead and get started. Mike?

MR. DIETL: Once again, thank you all for coming here and spending your -- part of your evening with us as we take public comments and scoping questions for the Sacramento River Bank Protection Project.

I'm going to start off with giving an overview of the project and what we plan to do for the next 80,000 linear feet of the bank protection project. Start with a program overview, a little bit of background and history, what our supplemental authority is, what the -- what steps of the environmental review we're going to go over and how you can participate.

The Sacramento River bank Protection Project's a long-term program to maintain the integrity of the entire Sacramento River Flood Control Project, which is approximately 1,300 miles of levees and bypasses. It was implemented by the Corps and the Central Valley Protection Board beginning in the 1960s. We've had a long history of cooperation with the Central Valley Flood Protection Board, formerly known as the Reclamation Board, going back to 1917 with the Sacramento River Flood Control Project.

The project -- the bank protection project is critical in addressing the public safety needs of the Sacramento River. The Sacramento River was originally designed to push the mining sediments out of the system, and with that, erode the -- erode -- it eroded the river banks and eroded the river bed, so we have to keep the levees protected from erosion to keep them from failing.

Operations and maintenance of the project is -- is done by the local sponsor, which is the Central Valley Flood Control -- Central Valley Flood Protection Board, and that is usually turned over to maintaining districts and local sponsors known as reclamation districts here in the central valley.

Construction is a hundred percent -- I mean, it is 75 percent cost shared by the Corps of Engineers and 25 percent by the reclamation board. Short term O & M costs, such as planting vegetation and the initial maintenance established, that is 100 percent a project cost. All other long-term O & M maintenance is borne by the local sponsor.

Here's a project map of the area. The project area goes from the north, from Elder Creek, all the way down to Collinsville. The levee system begins at Hamilton City in the north and flows all the way down to Collinsville as well.

The original authorization, known as phase one, was authorized in 1960 and consisted of the placement of 430,000 linear feet. It took approximately 15 years to complete and was authorized with no mitigation. The project was reauthorized with the need to protect additional eroding areas in 1974. It was authorized with a -- 405,000 linear feet with only 13,000 linear feet remaining, and mitigation was authorized as part of that project. It was a significant point because there was no mitigation and a lot of consternation involved with the completion of first phase.

Currently, we do yearly erosion surveys along the entire length of the Sacramento River Flood Control Project. We concluded our 2008 survey in October, and we found approximately 150 sites along the river. Repair occurs annually based on funding. We've had really good funding over the last several years. We constructed eight thou- -- eight sites in 2008. We have 9,000 linear feet scheduled for the summer of 2009. Prior to the 1990s, we repaired an average of 10,000 feet annually. That slowed down with the -- the enactment of various species being listed under the Endangered Species Act and some real roadblocks being encountered for the implementation of that project. Since then, we've really ramped up and gotten back to speed, and we'd like to continue that to provide public safety.

This is a map of the 2008 erosion sites. As you can see, they are spread all over the valley floor from north to south. We also have a high concentration of those -- of those sites in the delta. A lot of them are located here in Georgiana Slough. What we see out there is typical deficiencies where when we get back in -- get into action is -- when we see erosion into the 3:1 levee template, it's just an angle where we see erosion going into the toe levee or into the berm. It's usually noted by the evidence of steep or a loss of eroded banks. We also have some deficiencies in terms of existing vegetation on the levee banks, and when that falls out, it has a tendency to rip a lot of soil out and -- which may cause us to go in there and conduct some repairs.

I stated earlier that there was an authority for the second phase of Sac Bank, which we're here to talk about tonight, which had, originally, 405,000 linear feet authorized. We had an additional authorization of 80,000 linear feet in the Water Resources Development Act of 2000. So we're here to prepare and get your comments on what we should include in the environmental impact statement and impact report, because we cannot go to construction prior to completing this public document and having it approved.

As I said earlier, we only have 13,000 linear feet left, which leaves us, after this year, only 4,000 linear feet for construction in 2010 with -- and we have no ability to construct in 2011 at this time until we finish this document.

The purpose of the environmental review is to study the environmental impacts and disclose those to the public and follow the legal guidelines set under the California Environmental Quality Act and the National Environmental Quality Act -- Policy Act. Excuse me.

Purpose of scoping is to really hear from the public in a written format or a verbal format so that we can take it into consideration and hear your views and try to accommodate those in finding out what the -- what is important to the human environment, identify what -- the potential alternatives and gather input for the environmental document.

We've identified is six programmatic alternatives. They range from no action, which is really leaving the system in a basis where only PL 8499 or a -- which is the Corps' emergency authorities to come in before and after a levee to rehabilitate the levees. Sac Bank is a -- really a proactive program, which we're allowed to go in, identify erosion sites on a yearly basis and be proactive about repairing them before a flood occurs.

Our action alternatives range from setback levees to various different forms of bank protection. The reason we do that and have structured that is we want to capture the upper bounds and the lower bounds of what the impacts are so that we're not told to go analyze different scenarios at a later date. We want to capture what the total range of impacts are and analyze those.

On the screen, we have a number of different factors that we're going to analyze and possibly mitigate for and discuss in the document, and if you could point out anything in terms of your comments on how you would like to see those addressed, please do so, and please add to them as well.

There's a number of special status species in the area that we have to take special attention to. They're the delta smelt in this area, especially, and we have the steelhead, Chinook salmon, green sturgeon, bank swallows and Swainson's Hawk. And especially down here in the delta, except for bank swallows, we have the potential to find any of these at our sites.

Issues identified to date. We have effects on archaeological resources. We see that at one of the sites that's currently designed outside of Clarksburg. We have effects to the fish and wildlife. That's why we're actively going and planting vegetation to mitigate on site as much as possible. We have effects to landowners and residences from construction activities;

recreation effects; effects to riparian vegetation, effects to land use and potential effects to aesthetics on what people feel is the appropriate look of the river.

This is the Corps' vegetation policy. It's pretty simple and straightforward. What we're calling for in light of Katrina is a 15-foot-wide clearance zone at the foot of the levee and the backside of the levee and no vegetation on the -- on the levee itself except for grasses.

This is the 1974 authorization of the Sacramento River Bank Protection, which is a little bit different from what the vegetation policy is. I want to point out that we are going to design the project initially for the 80,000 feet to be in compliance with the Corps' vegetation policy. Where there is the possibility to -- or gray area in the policy, we will make -- we will make that decision initially at the district level.

This slide's a little hard to read, and I apologize for it, but what we're showing here is on -- phase two authorization at -- 2009 and the initial public scoping meeting to be -- and the document to be completed by two -- summer of 2011 and be ready for -- construction projects to be ready in 2011. We will be designing sites now for construction in 2011 in the anticipation that we're -- we're not going to see any huge hurdles.

There has been the talk of a phase three of Sac Bank, and we're going to be getting public scoping meetings this summer on that to be in that phase so that we can arrive and be able to implement that in 2015.

I'd like to say that this program's going to be fully coordinated with the state plan of flood control, the Central Valley Flood Protection Plan and other state projects. We will be coordinating closely with them in their public meetings and developing the project with them concurrently since we overlap a majority of the -- the same planning area and have to deal with the same planning issues.

This slide is to depict just the amount of -- amount of projects that are going on out there. I apologize for its busyness, but that's really what it intends to show. It shows the scope of the Central Valley Flood Protection Plan, the state flood protection plan, PL 8499 and various other projects that are under way with the Corps and the state in terms of flood control.

For more information, please contact me or Matt Davis, which is -- which isn't here tonight, but his number's up there; Dave Wheeldon from the state, which is the project manager and Kip Young behind -- there.

Now we would like to take your public comments, and we'd be happy to answer some questions, but we'd like to really hear more. If you could state your question as more of a comment or something you would like us to see -- us to do.

MS. BARBIERI: Yeah, so just put the list of things that might hear about in scoping, things that we're interested in hearing, looking at significant issues, just anything that you would like to tell us about sort of the breadth and depth of the -- of the environmental review process.

We are recording this, audiotape. We also have a court reporter over to your left, and so she's going to be, you know, taking down your comments as well. So if you do have comments, I'd ask you to come up and use the microphone, state your name so that we get it into the record and we'll just make sure it's all sort of captured that way.

So, Mary, do you want to come up first?

MS. McTAGGART: (Inaudible.)

MS. BARBIERI: Yeah, I know exactly what you're talking about. Is that it? No. There it is. Yeah, sure.

MS. McTAGGART: (Inaudible.)

MS. BARBIERI: These are some of them. You could add to it. You could give us your thoughts on any of these subjects. And of course -- you know, hopefully you had a chance beforehand to walk around and talk to folks and have some questions answered and, you know, we're going to stay for a little while afterwards, after this comment period, if you wanted to talk more in detail with folks, but if you'd like to make a comment, sort of get it into the record, now would be the time to do it or you could wait until later and make a written comment. We have the comment cards, and you can send them in that way as well.

Go ahead, Mary, and then we'll go to this gentleman.

MS. McTAGGART: Mary McTaggart from the Clarksburg area. I wondered if you could explain a little bit more about the 15-foot setback because I understand, on the land side, that was announced earlier, and this year, it was somewhat controversial, and maybe you could give us a little more on that. We understood that that -- you guys were coordinating with the state's thoughts about that in allowing more -- more vegetation than your policy would -- would allow, so...

MR. DIETL: Sure. I can go into that a little bit.

First, that is the -- the slide I put up there that shows the 15 feet is the national policy. It's my understanding that there's really only a 10-foot easement in the California area, and that's an issue that's being proactively worked, what's being called the California Levee Roundtable. So the State of California is working with the Corps of Engineers and the resource agencies currently to make -- come up with a framework policy on how that's going to be -- how that policy's going to be implemented in the central valley.

My understanding is that policy's coming out next month, and what that really focused on was the state wanting to focus on early implementation projects with the bond money passed through proposition 1E rather than go out and go focus on the -- on the vegetation policy.

So that framework, not being a public document now, will come out in March. And that, to my understanding, is going to be distributed through the Central Valley Flood Protection Board and there will be some public meetings held for that. To that -- I don't know what the dates are or those arrangements since I'm not involved.

MS. BARBIERI: Sir?

MR. MEDVITZ: Hi. I'm Al Medvitz. I'm a farmer down the river. There are a number of things that need to be addressed. One is, the Corps policies about vegetation are based on experiences in Katrina, which has a very different set of hydrodynamics related to flood and the stresses on the levees, so a very important part of this would be to have a scientifically-based justification for that policy applied here, in a region of very different dynamics and very different issues.

Now, the second issue is that to those -- to some of us, this looks a lot like armoring a central valley conveyance, and it may not be, it may be, but it sort of fits that pattern. And I made the comment earlier that the relationship of this particular study to all the other projects in the system need to be much more carefully identified and described for the public in a series of ellipses, overlapping ellipses. We need -- and this should be happening at the sc- -- before the scoping meetings so that people can ask their related questions. This is an integrated system, and this project needs to be integrated into that system. Third -- and we need to know that so that we can understand how it fits and relate it to state policy about exporting water and things.

The -- the third issue is, where is the materials for this going to come from and how is that going to impact maybe places far away from here? Where are you going to get the soils and what is the traffic going to be like on Highway 12, Highway 113 and the other -- and -- it's a regional project, so that needs to be taken into account, and the impacts on people or on the environment and people outside the immediate realm of the levees needs to be taken into account.

MR. DIETL: Thank you.

MS. BARBIERI: Thank you very much.

Would anyone -- yes, please.

MS. ROGALA: I'm a short person. How is this going to work?

MS. BARBIERI: It's okay. It'll work.

MS. ROGALA: I can probably talk without it. My name is Jan Rogala.

MS. BARBIERI: We need you to do it for the recording, that's all. Yeah.

MS. ROGALA: I'm an emergency planner and flood mitigation planner for the cities of Tehama, Rio Vista, Isleton. We also have emergency management responsibilities in Solano County Montezuma Fire

Protection District and Ryer Island. And as Al mentioned, this does seem, looking at it, to be an armoring of the central valley projects, so we have some -- some areas of concern. We're neither opposed or proposing what you're doing, but we want to know that you're taking sea rise into consideration. If we strengthen the levees above, let's say, Isleton and on up the river, it's going to put more water down the river. If we have sea water rise, will we have more flooding in Rio Vista and -- and the entire Solano County border on the Sacramento River?

The other -- the other issue that we're a little bit concerned about is, what kind of protection would you support for those communities that don't have levees, such as Rio Vista? Would you -- would you be looking at flood wall projects that -- and be supportive of those? Who can they propose to? And what are the long-term effects?

The other thing that -- that we're looking at is the coordination of programs. Again, as Al said, going from meeting to meeting and program to program is a nightmare. You know, I'm working with, what, five different areas along the Sacramento River, and I find no central database. I literally have to go and beg for information, and I do get kind of a big runaround, you know. You people here tonight have been incredibly helpful, and I appreciate it. Thank you.

MS. BARBIERI: Thank you.

MR. DIETL: There -- thank you for your comments. And I think there was a question in there as well that I want to clarify, and that had to do with the areas that didn't have levees.

This project really only deals with protecting the levee system itself, and it does not increase flood control beyond the authorized flood control project. It's not one that's going to provide an additional, as we say, one-in-100 chance of flooding in any given year. It's not doing that. It's really maintaining it to that 1957 profile, as authorized.

MS. BARBIERI: Other comments? Mary?

MS. McTAGGART: (Inaudible) traffic circulation here, and I know that --

MS. BARBIERI: Tell us your name again, just --

MS. McTAGGART: Mary McTaggart. I know that, in the past, we had a levee project on the levee north of us there near -- in Clarksburg. There was some problem with our school busses and the interruption of the school -- the school bus routes and stuff like that because there was no communication between the school district and the contractors, and so that was an issue.

And also, at certain times of the year, there's a lot more truck traffic due to harvest activities. I don't know when these things are going to be happening, but some of those trucks have to get to the wineries on a schedule, so better it would be to find out from the locals what those issues are rather than wait for them to blow up in people's faces. So I don't know if that's something you can do, but...

MS. BARBIERI: Thanks, Mary.

Al?

MR. MEDVITZ: Yeah. Quick response to your question. Doing all that work in here is going to change the dynamics elsewhere. And to say, "Well, that's somebody else's project" or, "That's somebody else's business," that's what I heard, isn't appropriate. That -- and that's part of the interconnectedness of all of this. And to -- to just focus on where there's particular agency authority and then say, "Well, this is our authority. This is what we're going to comment on," it will have an impact down river in other communities. Well, who else is going to protect those communities from the unintended outcomes here? And I think that's a really important component, and it has to do with the authorities' boundaries across the agencies. But I think this is so complex, so difficult, you're going to have to -- you're going to have to breach those levees to get your community to -- to participate.

MR. DIETL: Yeah, if I could just follow up to that, I will state that we do have to stick to that authority in this project, but there is some -- there is something unique about this, is -- because it is so geographically diverse from -- going from, essentially, Elder Creek, Hamilton City area down to the delta that we deal with those same -- all those same issues and we're going to have to deal with that, so it does give us a unique opportunity to reach out to different agencies and different stakeholders in this, and we're beginning that process.

MS. BARBIERI: Would anyone else like to make a comment?

You have another?

MS. ROGALA: I have a quick question. Did you do the LIDAR of the river? Was that you that did the radar evaluation of the river?

MR. DIETL: No, but I can shoot that over to Dave Wheeldon.

MR. WHEELDON: That was a state-sponsored project.

AUDIO OPERATOR: We're not recording any of this. You have to have that microphone.

MR. WHEELDON: Dave Wheeldon, Department of Water Resources.

AUDIO OPERATOR: Could you please repeat her question?

MR. WHEELDON: The question was: Who performed the LIDAR survey of the river, mainly the Sacramento River? That was the Department of Water Resources, the levee evaluations branch, who we work in conjunction with at levee repairs.

MS. ROGALA: Do you have the results of that study?

MR. WHEELDON: We do. It's a -- it's kind of an interactive model that the state uses kind of on an as-needed basis. I'm not sure it's at a point where we're able to convey that data to the public, but we do have the -- you know, if you have a request for that data, you can send that to us and then we can try to develop or provide you that data by tweaking the model or providing the inputs to the model.

MS. ROGALA: Great.

UNIDENTIFIED SPEAKER: Dave? Delta specific is also Joel Dudas at -- (inaudible).

THE REPORTER: I'm sorry, I didn't hear any of --

AUDIO OPERATOR: We're not getting any of this recorded.

MR. WHEELDON: Additionally, Joel Dudas, in the delta section, who's probably -- you know, since you're here tonight, that's probably your main interest is the delta area, so he's -- he's the one, and you can contact him through -- through Bob if you want to get ahold of him.

MS. BARBIERI: So are there any other comments folks would like to get into the record? Okay. If not, we'll go ahead and close this portion of the meeting, but like I said before, we're going to hang out for a little while. If you want to talk to folks, you know, ask some more questions, have some more conversation, we'll be here for a little while. So thank you very much for coming. Good night.

(Meeting adjourned at 7:02 p.m.)

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U.S. Army Corp Of Engineers

Scoping Meeting - Sacramento, California

Tuesday, February 24, 2009

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Reported by: Jan L. Gnirk Hansen, CSR #8034

(Meeting commenced at 4:30 p.m.)

MS. BARBIERI: Good afternoon, everyone. We're going to go ahead and get started, so if everybody could take a seat.

All right. Good afternoon, everybody. My name is Janet Barbieri, and I'll be helping to the meeting. Thanks for coming to the scoping meeting for the Sacramento River Bank Protection Project for the phase two supplemental authorization EIR/EIS.

So hopefully you've had a chance to take a look at the stations and talk to some of the staff who are here, get some of your questions answered. This part of the meeting is really focused on hearing from you, getting your comments about the environmental review.

In a minute, we'll have a brief presentation, and then we'll get into your comments. But before we do that, I want to have a couple of introductory remarks. I'd like to introduce Butch Hodgkins (phonetic) with the Central Valley Flood Protection Board.

Butch?

MR. HODGKINS: Yeah, welcome. And for those of you who don't know, there used to be a Reclamation Board. Now there's a Central Valley Flood Protection

Board; it got renamed.

We, in effect, will be the State of California under the board will be the nonfederal sponsor for this project. And so we too, with all the challenges we have in the central valley, look forward to hearing what you think and encourage you to speak up so that if you have an idea, it gets considered and thought about, analyzed, whatever is appropriate.

I think the other thing I would say for anyone who doesn't know is that erosion and how you stop it before it cuts into the foundation of a levee is really one of the biggest challenges we have in the central valley. The system was built with the idea of trying to minimize the amount of work necessary to keep the river navigable, which means the levees were put where they could be close to the river. And part of the overall goal was to flush out the debris that was left from hydraulic mining.

What people didn't know then, I don't think, is that sediment load in a river is part of the balance of energy in that flowing water. And so when you deprive it of the hydraulic mining debris, it still needs to get to that balance of energy, and so it picks up other dirt, and that's why we now have a system which is continually eating into the banks and moving towards our levees. So it's a huge problem. It's gotten very expensive to do.

And if you live in the valley, particularly behind a levee, you have a real interest in seeing that this work goes forward and goes forward in a sound way, both environmentally and from an engineering standpoint.

So we look forward to hearing what you have to say.

MS. BARBIERI: Thanks, Butch.

We're going to go ahead and give the brief presentation now. Before we do that, though, I just wanted to make one quick introduction.

Loren Murray (phonetic) is DWR Sacramento area regional coordinator for flood management. Loren, could you just stand up, wave your hand around? So if you have any questions of DWR, want to get ahold of them, Loren is your guy.

So now I'd like to introduce Mike Dietl. He's the Corps' project manager for this project, and Mike has got a brief presentation.

MR. DIETL: Thank you, everybody, for coming this afternoon and spending some time to discuss the Sacramento River Bank Protection Project.

We're here to do scoping. Scoping is a result of having to do an environmental impact statement as a requirement under the law for the National Environmental Policy Act.

We will take some questions afterwards, but really the point is not for questions. It's really for you to submit some comments on what you'd like to see analyzed during this environmental impact statement process and environmental impact report process.

I'm going to give a program overview, some background and history, how we got the additional authorization, what environmental review we're going to do and how the public can participate.

As Butch stated, erosion is a problem here in the Sacramento Valley. And really the bank protection project is a long-term program that is put together with the Corp of Engineers and the Central Valley Flood Protection Board to protect the levees from eroding and protect the public and property and the safety.

An operational and maintenance issue is that construction is cost shared wholly -- I mean, it's cost shared by the Corp of Engineers and the Central Valley Flood Protection Project.

And some of the operation and maintenance items in terms of vegetation, those were all paid for out of the Corp of Engineers and Central Valley Flood Protection Project for a period of three to five years before we turn that over to the local sponsor. Long-term O and M costs to the system are 100 percent the nonfederal sponsors' responsibility and cost. The State of California often turns this over to local reclamation districts.

We have a project area map. The project goes from the north -- essentially from Elder Creek and Deer Creek to two systems. But really begins at Hamilton City and goes all the way down to the confluence of the San Joaquin and the Sacramento River, approximately -- consisting of approximately 1,300 miles of levees and weirs.

The original authorization occurred in 1960 and was known as phase one. It was authorized by the Flood Control Act and comprised approximately 430,000 linear feet of bank protection. It was completed in 1975, and no mitigation was authorized for that. When I speak of mitigation, it was mitigation for fish and wildlife values.

The project was reauthorized in 1974 for 405,000 linear feet of which only 13,000 linear feet remain.

So what does that mean? That means that we're going to go out and build approximately 9,000 linear feet this year and 4,000 linear feet next year, and there will be no ability for the federal government to participate in bank protection unless we have this EIS completed.

Mitigation is authorized in the second phase as a result of a whole lot of controversy that was associated with the first phase of the bank protection project. Status of the project is really we go out as the Corp of Engineers and the Central Valley Flood Protection Board and reclamation districts every year and inspect the system. In 2008, we located approximately 150 sites in the need of repair.

Repair occurs annually, based on the amount of funding that as provided by the federal government and the State of California. We constructed eight sites in 2008. We plan to construct 9,000 feet in 2009. And prior to the 1990s, an average of 10,000 feet was constructed annually.

We're getting back to that, but I want to point that out that there was a huge gap of where there was no production in bank protection leading to a number of erosion sites accumulating in the system. This is primarily due to coming to grips with more stringent environmental laws and the listing of endangered species. Hopefully we passed a lot of that now, and we can get back to the current production rate.

This is a map of the locations of the 2008 erosion sites. As you can see, there's no part of the Sacramento River Flood Control Project that is immune from having erosion problems occurring on them. Go from the north all the way down to the south to the delta with huge implications.

We get involved when we see a deficiency, which is, in general, an encroachment into the three-to-one template of a levee where we see part of that levee being -- being eroded away. That's really where we pick something up and put that into our inventory. And that will be typified by steep eroding banks.

We see existing vegetation on the levee slope or the berm. We're often concerned about that because if a tree falls, then it has the potential to take a lot of soil with it exacerbating the problem.

Well, we have a new authority, which is really an extension of the old authority, for 80,000 linear feet. That was given to us in 2007 from the Water Resources Development Act of 2000 feet (sic). Really that's supposed to be a stop gap measure to allow us to begin planning for a phase three or until at least the state can complete their plan of flood control and give us some federal involvement in protecting the system as is currently aligned.

So we're here, and we have to prepare this problematic EIS/EIR to analyze the effects of bank protection. The purpose of the review is to evaluate a reasonable range of alternatives. And to follow the legal guidelines put forth under what we call NEPA and CEQA.

Purpose of the scoping is to inform the public about the project, identify interested parties, identify the alternatives and gather input on the range of alternatives and how we should focus our studies.

We have identified six tentative alternatives. One being a no-action alternative. And no-action alternative is emergency action only. We've also identified setback levees, which the authority has in a range of rock revetment alternatives. Why we've identified those as our action alternatives is to give the upper and lower bounds on the potential impacts of the project.

What we have up on the board is a number of environmental issues. We'd like you to focus on some of these, add to these in terms of areas of focus areas. If they're not listed, what kinds of studies or what are your concerns about, any of these particular issues that may be up there that we may address. We've had some really good comments along these areas at some of our meetings already.

I want to point out that on every project, we have the potential to encounter seven, eight listed species, either federally or state listed. That presents an enormous challenge to plan and cooperate with the resource agencies to get a project designed and constructed in one year.

We've got a number of issues that we've identified to date. Archaeological resources, the effects on fish and wildlife, noise. We often work in urban areas, close to houses, recreation effects, working the rivers with barges. There are people that like to go out and use the river for fishing and other activities, repairing vegetation, losses of that, wetlands, other natural communities. Land use and the effects of just the natural environment and what the visual characteristics of the river look like.

We have to deal with the Army Corp of Engineers' Vegetation Policy. In general, it's very simple. We do not want to have any vegetation in terms of trees or shrubs in a generalized sense on the levee or within 15 feet of where we say is the toe of the levee.

This is the 1974 authorization of the project. It is not directly comparable to the vegetation policy. But what I do want to point out is that we will consider in this 80,000 feet all projects to become in compliance with the Corps' vegetation policy. Should there be any question of what we've built previously under the emergency declarations, we will go back during the preparation of operations and maintenance manuals and work on that issue.

This slide is to represent that we have a long planning process in front of us. And here we are in 2009. We'd like to get in 2011 get to construction. And during the same time, we want to be working on phase three and actually go to construction with phase three in 2015.

This project has to be coordinated and jointly implemented with the state to be consistent with the Flood Safe Program. We will coordinate closely with the board and the planning efforts of the Central Valley Management Planning Program and the Levee Evaluation Program.

To the extent feasible, public engagement of the program will be also incorporated into additional public meetings that will occur with the Central Valley Flood Protection Project planning process.

This slide is busy and it only is shown to you to represent the number of ongoing projects that are in the planning stages or in the construction that this project has to coordinate with.

For more information, you can contact myself or Matt Davis -- can you please hold up your hand in the back of the room -- which is the lead for the environmental documentation of the Corp. Dave Wheeldon, project manager for the Central Valley Flood Protection Board and Kip Young also back there, happy to answer questions for you.

So now we'll take your comments. I'd be happy to answer some questions. But really, again, it's not supposed to be a question. It's supposed to be getting your comments necessarily, so we can take that and design our environmental impact statement properly.

Thank you.

MS. BARBIERI: Thanks, Mike.

I just wanted to back up just a little bit. Those are some of the -- just get your brain thinking -- these are some of the issues that we are considering in the environmental review process.

If any of the other slides would help you in honing your comments, I'd be happy to flip around for you.

Just a couple notes about what we're doing. We've got a court reporter here, and we also have audio recording to make sure that we get all the comments on record. So if you do have a comment, I'd ask you to come up to the microphone, so we get that in the audio and also state your name so that we get that into the record, so just be sure you do that.

So does anyone have anything they'd like to say? Any questions for Mike? Come on now.

You guys did such a good job in answering questions beforehand, I don't think we have any.

If really no one has any comments they'd like to make now, be sure to take a comment card with you. You can write your comments down and drop them off now or you can send them in later. The deadline for that again Mike is --

MR. DIETL: March 17th.

MS. BARBIERI: March 17th.

So I think we'll say going once, going twice. Okay.

Well, thank you, Mike, for the presentation. Thank you all for coming and listening. And we're going to hang out for a little bit if you have any questions or if you want to talk to folks afterwards, be happy to hang around and do that, so thanks for coming.

(The meeting adjourned at 4:50 p.m.)

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REPORTER'S CERTIFICATE

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I, JAN L. GNIRK HANSEN, a Certified Shorthand Reporter for the State of California, do hereby certify:

That I am a disinterested person herein; that the foregoing proceeding was reported in shorthand by me, JAN L. GNIRK HANSEN, a Certified Shorthand Reporter of the State of California, and thereafter transcribed into typewriting; that the foregoing is a true and correct record of the proceedings.

IN WITNESS WHEREOF, I hereby certify this transcript at my office in the County of Placer, State of California, this 12th day of March, 2009.

JAN L. GNIRK HANSEN, CSR #8034

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U.S. Army Corps of Engineers

Scoping Meeting - Chico, California

Wednesday, February 25, 2009

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Reported by: LINDSEY R. PERRY

(Meeting commenced at 6:34 p.m.)

MS. BARBIERI: Good evening, everybody. We're going to go ahead and get started. Thanks for coming. My name's Janet Barbieri. I'm with Jones & Stokes. I'll be helping to facilitate the meeting tonight. And we've got a brief presentation here, talking about the Sacramento River Bank Protection Project's phase two supplemental authorization. This is the scoping meeting for that. So hopefully you've had a chance to walk around, talk to folks, take a look at the boards, maybe get some questions answered. And this part of the meeting is really focused on hearing from you, getting your comments, and so we're going to launch in and do a little presentation and then we'll go ahead and do the comment piece.

But before we do that, though, I just wanted to make a quick introduction. Scott Rice is DWR's Division of Flood Management -- he's the regional coordinator for the northern Sacramento valley. So Scott's right there. If you have any need to connect with DWR, Scott's your guy.

So let me introduce mike Dietl. He's the Corps' project manager for this project. He's going to give the presentation.

MR. DIETL: Thank you, everybody, for coming tonight. Really, the purpose of this meeting is to get your comments to see -- so that we can hear what you'd like to see included in an environmental impact statement and going through that study process for a supplemental 80,000 linear foot authorization of the Sacramento River Bank Protection Project. And I would really like to encourage you guys and ladies to give your comments at the end of this, because we had no comments verbally in Sacramento yesterday, and we're really taking the time to come and hear from you, the public, on what your thoughts are on this project.

I'm going to give a little bit of the program overview, history, the supplemental authorization status, what we're going to do for environmental review and a little bit about public participation.

Well, the Sacramento River Bank Protection Project is a long-term bank protection project between the Central Valley Flood Protection Board and the U.S. Army Corps of Engineers. It's implemented primarily to address public safety and keep the river -- the river -- the flood control project from incurring damages from erosion and preventing erosion damages that inc- -- that will cause harm to the public and property.

Op- -- we're talking about operations and maintenance here because it's sometimes a complicated issue. Oper- -- construction is a cost-shared project by the Corps and the Central Valley Flood Protection Project, and we include our vegetation plantings and mitigation features in that establishment period as a cost share between the Flood Protection Board and the Corps as a project cost.

Long-term O & M for mitigation features and other features are a 100 percent nonfederal cost turned over to our local sponsor, and our local sponsor often turns that over to reclamation districts or maintaining agencies, but our agreement -- the Corps' agreement is with the Central Valley Flood Protection Board.

The project area of the project is huge. It's 1,300 miles of levees ranging from Elder Creek in the north, Deer Creek, but mainly consists of the levee portion of the Sacramento River beginning at Hamilton City and going down to Collinsville.

The background is -- the original authorization known as phase one was in 1960, and it consisted of over 400,000 linear feet of bank protection. It was completed in 1975. There was no mitigation provided in that initial phase. And when we talk about mitigation, that's mitigation for fish and wildlife values. That's an important point.

Project was reauthorized in 1974 for another

400,000 linear feet, of which 13,000 linear feet remain. Mitigation was authorized. It was authorized as environmental laws were passed and the huge consternation that occurred during phase one.

Every year, we conduct a survey, the Flood Board and the Corps, going down the Sacramento River Flood Control Project and, in 2008, we located 154 sites. We try to do erosion repairs on a yearly basis, and that's based on how much funding the federal government -- the Corps receives from the federal government.

We constructed eight sites in 2008. We're planning to construct an additional 9,000 this summer. And what that means is, on the previous slide, we had 13,000 linear feet authorized, approximately. We'll only have 4,000 left next year, so we need to have the 80,000 linear feet authorized for 2011 or there will be no federal participation in bank protection after 2010. Prior to the '90s, there was an average production of 10,000 feet of bank protection on an annual basis. It slowed down due to the various listings of endangered species within the project area.

This is a map of the 2008 erosion sites. You can see that they extend the entire length of the project authority area, and no area is immune from erosion into the levee system.

The Bank Protection Project gets involved when we see some typical deficiencies, which is really just getting into the standard levee template of 3:1 and the visual -- the visual seeing of steep and eroding banks into the levee template. There's also deficiencies in terms of existing vegetation. This is often -- this is often a point where, if vegetation falls into the water from the levee, there's the potential for a loss of a lot -- a huge amount of soil, thus, exacerbating the need to repair the levee.

Well, we have a new authority as -- and that's why we're here this evening, and the Water Resources Development Act of 2007 gives an additional 80,000 linear feet. At that -- at a production rate of 10,000 linear feet a year, that would give an additional eight years of authority. That gives the time for us to plan a phase three of Sac Bank, allow the state to prepare their Central Valley Flood Protection Plan and still have a federal interest in repairing the current alignment or the current situation, the current flood control project as it stands. And we need to prepare an EIS/EIR to implement that on a regular basis.

The purpose of the environmental review is to evaluate a reasonable range of alternatives, demonstrate what the impacts are to the human environment and to follow -- and that's mandated by a few laws known as SEQA and NEPA.

The purpose of scoping is to generally inform you about the project, who are the interested parties, for example, landowners, environmental groups, government organizations. What are potential alternatives? Are we looking at the right alternatives? And gather the input on how we should be looking at those alternatives and what things we should consider.

Currently, we've identified six alternatives that consist of no action; no action being a situation of where the federal government will only respond to flood emergencies on an emergency basis. We've identified setback levees and various alternatives of bank protections. What we do on these action alternatives and why we scope them is to really identify the broad range of impacts that are possible from the project. Most likely, it would land somewhere in between, but we cover the extremes.

Currently, we are considering the environmental factors up on -- up on the screen. We hope that you'd provide some comment on how we look at those factors and add any additional factors if they're not listed on -- on the screen.

Just want to outline the number of special status species in the area. These are either federally listed or state listed, sometimes both, recognizing that there are many other species of concern out there, but these are species that we would typically -- can typically find in every project that we implement.

Well, we -- there's a number of issues that we've identified to date. Historic and archaeological sites during construction, fish and wildlife habitat, temporary noise when we're working next to urban areas, also may affect wildlife species, the effect on recreation. We're often out there with -- with barges or working out on the highways with lots of trucks. How do we affect land use and the effect of what the scenic view or the characteristic of the site is.

On the screen is the Corps' vegetation policy, an item that's been discussed about recently. It's a pretty simple policy in general. If you talk about the 15-foot vegetation-free zone from where -- the toe levee here and a -- minimum vegetation on the levee itself and then, again, a 15-foot zone on the back.

There is also the 1974 authorization from the con- -- the report to congress, which authorized the project. It's a little bit different from what you see as the vegetation policy, but I want to highlight that we will initially be planning the project to be compliant with the Corps' vegetation policy.

Well, public participation and what -- the timeline. We're here the beginning of 2009, and we want to get to 2011, and this is really talking about our supplemental authorization. We want to implement projects in 2011. At the same time here, we want to begin a phase three. And the phase three of the project can take many different forms, and we expect that planning effort to take at least five years' time, but we'd like to begin implementing what is phase three of this project at that time, and we're going to begin in- -- initial scoping efforts this summer and spring on that effort and we'll be outlining some of the efforts that will be going on.

We're going to do coordination with the state. The program will be -- is a program that's implemented between the state and the Corps, and we're going to be consistent with the FloodSAFE strategic plan. We're going to be coordinating with the -- the planning of the Central Valley Flood Management Plan as well and, to the extent feasible, we will be participating and knowing what's going on, what the public's telling the state during their planning process so we can incorporate it into ours as well.

This slide really only shows you how busy the central valley is. There is a number of projects with broad geographic ranges that are -- overlap each other that are either in the construction phases or in the -- planning to be in -- constructed in the near future, and one of them is ours. And ours covers a very large geographic area, so we're going to have to deal with many of the same issues that would be dealt with, as the other programs do.

For more information, you can contact myself, Matt Davis, our NEPA compliance specialist, which isn't here tonight, or we can contact Dave Wheeldon, the project manager for Central Board, standing up, and Kip Young is here tonight and -- representing the state as well, and he's back there and you can ask him any questions as well.

And now we'll -- we'll take your comments.

MS. BARBIERI: So it's real important that we get all the comments into the record, and so we have a couple ways we're doing that. We're recording -- doing audio recording. We also have our court reporter, who's taking this down so we can make a transcript, so if you do have any questions or comments, we ask that you use the microphone, that you tell us who you are so that we can get it into the record.

Just as a refresher, this is sort of the purpose of scoping. And again, the list of some of the environmental factors that we're thinking about. You might have things to say on those, you might have others to add. Sort of up to you. So is there anyone who would like to be first?

Yeah, please, go ahead.

MR. GOLET: Do I need to step up there?

MS. BARBIERI: Yes, please.

MR. GOLET: Hi, I'm -- my name's Greg Golet. I'm with The Nature Conservancy based here in Chico, and it's -- I don't know, a comment or a question. With the different alternatives that are being considered, there's a suite of them, as you showed us, from no action to levee setbacks to different types of rocking projects that could go forward. My understanding is that it's a programmatic document, so there'll be general treatment of those concepts, and -- and that's fine and informative, but what really matters, of course, is that the appropriate strategy is implemented at the -- at every given site.

And so a concern that I would have is that there be adequate consideration of, you know, those -- those different alternatives at each of the different sites and that there be, you know, really rigorous environmental review. And so I'd like to know, I guess, when you have your sites identified, what are your plans for engagement with folks to provide that type of review?

MR. DIETL: Well, it is a programmatic level of documentation, but there is -- it's going to be -- what those alternatives are right now compared about the sites that we know are out there, so we're going to group -- we're going to -- tho- -- we know what those sites are, so we're going to compare those impacts right now, those six alternatives, and have that -- those values at those sites.

Now, at different si- -- the -- we're not going to behold necessarily to the sites that we've identified right now, but that's the best representation of the impacts that we can be given right now.

Now, when we go to a site-specific analysis, of course, we're going to have public -- have the public review of any environmental document out there, and if an EIS is necessary, we'd go to scoping again. We try to -- through the emergency repair process, have gone through holding public meetings in every location where there are proposed projects going to prior to construction, and we're going to try and become better at that, and it's going to be part, I believe, of the

Central Valley Flood Protection planning process as well. We've got your regional coordinator, Scott Rice, behind you to go work with DWR and the Central Valley Board. I could spend a lot of time talking on it, but I'm going to take that as a general answer and, again, please give your comment as how you would like to be informed and how the public participates as well.

MS. BARBIERI: Others?

MR. HERINGER: Yeah.

MS. BARBIERI: Yeah, go ahead.

MR. HERINGER: Okay. My name is Les Heringer. I manage the M & T Ranch just west of Chico here, and my comments aren't specific to -- to the environmental factors considered. My comments deal with the Butte Basin bypass area that was put into place in 1964, and it covers river mile 172 to about 192, and there -- there's three weir structures in that area where the water is allowed to leave the river during flood stage, and -- and there's design flows for each of the three weir sites. And over the years, it seems the Corps and the state is -- is -- is not giving as much importance to those design flows at each weir site as they did in 1964 when the system was put in place.

And I -- I think it's real important that the state and the -- the Department of Water Resources and the Corps or the rec board continues to maintain the importance of those three weir structures in the Butte Basin bypass area because people's lives are impacted by that, transportation is impacted by that, farming operations are impacted by that bypass area, and when it was put in place, people accepted that and -- and have set their lives and their livelihoods to the -- to the functioning of the bypass areas as they were designed. And it would appear now that -- that the Corps and Department of Water Resources are saying, "Well, whatever happens up there happens up there." If -- if more water leaves in one area, then the thing will still function and -- but people are getting flows at -- more flows at lower flows of the river and it continues to flow longer after the river goes down and the California Water Code called for protection of flood facilities all the way up to Big Chico Creek, and the commitment to do that doesn't seem to be there.

My point is, you need to maintain the flood control structures all the way up to Big Chico Creek, as you had committed to do in the -- in the mid 1960s.

MS. BARBIERI: Thanks. Thanks for that comment. Is there -- okay. Thank you.

MR. HERINGER: You're welcome.

MR. EDELL: I'm Stuart Edell with Butte County

Public Works. And as a follow-up to Les's comment on Butte Basin, a critical part of the Butte Basin overflow weirs is the three Bs structure, which was never constructed to Corps standards.

The silt levee erodes during a flood stage, and once that erosion's there, when they're releasing below warning stage, we're flooding Butte Basin, which means you're losing capacity for storage, it's impacting our roads, closing the roads, making farmers so they can't plant or harvest or get anything out of there, and basically, it's endangering your whole system.

MS. BARBIERI: Thank you.

Other comments, questions?

MR. LUSTER: My name's Ryan Luster with The Nature Conservancy, and I have two questions. The first one is just -- I wanted to clarify. You said the 2008 survey found 154 sites. And out of that, approximately 13,000 feet are to be repaired; is that -- is that correct? 9,000 have been done?

MR. DIETL: No, what --

MR. LUSTER: Or 9,000 will be done in 2009?

MR. DIETL: We have 13 -- approximately 13,000 feet of authority left prior to this 80,000 that was given to us in 2007.

MR. LUSTER: Okay.

MR. DIETL: And we're going to construct 9,000 of that 13,000 this year, 4,000 next year.

MR. LUSTER: Okay.

MR. DIETL: So until we get the EIS done, unless there's an emergency, we wouldn't be able to use that 80,000 feet.

MR. LUSTER: Okay. So those 154 sites that were identified equal what --

MR. DIETL: Approximately 80,000 feet, happenstance.

MR. LUSTER: Okay. Thanks.

MS. BARBIERI: Other questions, other comments?

MR. HENDERSON: It's just because it's, like, empty space. I feel like I need to fill it, like --

MS. BARBIERI: Thank you.

MR. HENDERSON: Adam Henderson, DWR out of Red Bluff. So we're having -- DWR is involved in a systemwide central valley assessment of the levee system, which will, I guess, be going on at the same time that the bank protection project is going on, so how will you adjust to, say, redesigns in flood control system or realignment of levees or, if we find that levees are made out of the wrong materials or sitting on the wrong geology, I mean, is there going to be an adaptive way for you to do that or do you keep steaming ahead and we may find that we're protecting a levee that is then going to be moved or reconstructed or changed? I guess, how will that be handled or can we handle that?

And a second question would be: Out of the 80,000 feet, do you have any idea the fraction of repair, like replacing blown-out rock or -- or -- in those sites versus, kind of, new sites where rock hasn't been previously on the river?

MR. DIETL: I can answer it a couple of different ways, but the easiest way is we're looking into how to deal with looking at all those problems, and we don't have the answer to both -- both questions as of yet, because the one -- the first question is really a planning question, and we definitely need to marry up with the Corps and the state on a lot of different levels to get that at a better phase.

And if anybody from the state, Dave, want to jump in here and answer part of that -- part of that question, but what -- I think what we're going to need to do is -- you know, to address the second question, there's a number of studies that are going to have to get at and address, geomorphologically and sediment-wise, historical air photos to do that, and that's something that we're going to be looking into, and that's something that goes into really that phase three effort. That 80,000 feet is really just a stopgap.

You know, and how would you define what phase three is? I think you have to answer a lot of those questions because you don't want to throw out a number, 400,000 linear feet, again, without having rationally explained what -- what you need to do. And that question of, what is the interest if you're going to move a flood control structure out there, yeah, you don't to want to do it. But inherently, the project is when to stop -- to protect the project from flooding and -- from flooding from the system.

And those erosion sites that are located on that map are all located in areas with less than 30 feet of berm with -- out there right now, so they are all potentially subject to imminent failure, not on a critical basis, as we have previously defined, but there's a lot of places out there that don't have a 30-foot berm and aren't on that list because they don't necessarily show the active erosion right now, like some of those others do. I mean, we could make that list a lot longer. I would think that those need to be protected.

MR. HENDERSON: So as far as the ratio goes --

MS. BARBIERI: If you could just make sure that your follow-up is in the mic so that we get it. Sorry.

MR. HENDERSON: As far as the ratio goes, is that too hard a question? So the 80,000 feet, as far as new rock on the river, which would add to a total length, or -- or replacing or repair rock that we've seen...

MR. DIETL: No, we don't --

MR. HENDERSON: Okay.

MR. DIETL: We'd have to look -- look back at the -- the mapping that we've done and --

MR. HENDERSON: Okay.

MR. DIETL: -- historical aerial atlases and -- et cetera. That's something that we are discussing, though.

MR. HENDERSON: Okay. And I guess I would just encourage the Corps, like they're doing now, is to kind of tap into the local knowledge of the groups that are working on the system now. A lot of those people are in the room, which, you know, we've had some conversations about. I think it's -- it's refreshing to -- to make those contacts.

MS. BARBIERI: Dave or Kip, anything you wanted to add? No? Yes?

MR. WHEELDON: Hi, my name is Dave Wheeldon with the Department of Water Resources. I think Mike answered it pretty well. Just to kind of reiterate the approach of our -- of the Sacramento River Bank Protection Program is erosion repairs along the banks of the Sacramento River and the major tributaries.

It sounded like some of the evaluations you were interested in -- in -- that you brought up, the levee evaluations, kind of material that's being implemented or that was used in the levees. We would, through this program, get into that if it's something that, you know, the erosion is encroaching upon those levees, so -- and like Mike said, you know, our approach is -- it's -- you know, you don't want to say a BAND-AID, but it is a quick fix for the sites that are critical or becoming critical while other solutions, like these regional setbacks, are being developed.

So they're -- you know, long-term, it might be a case where some of the repairs we've already done or are doing currently or will do may end up being, you know, in front of some of these regional solutions, but the impetus for our program is to hit these sites and fix these sites to that the erosion doesn't continue to advance.

MS. BARBIERI: Thank you.

So other comments and questions? Oh, sorry.

MR. INAMINE: My name's Mike Inamine with

California Department of Water Resources. This is just a follow-on to Dave's response and the question that was posed to Mike Dietl, and that is that the issues that you're talking about, again, we've been through this with the Critical Repairs Program, and one of the issues that we took out of the Critical Repairs or one of the criticisms of the Critical Repairs Program is that it was done very quickly with -- and a lot of people wanted more input into that program, which was an emergency repair program.

The advantage of doing this programmatically and in a much more strategic manner, even though these are, more or less, stopgap repairs until the Central Valley Flood Protection Plan comes out, is that consideration can be given to more -- to other types of repairs rather than this -- the crash-and-burn program of the critical repairs, where you had to get out and do them very, very, very quickly.

That program, the Central Valley Flood Protection Plan, gets to the issues, the strategic, long-term issues of -- that takes advantage of things like the ongoing Levee Evaluation Program, the planning studies, that full suite of programs and projects that will inform the eventual Central Valley Flood Protection Plan that comes out in 2012. So that's the venue for those long-term repairs and systemwide fixes.

Those workshops will be -- were originally scheduled to start taking place, I believe, in April. With the budget in pass, I'm sure that's going to be delayed until the money starts flowing, but that's the venue for the kinds of things that you're talking about. Mike's program, I think it can be characterized as the -- you know, the program to keep the system operating that it was originally intended to.

MS. BARBIERI: Thanks, Mike.

One more?

MR. GOLET: I'm going twice here. So I was really glad to see river meander on this list and --

MS. BARBIERI: Remind us who you are for -- yeah.

MR. GOLET: Oh, I'm Greg Golet with The Nature Conservancy. And what I would hope in this project being described is one that focuses on repairing critical erosion sites is that the focus is entirely on sites where the flood control system is threatened and the rock goes to repair sites where, you know, you have less than your 30-foot berm or whatever and you see erosion happening.

I would not like to see this project put rock in areas that prevents river meander where the flood control system is not imminently threatened. And also, you know, I don't want to have the rock going in sooner than it has to go in. River meander is hugely important in the system for a suite of species, for the ecosystem as a whole. It's why -- it's a large reason why we have so many imperiled species on the Sacramento River and elsewhere.

And so I -- I just think it's critically important that areas that are -- you know, that are in the flood plane and the active meander zone where there is not currently a levee do not be rocked, and in any instance where you have opportunities for mitigation that the mitigation looks at trying to promote meander and potentially remove rock that is not necessary so that we can help revitalize those important natural processes.

And I've got one more thought, and I don't want to have to get up here a third time, so --

MR. HENDERSON: You're not holding up the line, Greg.

MR. GOLET: Yeah. Oh, what is it? I'm sorry.

MS. BARBIERI: It's okay. It'll come to you. And if, you know, you think of it later, just put it in writing.

MR. GOLET: Okay.

MS. BARBIERI: All right. Anybody else for a question or a comment?

MR. GOLET: Oh, I know what it is.

MS. BARBIERI: Oh, you got it.

MR. GOLET: I think it's really important, actually. I looked at the biological opinion for the previous -- the 24,000 feet that was authorized as part of phase two, and it was really deficient in that it spoke about impacts to -- to the federally-threatened endangered species, but it talked about impacts from the standpoint of the loss of shaded rivering habitat. And it said that, you know, these projects are going to have impact in the short term because you're going to remove some vegetation that provides shade and cover, which is, of course, important, but then it said over the longer term, it's actually going to be beneficial because we're going to have established vegetation that provides shade and cover, but that's an extremely narrowly-defined sort of characteristic for what these species need. And if we have a river that's lined with riprap and has all the shade, you know, that you want, it's not going to provide the needs for these species, for the different life phases that have to have eroding banks and redeposited sediments and shallow point bars where the young fish can get up and access food and get away from their predators and that type of thing.

So in looking at even just the federally-listed species, we have to think about the full range of life phases of those and the different things that are important to them, and many of those things pertain to -- to river meander and mobilization of sediments and all of that, and it's not just all about shade and overhanging vegetation on banks. Thanks.

MS. BARBIERI: Great. Thank you.

Okay. Any other comments? If you think of something later, question, you can certainly contact these guys. There's contact information in there. The deadline for receiving scoping comments is March 17th?

MR. DIETL: Yes.

MS. BARBIERI: I think I got it now. So March 17th, get your comments in by then. Pick up a comment card. You can use that card or you can send in the letter to the address that's on there.

And we'll hang around for a little while. If you have any other questions or comments you'd like to make, we'll be here.

And thank you all very much for coming.

(Meeting adjourned at 7:10 p.m.)

Appendix A-4

Public Noticing Letters and Advertisements

Appendix B

January 26, 2009

Dear interested parties and agencies,

In February 2009, the Army Corps of Engineers (Corps) and the Central Valley Flood Protection Board will host four public scoping meetings regarding the Sacramento River Bank Protection Project (SRBPP) and an additional 80,000 linear feet of bank protection along the Sacramento River and its tributaries authorized through a provision of the Water Resources Development Act (WRDA) of 2007.

These meetings will allow the public to learn about and provide input regarding the preparation of an environmental impact statement/environmental impact report (EIS/EIR) for the SRBPP Phase II Supplemental Authorization. The meetings will also provide an opportunity to learn about the SRBPP's Phase III planning efforts, schedule and opportunities for public involvement, all of which are set to begin in 2009.

Scoping Meeting Dates and Locations

Colusa
6:00-8:00 p.m.
Tues. Feb. 17, 2009
Colusa Fairgrounds, Atwood Hall
1303 10th Street, Colusa

Walnut Grove
6:00-8:00 p.m.
Wed., Feb. 18, 2009
Jean Harvie Community and Senior Center
14273 River Road, Walnut Grove

Sacramento
4:00-6:00 p.m.
Tues., Feb. 24, 2009
Tsakopoulos Library Galleria
828 "I" Street, Sacramento

Chico
6:00-8:00 p.m.
Wed., Feb. 25, 2009
Chico Masonic Family Center
110 West East Avenue, Chico

Background Information

The SRBPP is a continuing construction project authorized by Section 203 of the Flood Control Act of 1960. The purpose of this project is to provide protection to the existing levee and flood control facilities of the Sacramento River Flood Control Project. To date, work has been carried out in two phases, with a total of about 820,000 feet of river stabilized under the project. Current SRBPP work is being conducted under Phase II of its existing federal authorization. The supplemental authorization of 80,000 linear feet is in addition to the previously constructed 820,000 linear feet.

Submitting Comments

Written comments concerning this project may be submitted to Matt Davis, U.S. Army Corps of Engineers, Sacramento District, Attn: CESPK-PD-R, 1325 J Street, Sacramento, CA 95814-2922. Send written comments by March 16, 2009.

For More Information

For more information about the scoping meetings or the project in general, please contact Matt Davis, NEPA Compliance Specialist, at (916) 557-6708 or Matthew.G.Davis@usace.army.mil or Kip Young, Staff Environmental Scientist, at (916) 574-1437 or kyoung@water.ca.gov.

US Army Corps
of Engineers
Sacramento District

CENTRAL VALLEY FLOOD PROTECTION BOARD
PUBLIC SAFETY AND FLOOD MANAGEMENT
STATE OF CALIFORNIA

Sacramento River Bank Protection Project
Public Scoping Meeting

Please join the U.S. Army Corps of Engineers and the Central Valley Flood Protection Board for a public scoping meeting to learn about a proposed project to provide levee protection along the Sacramento River.

Wednesday, Feb. 25, 6:00 p.m. – 8:00 p.m.
Chico Masonic Family Center
1110 W. East Avenue, Chico, CA 95926

The Sacramento River Bank Protection Project (SRBPP) would provide 80,000 linear feet of bank protection along the Sacramento River and its tributaries at eroded sites. The public is invited to make comments about what should be considered in the scope of the environmental review documents that will be prepared for the project.

For more information about the meeting, please contact Matt Davis, U.S. Army Corps of Engineers, at (916) 557-6708 or Matthew.G.Davis@usace.army.mil.

US Army Corps of Engineers
Sacramento District

Sacramento River Bank Protection Project
Public Scoping Meeting

Please join the U.S. Army Corps of Engineers and the Central Valley Flood Protection Board for a public scoping meeting to learn about a proposed project to provide levee protection along the Sacramento River.

Tuesday, February 17, 6:00 – 8:00 p.m.
Colusa Fairgrounds, Atwood Hall
1303 10th Street, Colusa, CA 95932

The Sacramento River Bank Protection Project (SRBPP) would provide 80,000 linear feet of bank protection along the Sacramento River and its tributaries at eroded sites. The public is invited to make comments about what should be considered in the scope of the environmental review documents that will be prepared for the project.

For more information about the meeting, please contact Matt Davis,
U.S. Army Corps of Engineers, at (916) 557-6708 or Matthew.G.Davis@usace.army.mil.

US Army Corps of Engineers
Sacramento District

CENTRAL VALLEY FLOOD PROTECTION BOARD
STATE OF CALIFORNIA

Sacramento River Bank Protection Project
Public Scoping Meeting

Please join the U.S. Army Corps of Engineers and the Central Valley Flood Protection Board for a public scoping meeting to learn about a proposed project to provide levee protection along the Sacramento River.

Tuesday, February 24, 4:00 – 6:00 p.m.
Tsakopoulos Library Galleria
828 I Street, Sacramento

The Sacramento River Bank Protection Project (SRBPP) would provide 80,000 linear feet of bank protection along the Sacramento River and its tributaries at eroded sites. The public is invited to make comments about what should be considered in the scope of the environmental review documents that will be prepared for the project.

For more information about the meeting, please contact Matt Davis,
U.S. Army Corps of Engineers, at (916) 557-6708 or Matthew.G.Davis@usace.army.mil.

US Army Corps
of Engineers
Sacramento District

Sacramento River Bank Protection Project
Public Scoping Meeting

Please join the U.S. Army Corps of Engineers and the Central Valley Flood Protection Board for a public scoping meeting to learn about a proposed project to provide levee protection along the Sacramento River.

Wednesday, February 18, 6:00 – 8:00 p.m.
Jean Harvie Community and Senior Center
14273 River Road, Walnut Grove

Tuesday, February 24, 4:00 – 6:00 p.m.
Tsakopoulos Library Galleria
828 I Street, Sacramento

The Sacramento River Bank Protection Project (SRBPP) would provide 80,000 linear feet of bank protection along the Sacramento River and its tributaries at eroded sites. The public is invited to make comments about what should be considered in the scope of the environmental review documents that will be prepared for the project.

For more information about the meeting, please contact Matt Davis,
U.S. Army Corps of Engineers, at (916) 557-6708 or Matthew.G.Davis@usace.army.mil.

US Army Corps
of Engineers
Sacramento District

CENTRAL VALLEY FLOOD PROTECTION BOARD
STATE OF CALIFORNIA

Appendix A-5

Summary of Feedback from Key Agency Interviews

Appendix C

Sacramento River Bank Protection Project
Phase II Supplemental Authorization - WRDA 2007

Agency Interview Recommendations and Summaries

Introduction

As a part of the Sacramento River Bank Protection Project Phase II Supplemental Authorization (additional 80,000 linear feet), the Corps solicited input from key agencies that have a direct interest in flood risk management and the environmental conditions associated with future locations and types of bank protection alternatives. The Corps enlisted the HDR/ICF Jones & Stokes team to conduct interviews with staff of key agencies in order to better understand their experience, perspectives, and vision for implementation of the additional 80,000 linear feet of bank protection and/or levee setbacks. Each interview participant was provided with background information on the SRBPP including a list of interview questions that served as a guide during the interviews (Attachment 1). The interviews resulted in several recommendations for improvement of the SRBPP planning and implementation process, which are presented below along with summaries of the interviews.

Recommendations

1. Create a flow chart of the SRBPP organization to outline who is involved, types of projects they oversee and how they relate to other flood control authorities and projects (e.g. PL 84-99, FloodSAFE, BDCP).
2. Involve resource agencies in the development of alternative designs/solutions and pursue solutions that are less intensive than rock.
3. Explore partnerships with academia or other agencies/organizations for the purposes of conducting research.
4. Conduct a robust cumulative impact analysis in order to provide an adequate environmental review; it is imperative to fully understand everything that is going on in the river.
5. Pursue a systemwide analysis that is fully coordinated with other related programs (e.g., FloodSAFE, BDCP, State Plan of Flood Control) and that produces a sustainable approach for long-term flood control. Implement SRBPP projects in a way that does not preclude future design options (e.g., setback levees) by making irreversible investments now.

6. Conduct additional analyses beyond the SAM, as it doesn't fully account for all habitat values (e.g., riparian vegetation, bank swallow nest sites).
7. Pursue long-term mitigation strategies/solutions.
8. The criteria/process for identifying and prioritizing sites should be improved and provide a more balanced consideration of various factors (e.g., geotech, economic, environmental).
9. Improve methods of developing and implementing setback levees, including increased communication with landowners, cities and counties in order to develop ties with those constituents.
10. Conduct studies to determine the degree of long-term success of riparian vegetation planted or naturally colonizing rocked sites.
11. Prepare O&M manuals at the time that plans and specifications are prepared.
12. Pursue more innovative designs if warranted by site-specific conditions, including less substantial structures (e.g., toe rock only) and greater reliance on biotechnical solutions.
13. Conduct a SRBPP workshop for the CVFPB (and other as warranted) to review the project background and clarify roles and responsibilities (i.e., CVFPB is the CEQA lead, not its typical role as a permitting agency). Workshop could include a half-day tour of constructed and/or potential sites.
14. Identify methods of utilizing/appropriating federal money that allow for more flexible planning and implementation timelines. This could help resolve various procedural issues including alternatives development and real estate acquisition.
15. Increase connectivity between Corps programs/resources (e.g., SRBPP, ERDC, ecosystem restoration) in order to improve projects.
16. Initiate a standing meeting between State and Corps senior management and staff of each agency/department to stay connected on the various activities going on simultaneously.

Appendix B

Cultural Resources Programmatic Agreement

PROGRAMMATIC AGREEMENT
AMONG THE
U.S. ARMY CORPS OF ENGINEERS, CENTRAL VALLEY FLOOD PROTECTION BOARD, AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
REGARDING THE
SACRAMENTO RIVER BANK PROTECTION PROJECT,
BUTTE, COLUSA, CONTRA COSTA, GLENN, PLACER, SACRAMENTO, SOLANO, SUTTER, TEHAMA, YOLO, AND YUBA COUNTIES, CALIFORNIA

WHEREAS, the Sacramento District of the U.S. Army Corps of Engineers (USACE) and the Central Valley Flood Protection Board (CVFPB) propose to implement the Sacramento River Bank Protection Program (Undertaking) located in Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties, California and USACE has determined that the Project constitutes an Undertaking as defined in the Advisory Council on Historic Preservation Procedures 36 CFR § 800.16(y); and

WHEREAS, the Undertaking consists of the construction of an additional 80,000 linear feet of bank protection in the Sacramento River Flood Control Project (SRFCP) area as described in Attachment 1, Chapter 1, *Introduction and Description of the Undertaking*, (subsection *Description of the Undertaking*) of this document; and

WHEREAS, USACE is the lead federal agency for the Undertaking and has consulted with the following agencies: CVFPB, California State Lands Commission (SLC), California Department of Water Resources (DWR); and

WHEREAS, USACE has consulted with the following Indian tribes: the Berry Creek Rancheria of Tyme Maidu Indians, Buena Vista Rancheria of Me-Wuk Indians, Cachil DeHe Band of Wintun Indians of the Colusa Indian Community, California Valley Miwok Tribe, Cortina Band of Indians, Enterprise Rancheria (Estom Yumeka), Grindstone Rancheria, Ione Band of Miwok Indians, Mechoopda Indian Tribe of Chico Rancheria, Mooretown Rancheria of Maidu Indians, Paskenta Band of Nomlaki Indians, Redding Rancheria, Shingle Springs Band of Miwok Indians, United Auburn Indian Community of Auburn Rancheria, Wilton Rancheria, Yocha Dehe Wintun Nation (Rumsey Rancheria); and

WHEREAS, USACE has consulted with the non-federally recognized Native American organizations and individuals (see Attachment 1, Appendix C) and historical societies and organizations (see Attachment 1, Appendix A); and

WHEREAS, USACE has consulted with the State Historic Preservation Officer (SHPO) in accordance with 36 CFR Part 800, the regulation implementing Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f), as amended (NHPA), regarding the Undertaking's potential to affect historic properties, and has decided to prepare a programmatic agreement (Agreement) pursuant to 36 CFR §800.4(b)(2) and 800.14(b), and has notified ACHP that an Agreement will be prepared, pursuant to 36 CFR §800.6(a)(1)(ii); and

WHEREAS, USACE has chosen to prepare this Agreement to ensure completion of the identification and evaluation of known and potential historic properties within the Undertaking's Area of Potential Effect (APE), and to provide for the resolution of any adverse effects on identified historic properties subsequent to its approval of implementation of each constituent activity of the Undertaking (Undertaking activity); and

WHEREAS, USACE has identified the Undertaking APE as encompassing the stream channels described in Attachment 1, Chapter 1, *Introduction and Description of the Undertaking*, the levee structures on each stream, and land on both the water and land sides of the levee structures; and

WHEREAS, the Undertaking has the potential to affect as yet unidentified historic properties, including archaeological properties and resources of importance to Native Americans; and

WHEREAS, USACE has prepared a historic properties treatment plan (HPTP), attached to this Agreement as Attachment 1 to establish appropriate identification efforts and treatments of affected historic properties; and

WHEREAS, CVFPB has participated in the consultation for this Undertaking and has been invited to be a signatory to this Agreement; and

WHEREAS, in accordance with 36 CFR § 800.2(4)(b) the ACHP has been invited to participate in consultation and declined in a letter dated August 15, 2011 (Attachment 2); and

WHEREAS, DWR, the Cachil DeHe Band of Wintun Indians of the Colusa Indian Community, Shingle Springs Band of Miwok Indians, the United Auburn Indian Community of Auburn Rancheria, and the Yocha DeHe Wintun Nation have participated in the consultation for this Undertaking and have been invited to be concurring parties to this Agreement;

NOW THEREFORE, SHPO and CVFPB agree that, upon USACE's decision to proceed with the Undertaking, USACE shall ensure that all Undertaking activities are carried out in accordance with the following stipulations in order to take into account the effects of the Undertaking on historic properties and further agree that these stipulations shall govern the Undertaking and each Undertaking activity until this Agreement expires or is terminated.

STIPULATIONS

USACE shall implement the following:

I. Applicability and Scope

This Agreement applies to all Undertaking activities, as described herein, and implementation of its requirements is incumbent upon USACE.

Although other state and local agencies may issue permits and otherwise provide assistance for Undertaking activities covered by this Agreement, USACE remains the lead federal agency responsible for ensuring compliance with all Section 106 responsibilities under the provisions of this Agreement.

This Agreement does not negate or supersede any agreements between USACE and Indian tribes in effect at the time the Agreement is executed, nor does it negate or supersede any agreement documents executed between USACE and SHPO pursuant to 36 CFR Part 800. If any agreement between USACE and Indian tribes or between USACE and SHPO in effect at the time the Agreement is executed is found to be in conflict with this Agreement, the respective signatories will confer to resolve the conflict. If the resolution results in a proposed amendment to this Agreement, the provisions under Stipulation XII Amendments will be followed.

An HPTP has been prepared and submitted as a supporting document to the Agreement. On every fifth anniversary of the execution of the Agreement, the HPTP will be reviewed by USACE to determine if any additions or revisions are required. If USACE determines the HPTP requires an amendment, USACE shall prepare and submit the Draft Amended HPTP to the signatory and concurring parties for a 45-day review and comment period. USACE will consider comments and prepare the Amended HPTP, which will be considered binding through this Agreement.

II. Definitions

The definitions set forth at 36 CFR §800.16 are applicable throughout this Agreement.

III. Notices

A. All notices, demands, requests, consents, approvals or communications from one party to another shall be personally delivered or sent by email or facsimile to the persons set forth in Appendix I (or such persons as any party may from time to time specify to other parties in writing) or shall be so deemed given five (5) days after deposit in the United States mail, certified and postage prepaid, return receipt requested, and addressed as indicated in Appendix I (or at such other address as any party may from time to time specify to the other parties in writing).

B. Concurring Parties. Provided the concurring parties listed in Appendix I accept the invitation to act as a concurring party to and sign the Agreement, they agree to receive communications as outlined in Stipulation III.A. If they do not sign the document, USACE will continue to communicate with the party in accordance with applicable laws and regulations.

C. The parties agree to accept facsimiles or copies of signed documents and agree to rely upon such facsimiles or copies as if they bore original signatures. Each party agrees to provide to the other parties, within seventy-two (72) hours after transmission of such a facsimile or copy, the original documents that bear the original signatures.

IV. Identification of Historic Properties

Prior to the approval and implementation of Undertaking activities, USACE shall ensure that a reasonable and good faith effort is made to identify historic properties, as described below.

A. Definition of the APE

1. The Undertaking APE extends along the Sacramento River south-to-north from the town of Collinsville at river mile (RM) 0 upstream to Chico and includes reaches of lower Elder and Deer Creeks. The Undertaking APE also includes Cache Creek, the lower reaches of the American, Feather, and Bear Rivers, and portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs. The Undertaking APE consists of a corridor that extends 0.37 mile from both sides of all stream centerlines described and delineated in Attachment 1 (page 1 and Figures 1-1 and 2-1). This corridor encompasses all Undertaking activities.

2. USACE will define the APE of each Undertaking activity more specifically and delineate the APE of the Undertaking activities accordingly on the APE map which is to be provided in the documentation prescribed by Stipulation VII.

3. USACE will consult with the signatory and concurring parties to this Agreement concerning any modification to the Undertaking APE. USACE will furnish the signatory and concurring parties with written descriptions and maps sufficient to define the area(s) to be added to the

Undertaking APE. The signatory and concurring parties will have thirty (30) days to consider and deliver comments to USACE. After allowing for the comment period, USACE will record its decision concerning the APE modification in a memorandum that will be distributed to the signatory and concurring parties. USACE shall not permit Undertaking activities in any areas other than those identified above in Paragraph IV.A.1.

B. Consultation with Interested Parties

1. USACE shall ensure that consultation with Indian tribes is initiated early with respect to Undertaking activities and continues with Indian tribes throughout the Section 106 compliance process prescribed by this Agreement to identity cultural, confidentiality, or other concerns and to allow adequate time and multiple opportunities for consideration of such concerns.

2. USACE shall ensure that Indian tribes that sign as concurring parties will be consulted with in the manner proscribed in Attachment 1, Chapter 6, *Native American Consultation Procedures*, and will be afforded the same status as other concurring parties to this document.

3. USACE shall ensure that consultation with other potentially interested parties, such as historical societies and organizations, is initiated early with respect to Undertaking activities.

C. Standards for Historic Properties Identification

1. USACE shall ensure that all identification activities conform to the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Standards for Identification* (Federal Register 48 [190]:44720–44723) and are carried out pursuant to the identification procedures outlined in Attachment 1, Chapter 5, *Identification of Historic Properties*.

2. Only professional archaeologists, professional architectural historians, and historians meeting the Secretary of Interior's Professional Qualification Standards (48 FR 44738–44739) and pursuant to 36 CFR 296.8, may design a sample survey, reconnaissance, or less-than-intensive survey.

3. USACE will ensure that an intensive survey or approved alternate survey (Stipulation IV.4.C.2 above) of lands is conducted within the APE as described in Attachment 1, Chapter 5, *Identification of Historic Properties*. USACE shall document the results of such inventory in accordance with Attachment 1, Chapter 5, *Identification of Historic Properties*. If no historic properties are identified USACE will include results in its Annual Report as specified in Stipulation VII.B. If historic properties are identified USACE will consult as specified under Stipulation IV.D.4.

D. Evaluation of Historic Properties

1. Property Types Exempt from Evaluation

   Attachment 1, Appendix H, *Properties Exempt from Evaluation*, to this Agreement lists the property types that the signatories agree shall be exempt from evaluation so long as all terms and conditions set forth in Attachment 1 are satisfactorily met, as determined by USACE. USACE shall evaluate all other identified properties in accordance with sub-paragraphs 2–4 of this subsection.

2. Evaluating Identified Properties

USACE shall evaluate NRHP eligibility and integrity of identified properties in accordance with Attachment 1, Chapter 5, *Identification of Historic Properties,* 36 CFR §800.4(c)(1), and 36 CFR §60.4. Evaluation of properties for NRHP eligibility requires the USACE to establish the appropriate historic context(s) and period(s) of significance for the property. These are determined and significance assessed by gathering data appropriate to the property type. As described in Attachment 1, Chapter 5, *Identification of Historic Properties*, data gathering may entail archival research, interviews, surface examinations, archaeological excavation, reporting, and other tasks. The USACE's consultation process for eligibility determinations is described in sub-paragraph 4 below.

3. Previously Evaluated Properties

When previously evaluated properties are identified within the APE of an Undertaking activity, USACE District Archaeologist or professionally qualified designee shall review those previous evaluations. The passage of time, changing perceptions of significance, new information, incomplete or flawed previous evaluations, and factual errors warrant such reviews and may prompt USACE to reevaluate the properties. USACE shall consult with Indian tribes during the review and reevaluation process when properties are involved to which Indian tribes may attach religious or cultural significance.

   a. If USACE, after reconsidering NRHP eligibility or formal listing or determination by the Secretary of the Interior or SHPO, agrees with the previous determination, USACE may assume that the previous NRHP evaluation remains valid for the purposes of this Agreement. No consultation with the Agreement parties is required under such circumstances.

   b. If USACE disagrees with the previous NRHP eligibility or formal listing or determination by the Secretary of the Interior or SHPO, USACE shall evaluate the property in accordance with sub-paragraph 2 above and Attachment 1, Chapter 5, *Identification of Historic Properties,* to this Agreement.

4. Consultation Regarding NRHP Evaluations

USACE shall submit, by hard copy and email, determinations of eligibility made hereunder and supporting documentation to SHPO for comment in accordance with 36 CFR §800.4(c)(2). USACE shall consult with Indian tribes or other entities that are concurring parties to this Agreement that may attach religious or cultural significance to the historic property. The purpose of this consultation is to determine whether the property has values that may qualify it as NRHP-eligible under Criterion A, B, or C in addition to, or instead of, Criterion D (see Attachment 1, Chapter 5, *Native American Property Types*).

   a. If SHPO or any concurring party has not responded to USACE within 15 days after receipt of the documentation cited in IV.D.4, USACE may either extend the review period in consultation with the party or parties, or proceed to the next step prescribed by this Agreement, based on USACE's determination of NRHP eligibility.

   b. Agreements or disagreements among the signatory parties regarding NRHP eligibility of properties evaluated hereunder shall be governed by 36 CFR §800.4(c) (2).

V. Assessment of Effects

Assessments of effect will be made in accordance with the provisions in Attachment 1, Chapter 7, *Assessment of Effects*, to this Agreement. To summarize, USACE will consider the effects of Undertaking activities on historic properties by consulting with signatory and other consulting parties, apply the criteria of adverse effect (36 CFR §800.5[a]), document its findings, and in the case of a finding of no historic properties affected or no adverse effect on historic properties, notify the signatory, concurring, and any additional consulting parties of USACE's findings. Should USACE determine that Undertaking activities would affect historic properties, USACE will notify the signatory, concurring, and any additional consulting parties of USACE's findings and resolve adverse effects pursuant to Stipulation VI below.

VI. Resolution of Adverse Effects

USACE shall resolve adverse effects through implementation of Attachment 1, Chapter 8, *Resolution of Adverse Effects*, to this Agreement. In brief, USACE will document the character of the subject property, nature of the adverse effect, and proposed resolution of effects. USACE will submit the documentation to the Agreement signatory and concurring parties, as well as any community groups that attach importance to the historic property, for a 15-day review and comment period. Upon receipt of comments and close of the commenting period, USACE will prepare a written decision summarizes USACE's proposed effects resolution, any comments received from reviewers, and USACE's planned resolution in consideration of all comments. USACE will provide a copy of the decision memorandum to the reviewing parties before proceeding with resolution of adverse effects. USACE will ensure that site-specific historic property treatment plans are prepared, as needed, and distributed to signatory, concurring and consulting parties for a 30-day review and comment period.

VII. Reporting Requirements and Related Reviews

A. All documentation that supports findings and determinations made under this Agreement shall be consistent with 36 CFR §800.11. Documentation prepared by local or state agencies or their consultants in support of such findings shall be submitted to USACE for review and approval by the USACE District Archaeologist.

B. USACE shall prepare and circulate among the signatory and concurring parties to this Agreement an Annual Report documenting the activities carried out pursuant to this Agreement. USACE shall submit the Annual Report to the Agreement signatory and concurring parties within forty-five (45) days of the anniversary of this Agreement's execution. The Annual Report is to present a summary of actions taken under the Agreement, all findings and determinations, accomplishments, public objections, and inadvertent effects. The Agreement signatory and concurring parties will review the Annual Report to determine the effectiveness of the Agreement as an alternative to the standard Section 106 consultation procedures under 36 CFR Part 800.

C. Unless otherwise specified, all documents produced for the Undertaking will be subject to a 30 calendar day review and comment period by signatory, concurring and consulting parties.

VIII. Inadvertent Discoveries and Unanticipated Effects

USACE is responsible for complying with 36 CFR §800.13 in the event of inadvertent discoveries of, or unexpected effects on, historic properties during implementation of the Undertaking activities. Attachment 1, Chapter 8, *Resolution of Adverse Effects*, provides procedures which USACE will follow in the event of inadvertent discoveries or unanticipated effects on historic properties.

A. Summary of Inadvertent Discovery Procedures

1. Workforce Training

To improve proper adherence to the procedures contained in Attachment 1, Chapter 8, *Resolution of Adverse Effects*, during implementation of Undertaking activities, USACE or authorized archaeologists will provide training to construction personnel regarding proper procedures and conduct in the event that archaeological materials are encountered during construction.

2. Procedures

a. If cultural resources are discovered during construction, all construction shall immediately stop within 100 ft (30 m) of the discovery, the location of the discovery will be marked for avoidance, and efforts will be made to prevent inadvertent destruction of the find. The contractor must notify the USACE (if not on location), who will determine whether the discovery is a potential NRHP-eligible resource. If USACE determines that the discovery is not a NRHP-eligible resource, the discovery will be documented and construction may proceed at the direction of USACE.

b. If USACE determines that human remains are not present, that the discovery is not an isolated find, and that the discovery is eligible for the NRHP, the USACE will notify the signatory and concurring parties of this Agreement and appropriate Indian Tribes and potential consulting parties of this determination within 48 hours of the discovery. Notification should include a description of the discovery, the circumstances leading to its identification, NRHP eligibility determination, and recommendations for further investigation or actions to resolve adverse effects.

c. Treatment of human remains is governed by Stipulation IX below.

B. Summary of Procedures for Unanticipated Effects

USACE shall determine actions that it can take to resolve unanticipated adverse effects and notify the Agreement signatory parties, as well as any Indian tribe that might attach religious and cultural significance to the affected property, within 48 hours of the discovery. The notification shall describe the effects and proposed actions to resolve the adverse effects. The Agreement signatory parties and Indian Tribes shall respond within 48 hours of the notification. USACE shall take into account their recommendations regarding proposed resolutions and then carry out appropriate actions. USACE may take a lack of response within 48 hours as concurrence with proposed treatments of the historic property. The USACE official shall provide the Agreement signatory parties and Indian Tribes a report of the actions when they are completed.

IX. Treatment of Human Remains

In the event that human remains are discovered during implementation of the Undertaking activities, USACE and CVFPB are responsible for complying with applicable laws, regulations, and standards pertaining to such discoveries. Such laws and standards may include, but are not limited to, ACHP's Policy Statement Regarding Treatment of Burial Sites, Human Remains and Funerary Objects; California Health and Safety Code 7050.5; and PRC 5097.98. USACE will use the procedures provided in Attachment 1, Chapter 8, *Resolution of Adverse Effects*, of this Agreement in the event of a human remains discovery.

X. Administrative Provisions

A. Standards

1. Professional Qualifications

All activities prescribed by stipulations IV–IX of this Agreement shall be carried out under the authority of USACE by or under the direct supervision of a person or persons meeting, at a minimum, the Secretary of the Interior's Professional Qualifications Standards (48 FR 44738–44739) in the appropriate disciplines. Nothing in this stipulation, however, may be interpreted to preclude USACE or any agent or contractor thereof from using the services of persons who do not meet the Secretary of Interior's Professional Qualifications Standards if they are supervised by an individual who does meet these standards.

2. Documentation Standards

Written documentation of activities prescribed by Stipulations IV–IX of this Agreement shall conform to the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716–44740) as well as to applicable standards and guidelines established by the State of California Office of Historic Preservation.

3. Curation and Curation Standards

USACE shall ensure that the materials and records resulting from the activities prescribed in this Agreement are curated in accordance with 36 CFR Part 79, except as required by state law and regulation applicable to CVFPB, including, but not limited to, PRC sections 5097.98 and 5097.991 for Native American human remains and associated grave goods on non-federal land, or as required by other provisions of law. Additionally, the disposition of abandoned shipwrecks and archaeological sites and historic resources on state lands under the jurisdiction of SLC shall be determined by SLC as provided by PRC section 6313. USACE will ensure that, to the extent permitted by applicable law and regulation, the views of the appropriate Native American descendant group(s) are taken into consideration when decisions are made about the disposition of Native American archaeological materials and records.

B. Confidentiality

The parties to this Agreement acknowledge that historic properties covered by this Agreement are subject to the provisions of Section 304 of the NHPA and California Government Code 6254.10 (Public Records Act) relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this Agreement are consistent with said laws.

XI. Resolving Objections

A. Should any signatory party object in writing to USACE regarding the manner in which the terms of this Agreement are carried out, USACE immediately will notify the other signatory parties of the objection and proceed to consult with the objecting signatory party to resolve the objection. USACE will honor the request of any other signatory party to participate in the consultation and will take any comments provided by such signatory party into account. USACE shall render a decision regarding the objection and respond to the objecting party within fifteen (15) days of USACE's receipt of the objection. USACE will promptly notify the other parties of its decision in writing, including a copy of the response to the objecting party. USACE's decision regarding resolution of the objection will be final. Following issuance of its final decision, USACE may authorize the action subject to dispute hereunder to proceed in accordance with the terms of that decision.

B. If the objection is resolved through consultation, USACE may authorize the disputed action to proceed in accordance with the terms of such resolution.

C. If after initiating such consultation, USACE determines that the objection cannot be resolved through consultation, USACE shall forward all documentation relevant to the objection to ACHP, including ACHP's proposed response, if any, to the objection. Within thirty (30) days after receipt of all pertinent documentation, ACHP shall exercise one of the following options:

1. Advise USACE that ACHP concurs within USACE's proposed response to the objection, whereupon USACE will respond to the objection accordingly; or

2. Provide USACE with recommendations, which USACE shall take into account in reaching a final decision regarding its response to the objection; or

3. Notify USACE that the objection will be referred for comment pursuant to 36 CFR §800.7(a)(4) and proceed to refer the objection and comment. In this event, USACE shall take the resulting comments into account in accordance with 36 CFR §800.7(c)(4).

D. Should the ACHP not exercise one of the options in XI.C above within thirty (30) days after receipt of all pertinent documentation, USACE may assume ACHP's concurrence in its proposed response to the objection.

E. USACE shall take into account any ACHP recommendation or comment and any comments from the other signatory parties to this Agreement in reaching a final decision regarding the objection. USACE's responsibility to carry out all actions under this Agreement that are not the subject of the objection shall remain unchanged.

F. USACE shall provide all other signatory parties to this Agreement with a written copy of its final decision regarding any objection addressed pursuant to this stipulation.

G. USACE may authorize any action subject to objection under items A–F of this stipulation to proceed, provided the objection has been resolved in accordance with the terms of aforesaid items A–F, as determined by USACE.

H. At any time during implementation of the terms of this Agreement, should any member of the public raise an objection in writing pertaining to such implementation to any signatory party to this Agreement, that signatory party shall immediately notify USACE. USACE shall immediately notify the other signatory parties in writing within fifteen (15) days of receipt of their notification. USACE shall consider the objection, and in reaching its decision, USACE will take all comments into account. Within fifteen (15) days following closure of the comment period, USACE will render a decision regarding the objection and respond to the objecting party. USACE will promptly notify the signatory parties of its decision in writing, including a copy of the response to the objecting party. USACE's decision regarding resolution of the objection will be final. Following issuance of its final decision, USACE may authorize the action subject to dispute hereunder to proceed in accordance with the terms of that decision.

XII. Amendments

Any signatory party to this Agreement may propose that this Agreement be amended, whereupon the signatory parties will consult for no more than thirty (30) days to consider such amendment. USACE may extend this consultation period. The amendment process shall comply with 36 CFR §800.6(c)(1) and §800.6(c)(7). This Agreement may be amended only upon the written agreement of the signatories.

XIII. Termination

A. Only signatory parties to this Agreement may terminate this Agreement. If this Agreement is not amended as provided for in Stipulation XII or if any signatory proposes termination of this Agreement, the party proposing termination shall notify the other signatory parties in writing, explain the reasons for proposing termination, and consult with the other parties for no more than thirty (30) days to seek alternatives to termination.

   Should such consultation result in an agreement on an alternative to termination, the signatories shall proceed in accordance with that agreement and if necessary, shall amend the Agreement in accordance with Stipulation XII.

B. Should such consultation fail to result in an agreed upon resolution by the signatory parties, the signatory party proposing termination may terminate this Agreement by promptly notifying the other signatories in writing.

C. Should this Agreement be terminated, USACE shall either consult in accordance with 36 CFR §800.14(b) to develop a new Agreement or request the comments of ACHP pursuant to 36 CFR Part 800.

D. Beginning with the date of termination, USACE shall ensure that, until and unless a new Agreement is executed for the Undertaking activities covered by this Agreement, such activities shall be considered separate actions and be reviewed individually in accordance with 36 CFR §§800.4–800.6.

XIV. Duration of the Agreement

Unless it is terminated pursuant to Stipulation XIII of this Agreement or superseded by another agreement executed for the Undertaking, this Agreement shall remain in effect until USACE, in consultation with the other signatory parties to this Agreement, determines that construction, monitoring, and maintenance of all aspects of the Undertaking have been completed and all terms of this Agreement have been fulfilled in a satisfactory manner or until ten (10) years have passed from the date of execution of this Agreement, whichever occurs first. Upon a determination by USACE that construction, monitoring, and maintenance of all aspects of the Undertaking have been completed and that all terms of this Agreement have been fulfilled in a satisfactory manner, or upon reaching the ten (10) year limit, USACE shall notify the other signatory and concurring parties of this determination in writing, whereupon this Agreement shall be null and void.

XV. Effective Date

This Agreement shall take effect on the date that it has been executed by all signatory parties.

EXECUTION and implementation of this Agreement is evidence that USACE has afforded ACHP a reasonable opportunity to comment on the Undertaking and the Undertaking activities, that USACE has taken into account the effects of the Undertaking and its activities on historic properties, and that USACE has complied with Section 106 of the NHPA and 36 CFR Part 800 for the Undertaking and the Undertaking activities.

ATTACHMENTS

1. Historic Properties Treatment Plan

2. Letter from Advisory Council on Historic Preservation

SIGNATORY PARTIES:

U.S. Army Corps of Engineers

By ________________________ Date 1 MAR 12

for William J. Leady, P.E.
Colonel, U.S. Army
District Commander

California State Office of Historic Preservation

By ________________________ Date 21 MAR 2012
Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

Central Valley Flood Protection Board

By Jay S. Punia Date 3/13/2012
Jay Punia
Executive Officer

Ione Band of Miwok Indians

By ______________________________ Date ______________
Chairperson
Tribal Council

Mechoopda Indian Tribe of Chico Rancheria

By ______________________________ Date ______________
Dennis Ramirez
Tribal Chairperson

Mooretown Rancheria of Maidu Indians

By ______________________________ Date ______________
Chairperson
Tribal Council

Paskenta Band of Nomlaki Indians

By ______________________________ Date ______________
Chairperson
Tribal Council

Redding Rancheria

By ______________________________ Date ______________
Tracy Edwards
Tribal CEO

Shingle Springs Band of Miwok Indians

By______________________________ Date______________
Nicholas Fonseca
Tribal Chairman

Strawberry Valley Rancheria

By ______________________________ Date ______________
Cathy Bishop
Tribal Chairperson

United Auburn Indian Community of Auburn Rancheria

By ______________________________ Date ______________
David Keyser
Tribal Chairman

Wilton Rancheria

By ______________________________ Date ______________
Chairperson
Tribal Council

Wintu Tribe of Northern California

By ______________________________ Date ______________
Wade McMaster
Chair

Yocha DeHe Wintun Nation

By ______________________________ Date ______________
Marshall McKay
Tribal Chairman

California Valley Miwok Tribe

By ________________ Date 5-3-2012
Silvia Burley
Chairperson

Mechoopda Indian Tribe of Chico Rancheria

By Dennis Ramirez Date 5/5/12
Dennis Ramirez
Tribal Chairperson

Ione Band of Miwok Indians

By ______________________ Date ____________
Chairperson
Tribal Council

Mechoopda Indian Tribe of Chico Rancheria

By ______________________ Date ____________
Dennis Ramirez
Tribal Chairperson

Mooretown Rancheria of Maidu Indians

By ______________________ Date ____________
Chairperson
Tribal Council

Paskenta Band of Nomlaki Indians

By ______________________ Date ____________
Chairperson
Tribal Council

Redding Rancheria

By ______________________ Date ____________
Tracy Edwards
Tribal CEO

Shingle Springs Band of Miwok Indians

By ______________________ Date 5-31-12
Nicholas Fonseca
Tribal Chairman

Strawberry Valley Rancheria

By ______________________ Date ____________
Cathy Bishop
Tribal Chairperson

United Auburn Indian Community of Auburn Rancheria

By ______________________ Date ____________
David Keyser
Tribal Chairman

Attachment 1

Final
Historic Properties Treatment Plan
Sacramento River Bank Protection Project

HISTORIC PROPERTIES TREATMENT PLAN SACRAMENTO RIVER BANK PROTECTION PROJECT

PREPARED FOR:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922
Contact: Nikki Polson
916.557.6977

PREPARED BY:

ICF International
630 K Street, Suite 400
Sacramento, CA 95814
Contact: Christiaan Havelaar
916.737.3000

January 2012

ICF INTERNATIONAL

ICF International. 2012. *Historic Properties Treatment Plan Sacramento River Bank Protection Project*. January. (ICF 00627.08.) Sacramento, CA. Prepared for U.S. Army Corps of Engineers, Sacramento, California.

Contents

Tables and Figures

Table

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Acronyms and Abbreviations

ac	acre
ACHP	Advisory Council on Historic Preservation
APE	areas of potential effect
Cal/OSHA	California Office of the Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CCTS	Central California Taxonomic System
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CHRIS	California Historical Resources Information System
cm	centimeters
CRHR	California Register of Historical Resources
CSCU	controlled surface collection unit
CVFPB	Central Valley Flood Protection Board
CVP	Central Valley Project
dbh	diameter at breast height
DPR	Department of Parks and Recreation
DWR	Department of Water Resources
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ESAs	environmentally sensitive areas
FR	Federal Register
ft	feet
GCID	Glenn-Colusa Irrigation District
GIS	geographic information system
GLO	General Land Office
GPS	global positioning system
ha	hectares
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HALS	Historic American Landscape Survey
HCD	California Department of Housing and Community Development
HPTP	Historic Properties Treatment Plan
HSC	Health and Safety Code
HSR	Historic Structure Report
ICF	ICF International
in	inches
Indian Tribes	federally recognized Native American tribes

IWM	in-stream woody material
km	kilometers
lft	linear feet
m	meters
mi	miles
MLD	Most Likely Descendant
MNIs	minimum number of individual items
MSL	mean sea level
MSWL	mean summer water level
NAHC	Native American Heritage Commission
NCIC	North Central Information Center
NEIC	Northeast Information Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
NWIC	Northwest Information Center
OHP	Office of Historic Preservation
oz	ounces
Panamerican	Panamerican Consultants, Inc.
PQS	professionally qualified staff
PRC	Public Resources Code
Undertaking	Phase II Supplemental Authority
Undertaking APE	Undertaking Area of Potential Effect
Undertaking PA	Programmatic Agreement for the Undertaking
RD	Reclamation Districts
RM	River Mile
Section 106	Section 106 of the National Historic Preservation Act
SHPO	State Historic Preservation Officer
SHRC	State Historical Resources Commission
SLC	State Lands Commission
SPRR	Southern Pacific Railroad
SR	State Route
SRFCP	Sacramento River Flood Control Project
TCP	traditional cultural property
USACE	U.S. Army Corps of Engineers
USC	United States Code
VFZ	vegetation-free zone

Chapter 1
Introduction and Description of the Undertaking

This Historic Properties Treatment Plan (HPTP) was prepared on behalf of the U.S. Army Corps of Engineers (USACE), Central Valley Flood Protection Board (CVFPB), and California Department of Water Resources (DWR) for the Sacramento River Bank Protection Project (SRBPP) Phase II Supplemental Authority (Undertaking). The purpose of this HPTP is to direct cultural resource management activities during the life of the Undertaking. USACE and CVFPB (formerly the Reclamation Board) are currently preparing an Undertaking Environmental Impact Statement/Environmental Impact Report (EIS/EIR; ICF Jones & Stokes 2009a) for the SRBPP for implementation of up to 80,000 linear feet (lft) of additional bank protection in the Sacramento River Flood Control Project (SRFCP) area, as authorized by Section 3031 of the Water Resources Development Act of 2007. The Undertaking Area spans portions of Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties in California (Figure 1-1).

The SRBPP is a continuing long-term project authorized by Section 203 of the Flood Control Act of 1960 (Public Law 86-645). It was authorized to provide protection to the existing levee and flood control facilities of the SRFCP. The SRFCP consists of approximately 980 miles (mi) of levees plus overflow weirs, pumping plants, and bypass channels that protect communities and agricultural lands in the Sacramento Valley and Sacramento River–San Joaquin River Delta.

The SRBPP has been divided into three phases. Phase I bank protection was completed in 1975 and resulted in 435,953 feet (ft) of bank protection. Current bank protection is being carried out under Phase II. The work authorized through Section 3031 of the Water Resources Development Act—the Undertaking—is a continuation of Phase II bank protection and increases the amount of currently authorized bank protection by 80,000 lft. Phase III is future work that will be formulated in a general reevaluation of the SRFCP. As construction of the Phase II Supplemental Authority is completed, implementation of Phase III will be critical to ensuring that Sacramento River levees seriously threatened by erosion receive corrective measures to prevent levee failure, catastrophic damage, and possible loss of life. Planning for Phase III is expected to conclude in 2013.

Purpose and Application of the Historic Properties Treatment Plan

The Undertaking is subject to several laws governing the management of cultural resources, the most prominent of which are the National Environmental Policy Act (NEPA), Section 106 of the National Historic Preservation Act (NHPA), and the California Environmental Quality Act (CEQA). The Undertaking will be implemented over a number of years in several phases. Combined with the expansive area encompassed by the Undertaking's Area of Potential Effects (Undertaking APE), it is infeasible to identify all of the *historic properties*—cultural resources eligible for listing or listed in the National Register of Historic Places (NRHP)—that may be affected by the Undertaking and to resolve adverse effects on them in a single effort.

ICF International (ICF) and its subconsultant team have conducted a pedestrian survey of 16 of the 107 critical erosion sites in the Undertaking Area and a survey for submerged cultural resources, and assisted with Native American outreach. These efforts, however, have resulted in only partial identification of historic properties. Additionally, many of the locations for the activities associated with the Undertaking (Undertaking activities) have not been determined at this time, but will be determined over the next 10 years. It is not only feasible to schedule identification efforts in the future when planning and design will take place for each repair site, but this approach allows for maximum flexibility and more efficient design and preservation.

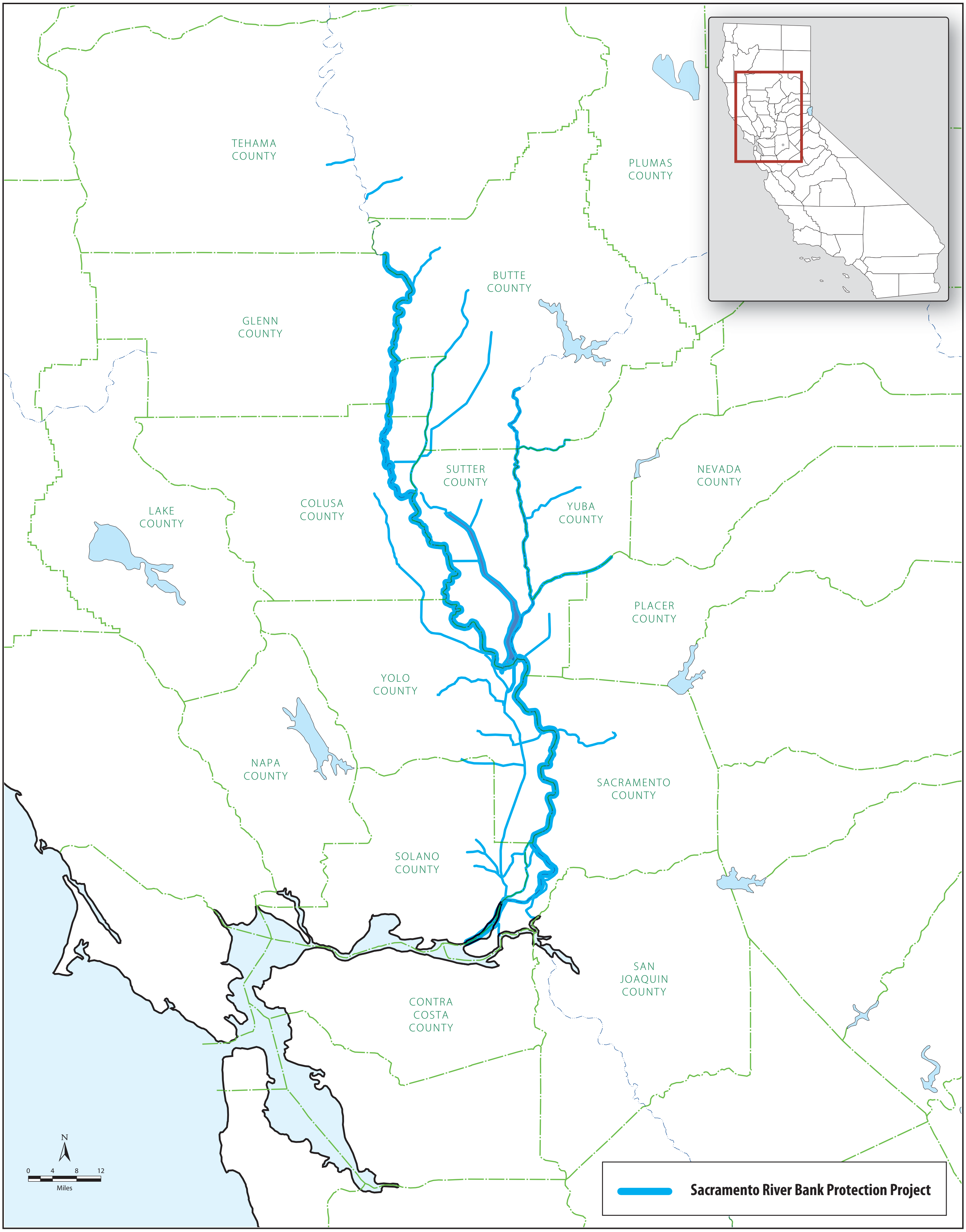
The Undertaking lends itself to a phased approach to historic properties management as permitted under 36 Code of Federal Regulations (CFR) 800.14(b). As such, USACE and DWR have determined that developing a Programmatic Agreement for the Undertaking (Undertaking PA) and an attending HPTP is the most effective way to accommodate the Undertaking requirements with compliance with NEPA, Section 106, and CEQA.

Organization of the Historic Properties Treatment Plan

This HPTP is divided into nine chapters. This chapter discusses the purpose, application, and organization of this HPTP, describes the regulatory context for the Undertaking and HPTP, and describes the Undertaking (including all alternatives) in detail. Chapter 2, *Cultural Resources Study*, documents efforts made to conduct a preliminary sample identification of cultural resources within the Undertaking APE. Chapter 3, *Context*, discusses environmental and cultural contexts for the Undertaking APE, including the range of historic property types expected in the Undertaking APE. Chapter 4, *General Standards and Procedures*, identifies the professional and legal standards under which HPTP activities are to be conducted, procedural requirements for activities such as permit acquisition for fieldwork on properties not owned or managed by USACE, requisite professional qualifications of cultural resource management personnel, and curatorial standards. Chapter 5, *Identification of Historic Properties*, describes the methods by which historic properties in the Undertaking APE will be identified, including the processes and responsible parties for consultation, inventory of the Undertaking activity APEs, standards for evaluation of expected property types, and documentation requirements. Chapter 6, *Native American Consultation Procedures*, presents the procedures for consulting with Native Americans. Chapter 7, *Assessment of Effects*, describes the assessment of effects process, including the criteria used to analyze whether there is an effect. Chapter 8, *Resolution of Adverse Effects*, describes the process for resolving adverse effects on historic properties and provides an example of treatment measures that can be applied to the range of historic property types discussed in earlier chapters. Chapter 9, *References Cited*, lists the references cited in this HPTP.

Personnel

Personnel responsible for conducting research, authoring the PA and HPTP, and producing the supportive technical data provided in the HPTP include staff from the USACE Sacramento District, ICF International's Sacramento office, Panamerican Consultants, Inc. (Panamerican), Helen McCarthy, DWR, and the State Lands Commission (SLC).



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ICF INTERNATIONAL

Figure 1-1
Project Vicinity

Direction of this effort was conducted by USACE cultural resources staff, Sannie Osborn, who provided initial direction and management, followed by Nikki Polson, who directed the completion of the PA and HPTP. Research, field surveys, analysis, and authorship of the PA and HPTP were conducted by ICF International staff and their subconsultant team, under the direction of Trish Fernandez. Panamerican conducted the submerged resources study. Helen McCarthy directed and conducted the Native American outreach efforts with the assistance from ICF staff Trish Fernandez, Christiaan Havelaar, and Melissa Cascella. Christiaan Havelaar and Melissa Cascella conducted the records searches, interested party outreach, and terrestrial surveys. Melissa Cascella conducted all GIS data entry, analysis and output, and produced maps and figures from this data. Patricia Ambacher of ICF conducted the levee evaluation assessment. Gabriel Roark of ICF wrote the initial draft PA, and he and Christiaan Havelaar wrote the initial draft of the HPTP. Pamela Griggs with SLC and Janis Offermann with DWR provided comments as did the USACE cultural staff; Trish Fernandez and Nikki Polson refined the PA and HPTP based on these comments.

Regulatory Context

Both federal and state agencies are involved in the Undertaking. Therefore, it is subject to the cultural resource requirements of NEPA, Section 106, and CEQA. Under NEPA, federal agencies must "preserve important historic, cultural and natural aspects of our national heritage" (Section 101(b)(4) [42 United States Code (USC) 4331]). Although NEPA and its implementing regulations do not provide standards specific to cultural resources, most federal agencies apply the standards promulgated by Section 106's implementing regulations (36 CFR 800) to comply with NEPA-driven cultural resources assessments.

Section 106 requires that, before beginning any undertaking, a federal agency must take into account the effects of the undertaking on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on these actions (16 USC 470[f]). The standard Section 106 process for assessing effects on historic properties entails a thorough program of research, consultation, fieldwork, and reporting, commensurate with the scale of the undertaking and its effects. Where access is restricted, undertakings are unusually large or complex, or the effects of the undertaking or group of undertakings are repetitive and predictable in nature, 36 CFR 800.14(b) permits the federal agency to implement a phased approach to historic properties management, codified in a PA. As described earlier in this chapter, the SRBPP is a complex, multi-year undertaking that encompasses a large land area. These conditions prompted USACE and DWR to prepare the Undertaking PA and this HPTP.

CEQA requires public agencies to evaluate the implications of their projects on the environment and includes cultural resources as part of the environment. Typically, cultural resource assessments under CEQA transpire in a manner similar to those under Section 106: research, consultation, fieldwork, significance evaluation, impact assessment, and reporting/public disclosure. Although CEQA standards are not of particular concern to Section 106 compliance, CEQA standards are discussed in this HPTP to demonstrate compliance with the mitigation measures contained in the SRBPP EIS/EIR (ICF Jones & Stokes 2009a).

Overview of the Historic Properties Treatment Plan

Whereas the Undertaking PA is essentially a policy and procedure document, this HPTP is a manual for historic properties identification, effects assessment, and treatment that is tailored specifically for the Undertaking. This HPTP contains research themes for each of six broad property types (e.g., prehistoric archaeological sites, historic structures) to guide all aspects of cultural resources inventories conducted for the Undertaking, as discussed in Chapter 5, *Identification of Historic Properties*. The research themes are geared specifically to provide an appropriate context within which to evaluate identified properties for NRHP eligibility. Although they are not a replacement for property-specific research designs, the research themes will foster methodological consistency and greater quality control despite the fact that several parties are likely to conduct cultural resources work during the life of the Undertaking.

The focus of this HPTP is the management of *historic properties*, which are defined by 36 CFR 800.16(l)(1) as:

> any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

Historic properties, then, are significant specimens of what are commonly called *cultural resources*. Different terms are used to refer to significant cultural resources under other regulatory frameworks, such as CEQA's *historical resource* and *unique archaeological resource*. Although primarily concerned with Section 106 compliance, this HPTP is also intended to meet CEQA cultural resource standards. NRHP and CEQA criteria are discussed in Chapter 5, *Identification of Historic Properties*.

Chapter 7, Assessment of Effects, and Chapter 8, *Resolution of Adverse Effects*, concern the assessment of effects and treatment of historic properties, respectively. Chapter 7, *Assessment of Effects*, is required by Stipulation V of the Undertaking PA and establishes both the standards for effects assessments and the consultation process involved in arriving at a determination of effect. The first part of Chapter 8, *Resolution of Effects*, is devoted to the consultation procedures required to establish appropriate treatment measures for adversely affected historic properties.

An overview of the Undertaking PA process is presented in Figure 1-2 in the form of a flowchart to assist in the proper ordering of compliance activities.

Undertaking Area of Potential Effects

Throughout this document, reference is made to the Undertaking APE and Undertaking activity APEs. The Undertaking APE is the overarching geographic area within which the Undertaking might affect historic properties. Briefly stated, the Undertaking APE extends south to north along the Sacramento River from Collinsville at River Mile (RM) 0 upstream to Chico at RM 194, and includes reaches of lower Elder and Deer Creeks. The Undertaking APE also includes Cache Creek, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs. These stream reaches, as depicted in Figure 1-3, represent the horizontal extent of the Undertaking APE. The Undertaking APE encompasses the entirety of the aforementioned stream

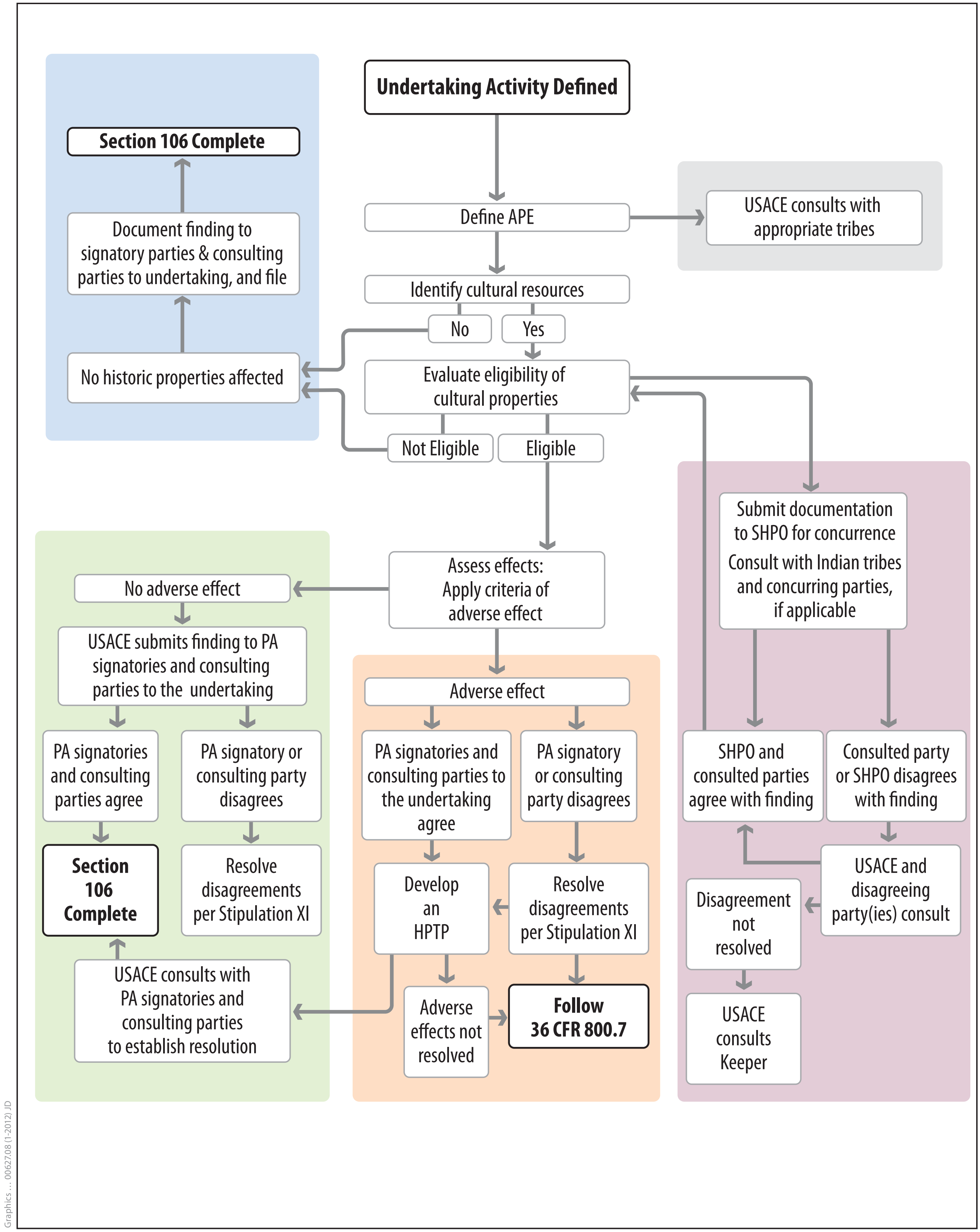

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Figure 1-2
PA/HPTP Flowchart

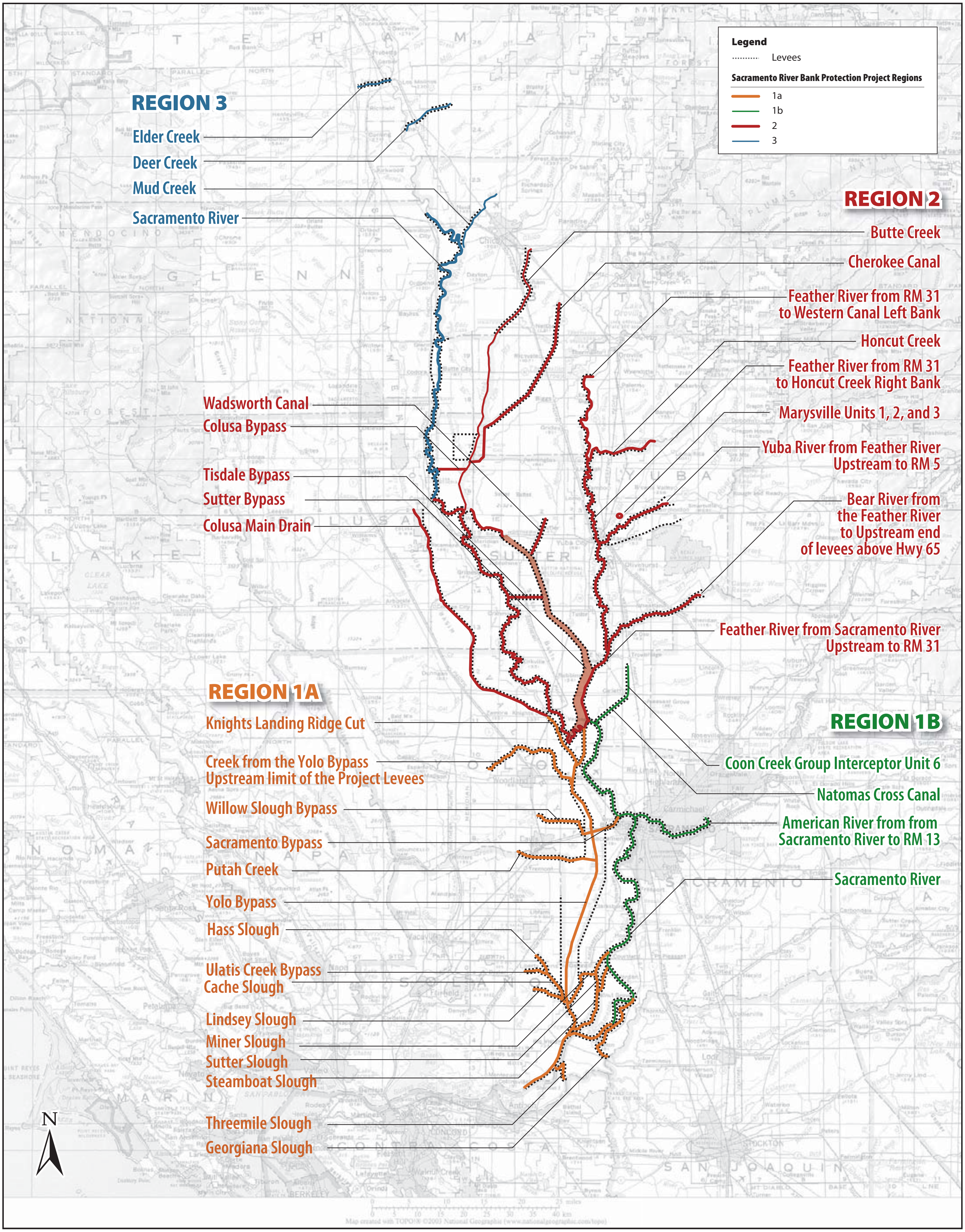

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Figure 1-3
Project Location

channels, the entire levee structure, and land on the landside of the levees. The vertical dimension of the Undertaking APE is undefined because the extent of excavation needed to implement the various Undertaking activities depends upon the particular levee deficiency or deficiencies identified in the Undertaking APE.

Undertaking activity APEs refer to the geographic area in which a particular suite of Undertaking activities might affect historic properties. Undertaking activity APEs will be defined subsequent to the execution of the SRBPP PA and will generally be contained within the Undertaking APE. The definition of Undertaking activity APEs will include horizontal and vertical dimensions.

Roles and Responsibilities

During the Section 106 consultation process for the SRBPP, the lead federal agency and consulting parties were identified, as well as signatory and concurring parties to the Undertaking PA. The consulting parties are USACE, ACHP, State Historic Preservation Officer (SHPO), CVFPB, SLC, Yocha Dehe Wintun Nation, Cachil DeHe Band of Wintun Indians of the Colusa Indian Community, and DWR. The signatory parties are USACE, ACHP, SHPO, and the CVFPB. The concurring parties are Cachil DeHe Band of Wintun Indians of the Colusa Indian Community, DWR, Shingle Springs Band of Miwok Indians, United Auburn Indian Community of the Auburn Rancheria and the Yocha Dehe Wintun Nation.

The responsibilities assigned to the aforementioned parties vary according to the role assigned by the Undertaking PA and 36 CFR 800. USACE is the lead federal agency for the Undertaking. Therefore, USACE is to fulfill the collective Section 106 responsibilities of any other federal agencies involved in the Undertaking, per 36 CFR 800.2(a)(2).

The signatory parties will be involved in most aspects of compliance with the Undertaking PA, including review of Annual Reports and proposed treatment measures for historic properties. The concurring parties will review annual reports and other documents at USACE's discretion. The consulting parties would be involved in consultation and document review on a case-by-case basis, as appropriate to Undertaking activities and as described throughout the Undertaking PA and HPTP.

Description of the Undertaking

USACE and CVFPB propose to implement the Undertaking, which would result in the construction of an additional 80,000 lft of bank protection in the SRFCP area. This section describes the components of the Undertaking, a summary of the alternatives screening process and alternatives selected for analysis, and physical and operational characteristics of the alternatives.

Location

The SRBPP area (referred to as the Undertaking Area) is located along the Sacramento River and its tributaries and spans Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties, California (Figure 1-1). The alternatives covered by the PA are those associated with future repair of bank erosion sites on an additional 80,000 lft within the SRBPP Undertaking Area.

Undertaking Area

The Undertaking Area extends south to north along the Sacramento River from Collinsville at RM 0 upstream to Chico at RM 194, and includes reaches of lower Elder and Deer Creeks. The Undertaking Area also includes Cache Creek, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs.

The Undertaking Area has been divided into four regions (1a, 1b, 2, and 3), organized south to north by the location of the downstream terminus of each watercourse with the mainstem Sacramento River (Figure 1-3). Within Region 1a, the Sacramento River flows below Isleton (RM 20) into the Delta, forming a distribution network of sloughs and channels. Region 1b includes the mainstem Sacramento River from Isleton (RM 20) in the Delta, upstream past Sacramento, to the Feather River confluence (RM 80) at Verona. Region 1b also includes the lower American River from the confluence with the Sacramento River upstream to RM 13, the Natomas East Main Drain, the Natomas Cross Canal, and Coon Creek Group Interceptor Unit 6. Within Region 2, the mainstem Sacramento River flows from Colusa (RM 143) downstream of the Colusa Bypass to the confluences with the Feather River and Sutter Bypass at Verona (RM 80). Region 3 includes the Sacramento River downstream of Chico Landing (RM 194) to Colusa (RM 143). Table 1-1 lists the watercourses, reach lengths, and counties within the Undertaking Area by region.

Table 1-1. Watercourses, Reach Lengths, and Counties within the Undertaking Area by Region

Region	Watercourse	Reach Length (mi)	Counties
1a	Sacramento River from Collinsville to Isleton	20.7	Contra Costa, Sacramento, Solano, Sutter, and Yolo
	Threemile Slough	3.7	
	Georgiana Slough	12.4	
	Steamboat Slough	13.1	
	Yolo Bypass	37.9	
	Miner Slough	7.7	
	Portions of Lindsay Slough	7.5	
	Cache Slough	10.7	
	Ulatus Creek Bypass Unit	1.6	
	Haas Slough	2.8	
	Sutter Slough	6.8	
	Putah Creek	29.5	
	Willow Slough Bypass	7.4	
	Sacramento Bypass	1.8	
	Cache Creek from Yolo Bypass to upstream limit of SRBPP levees	13.3	
	Knights Landing Ridge Cut	6.4	
	Total Length by Region	**183.3**	
1b	Sacramento River from Isleton to Feather River (RM 20–80)	60.3	Placer, Sacramento, Solano, Sutter, and
	American River from Sacramento River to RM 13	13.2	
	Natomas East Main Drain	16.0	
	Natomas Cross Canal	5.3	

Table 1-1. Watercourses, Reach Lengths, and Counties within the Undertaking Area by Region

Region	Watercourse	Reach Length (mi)	Counties
	Coon Creek Group Interceptor Unit 6	7.9	Yolo
	Total Length by Region	**102.7**	
2	Sacramento River from Feather River confluence to Colusa (RM 80–143)	62.3	Butte, Colusa, Glenn, Placer, Sutter, Yolo, and Yuba
	Colusa Basin Drain 35.8 NS NS	35.8	
	Sutter Bypass 37.2 NS NS	37.2	
	Tisdale Bypass 4.3 NS NS	4.3	
	Wadsworth Canal 4.6 NS NS	4.6	
	Colusa Bypass 2.8 NS NS	2.8	
	Cherokee Canal 18.2 NS NS	18.2	
	Butte Creek 32.5 NS NS	32.5	
	Feather River from Sacramento River upstream to RM 31	30.8	
	Bear River from Feather River to upstream end of levees above State Route 65	12.6	
	Yuba River from Feather River upstream to RM 5	4.9	
	Marysville Units 1, 2, and 3	7.5	
	Honcut Creek	8.0	
	Feather River from RM 31 to Honcut Creek right bank	13.2	
	Feather River from RM 31 to Western Canal left bank	27.2	
	Total Length by Region	**301.9**	
3	Sacramento River from Colusa to Chico (RM 143–194)	50.3	Butte, Colusa, Glenn, and Tehama
	Mud Creek	8.0	
	Dear Creek	6.7	
	Elder Creek	4.0	
	Total Length by Region	**69.0**	
	TOTAL LENGTH (mi)	**656.9**	

Erosion Sites

The USACE's Sacramento District and its non-federal sponsor, the CVFPB, conduct annual field reconnaissance reviews of the Sacramento River Flood Control System. Specific criteria are used to identify erosion sites within the system, as described in Ayres Associates (2008). In most cases, the criteria are based on bank and levee conditions that are threatening the function of the flood control system. An erosion site is defined as:

> [a] site that is at risk of erosion during floods and/or normal flow conditions; the term *critical* is used to indicate erosion sites that are an imminent threat to the integrity of the flood control system and of the highest priority for repair.

The 2008 Field Reconnaissance Report (Ayres Associates 2008) identified 154 erosion sites. Many of these sites are not classified as critical, but they do pose a substantial risk of erosion and threat to the flood control system. USACE selected 107 sites, totaling approximately 80,000 lft, for further evaluation and identification of suitable design alternatives for bank protection. These sites exhibited bank and levee conditions that are threatening the function of the flood control system (Kleinfelder-Geomatrix 2009).

For purposes of Section 106 consultation, the 107 critical eroding sites along the Sacramento River and its tributaries constitute a representative sample of the sites that would be treated eventually under the supplemental 80,000 lft. However, the number and extent of documented sites can change from year to year because of various factors, including identification of new sites, increased or decreased rates of erosion, repair or removal of existing sites, or reclassification of erosion sites to maintenance sites.

Undertaking Alternatives

The suite of SRBPP alternatives is described below and illustrated in Figures 1-4 through 1-6. Alternatives 3a, 3b, and 3c are variations of a single alternative, with habitat features such as vegetation and in-stream woody material (IWM) placed at varying locations. Alternatives will be selected on a case-by-case basis, as conditions and levee deficiencies vary throughout the Undertaking Area. Alternative 1, the No Action alternative, is omitted from the ensuing discussions.

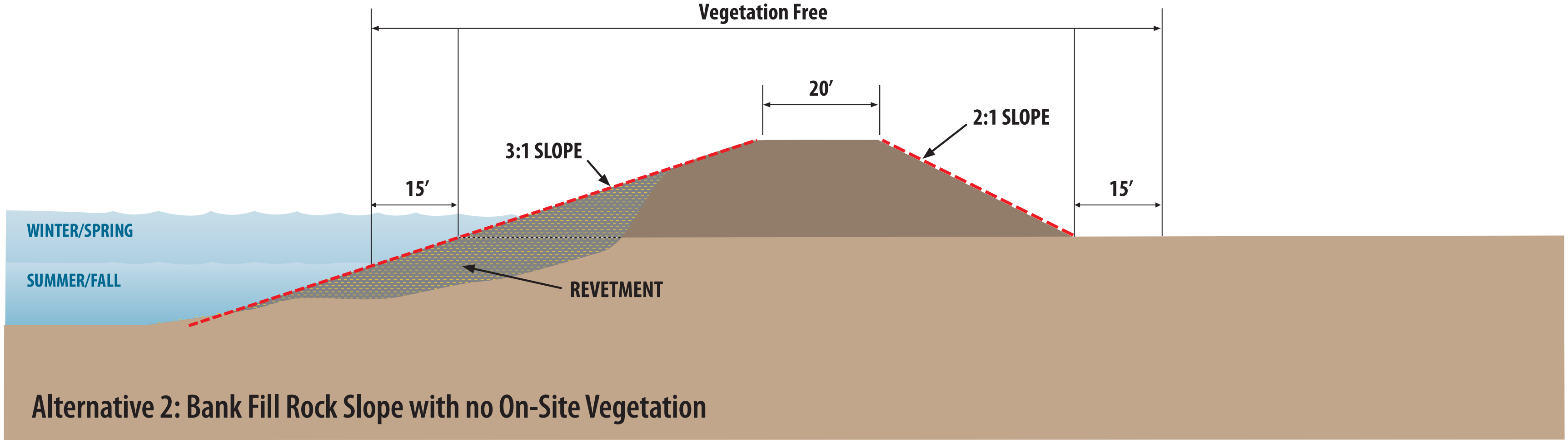
Alternative 2—Bank Fill Rock Slope with No On-Site Vegetation

Alternative 2 entails filling the eroded portion of the bank and installing revetment along the levee slope and streambank from the levee’s toe to crest (Figure 1-4). Vegetation would be limited to grass that would be mowed. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with riprap. Alternative 2 would be most applicable in areas where there is inadequate space or substantial constraints to implementing Alternatives 3 through 5.

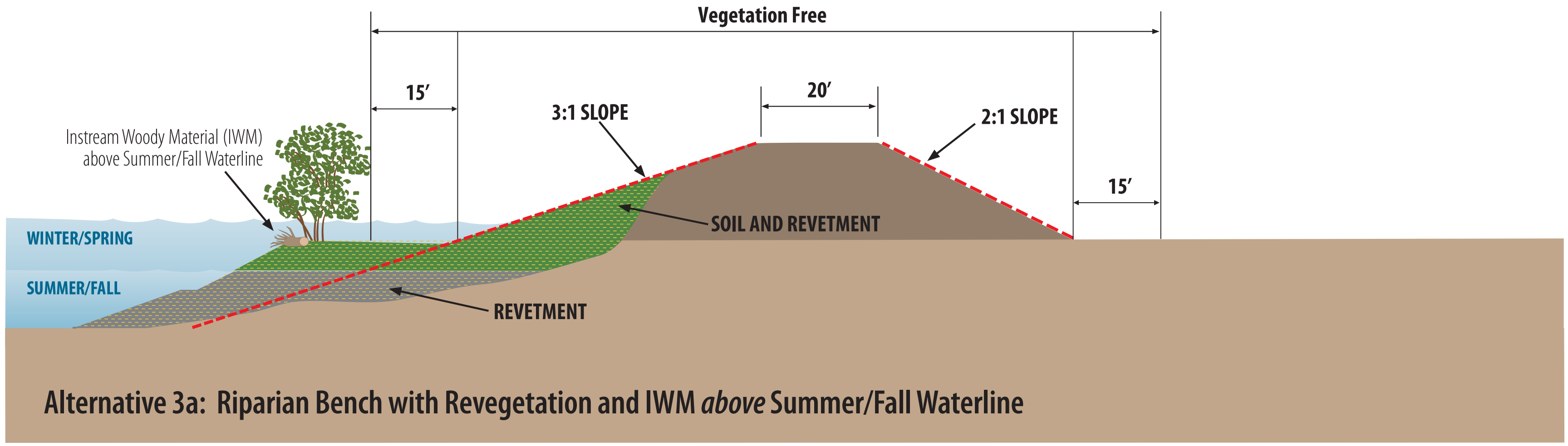
Treatment of Existing Vegetation

Existing woody vegetation and trees on the waterside levee slope (waterward of the waterside levee hinge point) and on the berm within 15 ft of the waterside toe would not be in compliance with the Engineering Technical Letter (ETL; U.S. Army Corps of Engineers 2009a) and would be removed. Although some of this vegetation may be outside the bank protection construction footprint, it is important that the Undertaking investment result in a levee that meets design and maintenance criteria. The Undertaking does not include removal of vegetation from the landside levee slope or in waterside areas upstream or downstream of the specific erosion site.

Existing woody vegetation and native trees that are in compliance with the ETL would be preserved to the extent practical. Unless removal is required for safety reasons, all native trees more than 4 inches (in) in diameter at breast height (dbh) would be preserved and protected. Herbaceous and woody vegetation, other than preserved trees, would be cleared manually to the ground surface. Clearing of vegetation would be limited to the extent required to place bank protection material or provide construction access. Necessary pruning and trimming of preserved trees, as determined at the time of construction, may be conducted before the placement of rock slope protection. All construction activities, including pruning and trimming vegetation, would be supervised by a qualified biologist to ensure a minimal effect on natural resources. Disturbed areas, including staging areas, would be seeded and covered with mulch to prevent erosion following Undertaking buildout.



Alternative 2: Bank Fill Rock Slope with no On-Site Vegetation



Alternative 3a: Riparian Bench with Revegetation and IWM *above* Summer/Fall Waterline

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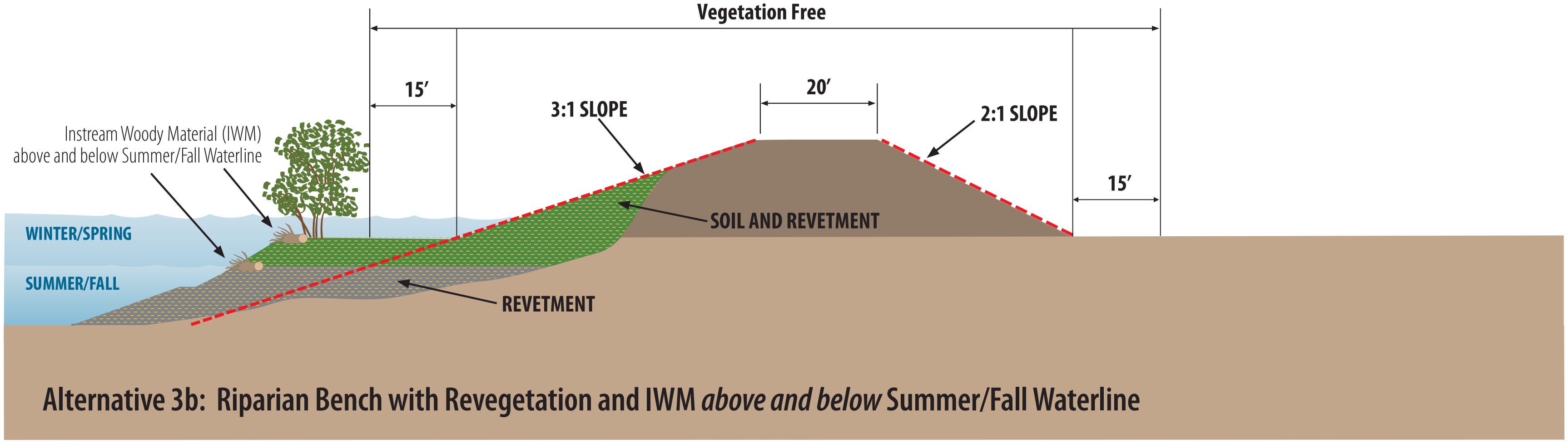
Figure 1-4
Alternatives 2 and 3a

Sacramento River Bank Protection Project



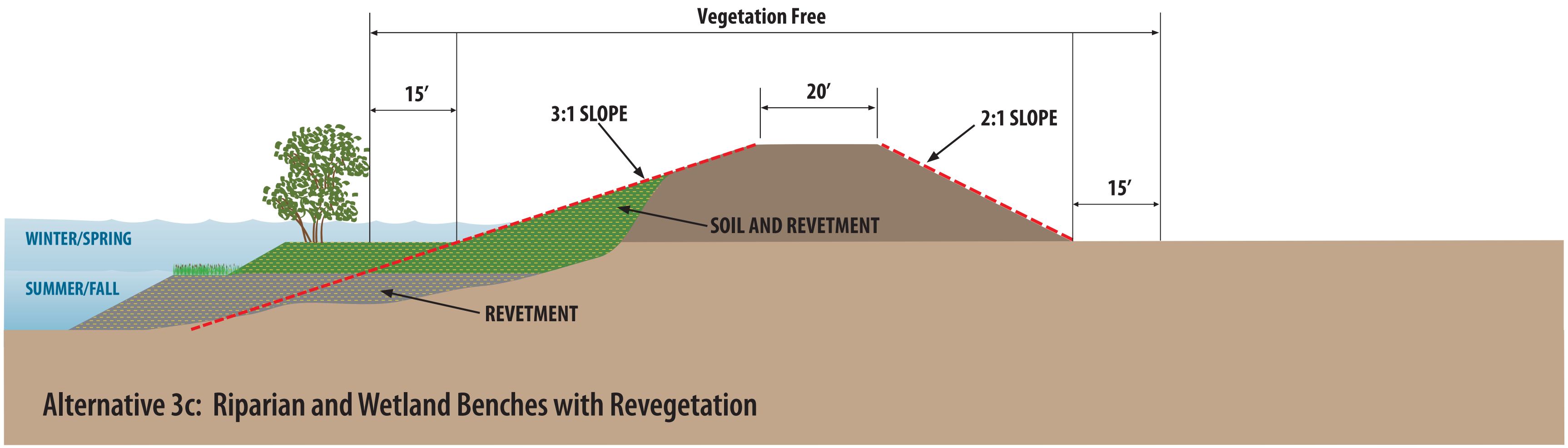


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Figure 1-5
Alternatives 3b and 3c

Sacramento River Bank Protection Project

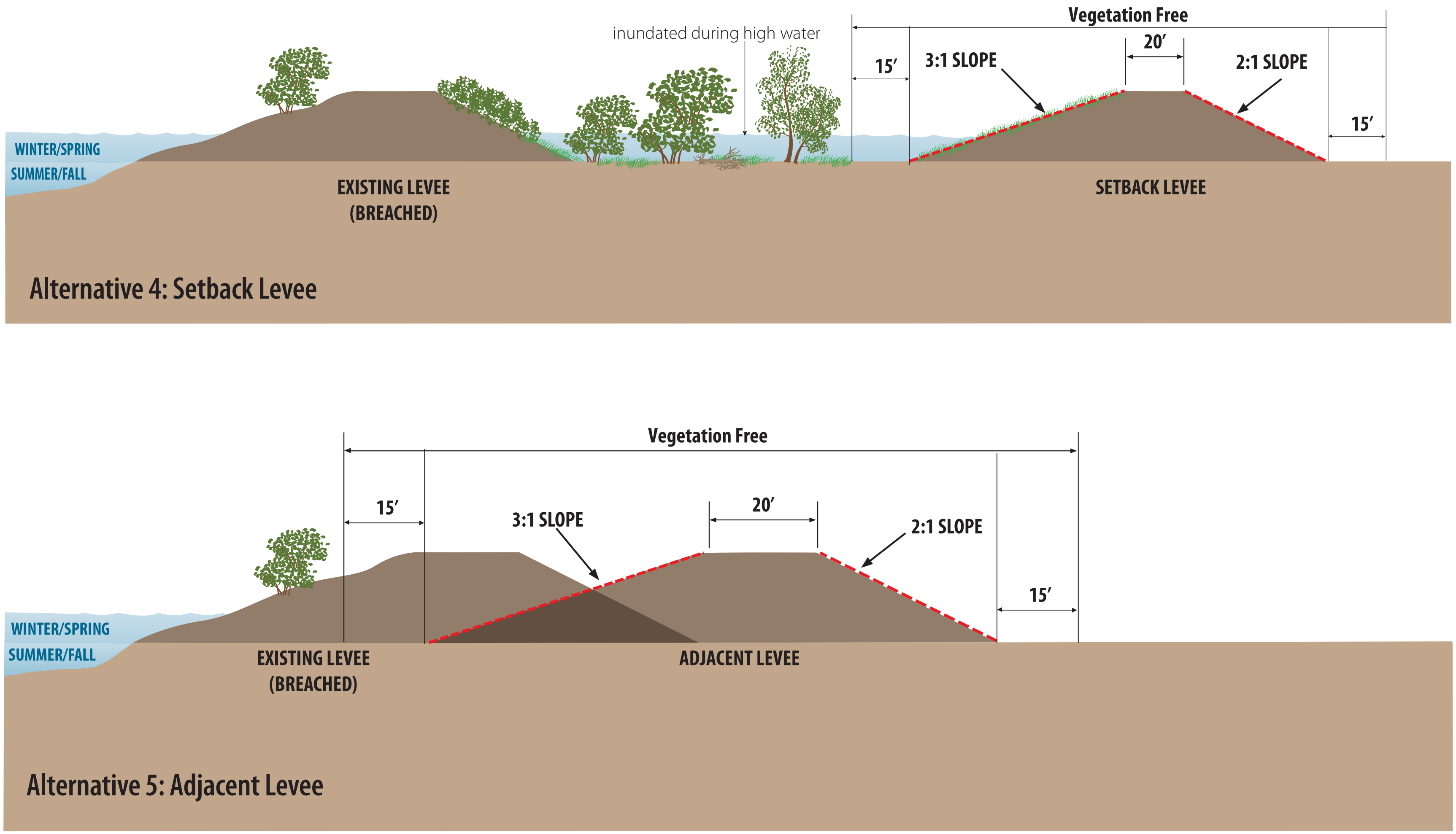

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Figure 1-6
Alternatives 4 and 5

Variances from the ETL are sometimes allowed per the proposed USACE Policy Guidance Letter (PGL), Variance from Vegetation Standards for Levees and Floodwalls, under certain conditions. Specifically, the variance must be shown to be necessary—and the only feasible means—to preserve, protect, and enhance natural resources, and/or protect the rights of Native Americans, pursuant to treaty, statute, or Executive Order; and with regard to the levee systems, the variance must ensure that safety, structural integrity, functionality, and accessibility for maintenance, inspection, monitoring, and flood fighting are retained. However, the SRBPP Supplemental Authority will assume that variances are not required for implementation of any alternative bank protection. The alternative bank protection measures, including this alternative, are intended to be compliant with the ETL without the need for a variance.

Site Preparation

Site preparation activities would include the removal or protection of facilities (e.g., pumps, piping, docks) and vegetation, and the development of on-site construction access. The specific circumstances of each facility would determine whether the facility remains or is removed or relocated. Facilities that would remain would be protected, and appropriate coordination would occur and authorizations obtained before any facilities would be relocated or removed.

As previously stated, native trees more than 4 in dbh would be preserved and protected to the extent feasible. Trees to be preserved would be trimmed as necessary, and the trunks would be wrapped with layers of protective fabric. Elderberry shrubs present on the site would be protected in place, or removed and transplanted to an appropriate location, such as a U.S. Fish and Wildlife Service–authorized mitigation bank. Invasive pest plants, including black locust, tamarisk, and giant reed, would be removed, along with all herbaceous and woody vegetation less than 4 in dbh. All vegetation would be removed manually; no herbicides or chemicals would be used. Vegetation would be cleared to the ground surface, and large tree roots would be removed. The surface of the erosion sites would not be subject to grubbing or contouring. Materials removed from the erosion sites would be loaded onto trucks or a barge and transported to an appropriate disposal facility.

Construction access ramps and construction access areas within the erosion sites would be positioned to minimize the need for tree removal. Signs and fencing would be established at each site to delineate construction areas and protected areas. Warning buoys would be placed in the river at the upstream and downstream boundaries of each site for the safety of boaters and other water users.

Lower Slope Quarry Stone

For all sites requiring repair below the mean summer water level (MSWL), clean quarry stone would be placed from the toe of the levee slope (i.e., the bottom of the channel) to the MSWL. The quarry stone would have a minimum thickness of 2 ft. The slope of the quarry stone below the MSWL would be no steeper than 2H:1V.

Alternative 3

Alternative 3 consists of three design variations presented as Alternatives 3a, 3b, and 3c. In general, this alternative involves the placement of clean quarry stone from the toe of the levee slope to the MSWL, and placing quarry stone and soil-filled quarry stone on the levee slope above the MSWL. The repairs would involve initial site preparation, installation of a fabric layer between the quarry stone and soil-filled quarry stone, and construction of benches. These alternatives vary in the placement and extent of environmental features (benches, vegetation, and IWM).

Alternative 3a—Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline

Alternative 3a's design entails installing revetment along the levee toe and upper bank, as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM (Figure 1-4). This design provides near-bank, shallow-water habitat for fish and is typically applicable to sites above Sacramento River RM 30. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone would be similar to those described for Alternative 2. Alternative 3a also would involve the following activities and features.

Geotextile Coir Fabric

A biodegradable, geotextile coir fabric layer would be placed above the quarry stone on the lower slope to prevent the migration of soil from the soil-filled quarry stone into the underlying quarry stone and to retain soil in the areas to be revegetated. The fabric would be an open-weave biodegradable geotextile material with a non-shifting square mesh consisting of 100% coir fiber yarns in both the warp and the weft. The fabric would have a thickness of 0.30 in, a weight of 25 ounces (oz) (plus or minus 2 oz) per square yard, and a tensile strength of 150 by 100 pounds per inch. The fabric would be dry, and its open area would be 40% maximum.

Soil-Filled Quarry Stone

After the coir fabric is installed, soil-filled quarry stone would be placed on the levee bank slope above the MSWL. Soil-filled quarry stone is a combination of quarry stone and soil fill material. The purpose of the soil component is to fill voids in the quarry stone and provide a medium for vegetation to grow. The top elevation for placement of the soil-filled quarry stone would be determined on a site-by-site basis based on water velocities and shear stresses along the levee. At most sites, the top elevation of the soil-filled quarry stone would be level with the edge of the levee's upper bench.

Riparian Bench

The riparian bench is a vegetation-supporting low bench constructed of soil-filled quarry stone that would project into the channel along the length of the erosion site. The vegetation is intended to provide overhead cover and near-shore aquatic habitat during the low-flow season. At some sites, the riparian bench also may be used as a construction platform to help avoid impacts on existing vegetation during the construction of the upper slope bank fill revetment. The riparian benches typically would be 10 to 20 ft wide with an average elevation set 2 to 3 ft above the MSWL to provide a substantial volume of moist but unsaturated soil as a growing medium.

Alternative 3b—Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

Alternative 3b's design entails installing revetment along the levee toe and upper bank, as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM (Figure 1-5). IWM also would be placed beyond the bench below the summer/fall waterline, thereby increasing the types and extent of mitigation for shallow-water fish habitat. This design is typically applicable to sites above Sacramento River RM 30. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone would be similar to those described for Alternative 2. Installation of geotextile coir fabric, soil-filled quarry stone, and riparian bench would be similar to those described for Alternative 3a.

Alternative 3c—Riparian and Wetland Benches with Revegetation

Alternative 3c's design entails installing revetment along the levee toe and upper bank, as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM (Figure 1-5). The design also includes a wetland bench below the summer/fall waterline to further increase habitat quality. This design is intended for sites downstream of Sacramento River RM 30 and targets mitigation of impacts on delta smelt habitat. Treatment of existing vegetation would be similar to that described for Alternative 2.

Alternative 4—Setback Levee

Alternative 4 entails constructing a new levee some distance landward of the existing levee, and would avoid or minimize construction in the stream channel or riparian areas (Figure 1-6). The land between the setback and the old levee would act as a floodplain. Land use in the new floodplain would be determined on a site-by-site basis. The old levee could be breached in several locations to allow high flows to inundate the new floodplain. Vegetation on the new setback levee and 15 ft beyond each toe would be restricted to mown perennial grass and managed as a vegetation-free zone. Existing vegetation on an old levee with a setback levee behind it could remain.

Setback levees can be very effective, but cost, existing land use, and technical issues limit opportunities for setback levees in the Undertaking Area.

Alternative 5—Adjacent Levee

Alternative 5 involves the construction of a new levee embankment adjacent to and landward of the existing levee (Figure 1-6). The adjacent levee would be constructed to USACE standards. The landward portion of the old levee would be an integral structural part of the new levee. The waterward portion of the old levee would be an overbuilt structure over a root-free zone. Vegetation and IWM would be placed on the overbuilt structure.

This alternative may be the only viable solution at some erosion sites. It should be retained as an alternative as long as it is considered in ETL compliance or with assurance that a variance would be granted. This is an important alternative that would be appropriate at many sites.

Treatment of Existing Vegetation

Vegetation on the original levee to the water side of a newly constructed adjacent levee may lie within the vegetation-free zone (VFZ). If this is the case, this vegetation would be removed.

Construction

Construction Activities

It is anticipated that construction would take place between April 1 and November 30, with in-water construction activities to be conducted between August 1 and November 30. No in-water construction would be permitted during winter (December through March). The anticipated construction season may need to be modified to respond to high water levels in the river, the presence of special-status species, or other constraints. Construction materials, including quarry stone, would be acquired from a previously permitted quarry or borrow site located within 100 mi of the site.

For waterside construction, work would be conducted from cranes mounted on barges, with the crane (boom) systems mechanically placing the rock along the shore and beneath the water line. Waterside construction typically would result in less noise, less roadway traffic, and less disturbance of vegetation than landside construction. The Contractor may choose to use excavators, loaders, and other construction equipment once the revetment has reached the MSWL.

Landside construction would take place at sites that are not accessible from the water side. A crane located on the levee would be used to mechanically place the rock along the shore and beneath the water line. The Contractor may choose to use excavators, loaders, and other construction equipment along the benches on sites that are inappropriate for a crane or once the revetment has reached the MSWL.

Protective fencing would be installed to prevent construction crews from getting too close to the waterside edge of the existing bank material and sensitive resources such as elderberry shrubs.

USACE or CVFPB would be responsible for implementing the erosion repairs at individual sites.

Staging Areas

Staging areas would be identified for each erosion site before construction. Staging areas typically are located within the erosion site construction easement or immediately adjacent to the erosion site. They are preferably located in an area that does not affect resources. These areas would be the sole locations used for staging vehicles, materials, and other associated construction equipment.

Chapter 2
Cultural Resources Study

This chapter documents the preliminary and sample identification effort within the Undertaking Area. The identification effort included a records search and literature review; consultation with Native Americans, historical societies, and other interested parties; a pedestrian archaeological survey of 16 repair locations; a survey for submerged resources; and an assessment of the levee system.

Records Search and Literature Review

Records searches were conducted at three information centers of the California Historical Resources Information System (CHRIS): the Northeast Information Center (NEIC) for portions of the Undertaking APE in Butte, Sutter, Glenn, and Tehama Counties; the North Central Information Center (NCIC) for portions of the Undertaking APE in Sacramento, Yuba, and Placer Counties; and the Northwest Information Center (NWIC) for portions of the Undertaking APE in Solano, Yolo, and Colusa Counties. ICF staff conducted the records search at the NWIC, located in Rohnert Park, California, on May 4, 2009; the NEIC, located in Chico, California, on April 13 and 14, 2009; and the NCIC located in Sacramento, California, on May 6 and 7, 2009. The records searches consulted the CHRIS base maps of previously recorded cultural resources for the study area, which consisted of the Undertaking APE and a 500-meter buffer. Additional sources of information, including previously conducted cultural resources surveys and historic maps (U.S. Geological Survey and General Land Office [GLO]), were selectively reviewed to determine areas that would have a high potential for the presence of historic and prehistoric sites. The following resources (available at the three information centers) were reviewed:

- NRHP and California Register of Historical Resources (CRHR)
- California Office of Historic Preservation Historic Property Directory (2010)
- California Inventory of Historic Resources (California Department of Parks and Recreation 1976)
- California State Historic Landmarks (California Department of Parks and Recreation 1996)
- California Points of Historical Interest (California Department of Parks and Recreation 1992)
- Historic Properties reference map

A total of 642 known cultural resources were identified within the study area as a result of the records search. Of these, 418 are historic structures and 224 are archaeological sites. Of the 224 archaeological sites, 127 are prehistoric archaeological sites, 67 are historical archaeological sites, and 30 of the 224 archaeological sites contain both historic and prehistoric components.

Previously Recorded Resources Database

The site location data from the information center base maps were transferred by hand to project maps. These maps were scanned, digitized, and saved into a geographic information system (GIS) database. Relevant site attributes recorded in the database include:

- Primary number
- Trinomial number
- County
- Resource type (e.g., building, structure, object, site, district, element of a district; California Department of Parks and Recreation [DPR] 523 form Section P4)
- Resource attributes (e.g., one- to three-story commercial building, privies/dumps/trash scatters, lithic scatter; DPR form Section P3b)
- Resource age (prehistoric, historic, or both; DPR form Section P6)
- Date of the most recent recordation

All site records were electronically copied and linked to the GIS database, enabling map users to access these records quickly and efficiently. The database was then turned over to USACE for review and periodic updates as more information on recorded sites became available.

Correspondence with Historical Societies

ICF identified the following historical societies and local government planning divisions with which to initiate consultation.

- Aerospace Museum of California (formerly McClellan Aviation Museum)
- Anderson Marsh State Historic Park
- Association for Northern California Records and Research
- Auburn Joss House Museum
- B. F. Hastings Building
- Bale Grist Mill State Historic Park
- Benicia Camel Barn Museum
- Benicia Capitol State Historic Park
- Benicia Historical Museum and Cultural Foundation
- Benicia Historical Society
- Bernhard Museum Complex
- Bidwell Mansion State Historic Park
- Bothe-Napa Valley State Park Visitor Center
- Butte County Historical Society
- Butte County Pioneer Memorial Museum

- California Bear Flag Museum
- California Citrus State Historic Park
- California Council for the Promotion of History
- California Historical Building Safety Board DSA Headquarters Office
- California Institute for Rural Studies
- California Military Museum
- California Office of Historic Preservation
- California State Archives
- California State Capitol Museum
- California State Indian Museum
- California State Library Foundation
- California State Museum Resource Center
- California State Railroad Museum
- California State University, Chico, Museum of Anthropology
- Center for California Studies
- Cherokee Museum
- Cherokee Museum Association
- Chico Museum
- Chumash Painted Cave State Historic Park
- Citizen Soldier's Museum Guard Historical Society
- Colfax Area Historical Society
- Colusa County Historical Records Commission
- Community Memorial Museum of Sutter County
- Crocker Art Museum/Foundation
- Discovery Museum of Sacramento
- Discovery Museum Science & Space Center
- Donner Memorial State Park
- E Clampus Vitus c/o Alan Wilson
- Effie Yeaw Nature Center
- Ehmann Home and Butte County Historical Society
- El Presidio de Santa Barbara State Historic Park
- Emigrant Trail Museum
- Fair Oaks Historical Society
- Folsom Historical Society
- Forbestown Museum/Yuba-Feather Historical Association

- Forest Hill Divide Museum and Historical Society
- Fort Ross State Historic Park
- Fort Tejon State Historic Park
- Gatekeeper's & M. Steinbach Museum
- Gold Country Museums
- Golden Drift Museum
- Golden State Museum
- Governor's Mansion State Historical Park
- Griffith Quarry Museum, Placer County
- Jack London State Historic Park
- Janet Turner Print Collection and Gallery
- Kelly-Griggs House Museum/Association
- La Raza/Galeria Posada
- Lake Oroville State Recreation Area
- Leland Stanford Mansion State Historic Park
- Limekiln State Park
- Live Oaks Educational Theater
- Mare Island Historic Park Foundation
- Mary Aaron Memorial Museum Association
- Marysville Mainstreet Board
- McArthur-Burney Falls Memorial State Park
- Native American Heritage Commission
- North Central Information Center
- Northeastern Information Center
- Nelson Gallery, University of California, Davis
- North American Indian Annex
- North Lake Tahoe Historical Society
- Northern California Association of Museums
- Oroville Chinese Temple
- Paradise Fact and Folklore
- Petaluma Adobe State Historic Park
- Placer County Department of Parks and Museums
- Placer County Historical Society
- Placer County Museum
- Plumas Eureka State Park

- Portuguese Historical and Cultural Society
- Red Rock Canyon State Park Visitor Center
- Rio Vista Museum Association
- Sacramento Archives and Museum Collection Center
- Sacramento County Historical Society
- Sacramento Old City Cemetery
- Sacramento Valley Museum
- Sacramento Zoo
- Santa Cruz Mission State Historic Park
- Shasta State Historic Park
- Sierra Nevada Virtual Museum
- Solano County Genealogical Society
- Solano County Historical Society
- Stansbury Home Preservation Association
- State Historical Resources Commission
- Sutter County Historical Society
- Sutter's Fort State Historic Park
- Tehama County Genealogical and Historical Society
- Tehama County Museum
- Tomo-Kahni Project: Kawaiisu Native American Village
- Towe Auto Museum Library and Archive Center
- Vacaville Museum
- Vallejo Naval and Historical Museum
- Wells Fargo History Museum
- Wells Fargo Museum
- West Sacramento Historical Society
- West Sacramento Museum and Visitor Center
- Western Railway Museum
- Wilder Ranch State Park
- William B. Ide Adobe State Historic Park
- Yankee Hill Historical Society
- Yolo County Historical Museum (Gibson House)
- Yolo County Historical Society
- Yuba County Library Local History Room

On May 14, 2009, ICF mailed letters to each of the organizations listed above. The letters described the Undertaking, included an overview map, and requested information the organizations may have regarding local cultural resources. A sample copy of the correspondence sent is provided in Appendix A. To date, ICF has received five replies from historical society representatives:

- Roxanne Yonn, executive director of the Aerospace Museum of California (formerly McClellan Aviation Museum), responded in a letter dated May 26, 2009, and stated that the museum did not anticipate that the effort would affect the historic resources under their control.
- Julie Stark, director of the Community Memorial Museum of Sutter County, responded in a letter dated May 27, 2009, and stated that the museum's only concern was the Hunter Burial Site, located on Cranmore Road 1 mi south of Tisdale Road, east of Frazier's Landing on the eastern side of the Snake River. ICF staff located the Hunter Burial Site in relation to the Undertaking Area, and confirmed that it is outside of the Undertaking Area, approximately 0.5 mi from the riverbank, and will not be affected by the Undertaking.
- Leslie Steidl, an archaeologist with the DPR North Buttes District in Chico, responded in two phone calls, received June 2 and 3, 2009, that she had several site records and other associated documents that could prove useful to the Undertaking. ICF staff emailed Ms. Steidl on June 3, 2009, and she provided three site records—one for P-06-000619 and two for CA-BUT-717 (dated 2009 and 1980)—in an email that same day. A follow-up phone call was made on June 8, 2009, and Ms. Steidl confirmed that there are no unrecorded sites on the DPR land. She also said that Gregg White conducted geomorphological testing on the 40-acre (ac) parcel containing CA-BUT-717, and she had the report if it would be useful. During his testing, Mr. White excavated several trenches, but found only one buried surface 4 ft below the present ground surface; the buried surface contained no cultural modifications or materials. Mr. White was, however, able to better define the boundaries of CA-BUT-717 to the north and east. The report, Ms. Steidl explained, contains a detailed geomorphological description for the area.
- On June 15, 2009, Thom Lewis of the West Sacramento Historical Society called and said he was in possession of data regarding historical sites in the downtown Sacramento area and wanted to know what the Undertaking timeframe was so that he could make sure to send ICF the information in time. Mr. Lewis agreed to follow-up the phone call with an email attaching pictures of the historical sites about which he was concerned. ICF received Mr. Lewis' email on June 15, 2009. The email contained historic pictures of historic features on the west side of the Sacramento River. In the email Mr. Lewis suggested that ICF contact the Western Railway Museum in Suisun City, California. ICF staff examined the photos, confirmed that no work was currently planned for those areas, and via email agreed with Mr. Lewis to keep the photos on file and take them into consideration should any Undertaking activity take place in those areas. ICF also sent a letter on June 15, 2009, to the Western Railway Museum to inquire about additional information.
- Linda Johnson, an archivist and the reference coordinator for the California State Archives, responded on June 4, 2009, and stated that because of staff limitations, they could not conduct in-depth research for the Undertaking Area, but encouraged ICF to utilize the Archives website and research facilities to conduct research.

Terrestrial Survey

Areas of Potential Effect: Repair Areas

The terrestrial areas of potential effect (APE) and the portions surveyed for cultural resources are indicated in Figures 2-1 through 2-32. The APEs were established by USACE with technical assistance from ICF and SHPO concurrence. The APEs encompass the levee repair alternatives and follow the maximum possible area of direct impact resulting from the Undertaking, including all new construction, easements, and staging areas.

For purposes of this study, 16 of the 107 critical eroding sites along the Sacramento River and its tributaries constitute a representative sample of the sites eventually to be treated under the supplemental 80,000 lft. These 16 sites were chosen by USACE archaeologists based on urgency of repair, location, and access. Because streambank erosion is episodic and new erosion sites can appear each year, however, the actual APE locations may differ in the future. Additional project-level environmental documentation, tiering from this program-level analysis, will be conducted each year to address the sites that will be constructed that year. Because of access limitations, 7 of the 16 APEs could not be surveyed in their entirety (Table 2-1).

Table 2-1. Terrestrial Areas of Potential Effect and Survey Coverage

Repair Location	Total Terrestrial Acres in APE	APNs with No Access	Terrestrial Acres with No Access	Percent of Terrestrial APE Surveyed	Terrestrial Acres in APE Surveyed	Figure Number
BC 3.8L	3.29	040-170-044, 040-170-049	0.33	90%	2.96	2-2
BR 5.7L	1.45	015-130-046, 015-130-052	0.71	51%	0.75	2-4
FR 4.9L	5.00		0.00	100%	5.00	2-6
SR 101.3R	3.24		0.00	100%	3.24	2-8
SR 103.4L	2.08		0.01	100%	2.07	2-10
SR 11.2L	5.04	157-011-0055, 157-011-0056	2.96	41%	2.08	2-12
SR 172.0L	13.75		0.02	100%	13.73	2-14
SR 23.2L	3.38	156-0020-0001	0.69	79%	2.68	2-16
SR 25.2L	1.05	156-0010-0440	0.35	74%	0.70	2-18
SR 38.5R	1.61		0.00	100%	1.61	2-20
SR 56.5R	1.93	046-010-13-1	0.17	91%	1.76	2-22
SR 56.6L	1.40		0.00	100%	1.40	2-24
SR 77.7R	1.46		0.00	100%	1.46	2-26
SR 86.9R	5.96	050-170-161	2.59	56%	3.36	2-28
SS 15.7R	0.66		0.00	100%	0.66	2-30
SS 24.7R	9.79		0.00	100%	9.79	2-32
Totals	**61.09**		**7.83**	**87%**	**53.25**	

Notes: BC = Butte Creek; BR = Bear River; FR = Feather River; SR = Sacramento River; SS = Steamboat Slough.
Numbers represent RM upstream.
L or R indicates left or right side of river bank if facing downstream.

Survey Methods and Results

Between December 2009 and May 2010, ICF archaeologists conducted an intensive cultural resources survey of 16 repair area APEs. Archaeologists walked transects no wider than 5 meters (m) across all accessible areas within the APEs. This spacing ensured maximum ground coverage in a timely manner. The survey also included observation and inspection of cuts, fill, walls of drainage ditches and levees, and rodent burrow spoil piles. In areas with poor visibility, boot scrapes were conducted every 10 m to more closely inspect the ground surface. No cultural resources were identified as a result of the survey effort.

BC 3.8L

This APE is located along both sides of Butte Creek in Butte County just north of the Durham Dayton Highway (Figure 2-17). In total, 90% (2.96 ac) of the APE was subjected to survey. Visibility was excellent (80–100%).

BR 5.7L

This APE is located along the south side of the Bear River in Sutter County just north of Bear River Drive (Figure 2-18). In total, 51% (.75 ac) of the APE was subjected to survey. Visibility was generally good (50–80%), with the exception of several small patches of dense, impenetrable vegetation along the riverbank.

FR 4.9L

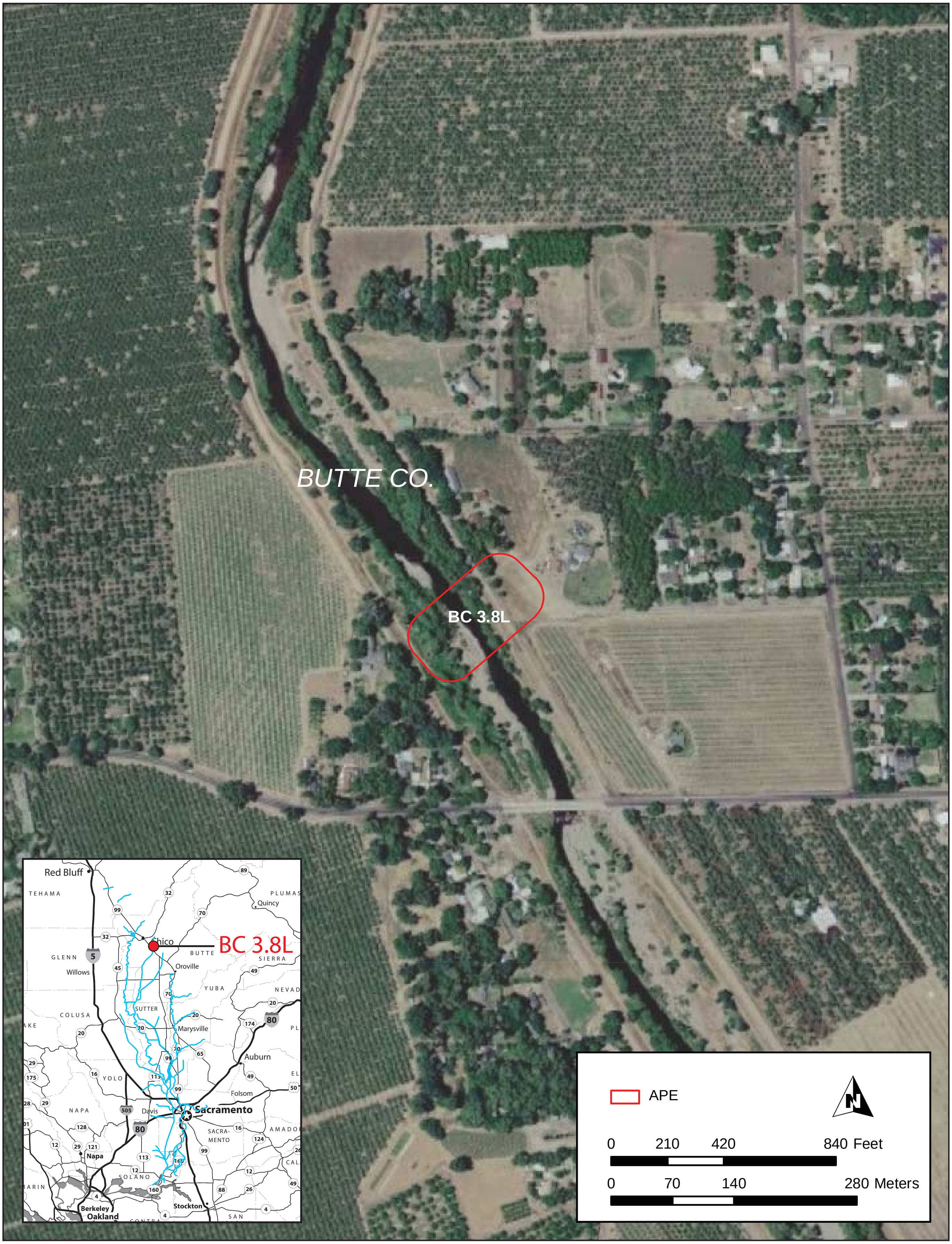
This APE is located on the east side of the Feather River in Sutter County adjacent to the Garden Highway (Figure 2-19). No access constraints were encountered; as a result, 100% (5 ac) of the APE was subjected to survey. Visibility was excellent (80–100%).

SR 101.3R

This APE is located on the west side of the Sacramento River in Yolo County just east of State Route (SR) 45 and extends eastward into Sutter County (Figure 2-20). No access constraints were encountered; as a result, 100% (3.24 ac) of the APE was subjected to survey. Visibility was generally good (50–80%), with the exception of several small patches of dense, impenetrable vegetation along the riverbank.

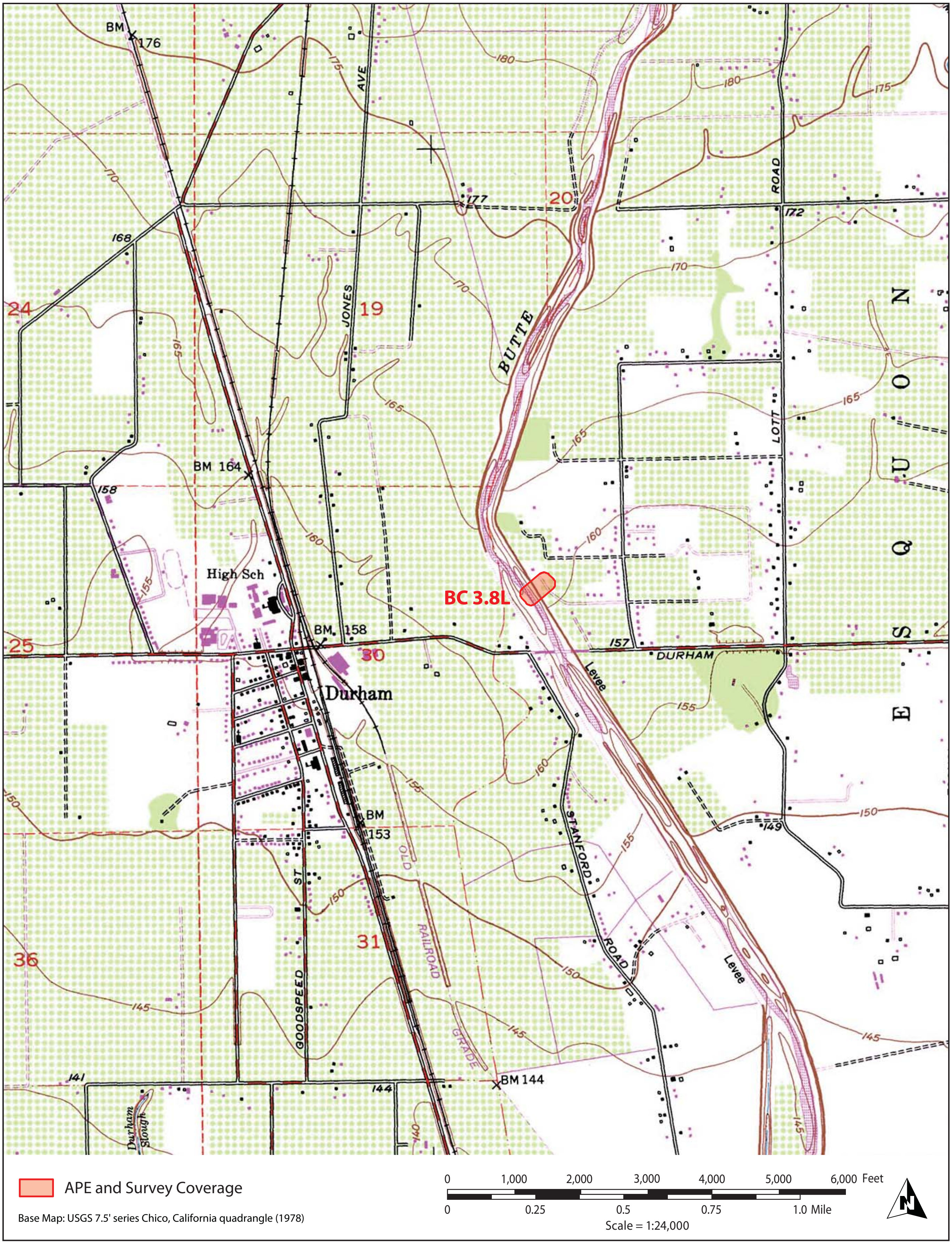
SR 103.4L

This APE is located on the east side of the Sacramento River in Sutter and Yolo Counties (Figure 2-21). Roads in the vicinity consist of unnamed farm and levee access roads. No access constraints were encountered; as a result, 100% (2.07 ac) of the APE was subjected to survey. Visibility was generally good (50–80%), with little to no vegetation obscuring the ground surface.



Graphics ... 00627.08 784 (1-11)

Figure 2-1
BC 3.8L Area of Potential Effects



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

Figure 2-2
BC 3.8L Survey Coverage

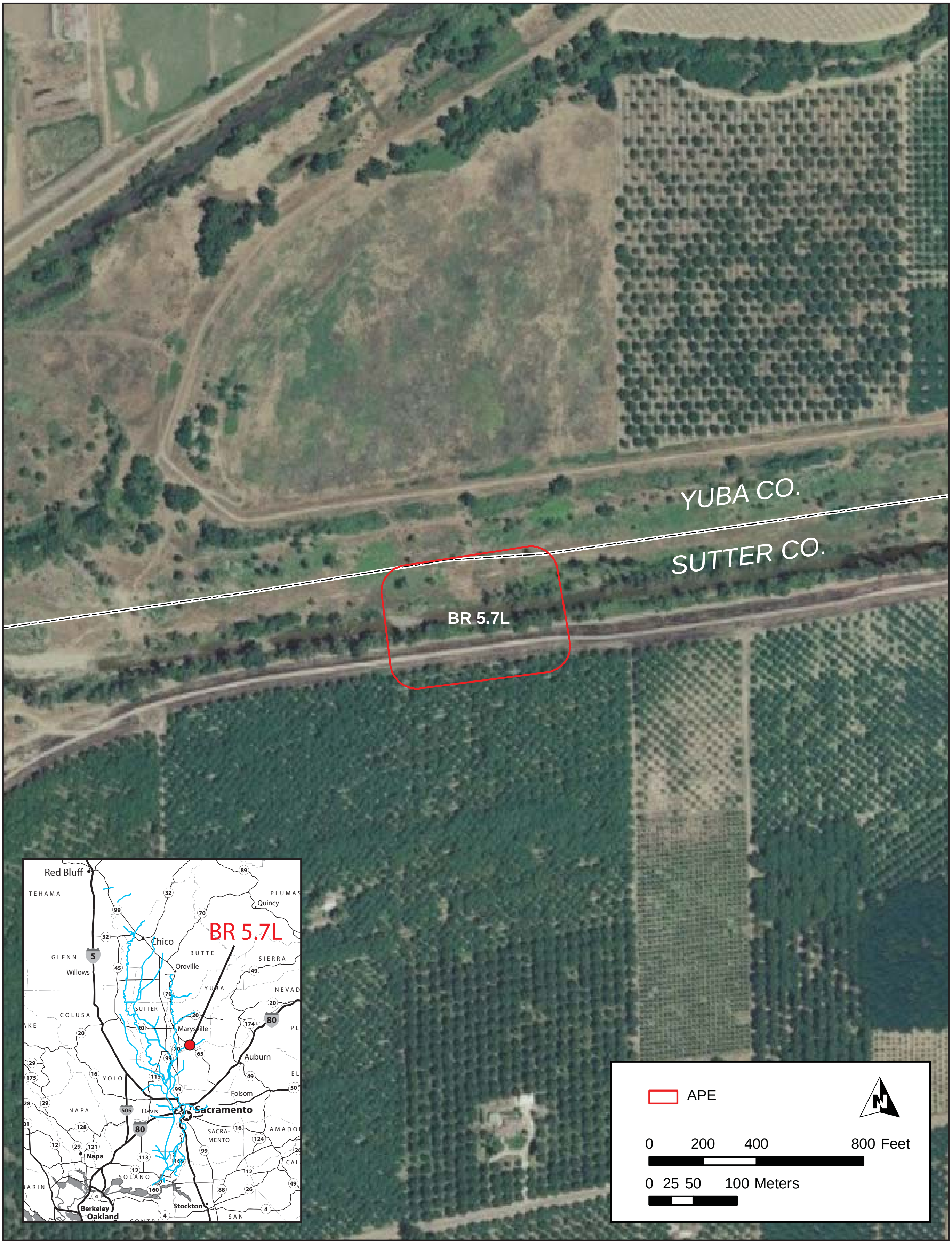
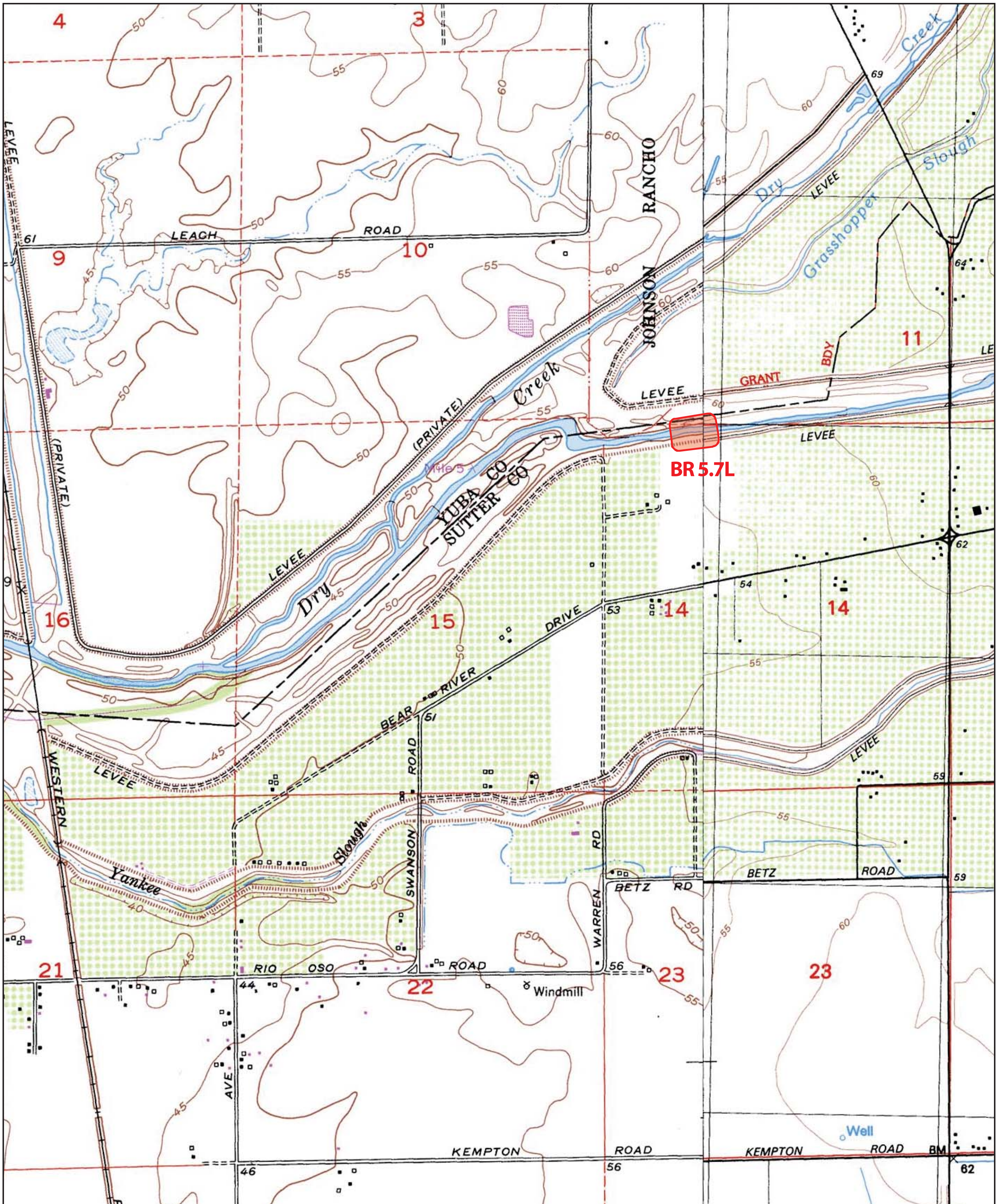


Figure 2-3
BR 5.7L Area of Potential Effects



APE and Survey Coverage

Base Map: USGS 7.5' series Nicolaus and Sheridan, California quadrangles (1992)

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

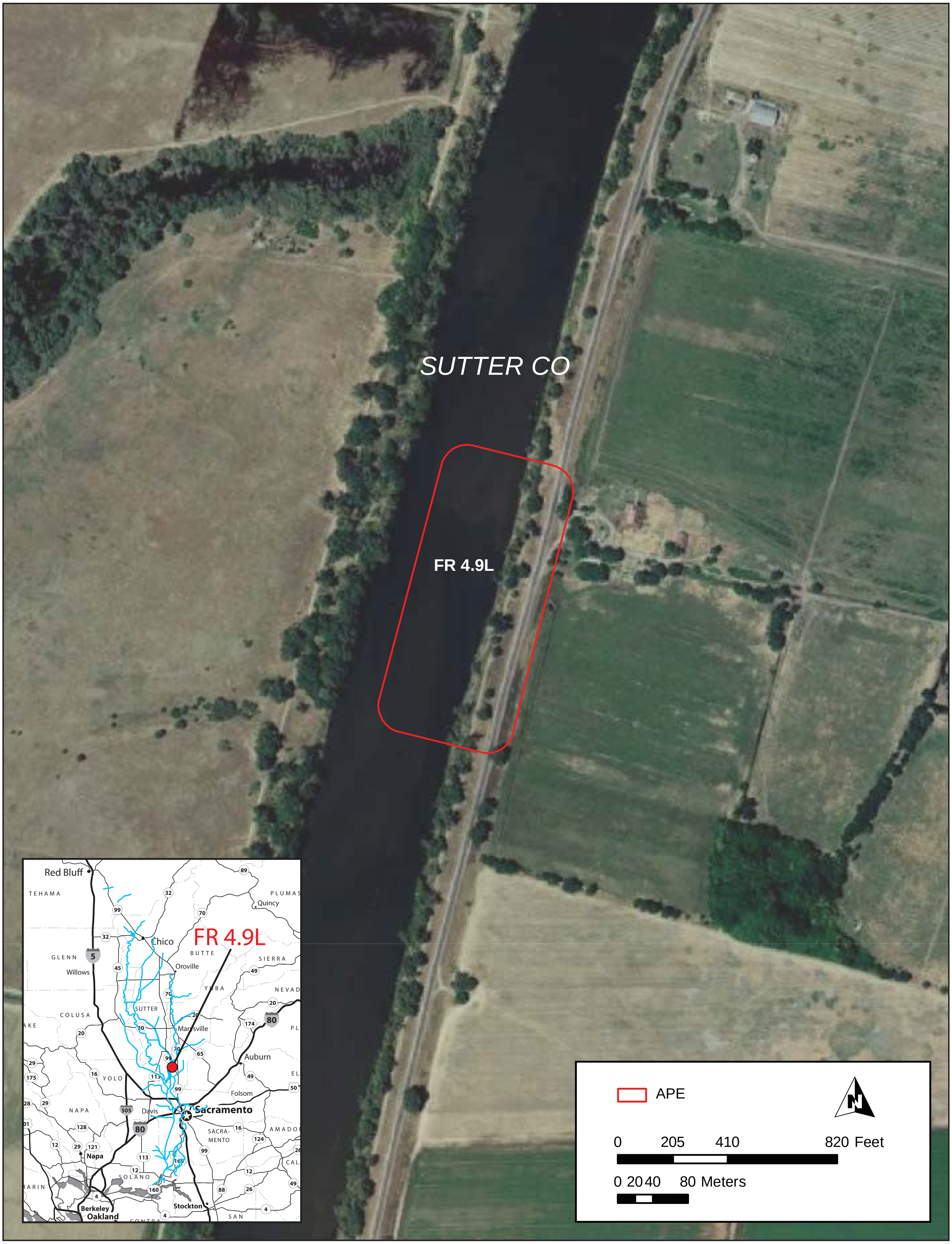
0 0.25 0.5 0.75 1.0 Mile

Scale = 1:24,000

Graphics … 00627.08 7B4 (1-11)

ICF INTERNATIONAL

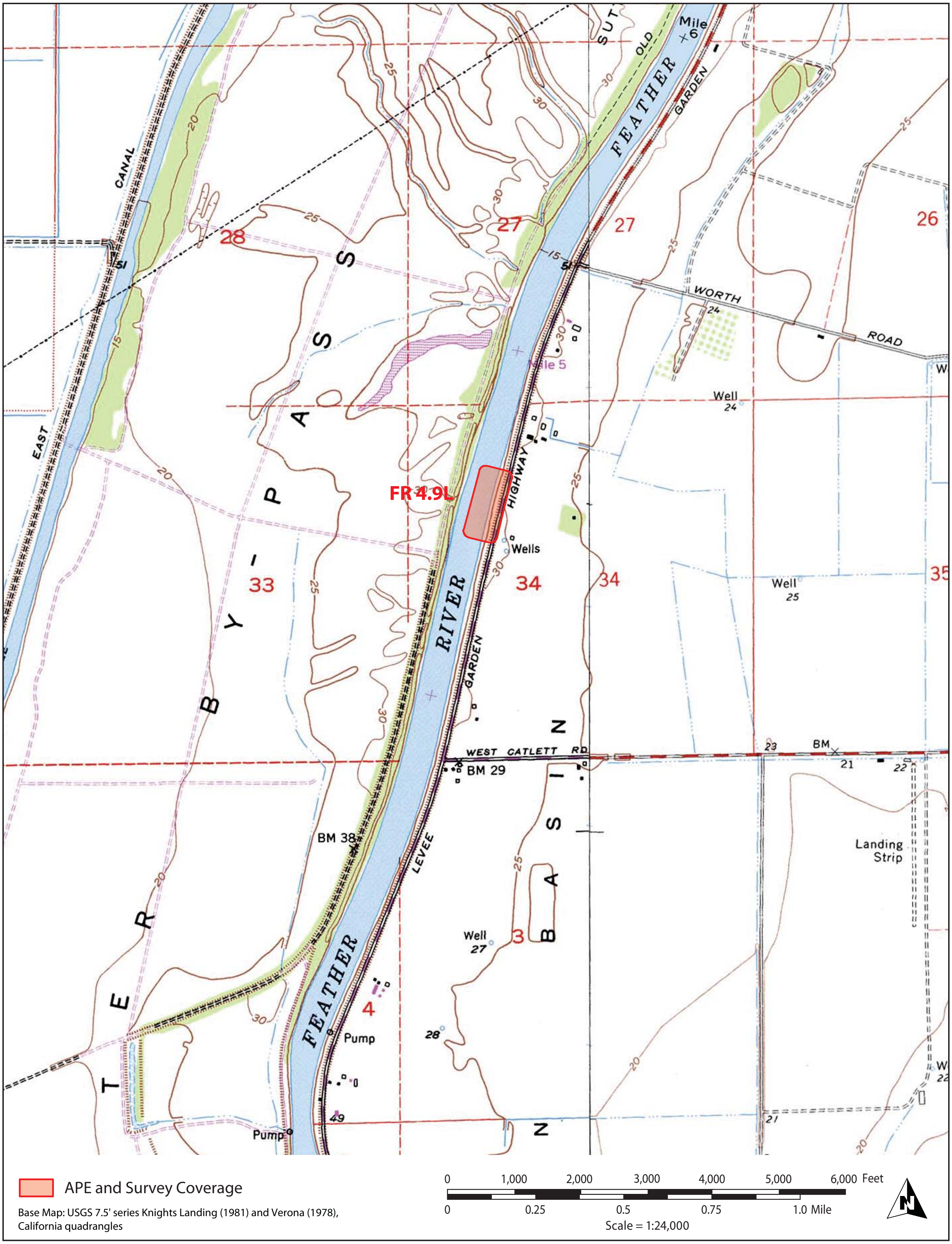
Figure 2-4
BR 5.7L Survey Coverage



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

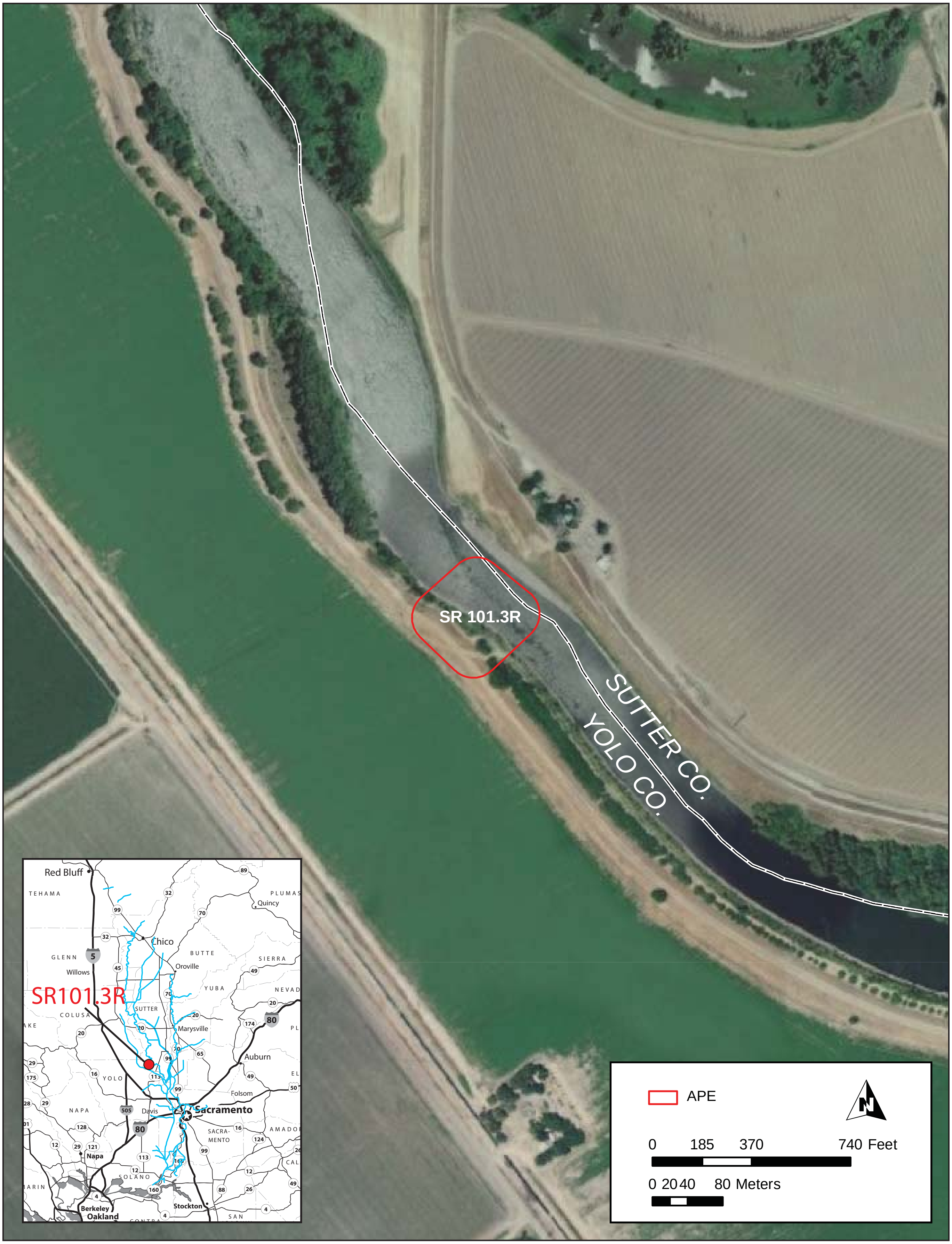
Figure 2-5
FR 4.9L Area of Potential Effects



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

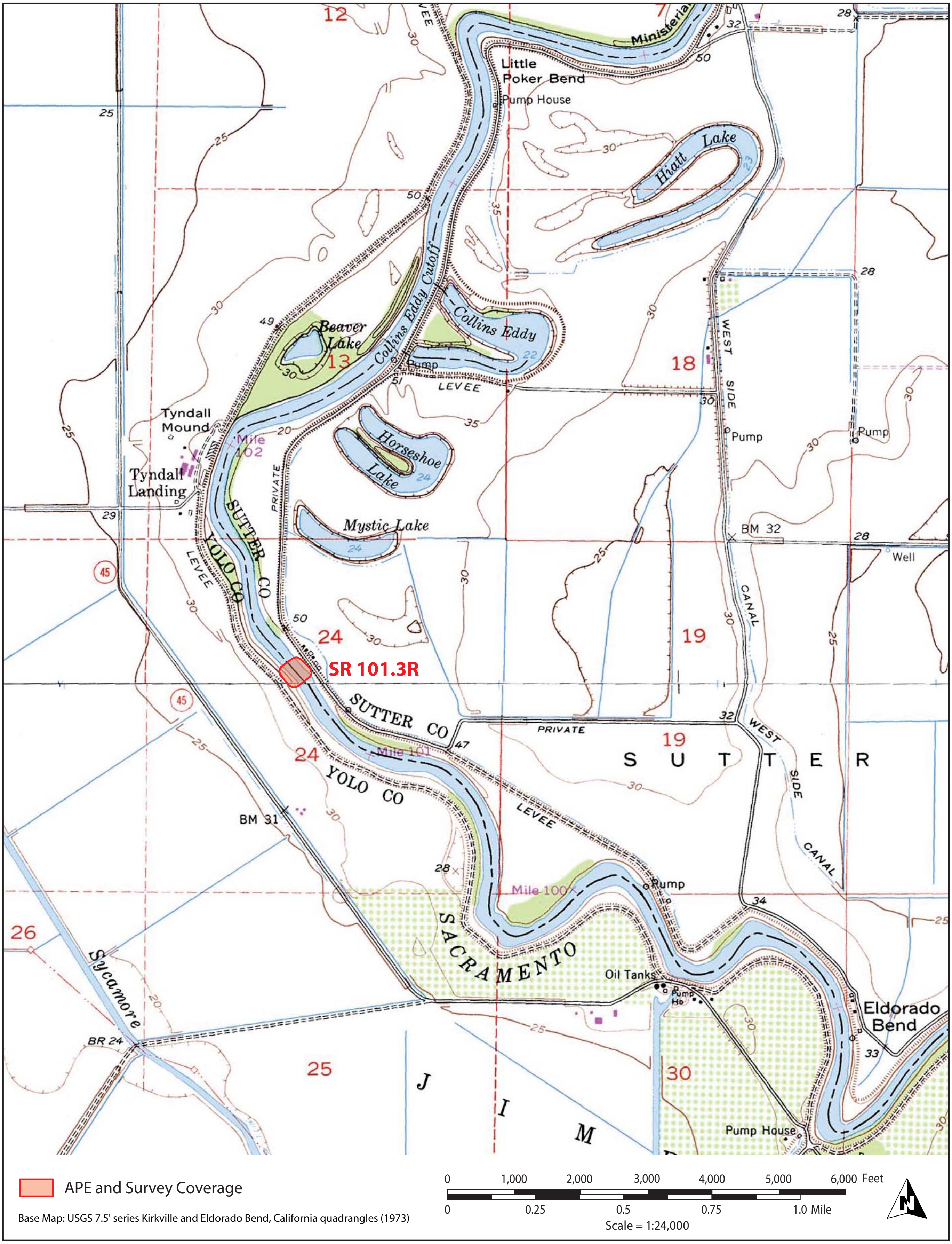
Figure 2-6
FR 4.9L Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

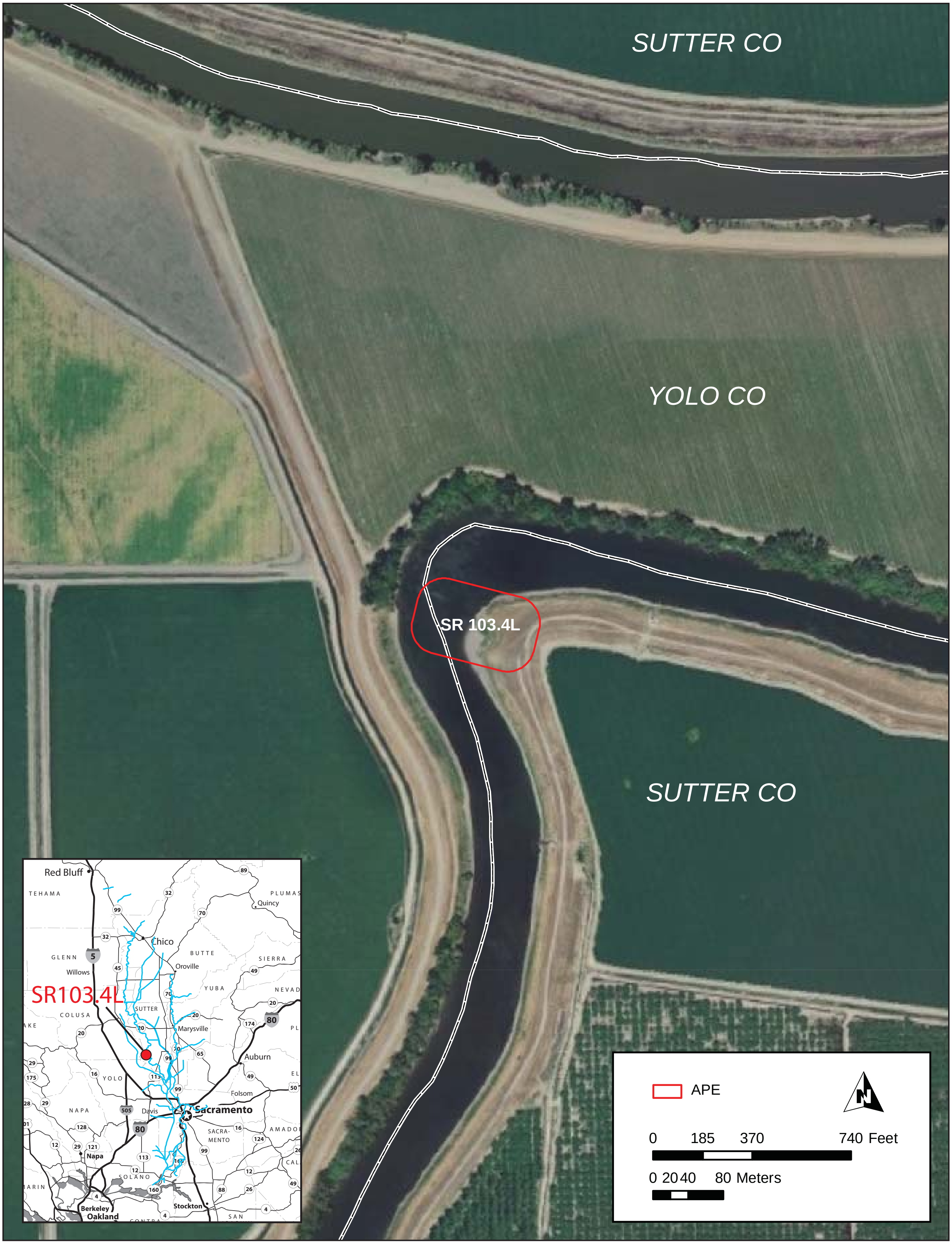
Figure 2-7
SR 101.3R Area of Potential Effects



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

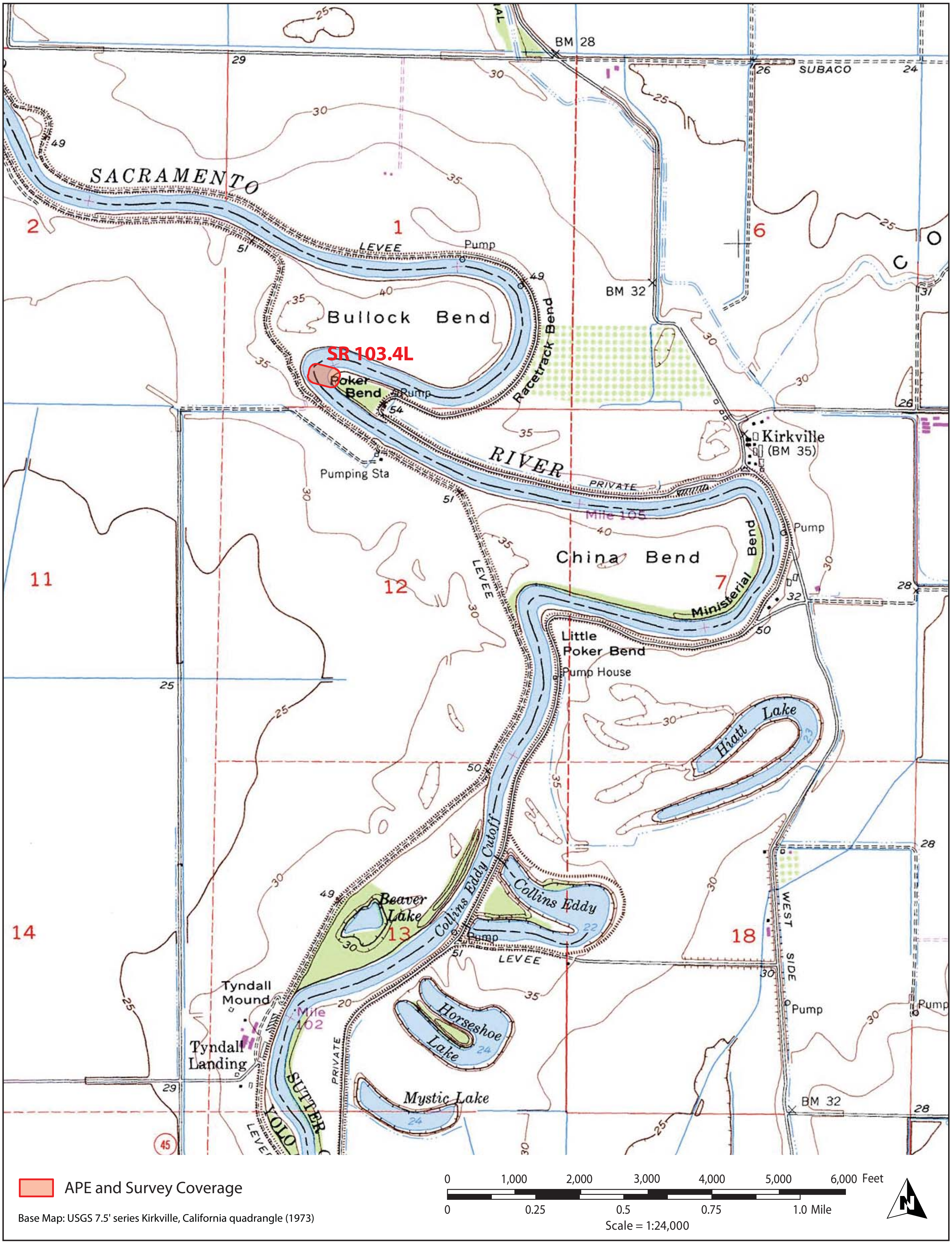
Figure 2-8
SR 101.3R Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

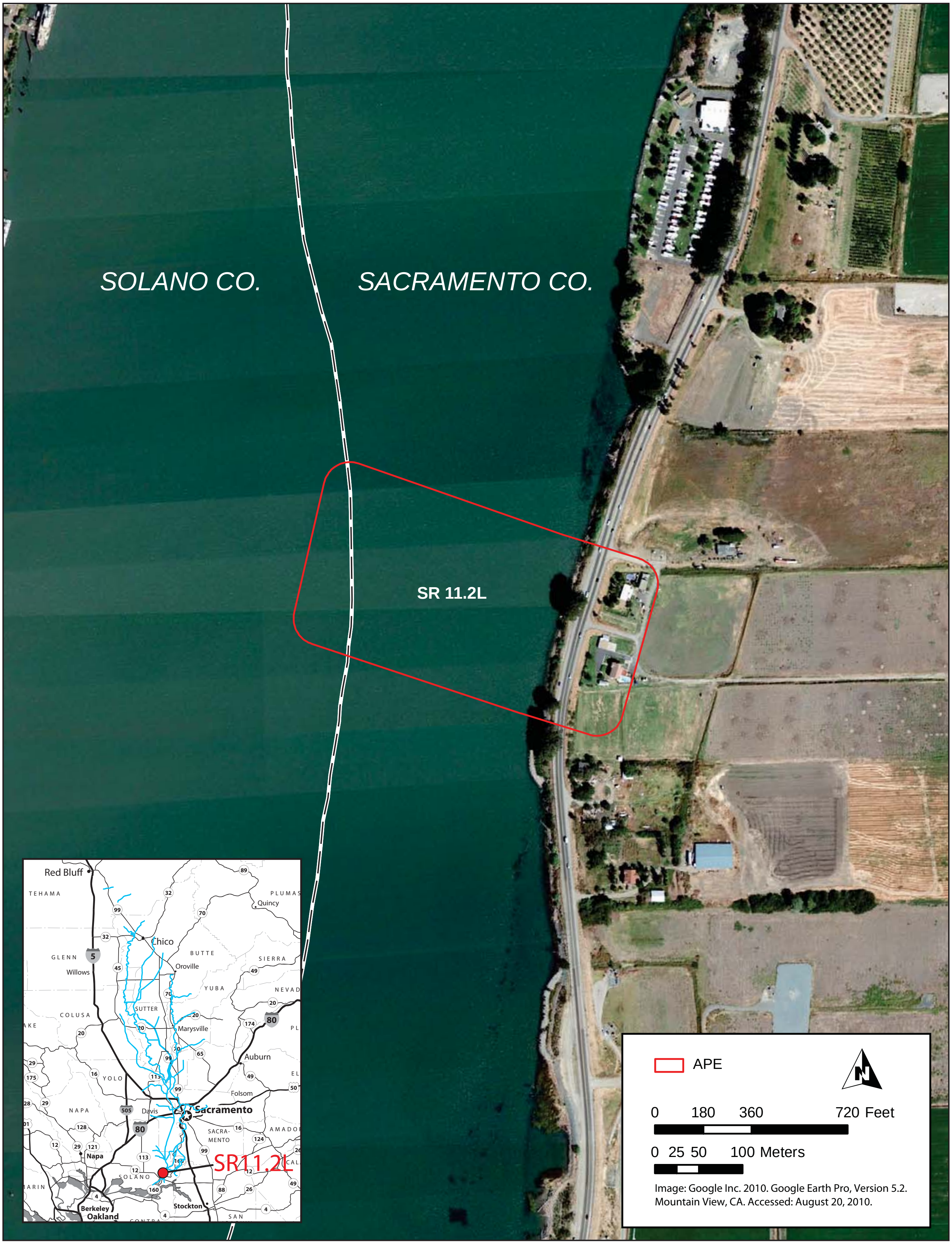
Figure 2-9
SR 103.4L Area of Potential Effects



Graphics … 00627.08 7B4 (1-11)

ICF INTERNATIONAL

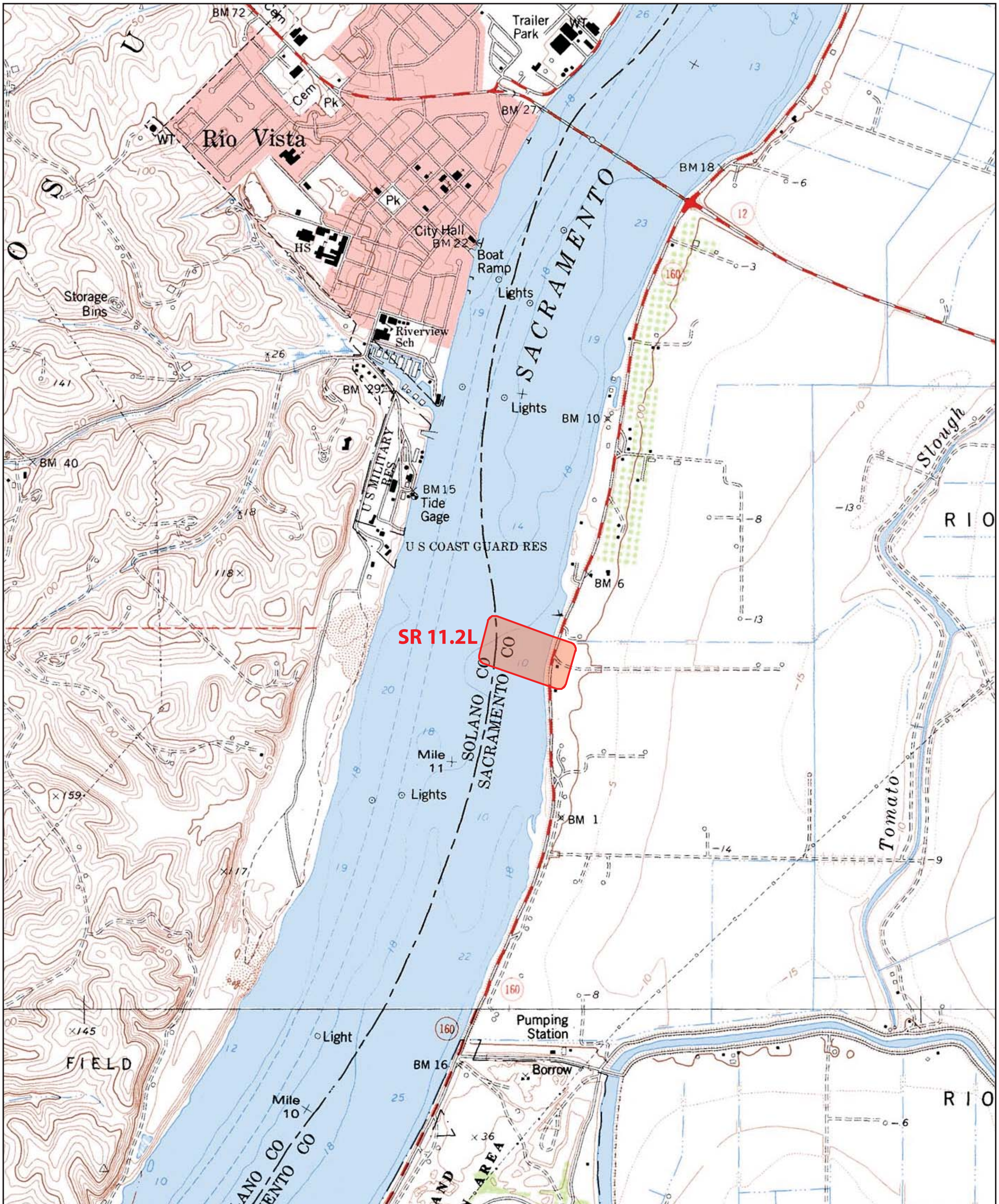
Figure 2-10
SR 103.4L Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

Figure 2-11
SR 11.2L Area of Potential Effects



APE and Survey Coverage

Base Map: USGS 7.5' series Rio Vista and Jersey Island, California quadrangles (1978)

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

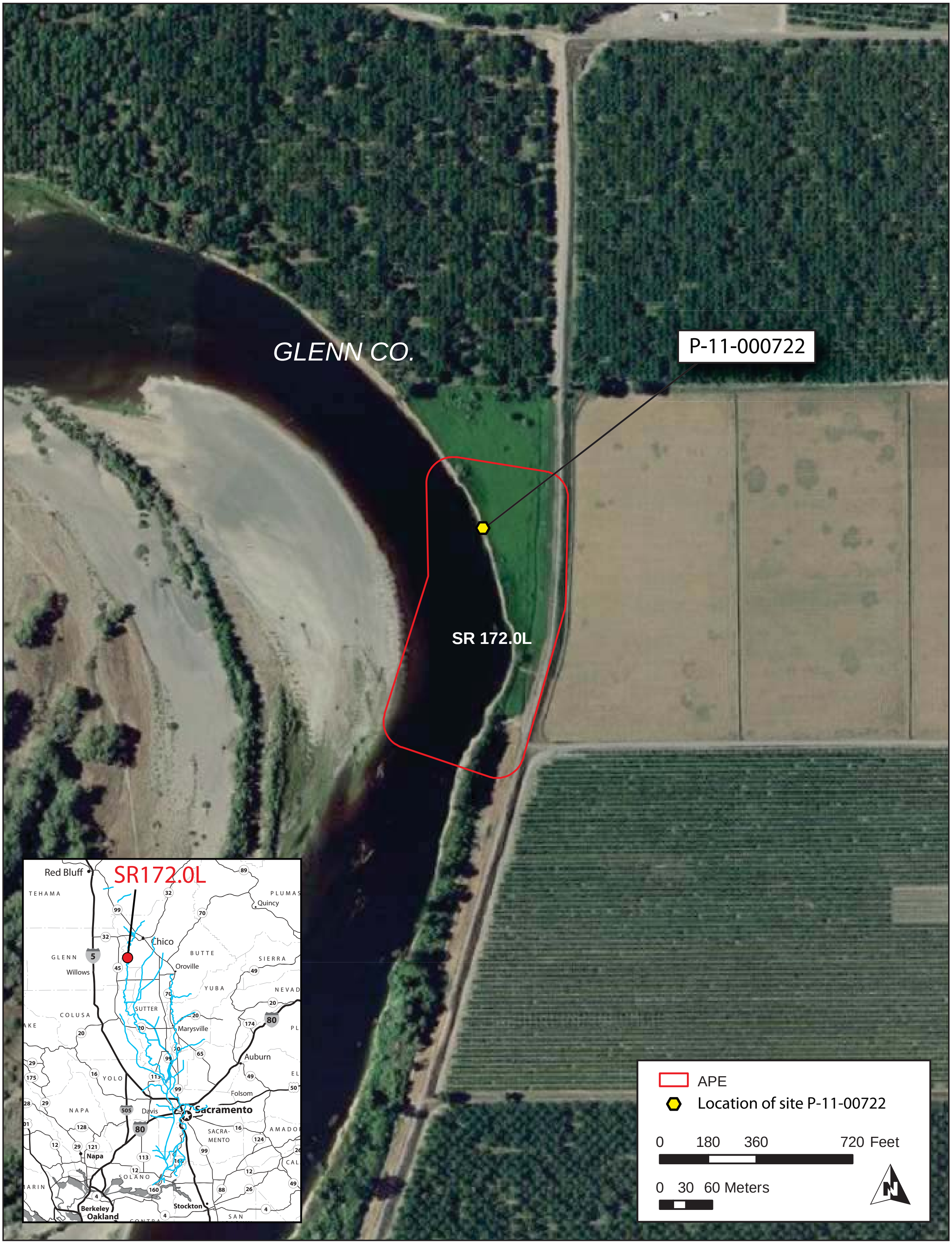
0 0.25 0.5 0.75 1.0 Mile

Scale = 1:24,000

Graphics ... 00627.08 784 (1-11)

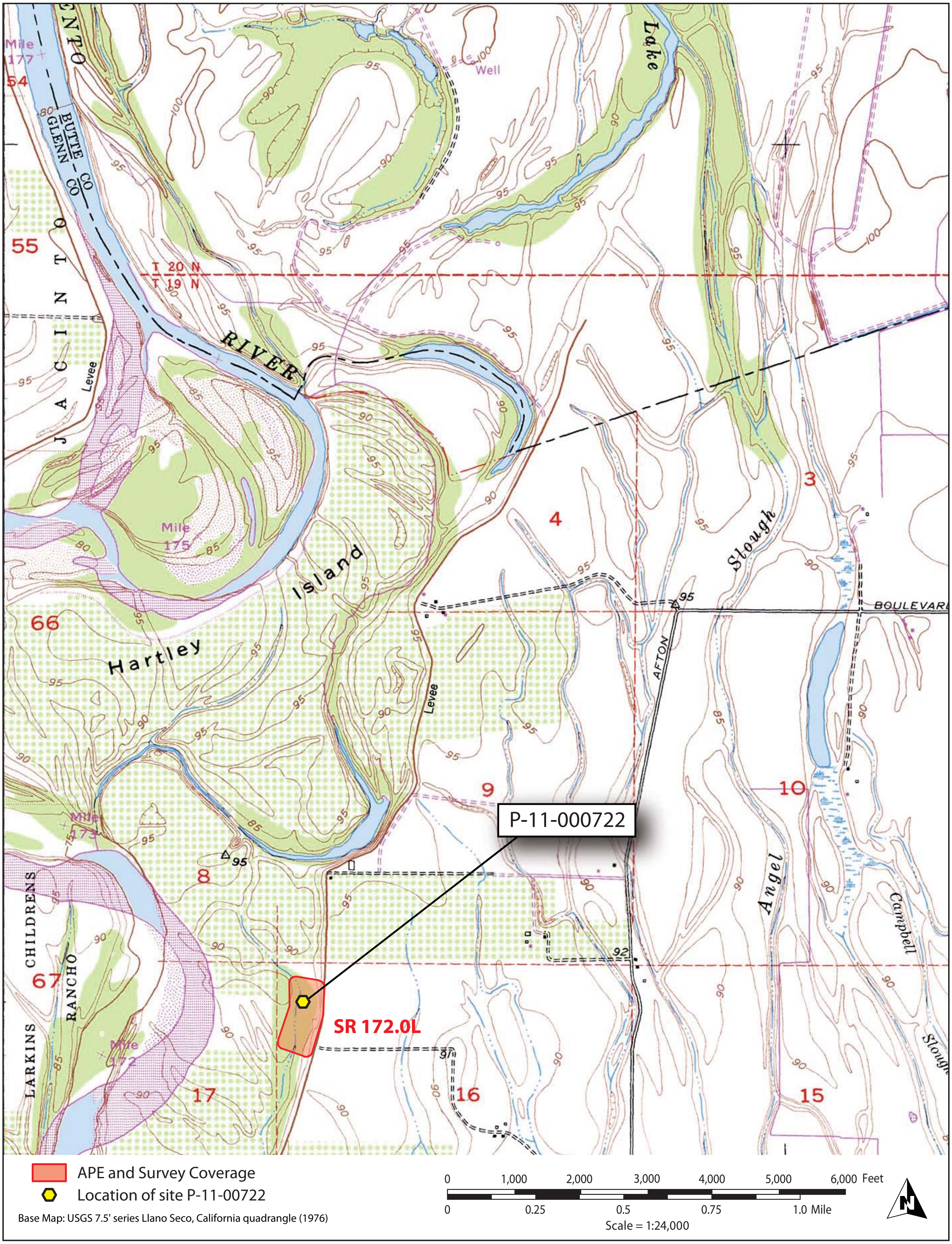
ICF INTERNATIONAL

Figure 2-12
SR 11.2L Survey Coverage



ICF INTERNATIONAL

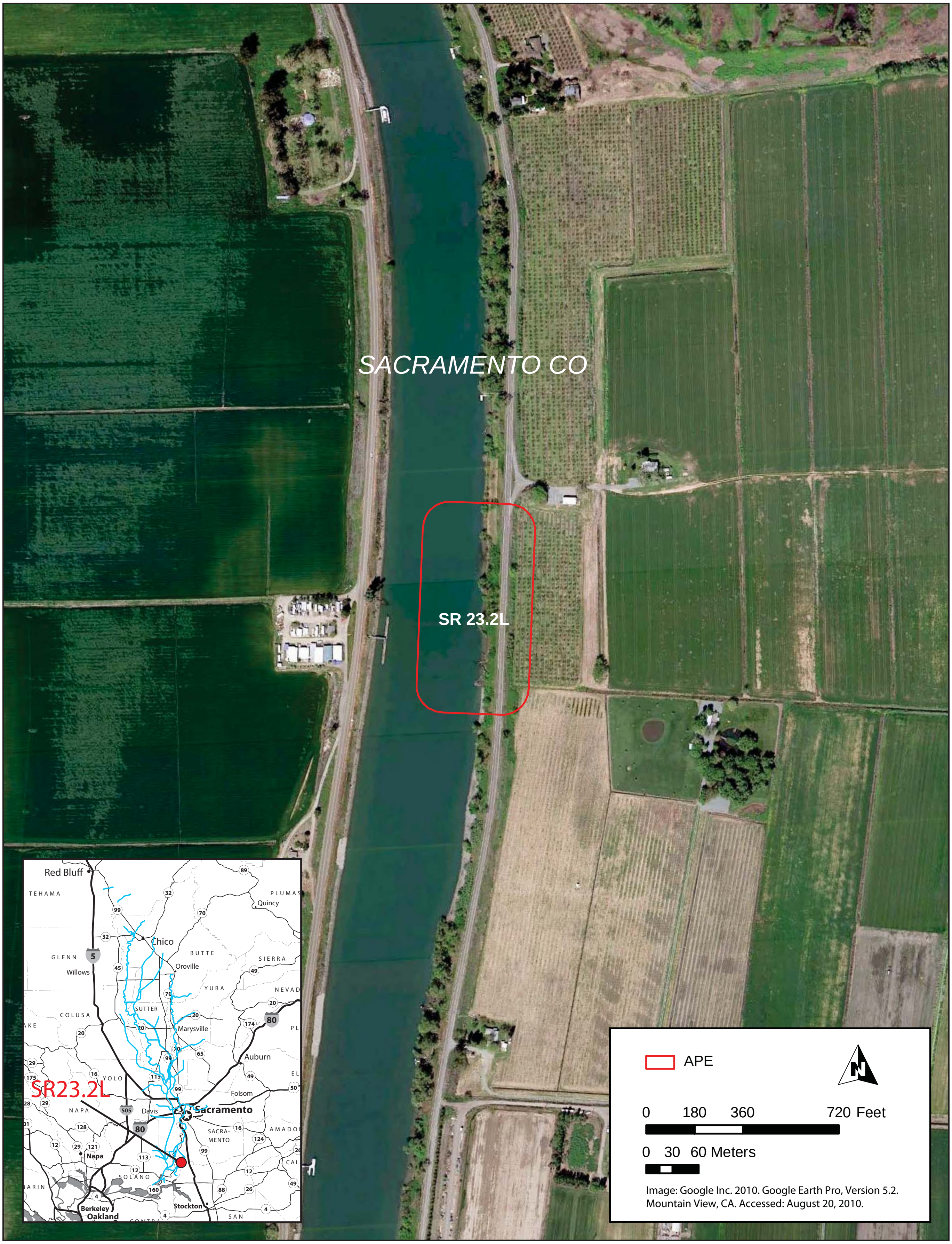
Figure 2-13
SR 172.0L Area of Potential Effects



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

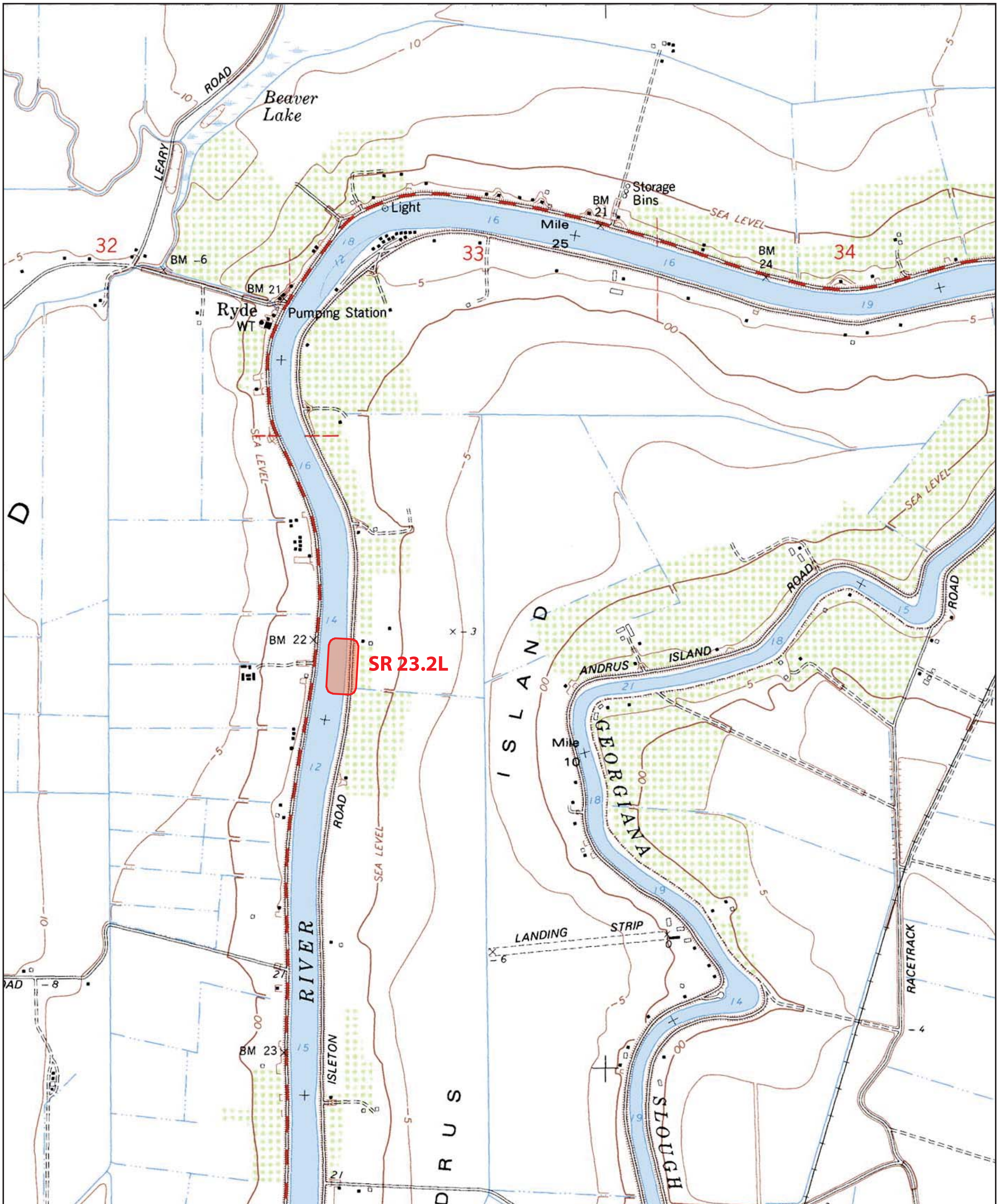
Figure 2-14
SR 172.0L Survey Coverage



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

Figure 2-15
SR 23.2L Area of Potential Effects



APE and Survey Coverage

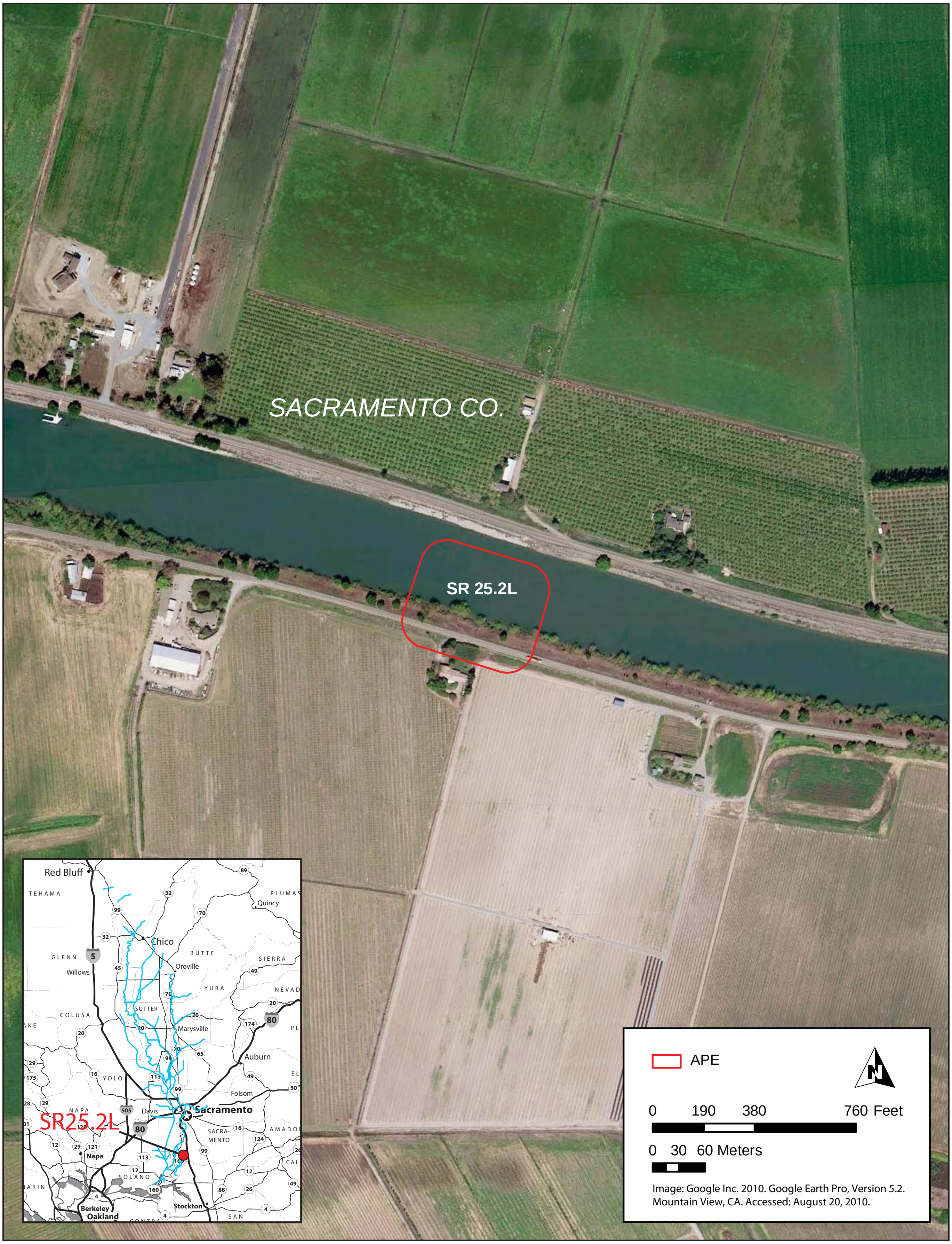
Base Map: USGS 7.5' series Isleton, California quadrangle (1993)

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

0 0.25 0.5 0.75 1.0 Mile

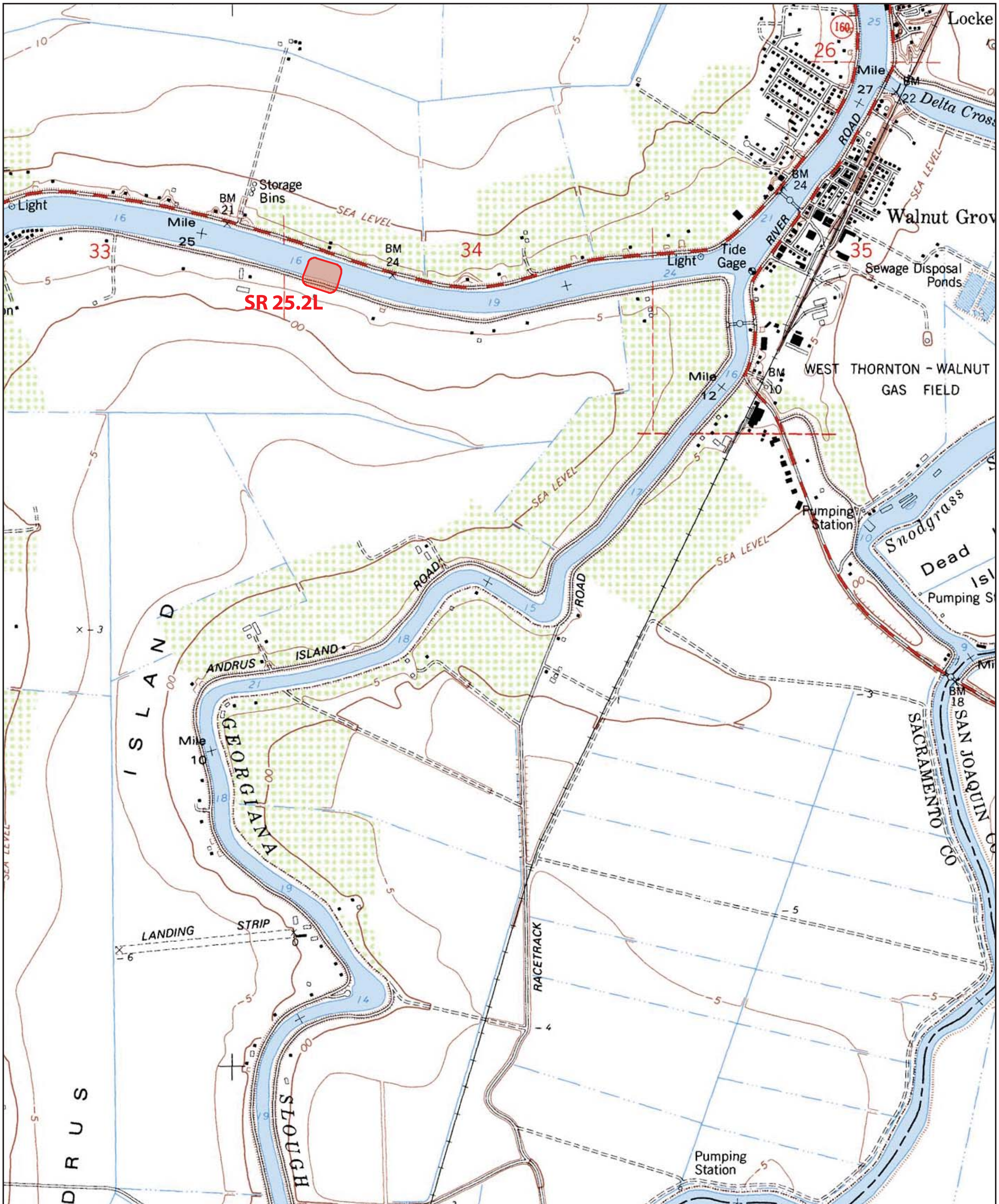
Scale = 1:24,000

Figure 2-16
SR 23.2L Survey Coverage



Graphics ... 00627.08 784 (1-11)

Figure 2-17
SR 25.2L Area of Potential Effects



APE and Survey Coverage

Base Map: USGS 7.5' series Isleton, California quadrangle (1993)

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

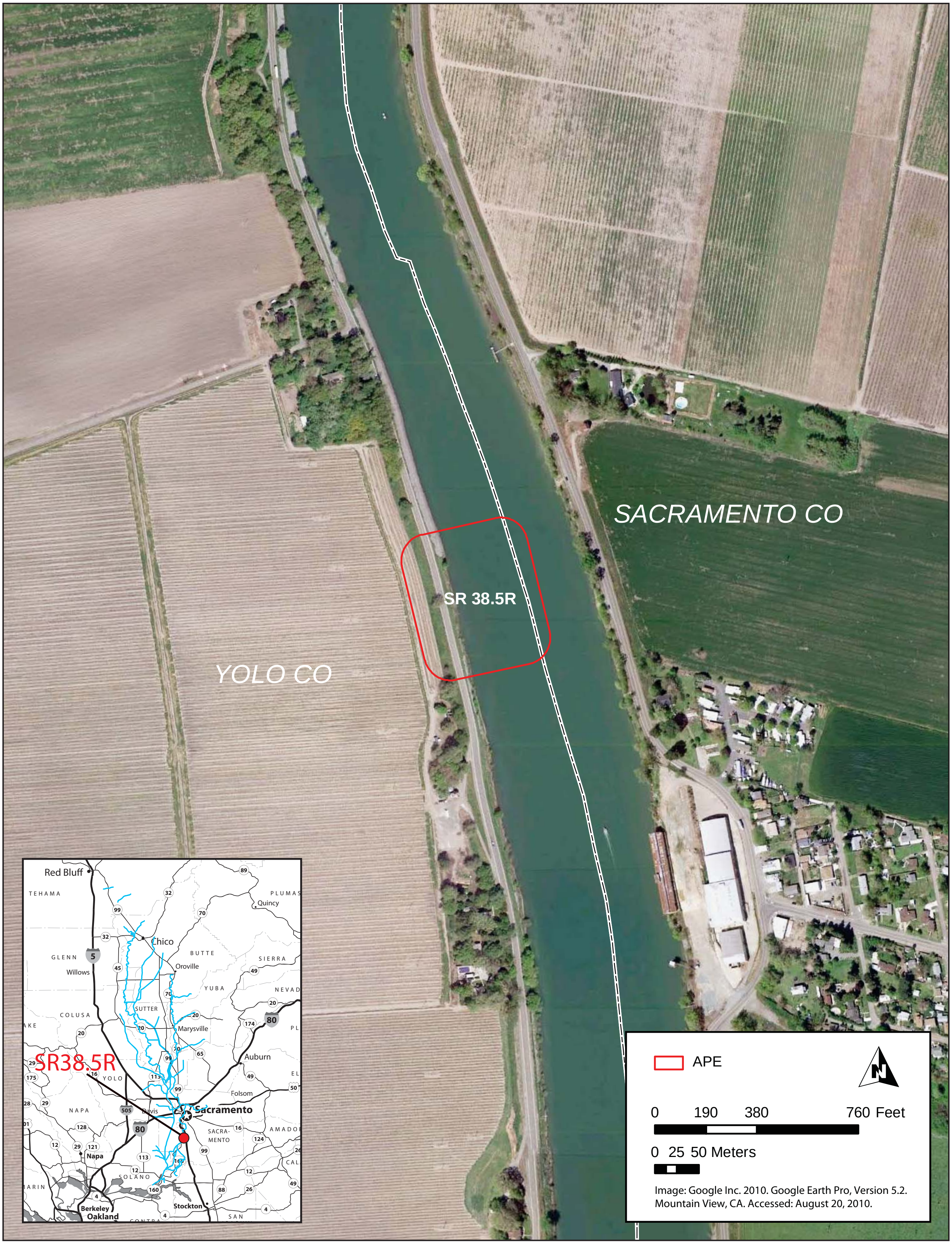
0 0.25 0.5 0.75 1.0 Mile

Scale = 1:24,000

N

Graphics ... 00627.08 7B4 (1-11)

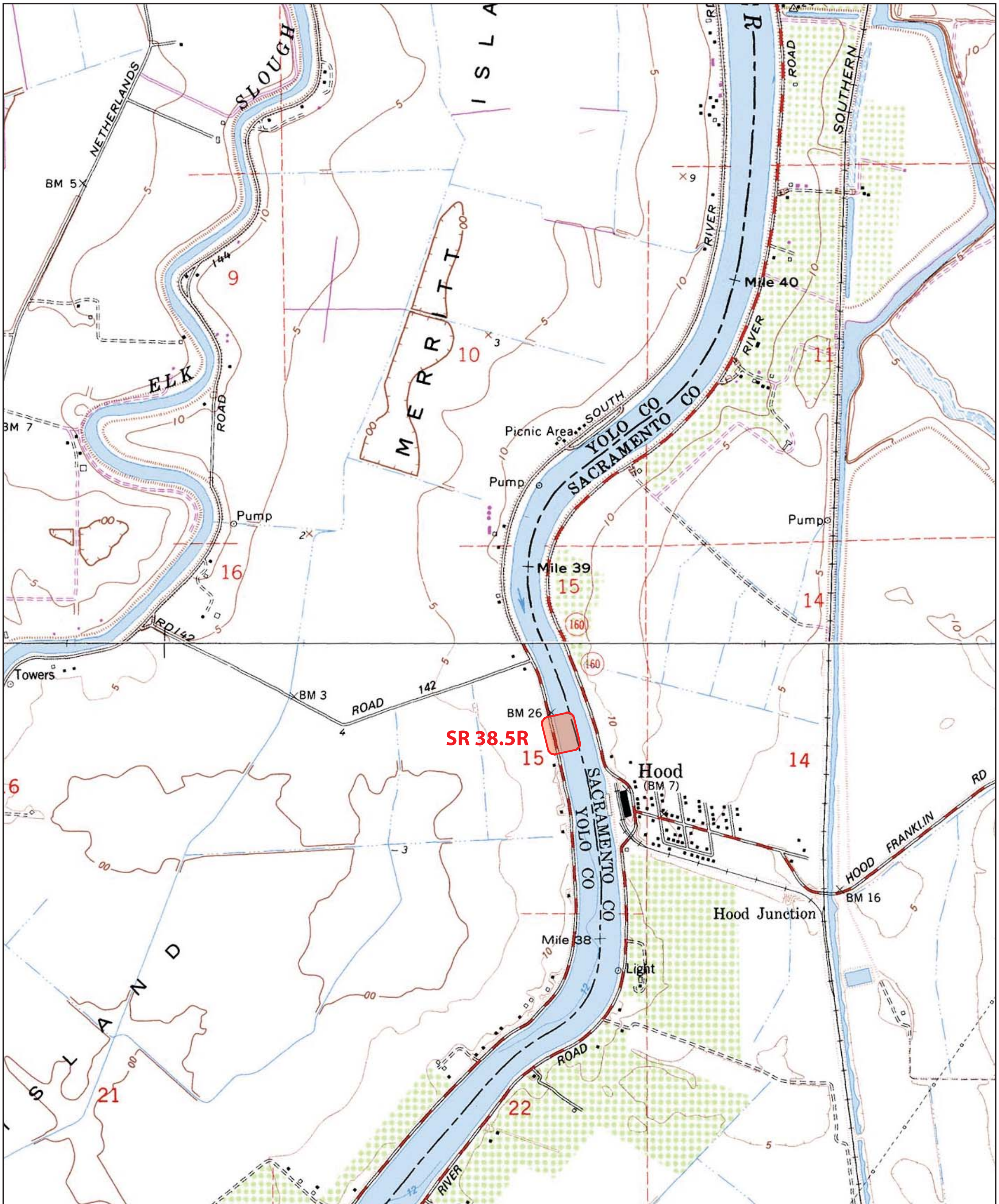
Figure 2-18
SR 25.2L Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

Figure 2-19
SR 38.5R Area of Potential Effects



APE and Survey Coverage

Base Map: USGS 7.5' series Clarksburg (1980) and Courtland (1993), California quadrangles

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

0 0.25 0.5 0.75 1.0 Mile

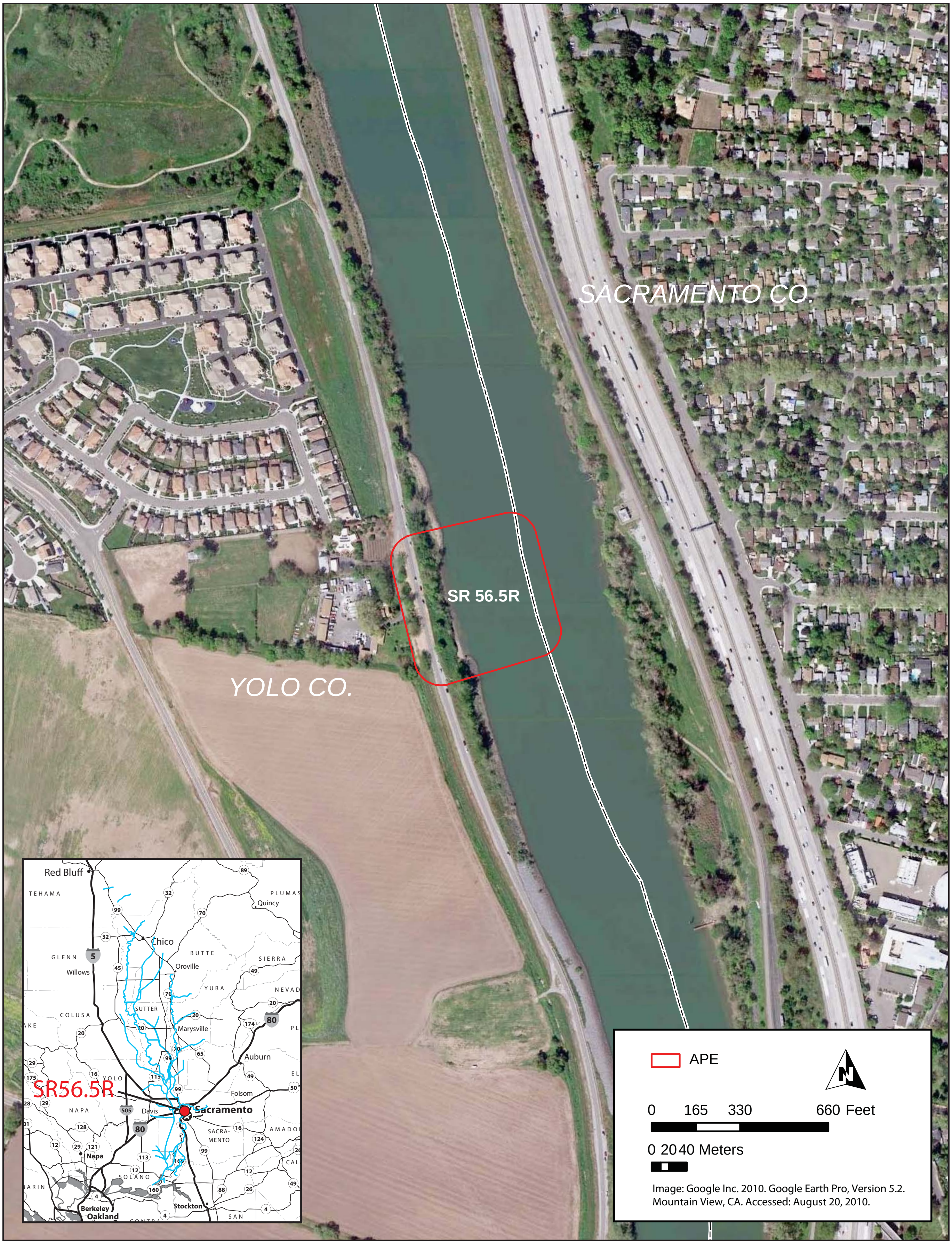
Scale = 1:24,000

N

Graphics … 00627.08 7B4 (1-11)

ICF INTERNATIONAL

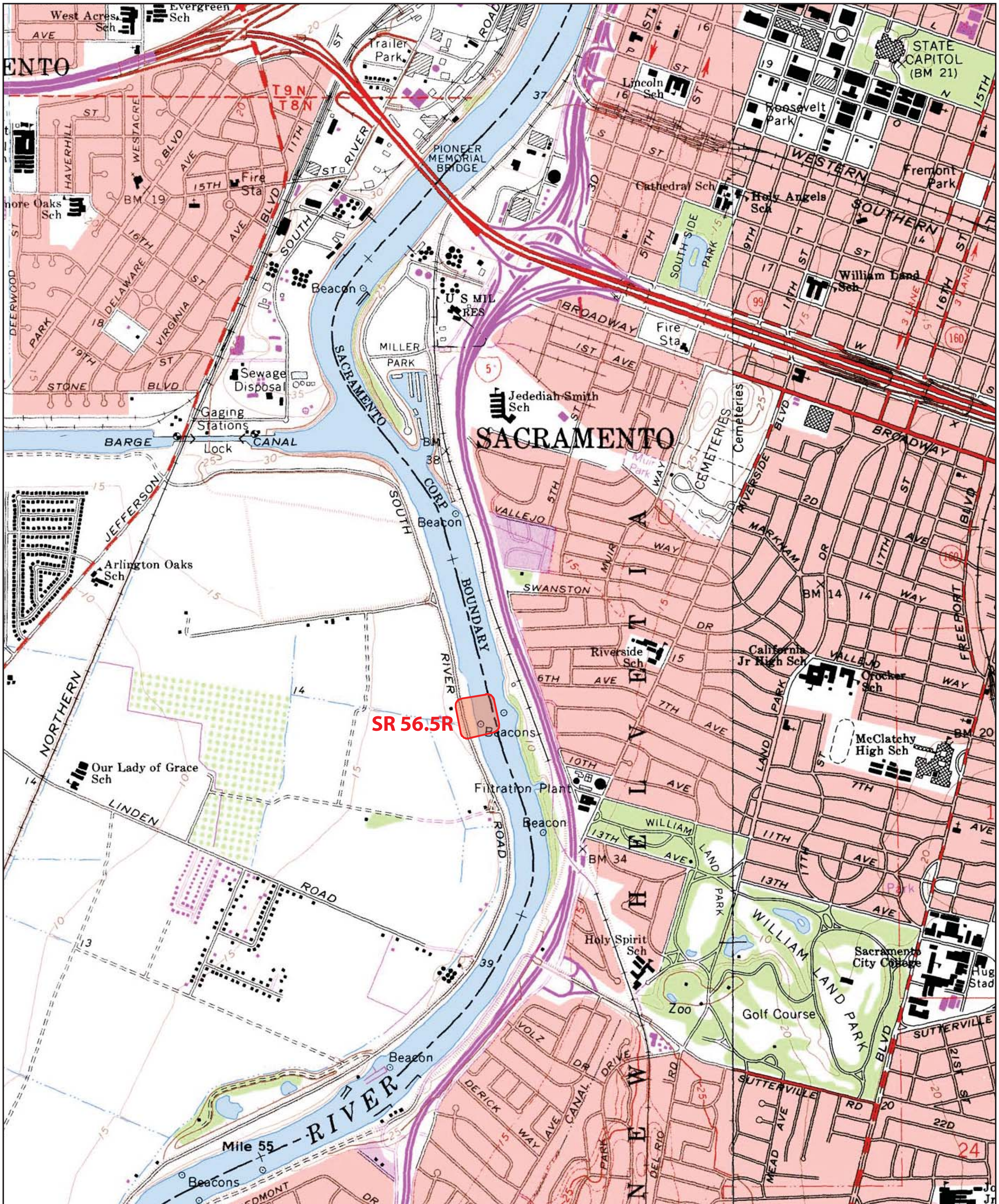
Figure 2-20
SR 38.5R Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

Figure 2-21
SR 56.5R Area of Potential Effects



APE and Survey Coverage

Base Map: USGS 7.5' series Sacramento West and Secramento East, California quadrangles (1980)

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

0 0.25 0.5 0.75 1.0 Mile

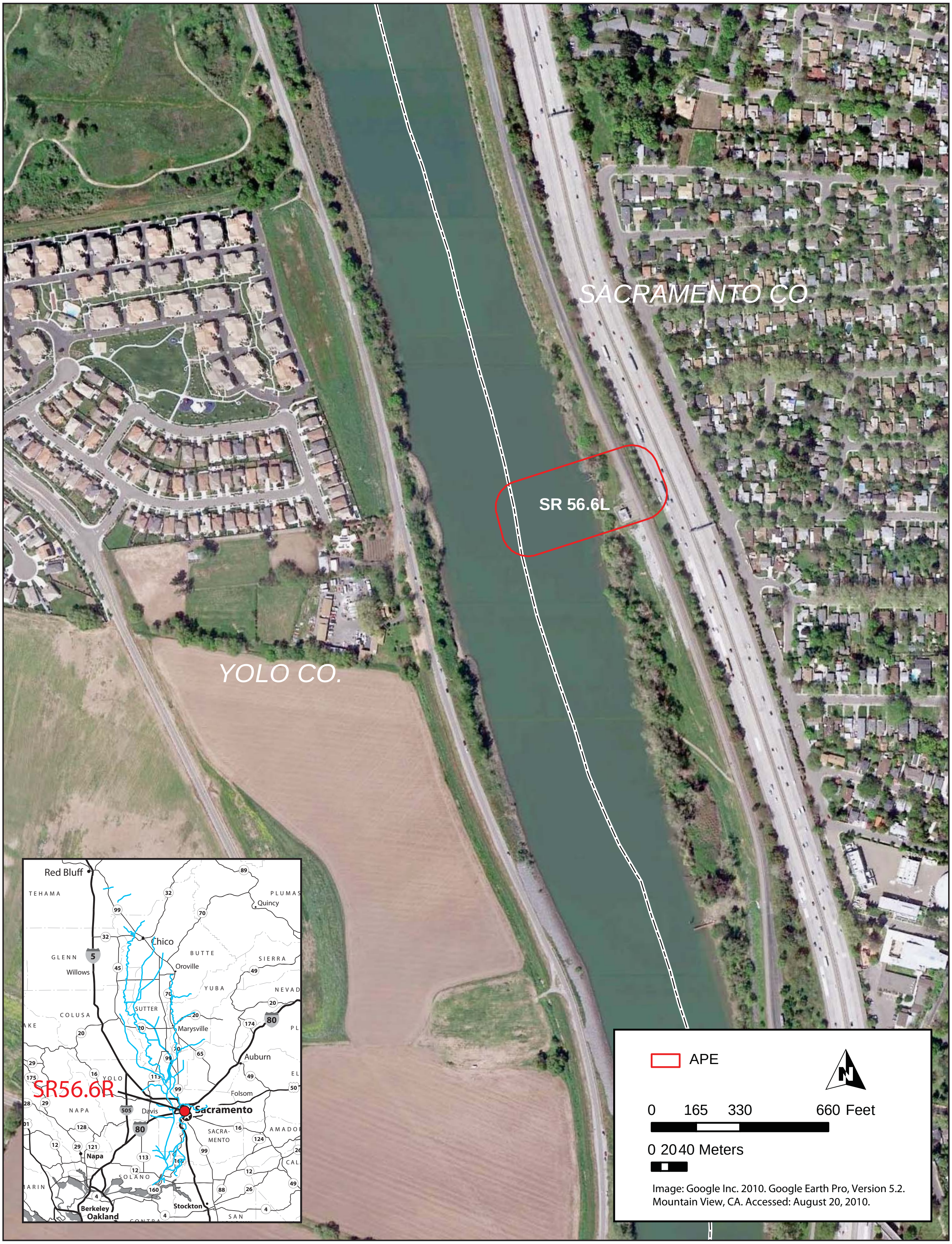
Scale = 1:24,000

N

Graphics ... 00627.08 7B4 (1-11) JD

ICF INTERNATIONAL

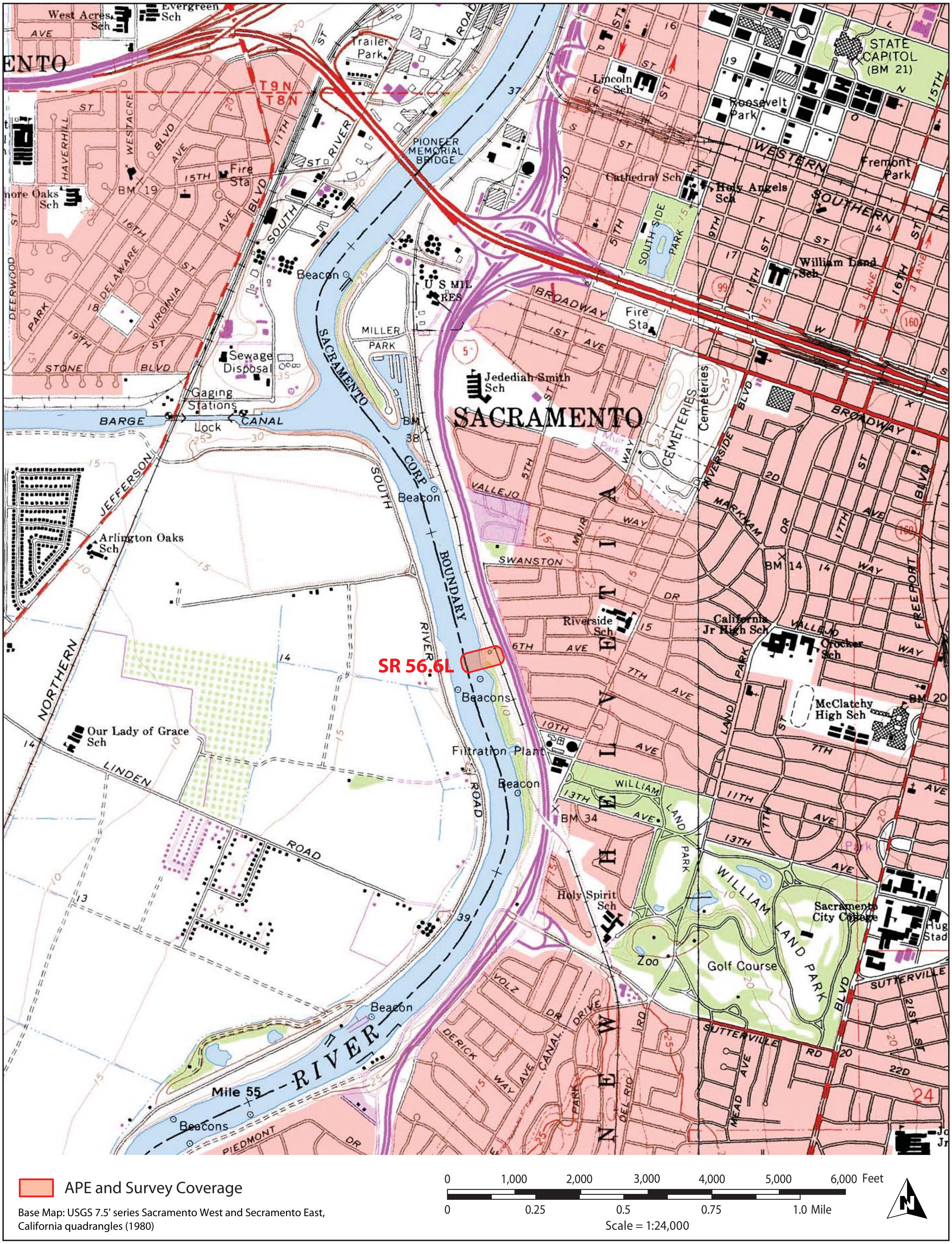
Figure 2-22
SR 56.5R Survey Coverage



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

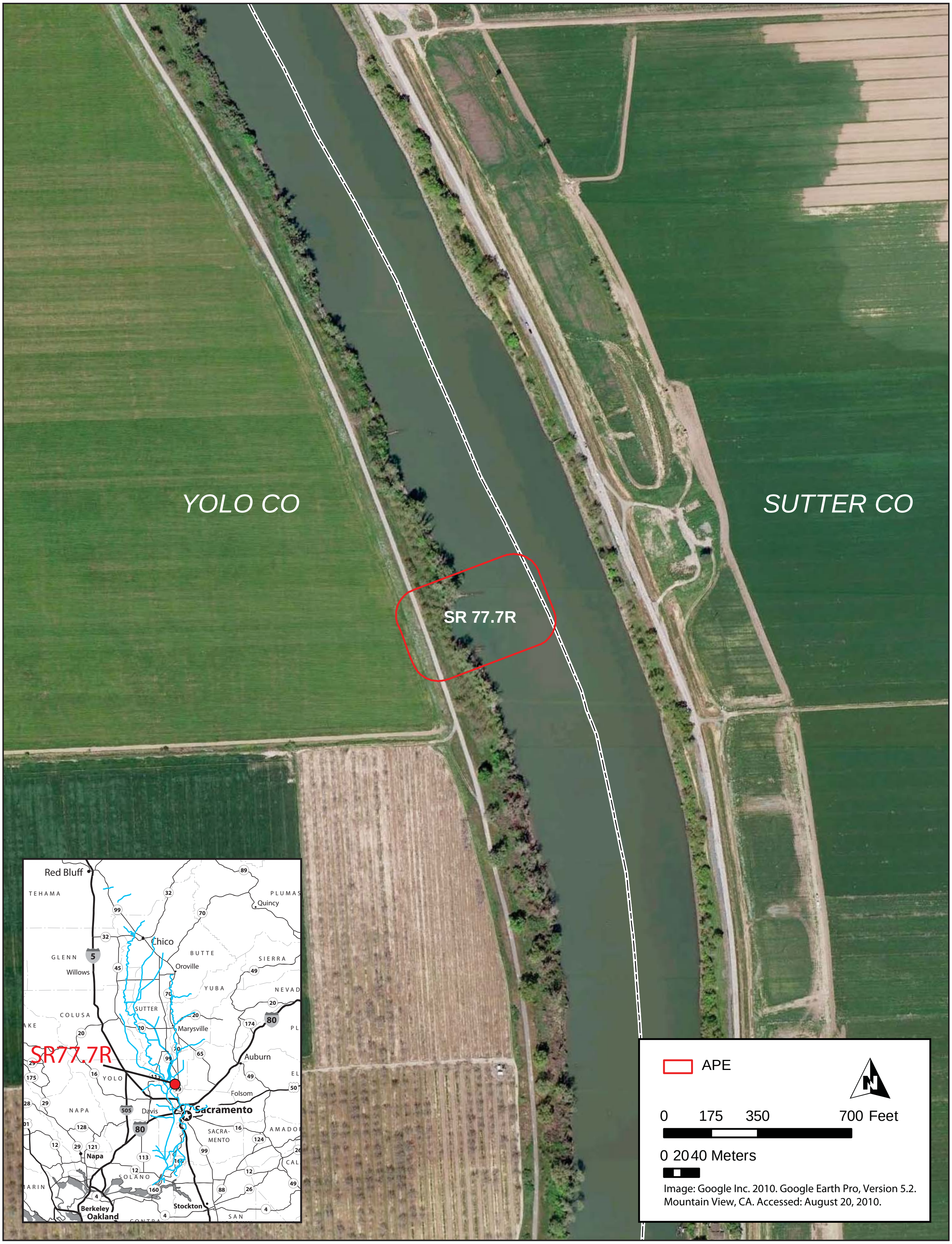
Figure 2-23
SR 56.6L Area of Potential Effects



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

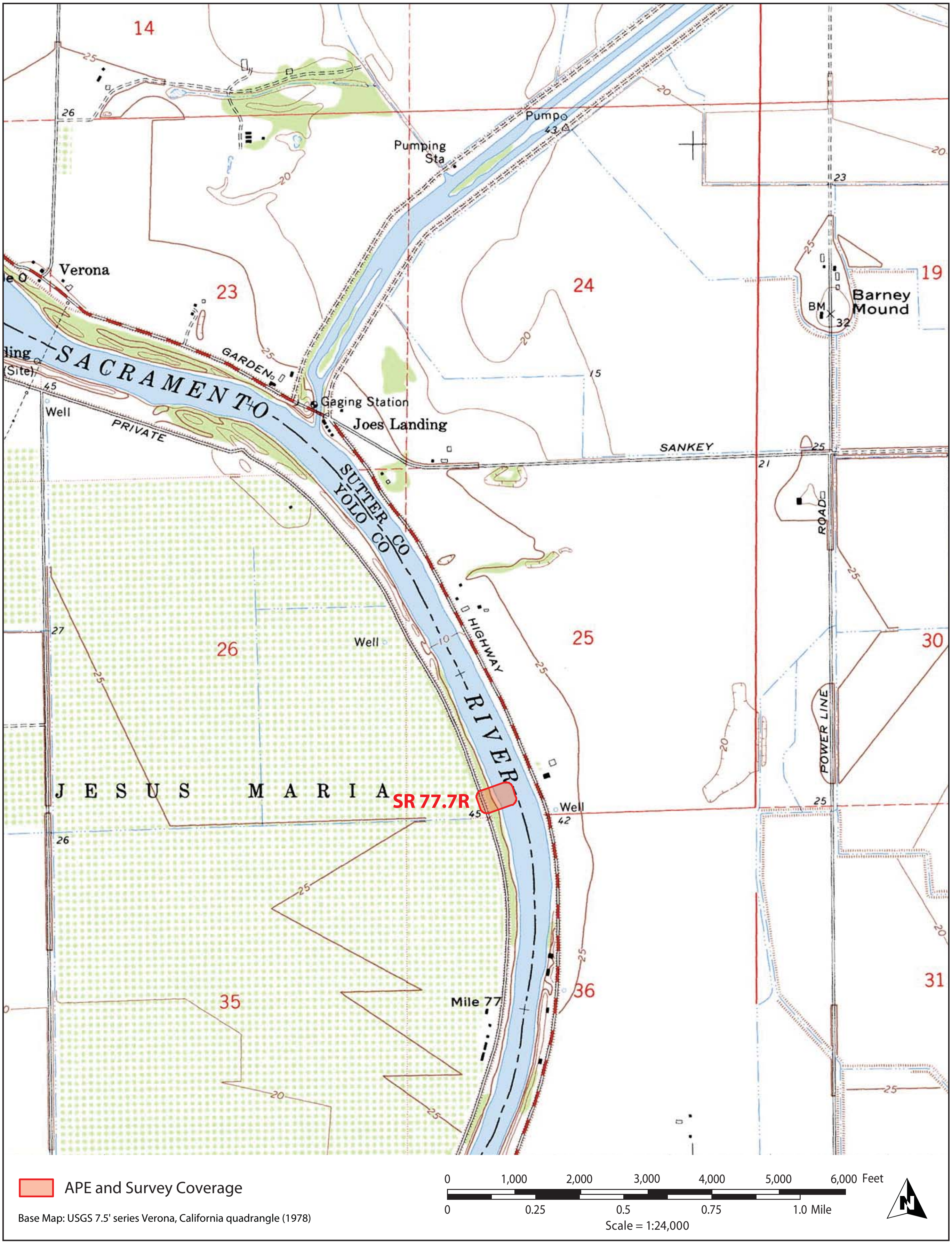
Figure 2-24
SR 56.6L Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

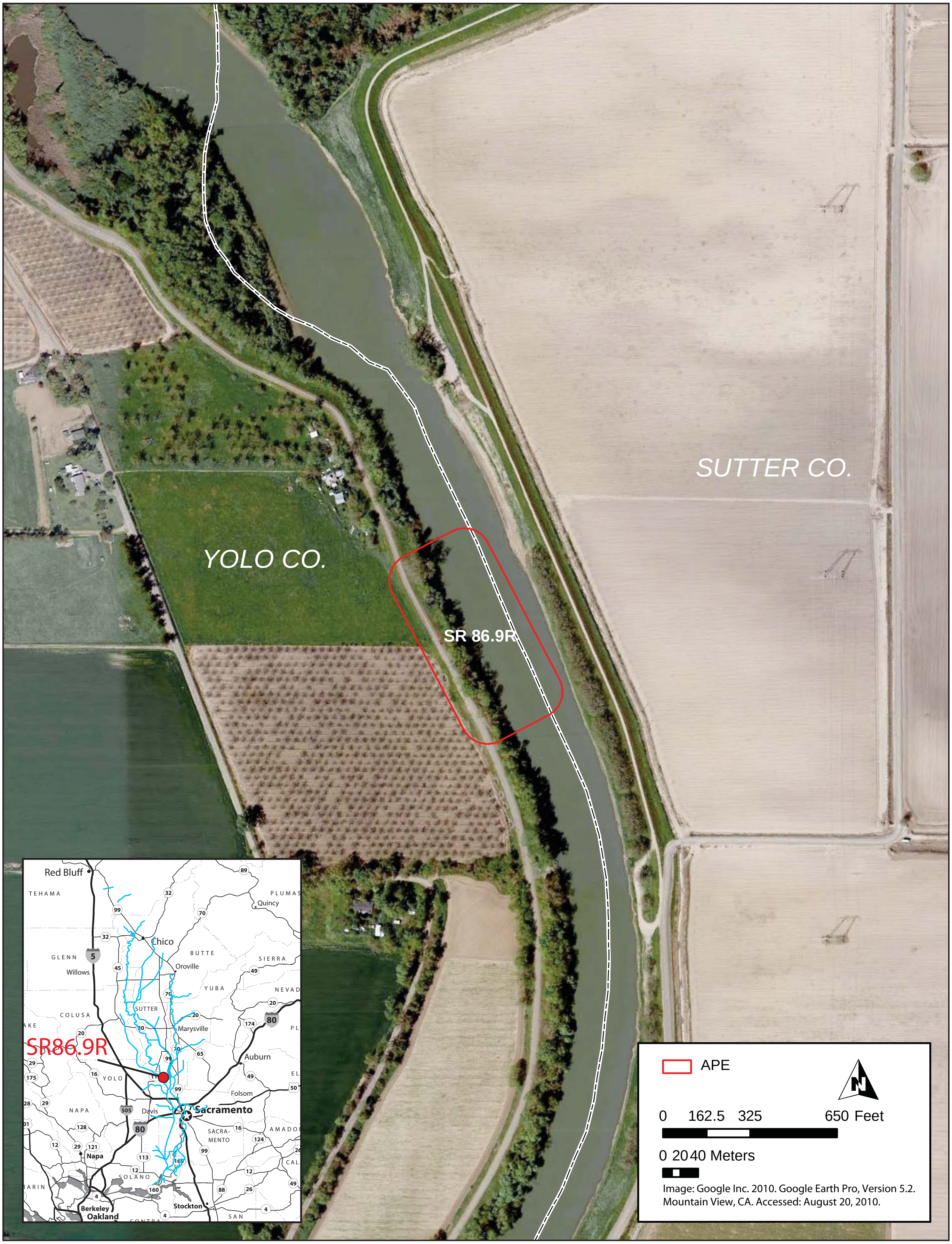
Figure 2-25
SR 77.7R Area of Potential Effects



Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

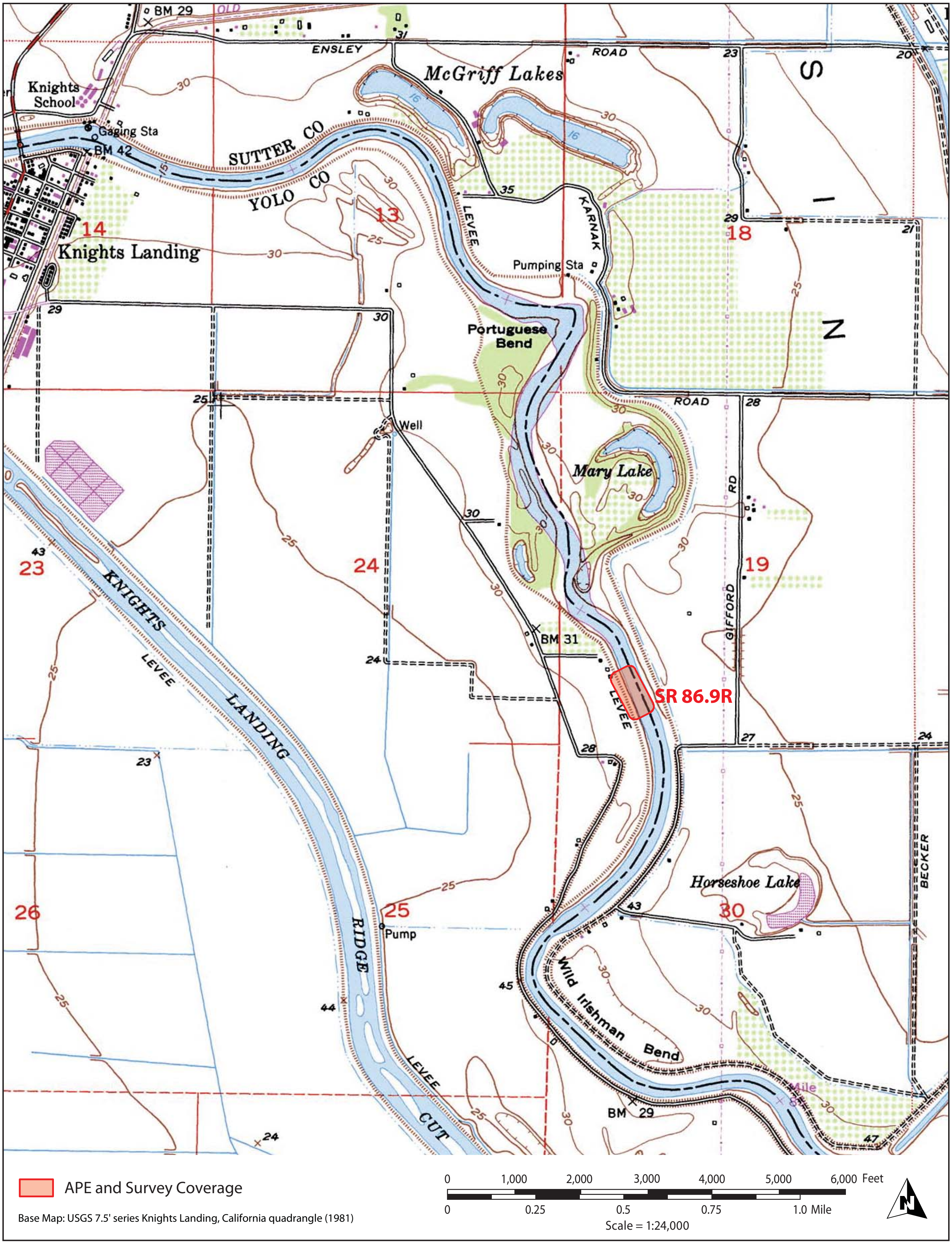
Figure 2-26
SR 77.7R Survey Coverage



Graphics ... 00627.08 7B4 (1-11)

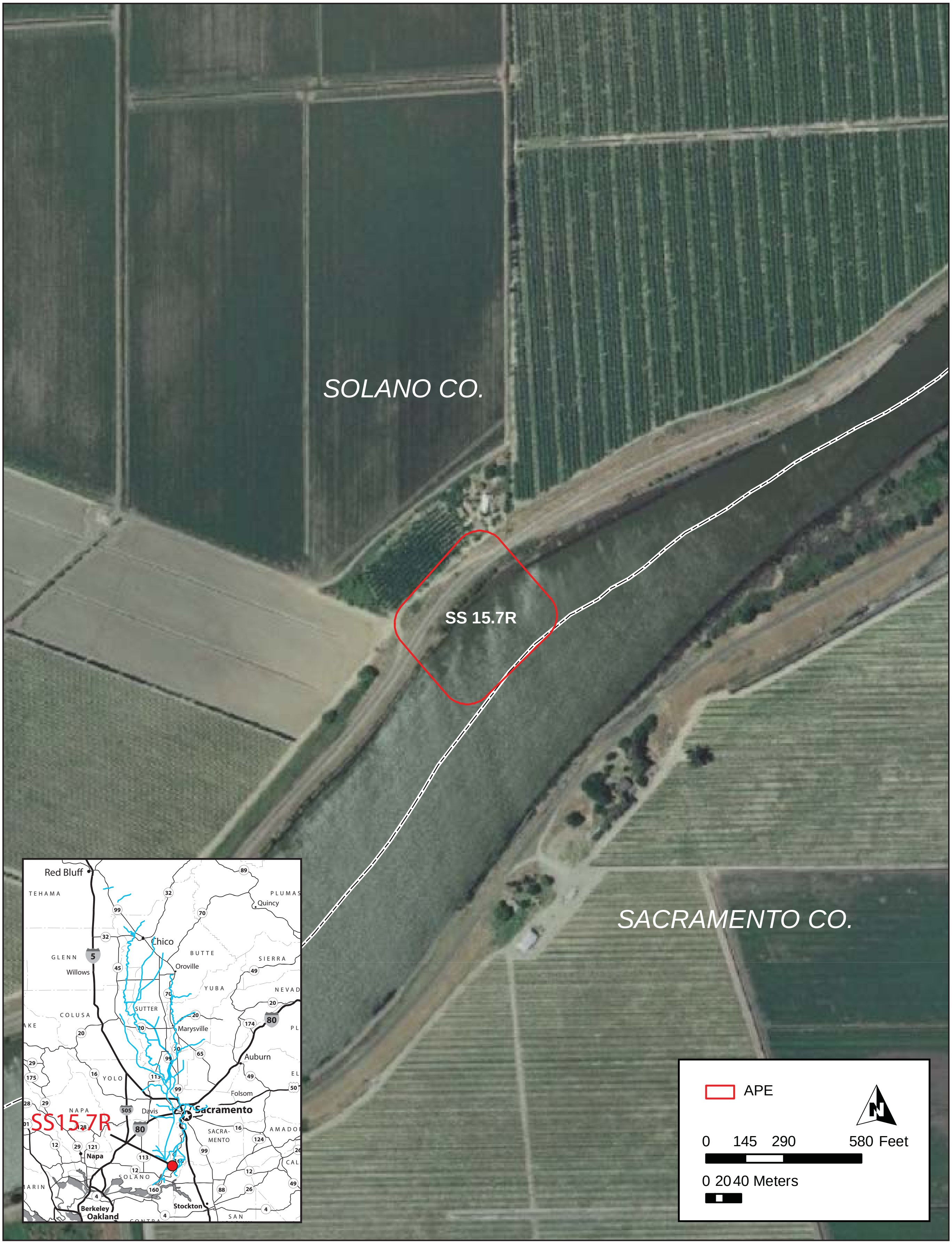
ICF INTERNATIONAL

Figure 2-27
SR 86.9R Area of Potential Effects



ICF INTERNATIONAL

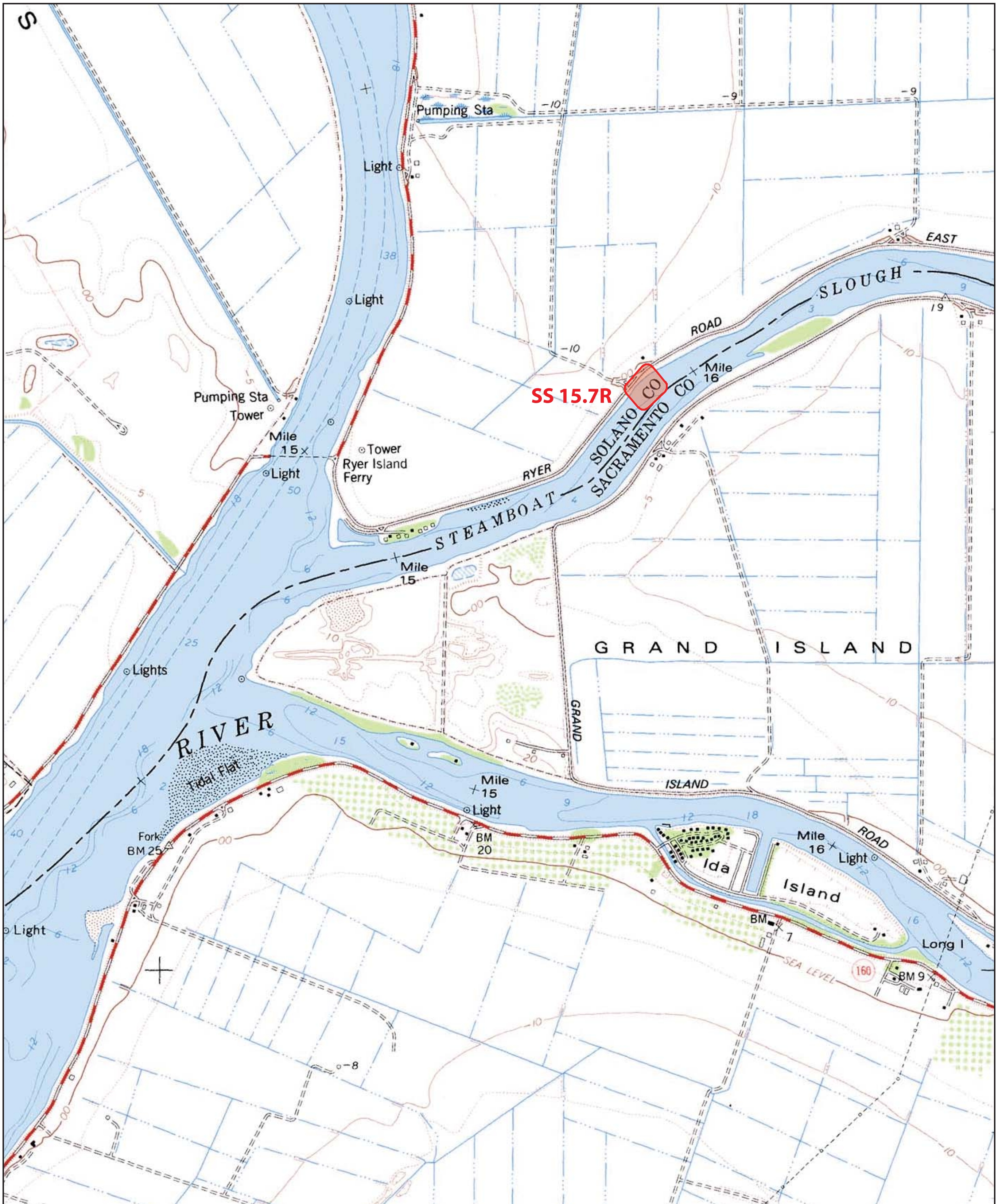
Figure 2-28
SR 86.9R Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

Figure 2-29
SS 15.7R Area of Potential Effects



APE and Survey Coverage

Base Map: USGS 7.5' series Rio Vista, California quadrangle (1978)

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

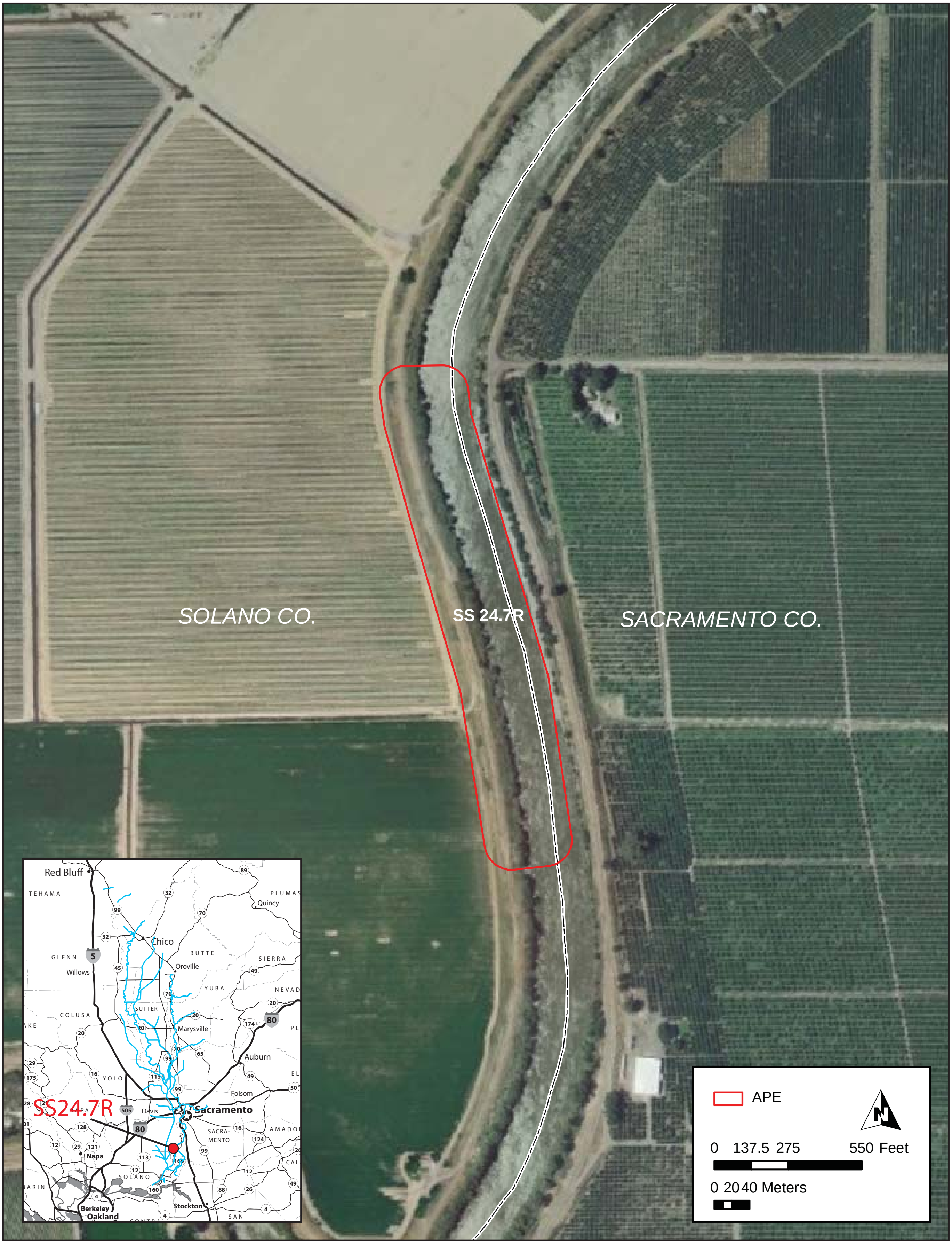
0 0.25 0.5 0.75 1.0 Mile

Scale = 1:24,000

Graphics ... 00627.08 7B4 (1-11)

ICF INTERNATIONAL

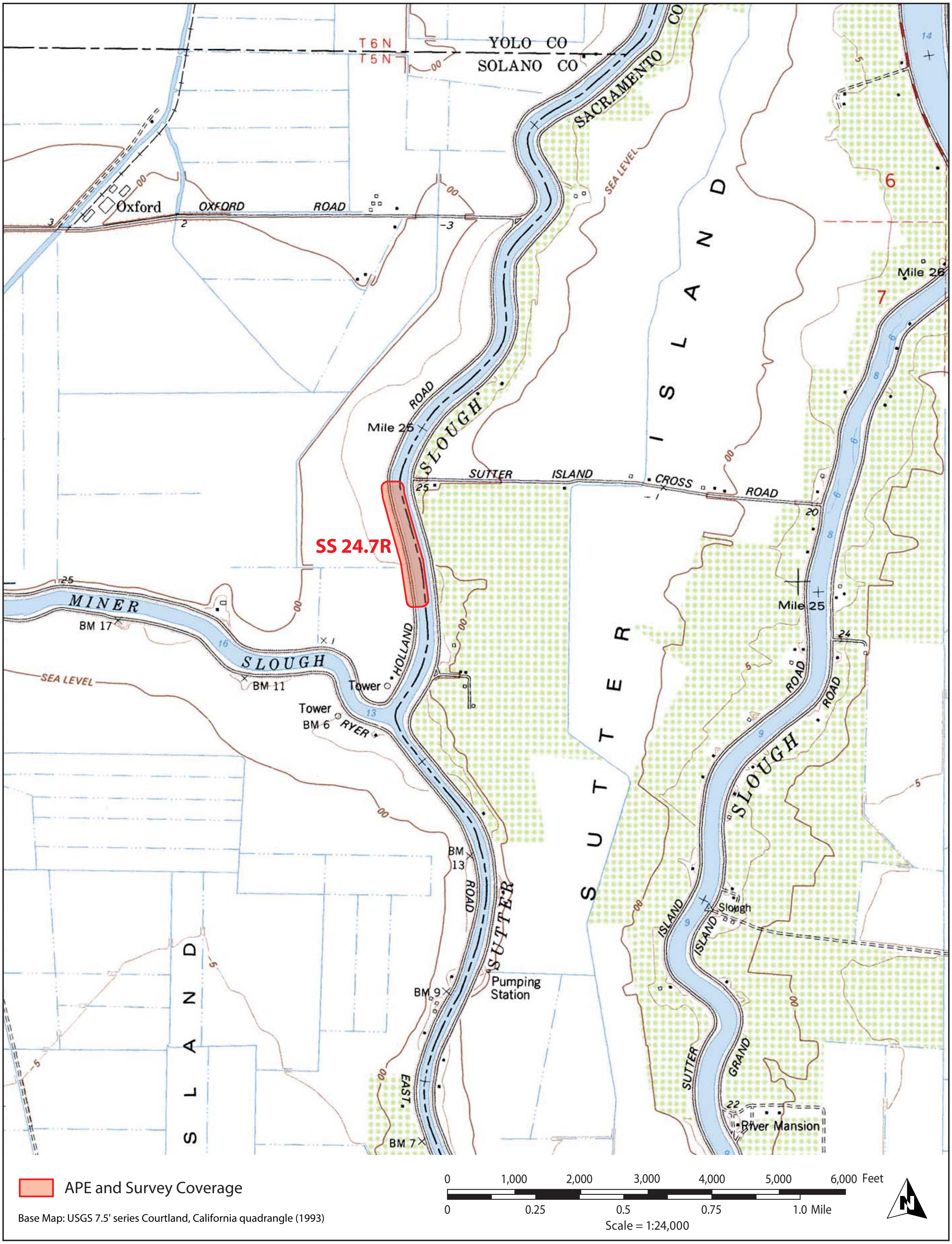
Figure 2-30
SS 15.7R Survey Coverage



Graphics ... 00627.08 784 (1-11)

ICF INTERNATIONAL

Figure 2-31
SS 24.7R Area of Potential Effects



ICF INTERNATIONAL

Figure 2-32
SS 24.7R Survey Coverage

SR 11.2L

This APE is located on the east side of the Sacramento River in Sacramento and Solano Counties (Figure 2-22). SR 160 traverses north–south across the APE. A total of 41% (2.08 ac) of the APE was subjected to survey. The area east of the highway is farmland with excellent visibility (80–100%), while the area of the APE along the riverbank was covered in dense vegetation that obscured the ground surface (0–40%).

SR 172.0L

This APE is located east of the Sacramento River in Glenn County (Figure 2-23). Roads in the vicinity consist of unnamed farm and levee access roads. No access constraints were encountered; as a result, 100% (13.73 ac) of the APE was subjected to survey. Visibility was generally poor (0–40%) because low-lying grasses obscured the ground surface. Boot scrapes were performed every 10 m to better inspect the ground surface.

SR 23.2L

This APE is located on the east side of the Sacramento River in Sacramento County directly adjacent to Isleton Road (Figure 2-24). In total, 79% (2.68 ac) of the APE was subjected to survey. Visibility was generally good (50–80%), with the exception of several patches of dense, impenetrable vegetation along the riverbank.

SR 25.2L

This APE is located on the south side of the Sacramento River in Sacramento County directly adjacent to Isleton Road (Figure 2-25). In total, 74% (.70 ac) of the APE was subjected to survey. Visibility was generally good (50–80%), with the exception of several patches of dense, impenetrable vegetation along the riverbank.

SR 38.5R

This APE is located on the west side of the Sacramento River in Yolo County directly adjacent to South River Road (Figure 2-26). No access constraints were encountered; as a result, 100% (1.61 ac) of the APE was subjected to survey. Visibility was generally good (50–80%), with little vegetation aside from some sparse patches of grass.

SR 56.5R

This APE is located on the west side of the Sacramento River in Yolo County directly adjacent to South River Road (Figure 2-27). In total, 91% (1.76 ac) of the APE was subjected to survey. Visibility was generally poor (0–40%), with dense, impenetrable vegetation covering most of the APE. Several homeless camps were observed and avoided for safety reasons.

SR 56.6L

This APE is located on the east side of the Sacramento River in Sacramento County directly adjacent to a City of Sacramento bicycle path (Figure 2-28). Access to the path was gained from nearby Miller Park. No access constraints were encountered; as a result, 100% (1.40 ac) of the APE was subjected to survey. Visibility was generally good (50–80%), with little vegetation obscuring the ground surface.

SR 77.7R

This APE is located on the west side of the Sacramento River in Yolo County directly adjacent to South River Road (Figure 2-29). No access constraints were encountered; as a result, 100% (1.46 ac) of the APE was subjected to survey. Visibility was generally poor (0–40%), with dense vegetation obscuring the ground surface. Boot scrapes were conducted every 10 m where possible to more closely inspect the ground surface.

SR 86.9R

This APE is located on the west side of the Sacramento River in Yolo County directly east of County Road 116B (Figure 2-30). In total, 56% (3.36 ac) of the Undertaking APE was subjected to survey. Visibility was generally good (50–80%), with the exception of a few dense, impenetrable thickets of vegetation adjacent to the riverbank. Records search maps indicate that cultural resource P-57-132, a valley oak grove, extends into the Undertaking APE. During the survey, no valley oaks were noted in the Undertaking APE.

SS 15.7R

This APE is located on the west side of Steamboat Slough in Solano County (Figure 2-31). Ryer Road East trends northwest–southeast through the APE. No access constraints were encountered; as a result, 100% (.66 ac) of the APE was subjected to survey. Visibility was generally poor (0–40%), with dense grasses obscuring the ground surface on the water side of the levee. Visibility was good (50–80%), on the land side of the levee, although an electric fence prevented the survey crew from entering a small area (less than 0.01 ac) in a vineyard. Boot scrapes were conducted every 10 m on the water side of the levee to more closely inspect the ground surface.

SS 24.7R

This APE is located on the west side of Steamboat Slough in Solano County. Holland Road trends north–south through the APE (Figure 2-32). No access constraints were encountered; as a result, 100% (9.79 ac) of the APE was subjected to survey. Visibility was generally poor (0–40%), with dense grasses obscuring the ground surface on the water side of the levee. Because the land side of the levee is agricultural fields, visibility was good (50–80%). Boot scrapes were conducted every 10 m on the water side of the levee to more closely inspect the ground surface.

Recommendations

APEs that have not been subject to 100% pedestrian survey will need to be surveyed accordingly before repairs can take place in any of the APEs. Additionally, areas within SR 11.2L, SR 56.5R, SR 77.7R, SR172.0L, SS 15.7R, SS 24.7R that were covered in dense vegetation should be resurveyed after vegetation removal or monitored during ground disturbing activities as part of construction. If any of the APEs are expanded or altered to include areas not surveyed for this study, additional survey will be necessary before any ground-disturbing activities can take place.

Submerged Resources Study

Panamerican, of Memphis, Tennessee, was hired to conduct a remote sensing survey within selected portions of the study area to identify submerged cultural resources (Panamerican Consultants 2010). Panamerican also conducted 5 days of diving investigations to assess potentially NRHP-eligible resources located during the survey. Areas selected for survey were chosen based on three criteria: potential for locating cultural resources, number of identified levee repair locations in the area, and the goal of gathering data from a variety of location types. Areas with high potential for locating cultural resources were selected as a result of historic shipwreck data obtained during prefield research. This documentation included information from the CHRIS, the California State Lands Commission Shipwreck Database, GLO maps, and newspaper articles. Areas chosen for survey included Knights Landing, the mouth of the American River, northern Sacramento, the Old Sacramento waterfront, southern Sacramento, Hood/Courtland, Walnut Grove/Locke, Isleton, Steamboat Slough/Grand Island, Rio Vista, and Cache Slough (Figures 2-33 through 2-42—see Appendix B). This study was conducted between September 22 and October 29, 2009.

Methods

The remote sensing phase of the study relied on a combination of data collection devices used in concert to identify anomalies below the water surface. Devices used included a magnetometer, sidescan sonar, a personal computer, and a differential global positioning system (GPS). Used together, these instruments provided a real-time image of the river bottom on the onboard computer screen.

The survey was conducted on an open-bow skiff with a portable generator providing power to the equipment. Transects no wider than 50 ft were used to ensure 100% coverage of the areas subjected to survey. The 50 ft swaths were guided by pre-plotted track lines displayed on the computer in combination with real-time locational data provided by the GPS. The speed of the survey vessel was maintained at 3 to 4 knots to ensure the uniform acquisition of data along each transect.

Once collected, the data were processed and analyzed with an array of software packages designed to display, edit, manipulate, map, and compare the results. Anomaly characteristics were assessed to determine whether they were shipwrecks.

The second phase of the study consisted of dive investigations of selected targets (i.e., potential resources). Magnetic anomalies, sidescan targets, and visual targets identified during analysis were prioritized based on their potential to be cultural resources. Diving was conducted from a pontoon boat manned by a three-person crew. Dry suits were worn by the divers, and surface-supplied air was chosen as the safest method for the investigation. Targets were inspected to verify vessel type, assess integrity, and locate any features that would aid in identification and evaluation.

Results

Targets Identified and Recommended for Further Study

As a result of the survey, 383 magnetic anomalies, 110 sidescan sonar targets, and 30 visual targets (resources visible without aid of instrumentation) were identified. However, in a number of cases it was determined that the same target was captured through multiple recording methods. Specifically, 28 targets were identified both as magnetic anomaly and sidescan sonar targets. Of these 28, 11 were also identified as visual targets. In addition, three magnetic anomaly targets were also identified visually. A total of 428 targets were identified.

Based on data analysis and comparison with observed objects in the survey areas, only 73 of the total 428 identified targets were recommended for further study. These 73 targets are identified as Dive Targets (D001–D073) in Table 2-2 and in Figures 2-33 through 2-42 (see Appendix B). Table 2-2 also presents the target's nomenclature according to its original method of identification (anomaly, sonar, visual, or previously recorded), as well as the figures (2-33 through 2-42) in which it is depicted. Because some targets appear coincident with each other, the UTMs are provided in the table to aid future relocation efforts. More detailed information about the methods and results of the submerged survey can be found in Panamerican Consultants (2010).

Diver Investigated Targets

Five targets were selected for dive investigation (Table 2-3). The diving phase encompassed 5 days. Magnetic anomalies, sidescan, and visual targets identified during the analysis were prioritized to select the targets to be investigated. Logistics limited the diving phase to assessing only one target per day. These targets and their NRHP eligibility recommendations are described in Table 2-3.

Table 2-3. Diver-Investigated Targets

Target	Water Depth (ft)	Description	NRHP Eligible?
D001	0–15	Mid-twentieth-century wooden vessel, 25 ft long	No
D002	0–6	Large-scantling wooden sailing vessel, 200+ ft long	Yes
D003	0–6	Two flat-bottomed hulls; probably river barges	Yes
D004	30	Steamboat hull, 200+ ft long	Yes
D005	12	Sunken floating dock	No

Discussion of Eligibility

Each of these five targets was evaluated against the NRHP and CRHR criteria. As a result, three of the five resources are recommended as eligible for listing on the NRHP and CRHR. Specific evaluations and applicable criteria are as follows.

D001

This dive target represents a mid-twentieth-century wooden sailing vessel. There are many vessels of similar form, size, and age in the Delta. Given the fragmentary condition of the vessel, it does not possess the level of integrity or data potential required to meet NRHP or CRHR eligibility. The vessel does not meet any of the criteria of the NRHP or CRHR and further investigation is not recommended.

D002

This dive target represents the remains of a wooden sailing ship of considerable size. The structural remains suggest it was at least 200 ft long. Sailing vessels of this size played an important role in the history of California from the Gold Rush to the opening of the Panama Canal in 1914. Until 1914, goods from the eastern United States had to be transported overland or around Cape Horn. From the speedy clippers of the mid-nineteenth century to the larger-capacity downeasters, such sailing vessels carried most of the goods to the West Coast. By the late nineteenth century, the fast clippers, which sacrificed cargo capacity for speed, gave way to the slower but larger and stouter downeasters. Built primarily in New England, these tough vessels were the workhorses of trade until the opening of the canal. Although undoubtedly not the only vessels to make the journey around Cape Horn, they were the predominant vessel for transport. Given the relatively large size of D002, it likely represents a downeaster, a vessel type that is significant in California history. The vessel represented by D002 appears eligible for NRHP and CRHR status under Criteria C and 3 because it is representative of a distinct type of vessel, and Criteria D and 4 because it is likely to yield information important to the history of the Delta.

D003

This dive target represents two flat-bottomed river vessels. They are likely the remains of large produce barges commonly in use from the late nineteenth to the mid-twentieth century in the Delta. These types of vessels are understudied. They exhibit distinctive characteristics associated with that type of vessel. As distinctive representatives of an understudied vessel type, these are likely to yield information important in California history and are therefore eligible for NRHP and CRHR status under Criteria C and 3 and Criteria D and 4.

D004

This dive target represents a large, flat-bottomed river vessel. The construction details noted, including stern-wheel support framing and hull morphology, strongly suggest it is the hull of a stern-wheel steamboat. Steamboats are a vessel type that played a significant role in the history of the Delta, and D004 represents one of the better-preserved archaeological examples. Its archaeological and historical value lies in the completeness of the hull, which is apparently intact up to the main deck, and would allow a detailed examination of construction techniques and wood types used in construction of steamboats in the Delta. As such, it is eligible for NRHP and CRHR status under Criteria C and 3 in that it "embodies the distinctive characteristics of a type, period, or method of construction," and under Criteria D and 4 in that it is likely to yield information important in history.

D005

This dive target represents a sunken section of a wooden dock. It is not eligible for NRHP or CRHR status under any criteria.

Recommendations

Resources Recommended Not Eligible

Initial analysis of the data collected during dive investigations indicates that two of the five resources examined appear to be not eligible for NRHP or CRHR status. As a result, no further actions are necessary.

Potentially Significant Resources

Because future locations of bank repair and stabilization are unknown, it is not known whether any of these potentially significant cultural resources will be adversely affected by Undertaking activities. If the potentially significant sites (Table 2-3) will be affected and cannot be avoided, it is recommended that the sites be further investigated to determine whether they meet NRHP and CRHR eligibility.

Resources Recommended Eligible

Initial analysis of the data collected during dive investigations indicates that three of the five sites examined appear eligible for NRHP and CRHR status. It is recommended that any bank stabilization activities avoid these three resources. If avoidance is not feasible, adverse effects on the resources must be resolved in compliance with Section 106. The most common resolution would include extensive historic background research and thorough documentation and recordation of each site with photography, video, and measured drawings.

Unsurveyed Areas

It is also recommended, with regard to future levee repair sites, that additional Phase I remote-sensing surveys, including a complete remote-sensing survey and data analysis of the remaining portions of the Sacramento River and its tributaries involved in the Undertaking, are done. Although the current survey was extensive, not all potential repair areas were surveyed, necessitating their survey before any future repair work. It is recommended that a comprehensive remote-sensing survey of the affected portions of the Sacramento River and its tributaries be conducted in unsurveyed areas before further levee repairs. A comprehensive remote-sensing survey would create a database of potential cultural resources that could be consulted before repair work, and it would also eliminate the cost of numerous small surveys.

Curation

USACE will ensure that the materials and records resulting from the activities in this document are curated in accordance with 36 CFR 79, except as required by state law and regulation, including but not limited to PRC 5097.98 and 5097.991 for Native American human remains and associated grave goods on non-federal land, or as required by other provisions of law (Stipulation X.A.3 of the Undertaking PA). Additionally, the disposition of abandoned shipwrecks and archaeological sites and historic resources on state lands under the jurisdiction of the SLC shall be determined by the SLC as provided by PRC Section 6313. USACE will ensure that, to the extent permitted by applicable law and regulation, the views of the Native American descendant group(s) are taken into consideration when decisions are made about the disposition of other Native American archaeological materials and records.

Native American Outreach

The objective of the Native American outreach and consultation process component of the Undertaking is to identify Native American groups or individuals that may have interests or concerns about sensitive sites or areas or archaeological investigations associated with implementation of the Undertaking. This outreach effort was led by Helen McCarthy with assistance from USACE and ICF. The effort is considered a preliminary step that will facilitate effective future consultation required under Section 106 and California state law concerning the identification and treatment of Native American burials. The general strategy for the outreach program consisted of several phases. The first was to identify all Native American groups that might have interests or concerns in the Undertaking Area. The second was to inform these groups by letter of the Undertaking and invite them to attend an informational meeting where more detailed data could be exchanged. Lastly, interested Native American groups would be invited to participate in Section 106 consultation throughout the project.

Identification of Contacts

A major effort was made to identify all the appropriate federally recognized tribes, as well as other Native American entities and individuals who might be considered interested parties. The list of tribal contacts for the Undertaking was developed based on two official listings for Indian Tribes and other Native American entities: 1) the Native American Heritage Commission (NAHC) list; and 2) the Field Directory of the California Indian Community (Housing Directory) produced by the California Indian Assistance Program, Department of Housing and Community Development (HCD), State of California.

The NAHC list includes federally recognized tribes and non-federally recognized Native American organizations and individuals who have documented their interest in cultural resources management within California. The main purpose of this list is to assist agencies and other development groups to contact the appropriate Native American parties in order to comply with state and federal cultural resource protection laws as required—for example, Section 106 of the NHPA. This compilation is organized by county and is obtained by request by the project agency or by the cultural resources firm engaged to perform the required investigation. The Housing Directory complements the NAHC list: it lists all federally recognized tribes as well as all unrecognized tribes that are petitioning for recognition. This latter group is referred to as California State recognized Tribes. In addition, the Housing Directory lists other Native American entities that are organized for health or educational purposes. Taken together, these two databases provide excellent coverage of Native American tribes and entities across the state and for the Undertaking Area.

The process for developing the list of Native Americans to contact for the Undertaking Area began on May 4, 2009, when ICF requested that the NAHC search its Sacred Lands File for the presence of cultural resources in the Undertaking APE that are of interest to Native Americans and to provide a list of local Native American representatives who might have any information or concerns regarding the Undertaking. On May 12, 2009, the NAHC responded with a list of 39 Native American representatives and indicated that the search of the Sacred Lands File identified four sacred properties in the vicinity of the Undertaking Area: CA-YUB-751, CA-TEH-34, CA-TEH-1332/42, and CA-COL-55. This list was then augmented by the most current Housing Directory list, obtained by Helen McCarthy, in July 2009.

Caltrans Native American Studies Branch Chief Tina Biorn, who keeps updated information for Native American contacts throughout the state for consultation purposes, was then contacted. She provided current addresses and phone numbers for several individuals. In October 2009, Janis Offerman, DWR archaeologist, was also consulted to check the accuracy and inclusiveness of the list. Finally, the list was compared with the Stewardship Council lists, which have been prepared for extensive Native American consultations for the Pacific Gas & Electric Company. The resulting list (Appendix C) was presented to USACE on November 10, 2009.

Outreach Efforts

An informational letter was prepared to notify Native American groups on the list about the Undertaking. The letter included a brief project description and preliminary information about two workshops to be held for Native Americans interested in consulting during the planning of the Undertaking. USACE finalized the letter and sent it out to all recipients via mail, fax, and email on December 18, 2009.

USACE conducted a meeting on January 14, 2010, with USACE Sacramento District Tribal Liaison Officer Mark Gilfillan. In this meeting, Mr. Gilfillan outlined USACE consultation policies and answered questions from the Sacramento Bank Cultural Resources Working Group. He stressed government-to-government consultations that recognized tribal sovereignty with open, transparent, and respectful discussions of the Undertaking before any decision making. He emphasized due diligence in contacting and informing groups about what will be involved with the Undertaking. He was affirmative that the team should work with both recognized and unrecognized groups.

From February 2 to February 5, 2010, USACE and ICF staff sent second letters via mail, fax, and email to all the potentially interested groups, informing them of the dates and locations of two workshops. The groups were notified about both meetings so they could choose which one would be more convenient for them to attend. The first meeting was planned for Saturday, February 27, 2010, in Sacramento, and the second was scheduled for Saturday, March 6, 2010, in Chico.

These workshops were organized to provide attendees with detailed information, including maps that identify the locations where levee repair work may occur. Representatives from three recognized tribes attended the meeting in Sacramento on February 27: Phoebe Bender from Yocha Dehe Wintu (Rumsey), Jeffery Flores from Cortina, and Oscar Serrano from the Colusa Indian Community. They were all attentive to the prepared presentation. Also, USACE Native American Coordinator Ed Ketchum provided the group with useful information regarding the ways in which Native American groups could participate in the Undertaking and how USACE could address their concerns. A productive discussion followed covering topics ranging from construction to monitoring. It seemed clear that these representatives had integrated the information that USACE and ICF had provided, and that these three tribes would be ready to participate in consultation over the next phases of the Undertaking. Although much interest was expressed, no Native American representatives attended the Chico workshop.

A follow-up letter was sent by USACE on June 10, 2010, to all Native American groups and individuals on the list. The letter recapped information provided at the February 27 workshop, and informed them that a PA would be available for review by the end of 2010 and an EIS by the beginning of 2011. USACE indicated that all Native American groups were invited to review and comment on both documents. The letter also encouraged all groups to participate in consultation throughout the planning process.

Several groups have since responded requesting further information. Ren Reynolds of the Enterprise Rancheria, responded with a request for meeting minutes. Billie Blue of the Ione Band of Miwok Indians and Debbie Grimes of the Calaveras Band of Miwok Indians requested further information. Mike Despain of the Mechoopda Indian Tribe expressed interest in the project and requested current maps, which were provided to him in a follow up letter from USACE. The United Auburn Indian Community requested further information and USACE met with them on January 28, 2011, inviting them to participate in the consultation process. USACE has also met with the Yocha Dehe Wintun Nation on December 2, 2010, and Shingle Springs Band of Miwok Indians on February

11, 2011, inviting their participation in the consultation process. To date, no further responses have been received. Samples of initial Native American correspondence are provided in Appendix C.

Levee Evaluation Process

Methods

The strategy proposed for the evaluation of levees is intended to guide future inventories while allowing flexibility in terms of approach and context as the Undertaking and specific geographic locale dictates. A Multiple Property approach is proposed for evaluating the levee system. This approach is a method for documenting, as a group, historic properties (buildings, structures, sites, objects, or districts) related by theme, general geographic area, and period of time. This approach establishes the eligibility requirements for properties that may be evaluated in future projects. With a Multiple Property approach, the historic context and eligibility requirements are established and approved, providing for a streamlined subsequent process. It also facilitates the evaluation of individual properties by comparing them to others that share similar physical characteristics and historical associations.

A Multiple Property approach is often based on previous surveys or inventories of historic properties. In the case of the Undertaking, the advantage of this approach is that it provides a cover document that can be used as the basis for evaluating the levee system. The document can be modified and added to as necessary, including additional contexts and property types. This approach provides the analytical framework needed to evaluate the levee system and allows for a phased approach, which is necessary given the expansive area in which the levee system occurs and the long-term nature of the Undertaking's potential effects on it.

The Multiple Property approach has been used most recently and relevantly by the Bureau of Reclamation to record and evaluate properties and structures associated with the Central Valley Project (CVP; Bailey 2007). A similar tactic was undertaken by the USACE Fort Worth District for evaluating the Dallas Floodway (U.S. Army Corps of Engineers 2009b). The components for completing the Multiple Property approach are outlined below.

Establish Historic Contexts

The *historic context* is defined as the means for organizing and interpreting history by grouping information about historic properties that share a common theme, geographic location, and time period (National Park Service 1997: Appendix IV, 2). Developing the appropriate historic context(s) is not only critical in determining the significance of the levee system and its associated property types, but also in determining those aspects of integrity necessary to convey that significance. With the Multiple Property approach, the context need not be narrowly defined; in fact, it is necessary that the context be broad enough to not impede future honing of contexts for specific segments of the resource (National Park Service 1999:11).

The length of the levee system is extensive, and organizing the context thematically provides an opportunity to learn more about different types of resources prevalent within the Undertaking Area. Although the overall purpose of the levee system is flood control, different political and economic drivers can be identified within the regions to document why, when, and who constructed the levees. Within these different themes, there may also be different levels of significance (city/county, region, state, or national) associated with the historic context.

The historic context also determines the period of significance for the levee system and associated property types. The period of significance reflects the length of time the historic property was directly associated with the event, activities, or persons, or attained the characteristics for which it is significant (National Park Service 1997:42). A period of significance for historic properties associated with events in history, associated with historically significant persons, or that have the potential to yield important information may have a period of significance that spans several years. For properties that are significant for their architectural or engineering qualities, the period of significance may be the date of construction.

Identify Property Types

Appropriate property types associated with the historic context are also identified as part of the Multiple Property approach. For the NRHP, a property type is defined as a "grouping of properties defined by common physical and associative attributes" (National Park Service 1997:53). These properties can include buildings, structures, objects, sites, districts, or a combination thereof. The property types link the context to the resource(s) and are identified through survey. Cultural resources specialists have previously identified archaeological resources within the vicinity of the Sacramento River. However, it is also important to look at the levees and their associated property types as resources. The levees were not constructed as a single system; they have evolved into a system within the historic context of flood control on local, state, and national levels. An important step in this identification process is a physical survey of the levee system to document the existing condition, dates of construction, and alterations. A survey provides a baseline against which future evaluations can be measured.

Part of establishing the appropriate property type is identifying the character-defining features of the levee system and its associated property types. For the levees, such features might include the levee's slope, crown, hinge point, height, width, and pyramidal shape.

Eligibility Requirements

Requirements for evaluation are determined based on the historic context and in relation to the associated property types. The NRHP uses four criteria for determining eligibility, as does the CRHR. To be eligible, a property must meet one of the following criteria:

- **Criterion A (CRHR Criterion 1).** The property must be associated with events that have made a significant contribution to the broad patterns of history.
- **Criterion B (CRHR Criterion 2).** The property must be associated with the lives of persons significant in our past.
- **Criterion C (CRHR Criterion 3).** The property must embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual affiliation.
- **Criterion D (CRHR Criterion 4).** The property must have yielded, or may yield important information in prehistory or history.

It is only necessary to meet one of the NRHP criteria, but it is possible to meet more than one criterion and fall within one or more historic contexts. Engineering features such as levees are typically eligible under Criteria A and C. However, Criterion D may also be a factor for a property type such as a levee because of the property's potential to yield information.

To be eligible for the NRHP, the levee system not only needs to meet at least one of the criteria, but it also must retain integrity. It is not necessary to retain all seven aspects of integrity, but enough integrity is needed to convey significance to the period in which the levee achieved its significance. Over the course of its existence, the levee system has been maintained to keep it functioning as it was intended. Therefore, modifications may have resulted in a loss of integrity. Other associated property types that have been altered or modified may also have lost integrity.

To retain integrity, the levee system will need to minimally retain the important elements of its location, design, materials, and setting. Feeling and association may also be important in assessing integrity, but retaining only feeling and association would not be considered sufficient integrity for NRHP eligibility. Understanding the necessary aspects of integrity needed will relate to the historic context and retention of the property's character-defining features. Issues to consider when assessing integrity of the levee system will be whether the levee system appears as it did historically, which can be determined through archival research. Integrity cannot be assessed before significance is determined because understanding why, where, and when the levee system is important is necessary to decide which aspects of integrity convey its importance.

During the course of evaluating the eligibility of the levee system, it will be important to note the presence of any possible cultural landscape components. A *cultural landscape* is defined as "a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein), associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values" (Birnbaum 1994:4). Cultural landscapes are usually classified as districts or sites; to be eligible, they must still meet one of the four NRHP criteria and retain integrity. A cultural landscape consists of more than one feature; therefore, the levee system will be difficult to address as a cultural landscape without including all other resources that might contribute as features to the landscape. When evaluating a potential cultural landscape with respect to the levee system, the physical arrangement and spatial relationships between the levees and their related landscape components need to be considered as part of the whole levee system.

Chapter 3
Context

The Undertaking Area is located in the central and northern portions of the Sacramento Valley within California's Great Valley geomorphic province, as well as small portions of the southern Cascade Range and Sierra Nevada foothills (California Geological Survey 2002). The Great Valley of California, also called the Central Valley, is a nearly flat alluvial plain extending from the Tehachapi Mountains in the south to the Klamath Mountains in the north and from the Sierra Nevada on the east to the Coast Ranges on the west. The valley is about 450 mi long and has an average width of about 50 mi. Elevations of the alluvial plain are generally just a few hundred feet above mean sea level (MSL), with extremes ranging from a few feet below MSL to about 1,000 ft above MSL (Hackel 1966).

The Sacramento Valley contains thousands of feet of accumulated fluvial, overbank, and fan deposits resulting from erosion of these surrounding ranges. The sediments vary from a thin veneer at the edges of the valley to 50,000 ft in the west-central portion and are estimated to be about 8,000 ft thick in the Undertaking Area (Northwest Hydraulic Consultants 2007).

The Sacramento River is the main drainage of the region, flowing generally south from the Klamath Mountains to its discharge point into Suisun Bay in the San Francisco Bay Area. Other prominent watercourses in the Undertaking Area are the American, Bear, Feather, and Yuba rivers; a comprehensive list of watercourses in the Undertaking Area is presented in Table 1-1. Many of the watercourses in the Undertaking Area have been confined by human-made levees since the turn of the twentieth century. In the Undertaking Area, these levees generally were constructed on Holocene Epoch (less than 11,000 years old) alluvial and fluvial sediments deposited by the current and historical Sacramento River and its tributaries (Kleinfelder 2007).

Environmental Context

The natural environments in which human societies are situated profoundly affect the character of those societies. Soil development, seismic activity, climate, weather, hydrology, topography, and local biota interact in complex ways, forming the tableau on which human cultures write themselves. Settlement location and density, for instance, are constrained by factors such as topography and proximity to fresh water and other resources. Use of the landscape also depends on such phenomena as the seasonality of resources. Similarly, the archaeological record—the leavings of human-environment interactions—is effected by the same natural processes. Landslides, erosion, sedimentation, and vegetative cover all structure how archaeological materials are manifested on the present-day landscape, rendering some resources more visible than others, preserving some, and destroying others. The importance of the natural environment is by no means diminished by the advance of time and technology; flood control renders hydrology and geology as important as economic, political, and general social discourse, despite the enclosure of a great many rivers and streams within modern levees. The natural (and human-modified) environment, then, is of interest to cultural resources managers. To properly frame the representation of cultural resources in the Undertaking Area, therefore, discussions of regional geology, climate, flora, and fauna are presented below.

Regional Surface Geology

The Undertaking Area has been mapped by a number of geologists at a regional scale (Helley and Harwood 1985; Jennings 1977; Jennings and Strand 1960; Saucedo and Wagner 1992; Wagner and Bortugno 1982; Wagner et al. 1987). Jennings (1977), Jennings and Strand (1960), Saucedo and Wagner (1992), and Wagner et al. (1987) are compilation maps that reflect mapping by previous authors and accordingly portray geologic interpretations similar to Helley and Harwood (1985).

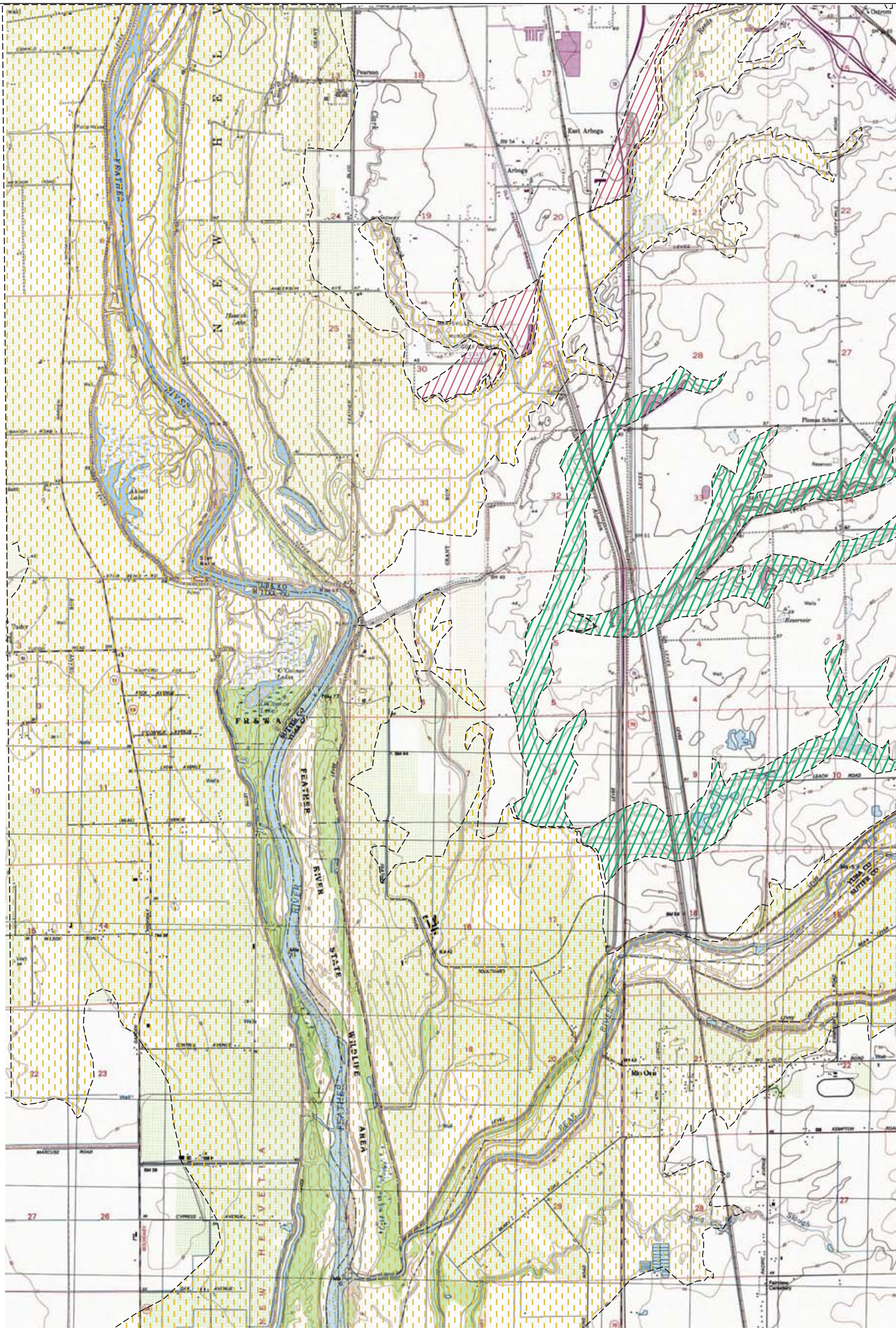
The current and historic floodplains are filled with Holocene and Pleistocene Epoch alluvial deposits. The Bear and Feather rivers and their associated watersheds were originally confined within broad natural levees that sloped away from the rivers. The natural levees formed through the deposition of alluvium during periods of flooding. As floodwaters lost energy, the coarser materials settled out close to the rivers, forming natural levees and sandbars in the vicinity of the river channel. The finer material was carried in suspension farther from the rivers and settled out in quiet water areas such as swales, abandoned meander channels, and lakes. However, because rivers meander and rework older, previously deposited sediments, extreme variations in sediment material may be found over a relatively short distance. Farther from the current floodplains are Pleistocene terrace deposits. The terrace deposits were ancient floodplains formed by streams that existed during the most recent period of alpine glaciation. These streams most likely had higher energy and greater transport capacity than the present-day streams, although they were located in a similar area.

Geological Overview of Region 2

In Region 2 of the Undertaking Area, the lower Bear and Feather rivers flow through levee and channel deposits (Wagner et al. 1987). Areas above the levee and channel deposits of the rivers are mapped as Holocene alluvium and the alluvium of the Modesto and Riverbank formations (Helley and Harwood 1985). The Holocene alluvium is composed of unweathered gravel, sand, and silt deposited by present-day streams. These deposits form natural levees along the Bear and Feather rivers. A representative cross-section that depicts the distribution of geologic formations in Region 2 is shown in Figure 3-1.Thickness varies from a few centimeters (cm) to 30 ft. The stream terrace deposits of the Modesto Formation are composed of Pleistocene alluvial gravel, sand, and silt and range in thickness from 0 ft to more than 360 ft (Helley and Harwood 1985). This unit forms the lowest deposits lying topographically above the Holocene levee and channel deposits. The Modesto Formation was deposited by streams still existing today because the deposits, for the most part, border existing streams (Helley and Harwood 1985).

Geological Overview of Regions 1a, 1b, and 3

The surface geology of Regions 1a, 1b, and 3 is dominated by Holocene and latest Pleistocene deposits. The most common deposits in the Undertaking Area are stream channel, basin, and alluvial deposits, and the Modesto and Riverbank Formations. The surface geology of most of the Undertaking Area can be characterized in terms of the lateral distribution of geological formations with respect to major streams like the Sacramento River. Quaternary Period (predominantly Holocene) stream channel deposits mark existing and former stream channels, flanked by Holocene alluvial deposits. Fine alluvial sediments (clay and silt) accumulate in basins as a result of overbank deposition beyond the alluvial fan deposits. With increasing distance from stream channels, the mantle of Holocene sediments becomes thinner, exposing the Pleistocene sediments of the Modesto



Legend

Geologic Units

- Quaternary Alluvium (Helly and Harwood 1985)
- Quaternary Alluvium
- Possible Quaternary Alluvium (Kleinfelder 2003)
- Qr Riverbank Formation

Source: Kleinfelder 2003.

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Figure 3-1
Geologic Formations, Region 2,
Feather-Bear River Confluence

and Riverbank formations. This suite of geologic formations is illustrated in Figure 3-2 and is illustrative of general patterns of geology and geomorphology in Regions 1, 1b, and 3.

Stream channel and alluvial deposits in Regions 1a, 1b, and 3 are essentially identical to those described for Region 2. Basin deposits occur in level areas of the Central Valley floor and generally consist of fine-grained, unconsolidated Holocene alluvium. Basin deposits are generally 3–6 ft thick near the valley perimeter and can be as thick as 180 ft in the valley center.

The lower member of the Modesto Formation occurs toward the valley margins and underlies most Holocene deposits in the Undertaking Area. The thickness of this member is poorly defined in the Undertaking Area, although it is known to be as thick as 59 ft in parts of the Sacramento Valley (Busacca et al. 1989). Similarly, the lower member of the Riverbank Formation occupies valley margins and low foothills. The formation dates to the Middle to Late Pleistocene and consists of semi-consolidated gravel, sand, and silt alluvium. It typically contains soils with a subsurface hardpan layer. Like the lower member of the Modesto Formation, the thickness of the Riverbank Formation is poorly defined in the Undertaking Area. However, Busacca et al. (1989) indicates that in other parts of the Sacramento River, the lower member of the Riverbank Formation has been described as having a maximum thickness of 30 ft.

Regional Geomorphology

In geologic history, the Sacramento River migrated frequently and freely within its meander belt, which typically exceeded several thousand feet in width (Buer 1984 in North State Resources and Stillwater Sciences 2009). Before Euroamerican settlement, the mainstem Sacramento River and its tributaries along the valley floor would naturally overtop their banks at regular cycles and flood the adjacent lands, replenishing wetlands and depositing sediments. Despite overbank deposition, these flood basins have maintained a low topographic profile, which suggests that they are subsiding at a rate equal to or greater than overbank deposition (Gilbert 1917; Water Engineering and Technology 1989 in North State Resources and Stillwater Sciences 2009). These floodplains have historically provided crucial fluvial geomorphic roles for the Sacramento River and other rivers and creeks in the Undertaking Area because the flow loss to the flood basins causes the Sacramento River to downsize in the downstream direction in its lower reaches (Water Engineering and Technology 1990, cited in North State Resources and Stillwater Sciences 2009).

Beginning in the late 1800s, the Sacramento River's channel morphology and sediment transport regime have been progressively altered by human activities, including the clearing of riparian vegetation and construction of levees and upstream dams for flood control and water supply. Bank armoring of the levees has resulted in lower sinuosity, fewer overbank flows, and an altered pattern of channel migration and meander cutoff (Brice 1977 in North State Resources and Stillwater Sciences 2009; Larsen et al. 1997, 2004 in North State Resources and Stillwater Sciences 2009; Larsen and Greco 2002). The present-day Sacramento River is a single-thread channel that transitions from a coarse gravel bed upstream into a sand-bedded channel (by about RM 128), with occasional outcrops of cemented alluvial deposits (such as the Modesto Terrace Formation) that historically provided natural constraints to lateral migration (North State Resources and Stillwater Sciences 2009).

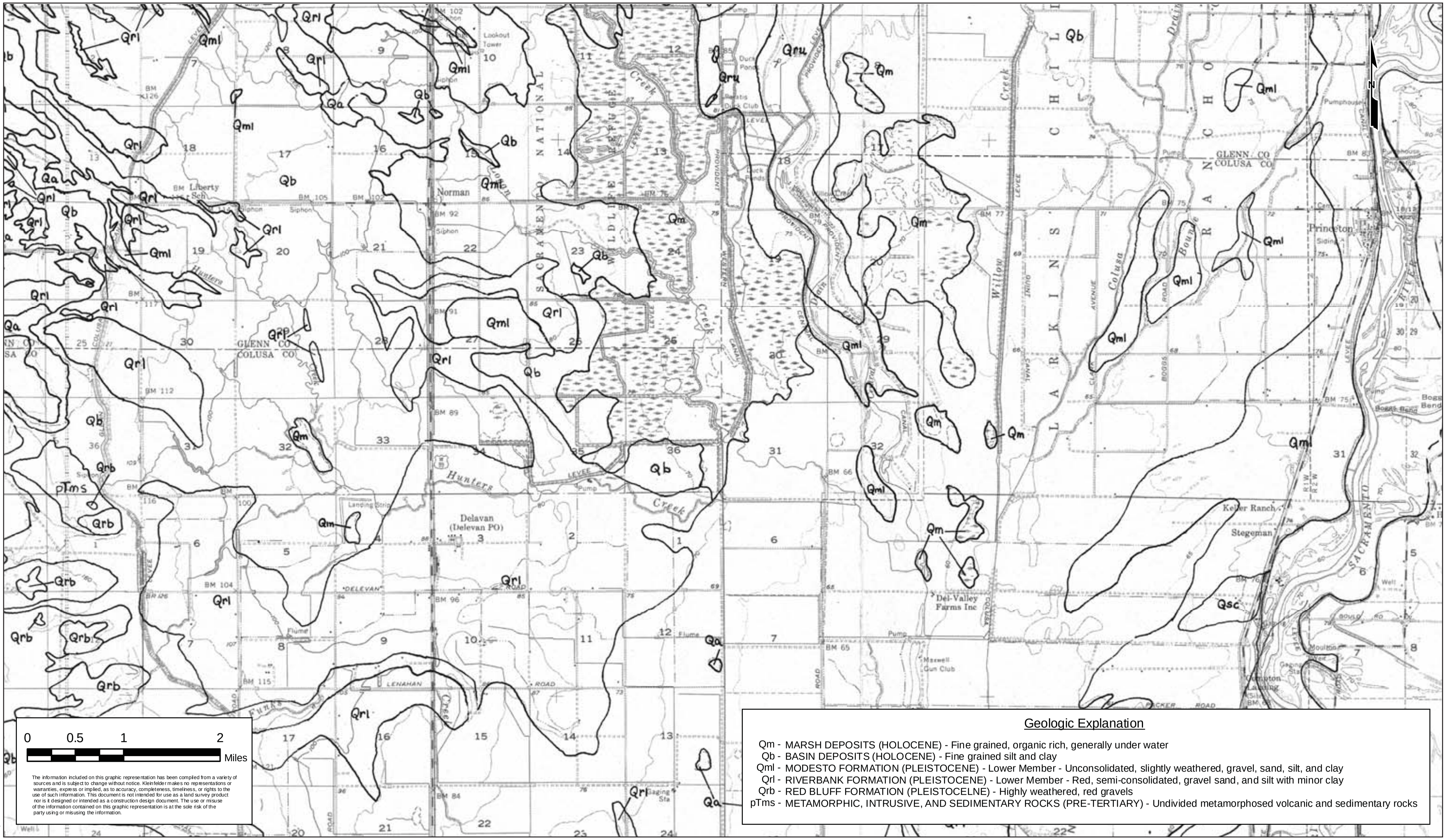
The modern Delta followed a different (though related) temporal trajectory from that of the Sacramento River. The present-day Delta is the most recent of several that formed during a sequence of depositional and erosional cycles in the Quaternary Period (1.6 million years ago to present) (Shlemon 1971; Shlemon and Begg 1975). These cycles resulted from fluctuations in climate and sea level related to the advance and retreat of glacial ice. The most current cycle is one of deposition, resulting from a rise in sea level following the height of the last (Tioga) glaciation approximately 20,000 years ago. A time when sea level was approximately 394 ft lower than today (Hickman 1993; U.S. Army Corps of Engineers 1974). As glacial ice retreated, sea level rose more rapidly at first, then slowed to a rate of about 0.4–0.8 in per year, a rate that has persisted from about 6,000 years ago to the present time (Atwater et al. 1977).

Unlike most deltas, the modern Delta formed during the Holocene (ca. 10,000 years ago to present) in an inland direction as rising sea levels intruded upstream and flooded a pre-Holocene valley, creating a broad tidal marsh. Rising sea levels gradually submerged the valley, creating anaerobic conditions that greatly reduced the rate of plant decomposition. The accumulation of decomposing plant material kept pace with rising sea levels over approximately 7,000 to 11,000 years resulted in the formation of thick peat deposits (Prokopovich 1988; Shlemon and Begg 1975) and permitted the formation of extensive tidal-marsh deposits during the Middle Holocene (7000–4000 before present [BP]) (Meyer and Rosenthal 2007). These deposits are currently the thickest in the west and central parts of the Delta (i.e., Suisun Marsh) and grade to thinner accumulations inland toward the Delta margins (California Department of Water Resources 1995).

As base levels increased in response to sea-level rise, the lower reaches of stream and river channels became choked with sediment that spilled onto the surface of existing fans and floodplains, forming large alluvial plains (Meyer and Rosenthal 2007:3). The Delta expanded in response to higher sea levels and the decomposition, compaction, and subsidence of inter-tidal deposits. As a result, many older land surfaces were covered by at least 6.6–9.8 ft of Holocene-age alluvial deposits. These older buried land surfaces usually are marked by well-developed soils that represent a significant stratigraphic boundary in the region, typically characterized by distinct A, B, and C horizons (Meyer and Rosenthal 2007:3, 6).

Climate

Climate is influential to human societies because it affects geology, hydrology, and distribution of food and plant resources. Geology and other sciences have long demonstrated that climate is characterized by change. One of the hallmark contributions of archaeology to the study of humankind is its deep-time view of human history and the context in which that history unfolded. Although very early climate changes and modern-day global warming are prominent in popular scientific press, the Holocene too was anything but static, and its fluctuations had attendant effects on human habitation of the Central Valley. Indeed, the Holocene environment of the region was characterized by a general warming trend that subsumed episodes of relatively cool climates. Most paleoclimatic reconstructions for the Central Valley are based on Antev's (1948, 1953, 1955) three-part global climatic sequence. The sequence spans the Holocene, consisting of the moderately cool/moist Anathermal (ca. 10,000–7500 BP), the warm and dry Altithermal (ca. 7500–4000 B.P.), and the Medithermal (ca. 4000 BP to present). Tree-ring growth chronologies from central-eastern California, glacial chronologies, and pollen cores generally corroborate Antevs' sequence, with the caveat that California's Holocene environment exhibited regional variation (Adam 1967; Birkeland et al. 1976; Birman 1964; Curry 1969, 1970; Moratto et al. 1978; Šercelj and Adam 1975; Tremaine 2008:62–67). Pollen diagrams from the Lake Tahoe and Yosemite areas indicate a vegetation shift that suggests a general increase in temperature from 9000 to 2900 BP, although six relatively cool and moist periods, each lasting 400–1,500 years, punctuated the general warm and dry trend



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Geologic Explanation

- Qm - MARSH DEPOSITS (HOLOCENE) - Fine grained, organic rich, generally under water
- Qb - BASIN DEPOSITS (HOLOCENE) - Fine grained silt and clay
- Qml - MODESTO FORMATION (PLEISTOCENE) - Lower Member - Unconsolidated, slightly weathered, gravel, sand, silt, and clay
- Qrl - RIVERBANK FORMATION (PLEISTOCENE) - Lower Member - Red, semi-consolidated, gravel sand, and silt with minor clay
- Qrb - RED BLUFF FORMATION (PLEISTOCELNE) - Highly weathered, red gravels
- pTms - METAMORPHIC, INTRUSIVE, AND SEDIMENTARY ROCKS (PRE-TERTIARY) - Undivided metamorphosed volcanic and sedimentary rocks

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Figure 3-2
Geologic Cross-Section, Princeton, Colusa County Vicinity

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(Moratto et al. 1978:150–151). Modern average temperatures vacillate between 56° F and 62° F annually. Most precipitation occurs as rain and falls along a north–south annual mean precipitation gradient of 95 cm (38 in) in Redding to 46 cm (18 in) in Sacramento (Schoenherr 1992:518).

Flora and Fauna

Previously in this chapter, regional geology, geomorphology, and climate were discussed to contextualize the prehistoric, ethnographic, and historic contexts presented later herein. Such contextualization would be incomplete, however, without due consideration to the biota of the Undertaking Area, both faunal and floral. These are best examined in tandem and in their own context—that of ecological communities comprising plants and animals. Three basic ecological communities occupy the Undertaking Area: riparian forests, California prairie/annual grassland, and seasonal wetlands (Westwood 2005:13).

Riparian Forests

Riparian forests are typically associated with major watercourses, low-gradient streams, and floodplains, but they also occur adjacent to ponds and canals. The vegetative composition of plant species in riparian forests is highly variable and depends on geographic location, elevation, substrate, and groundwater elevation. Riparian woodlands, based on examinations of relict stands, possessed complex composition. Sacramento Valley woodlands are characterized by woody upper and intermediate overstories with a dense understory of vines and herbaceous and shrubby plants (Westwood 2005:13).

The dominant overstory species are frequently valley oak (*Quercus lobata*) or Fremont cottonwood (*Populus fremontii* ssp. *fremontii*). Other trees observed in riparian forests are box elder (*Acer negundo* var. *californicum*), Oregon ash (*Fraxinus latifolia*), white alder (*Alnus rhombifolia*), western sycamore (*Platanus racemosa*), coast live oak (*Quercus agrifolia*), Goodding's black willow (*Salix gooddingii*), red willow (*Salix laevigata*), and yellow willow (*Salix lucida* ssp. *lasiandra*) (Schoenherr 1992:533–534). Non-native tree species that are known to occur in riparian forests are black locust (*Robinia pseudoacacia*), English walnut (*Juglans regia*), edible fig (*Ficus carica*), and acacia (*Acacia* sp.).

The shrub layer of riparian forests is also highly variable and can range from extremely sparse to well developed. Representative species that occur in the shrub understory of riparian forests are buttonbush (*Cephalanthus occidentalis*), poison oak (*Toxicodendron diversilobum*), California blackberry (*Rubus ursinus*), Himalayan blackberry (*Rubus armeniacus*), California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversilobum*), and California wild grape (*Vitis californica*). Blue elderberry (*Sambucus mexicana*), the host plant for the federally threatened valley elderberry longhorn beetle, is also commonly present in riparian areas.

The herbaceous understory of riparian forests typically contains a mixture of native and introduced species. Representative grasses and forbs are mugwort (*Artemisia douglasiana*), horsetail (*Equisetum* sp.), horseweed (*Conyza canadensis*), and Santa Barbara sedge (*Carex barbarae*). Common nonnative species include white sweet-clover (*Melilotus alba*), wild oats (*Avena* spp.), ripgut brome (*Bromus diandrus*), black mustard (*Brassica nigra*), Bermuda grass (*Cynodon dactylon*), yellow star-thistle (*Centaurea solstitalis*), prickly lettuce (*Lactuca serriola*), and curly dock (*Rumex crispus*). (Westwood 2005:13.)

Riparian forest communities provide wildlife dispersal and migration corridors and foraging, cover, nesting, and breeding habitat (including shade and cover for aquatic species). Many species of birds, mammals, reptiles, and amphibians are known to use riparian communities and other woody vegetation communities located close to watercourses. Riparian trees provide suitable nesting and roosting habitat for a variety of raptors, egrets, herons, songbirds, and bats. Birds known to nest in these communities include red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), Cooper's hawk (*Accipiter cooperii*), and American kestrel (*Falco sparverius*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), Nuttall's woodpecker (*Picoides nuttallii*), western scrub-jay (*Aphelocoma californica*), California towhee (*Pipilo crissalis*), spotted towhee (*Pipilo maculates*), black phoebe (*Sayornis nigricans*), warbling vireo (*Vireo gilvus*), yellow-rumped warbler (*Dendroica coronata*), wrentit (*Chamaea fasciata*), and house wren (*Troglodytes aedon*).

Bat species known to use riparian habitats for roosting in the Undertaking Area include California myotis (*Myotis californicus*), Yuma myotis (*Myotis yumanensis*), hoary bat (*Lasiurus cinereus*), western red bat (*Lasiurus blossevillii*), and pallid bat (*Antrozous pallidus*). Other mammal species known to use these communities include beaver (*Castor canadensis*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), black-tailed deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), and muskrat (*Ondatra zibethicus*). Reptiles associated with these communities include common garter snake (*Thamnophis sirtalis*), western fence lizard (*Sceloporus occidentalis*), and western pond turtle (*Actinemys marmorata*). Amphibians include Pacific tree frog (*Hylla regilla*), western toad (*Bufo boreas*), and bullfrog (*Rana catesbeiana*). (Schoenherr 1992:535; Westwood 2005:15–16.)

California Prairie/Annual Grassland

Before Euroamerican settlement of the Sacramento Valley, the dominant native vegetation in the valley consisted of purple needlegrass (*Nassella pulchra*) (Heady 1977). This perennial grass is the distinctive and characteristic species of the California prairie, which occupied the largest section of the valley floor (Westwood 2005:14). Plant succession cycles in the prairie tended toward perennial bunchgrasses, such as purple needlegrass, on all well-drained upland sites (Heady 1977). Although purple needlegrass is a quintessential and indicator species of the California prairie, the valley supported a mosaic of other plant communities. In particular, the numerous waterways bisecting the valley supported many riparian species. Common riparian species are willow (*Salix* sp.), buttonbush (*Cephalanthus occidentalis*), California sycamore (*Platanus racemosa*), and Fremont's cottonwood (*Populus fremontii*).

Native fauna in the region included pronghorn antelope (*Antilocarpa americana*), deer (*Odocoileus hemionus*), jackrabbit (*Lepus californicus*), California ground squirrel (*Spermophilus beecheyi*), kangaroo rat (*Dipodomys heermanni*), pocket gopher (*Thomomys bottae*), and tule elk (*Cervus elophus nannodes*). The development of subspecies and strains unique to the Central Valley among this fauna suggest a long association between the floristic and faunal communities. (Heady 1977; Westwood 2005:14–15.)

Seasonal Wetlands

Although much more extensive in the vicinity of the Undertaking Area, seasonal wetlands in the Undertaking Area itself are best represented by emergent marsh. This vegetation community is restricted to a relatively narrow saturation zone along the toes of levee slopes and is characterized by the presence of hydrophytic (i.e., "water-loving") herbaceous plant species that are able to tolerate fluctuating water levels and persist in continuously saturated soils. Vegetative cover of this community type is generally sparse because of bankline erosion caused by watercraft and high flow events, especially along major waterways. Representative species observed in emergent marsh in the Undertaking Area are cattails (*Typha* spp.), tule (*Scirpus* spp.), common rush (*Juncus effusus*), Santa Barbara sedge, Vasey's grass (*Paspalum urvillei*), smartweed (*Polygonum lapathifolium*), creeping water-primrose (*Ludwigia peploides* ssp. *montevidensis*), purple-top vervain (*Verbena bonariensis*), western goldenrod (*Euthamia occidentalis*), wild licorice (*Glycyrrhiza lepidota*), and bitter dogbane (*Apocynum androsaemifolium*). (Schoenherr 1992:527–528.)

These areas provide cover and breeding habitat for bullfrog, tree frog, western toad, and common garter snake, and larger patches may also support nesting of marsh wren (*Cistothorus palustris*), wading birds such as Virginia rail (*Rallus limicola*), and songbirds including red-winged blackbird (*Agelaius phoeniceus*), tricolored blackbird (*Agelaius tricolor*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*).

Cultural Context

Prehistoric Archaeology

As a result of continuing research and interpretation, the archaeological record of the Central Valley and Delta region has been approached in two fundamentally different ways; the first is chronological, and the second involves the elucidation of contemporaneous cultural patterns. The discussion below is a succinct description of both approaches to Central Valley prehistory, beginning with the nascent, salvage-oriented archaeology of the late nineteenth century, followed by the development of cultural historical frameworks for the Central Valley under the aegis of Sacramento Junior College and the University of California. The discussion moves from this chronologically oriented approach to the functional and systems approaches favored in California archaeology from the 1960s through the present.

In the late 1800s and early 1900s, knowledge of Delta prehistory was derived largely from local collectors. The collections of J. A. Barr and E. J. Dawson, amateur archaeologists working in the Stockton area from 1893 to the early 1930s, provided the groundwork for the later development of a three-phase chronological sequence for central California (Ragir 1972). Professional archaeological research in the lower Sacramento Valley was initiated during the 1920s and 1930s. Lillard and Purves (1936) worked at several mound sites near the Deer Creek/Cosumnes River confluence in Sacramento County. From the relative sequences in stratified occupational and burial sites, Lillard and Purves identified a three-stage chronology based on artifacts, burial orientation, and condition. Simply called the Early, Transitional (later called Middle), and Late horizons, these were defined by shifting patterns in site assemblages and mortuary morphology. Although interpretations varied, explanations for change usually were linked to the movements of people. In 1939, a synthesis of this research was published and later expanded into the Central California Taxonomic System (CCTS) (Lillard et al. 1939). Later refined by Heizer (1949) and Beardsley (1948, 1954a, 1954b), the CCTS was characterized by specific artifact types, mortuary practices, and other cultural features.

Subsequent archaeological research was aimed at refining the CCTS and incorporating the study of paleoenvironmental change, settlement patterns, population movement, subsistence strategies, and development of exchange networks. These studies led to the development of a second approach. As absolute dates became available for sites with early, middle, and late assemblages, it was discovered that sites with different assemblages actually were contemporaneous. This was particularly true with sites from the Early and Middle horizons. This discovery, along with a change in archaeological paradigms to a more economic and functional orientation in the 1960s, led to a reorganization of the CCTS. This new scheme used the same archaeological manifestations to differentiate sites as did the CCTS, but ordered sites into functional groups rather than temporal ones which led to the establishment of different cultural models for many localities of central California.

This approach was advanced by Fredrickson (1973), who used the term *pattern* to describe an "adaptive mode extending across one or more regions, characterized by particular technological skills and devices, and particular economic modes." Three patterns were introduced: Windmiller, Berkeley, and Augustine. These patterns, while generally corresponding to the Early, Middle, and Late horizons within the Central Valley, were conceptually different and free of spatial and temporal constraints. By changing the paradigm from a cultural/historical orientation to a more processual/adaptive one and introducing the concept of pattern, Fredrickson addressed problems with the chronological and regional sequences that had been nagging archaeologists for several decades (cf. King 1974).

One problem with both approaches is that they have been based on an archaeological record derived primarily from village sites. This poses less of a problem under a chronological framework but presents a more substantial problem when an economic perspective is taken. Current understanding of the prehistoric valley settlement and subsistence systems is heavily biased toward large habitation sites adjacent to permanent water sources. These sites, by their very nature, can provide only limited information on the total economic system. Much more archaeological work is needed at ephemeral and peripheral sites located away from the larger habitation sites.

The taxonomic framework of the Sacramento Valley has been described in the following sections in terms of archaeological patterns, following Fredrickson's (1973) system. A *pattern* is a general mode of life characterized archaeologically by technology, particular artifacts, economic systems, trade, burial practices, and other aspects of culture. Fredrickson's (1973) *periods* are also employed in the discussion below: Paleoindian (12,000–8000 BP), Lower Archaic (8000–5000 BP), Middle Archaic (5000–2500 B.P.), Upper Archaic (2500–950 BP), Lower Emergent (950–450 BP), and Upper Emergent (450–150 BP) (White et al. 2002:Figure 15). In Fredrickson's use, periods served as arbitrary intervals that could be used to compare patterns over space and time. Only with the clear identification of pervasive temporal patterns would periods acquire specific archaeological meaning.

Terminal Pleistocene and Early Holocene: 13,500–7000 BP

At the end of the Pleistocene (roughly the beginning of the Paleoindian Period), circa 13,500 to 10,500 BP, parts of the Sierra Nevada adjacent to the Central Valley were covered with large glaciers (West et al. 2007:27), and the valley provided a major transportation route for animals and people. This transportation corridor, perhaps rivaled only by maritime coastal travel (Erlandson et al. 2007), was undoubtedly used heavily by early Californians. Evidence for human occupation during this period, however, is scarce, the hypothesized result of being buried by deep alluvial sediments that accumulated rapidly during the late Holocene (Westwood 2005:17).

Although rare, archaeological remains of this early period were reported in and around the Central Valley (Ann S. Peak & Associates 1981; Johnson 1967; Treganza and Heizer 1953). Johnson (1967:283–284) presents evidence for some use of the Mokelumne River area, under what is now Camanche Reservoir, during the late Pleistocene. Archaeologists working at Camanche Reservoir found a number of lithic cores and a flake that are associated with Pleistocene gravels. These archaeological remains were grouped into what is called the Farmington Complex, which is characterized by core tools and large, reworked percussion flakes (Treganza and Heizer 1953:28). Farther north, at Rancho Murrieta, lithic artifacts spanning the reduction sequence, as well as unworked raw material, were recovered from gravel deposits attributed to the late Pleistocene (Ann S. Peak & Associates 1981). Recent geoarchaeological investigations at CA-STA-69 (in the vicinity of Farmington Complex–type site CA-STA-44), however, indicate that the Farmington Complex assemblage at the site is contained completely within Holocene alluvial terrace deposits, not Pleistocene glacial outwash deposits. These findings raise the question of whether reinvestigation of other Farmington Complex assemblages will reveal a Holocene assemblage (Rosenthal and Meyer 2004:96; Rosenthal et al. 2007:151).

The economy of the Central Valley residents during the late Pleistocene is thought to have been based on the hunting of large Pleistocene mammals. Although no direct evidence of this exists in the Central Valley, the similarity of the artifact assemblages with those of other locations in western North America lends some support the notion of a large-game economic focus. Much of the Pleistocene megafauna became extinct at the Pleistocene/Holocene transition. These extinctions were caused by warming temperatures, rising sea levels, and changing precipitation patterns. As the Central Valley gradually became both warmer and dryer, pine forests were replaced with vegetation similar to that found today. The rising sea level filled San Francisco Bay and created the Delta marshes. To survive without large game, people had to change their food procurement strategies to make use of a more diverse range of smaller plants and animals.

Middle to Late Holocene: 7000–1200 BP

Using a wider range of smaller resources meant people had to have access to larger areas of land to hunt and collect the food and other resources they needed. Small groups of people probably moved through the valley, foothills, and Sierra Nevada to take advantage of seasonally available resources and resources limited to particular ecozones. This mobile foraging strategy was essential to their survival.

Reliance on a diverse number of smaller plants and animals had several consequences. First, people had to move around from one area to another to take advantage of the seasonal availability of particular resources. Second, large areas of land were needed to ensure that enough resources were available during all times of the year. Third, more specialized tools were necessary to procure and process the wider range of plants and animals that were being used. This generalized subsistence strategy worked well for the inhabitants of the Central Valley for many millennia.

During the Lower Archaic Period, beginning approximately 6000 BP, a shift to a more specialized subsistence strategy began to take place. The more specialized strategy focused on ways of increasing the amount of food that could be produced from smaller portions of land. This change can be at least partially explained by the increasing numbers of people living in the Central Valley. An increased population is indicated by a much more abundant archaeological record and by dietary stress, as indicated by dental pathologies (Morrato 1984:203–204). As the population slowly increased, it became more difficult for people to obtain seasonally available resources across large areas of land. The beginnings of this intensification can be seen in the Middle-Archaic Windmiller Pattern (4500–2800 BP) and is based on the assemblage at the Windmiller site (CA-SAC-107). The Windmiller Pattern shows evidence of a mixed economy of game procurement and use of wild plant foods. Artifacts and faunal remains at Windmiller sites include seeds, a variety of small game, and fish. The archaeological record contains numerous projectile points and a wide range of faunal remains. Hunting was not limited to terrestrial animals, as evidenced by fishing hooks and spears that have been found in association with the remains of sturgeon (*Acipenser* sp.), salmon (*Oncorhynchus* sp.), and other fish. Plants also were used, as indicated by ground-stone artifacts and clay balls that were used for boiling acorn mush. The bone tool industry appears minimal but includes awls, needles, and flakers. Other characteristic artifacts include charmstones, quartz crystals, bone awls and needles, and abalone (*Haliotis* sp.) and olive snail (*Olivella* sp.) shell beads and ornaments. Trade is reflected in the material from which utilitarian, ornamental, and ceremonial objects were produced.

Windmiller Pattern origins are believed to be linked to the arrival of Utian peoples from outside California who were adapted to riverine and wetland environments (Moratto 1984). Windmiller sites are concentrated on low rises or knolls within the floodplains of major creeks or rivers. Such locations provided protection from seasonal flooding and proximity to riverine, marsh, and valley grassland biotic communities. People with a Windmiller adaptation buried their dead in formal cemeteries, suggesting a degree of sedentism, both within and separate from their villages, in a ritual context that included the use of red ochre, often rich grave offerings, and ventral extension with a predominantly western orientation (although other burial positions, such as dorsal extension and flexed, and cremations are also known) (Moratto 1984).

Settlement strategies during the Windmiller period reflect seasonal adaptations; habitation sites in the valley were occupied during winter, but populations moved into the foothills during summer (Moratto 1984). The earliest evidence of widespread occupation of the lower Sacramento Valley/Delta region comes from several sites assigned to the Windmiller Pattern (previously, Early Horizon), dated ca. 4500–2800 BP (Ragir 1972). While the Windmiller Pattern is identified with the Delta, work at Camanche Reservoir has identified sites with Windmiller assemblages (Johnson 1967), indicating that other valley settings were also used by people exhibiting these adaptations (Beardsley 1948; Gerow 1974; Heizer 1949; Heizer and Fenenga 1939; Lillard et al. 1939; Ragir 1972; Schulz 1970).

Central Valley inhabitants responded to the Middle Archaic population increase in two ways. First, they used the marshlands of the Delta, which were much more extensive and rich in food resources than they are today. Second, they increased the use of the acorn as a food source. The acorn had been used before this time, but it became a much more predominant resource with specialized procurement and processing technologies. People following these strategies were more sedentary than they had been in the past, and village sites are found throughout the valley along rivers and near other areas with permanent sources of water. An economic shift from a foraging to a collecting strategy probably occurred during the Middle Archaic.

The result of the settlement and subsistence reorientation described in the previous paragraph was a coeval, adaptive pattern with the Windmiller Pattern labeled the Berkeley Pattern (3500–2500 BP) (Fredrickson 1973). Windmiller Pattern sites seem to occur with more frequency in or near the Delta, while Berkeley Pattern sites tend to be more prevalent farther north. Berkeley Pattern sites are more numerous and more widely distributed than Windmiller sites and are characterized by deep midden deposits, suggesting intensified occupation and a broadened subsistence base. The

Berkeley Pattern also has a greater emphasis on the exploitation of the acorn as a staple. A reduction in the number of handstones and millingstones and an increase in the number of mortars and pestles reflect this greater dependence on acorns. Although gathered resources gained importance during this period, the continued presence of projectile points and atlatls (spear-throwers) in the archaeological record indicates that hunting was still an important activity (Fredrickson 1973). Fishing technology improved and diversified, suggesting greater reliance on riverine estuarine resources. This pattern is also noted for its especially well-developed bone industry and such technological innovations as ribbon flaking of chipped stone artifacts.

Material culture similarities to the Windmiller Pattern include mortars and millingstones, quartz crystals, charmstones, projectile points, shell beads and ornaments, and bone tools. New elements include steatite beads, tubes and ear ornaments, slate pendants, and burial of the dead in flexed positions with variable orientation or cremations accompanied by fewer grave goods. During this period, flexed burials are found alongside extended burials at CA-COL-247, contrary to the pattern elsewhere in the valley, which saw near exclusive use of flexed burials for interment of the deceased (Moratto 1984; Rosenthal et al. 2007:155; White 2003:175). The use of grave goods generally declined (Moratto 1984), and trade continued to be important (Beardsley 1948; Fredrickson 1973; Heizer and Fenenga 1939; Lillard et al. 1939; Moratto 1984).

A restricted land base, coupled with a more specialized resource base, meant that people had to develop economic relationships with other groups of people with different specialized resources living in other areas. Although resources and commodities were being exchanged throughout the region before this period, more extensive and more frequently used economic networks developed during this time. Transported resources likely included foods (trans-Sierra acorn movement is known from later periods [d'Azevedo 1986]) and commodities more visible in the archaeological record, such as shell and lithic materials (Rosenthal et al. 2007:155).

Late Horizon: 1200 BP to Historic Period

The trends toward specialization, exchange, and spatial circumscription that characterized prior periods continued in the Late Horizon. Population continued to increase, and group territories continued to become smaller and more defined. The Delta region of the Central Valley reached population density figures higher than almost any other area of North America (Chartkoff and Chartkoff 1984). Patterns in the activities, social relationships, belief systems, and material culture continued to develop during this period and took forms similar to those described by the first Europeans that entered the area.

The predominant generalized subsistence pattern during this period is called the Augustine Pattern (1200 BP) and shows a high degree of technological specialization (Fredrickson 1973). Development of the Augustine Pattern was apparently stimulated by the southward expansion of Wintuan populations into the Sacramento Valley (Moratto 1984). The Augustine Pattern reflects a change in subsistence and land use patterns to those of the ethnographically known people of the historic era. This pattern exhibits a great elaboration of ceremonial and social organization, including the development of social stratification. Exchange became well developed, and an even more intensive emphasis was placed on the use of the acorn, as evidenced by the presence of shaped mortars and pestles and numerous hopper mortars in the archaeological record.

Other notable elements of the artifact assemblage associated with the Augustine Pattern include flanged tubular smoking pipes, harpoons, clam shell disc beads, bone awls for basketry, bone whistles and stone pipes, and an especially elaborate baked clay industry, which includes figurines and pottery vessels (Cosumnes Brownware). The presence of small projectile point types, referred to as the Gunther Barbed series, suggests the use of bow and arrow. Other traits associated with the Augustine Pattern include the introduction of preinterment burning of offerings in a grave pit during a mortuary ritual, increased village sedentism, maintenance of extensive exchange networks, population growth, and an incipient monetary economy in which beads were used as a standard of exchange (Moratto 1984). Burials were flexed with variable orientation and generally lacked grave goods (Beardsley 1948; Fredrickson 1973; Moratto 1984; Ragir 1972).

Ethnographic Context

To facilitate management of California Indian cultural resources in the Undertaking APE and to identify the appropriate Indian groups with which to consult regarding Undertaking activities, this ethnographic context is organized by Undertaking region (Regions 1a, 1b, 2, and 3). Seven Native American groups live within the Undertaking Area: the Bay Miwok, Konkow Maidu, Northern Valley Yokuts, Patwin, Plains Miwok, River Nomlaki, and Valley Nisenan (Figure 3-3). The boundaries and names of the Native American groups depicted in the Figure 3-3 are products, in part, of non-Indian cultural biases and do not represent historic (and frequently not modern) indigenous concepts of social organization or identity. Rather, designations such as "Bay Miwok" indicate a sociolinguistic unit generally concocted by University of California ethnographers interested in linguistic relationships among California Indians and in broad trends in religious practice and cosmology. They also have their basis in government policy, which sought to marginalize Native Americans from their best lands in favor of American citizens. The end result is a series of sociolinguistic groups, amalgamated on the basis of linguistic and cultural similarities. Although the construction of such analytical units is not inherently incorrect, it is important to recognize that such California Indians formerly ascribed no meaning to these terms, that Native Americans today frequently do not, and that these terms sometimes mask cultural heterogeneity within the groups.

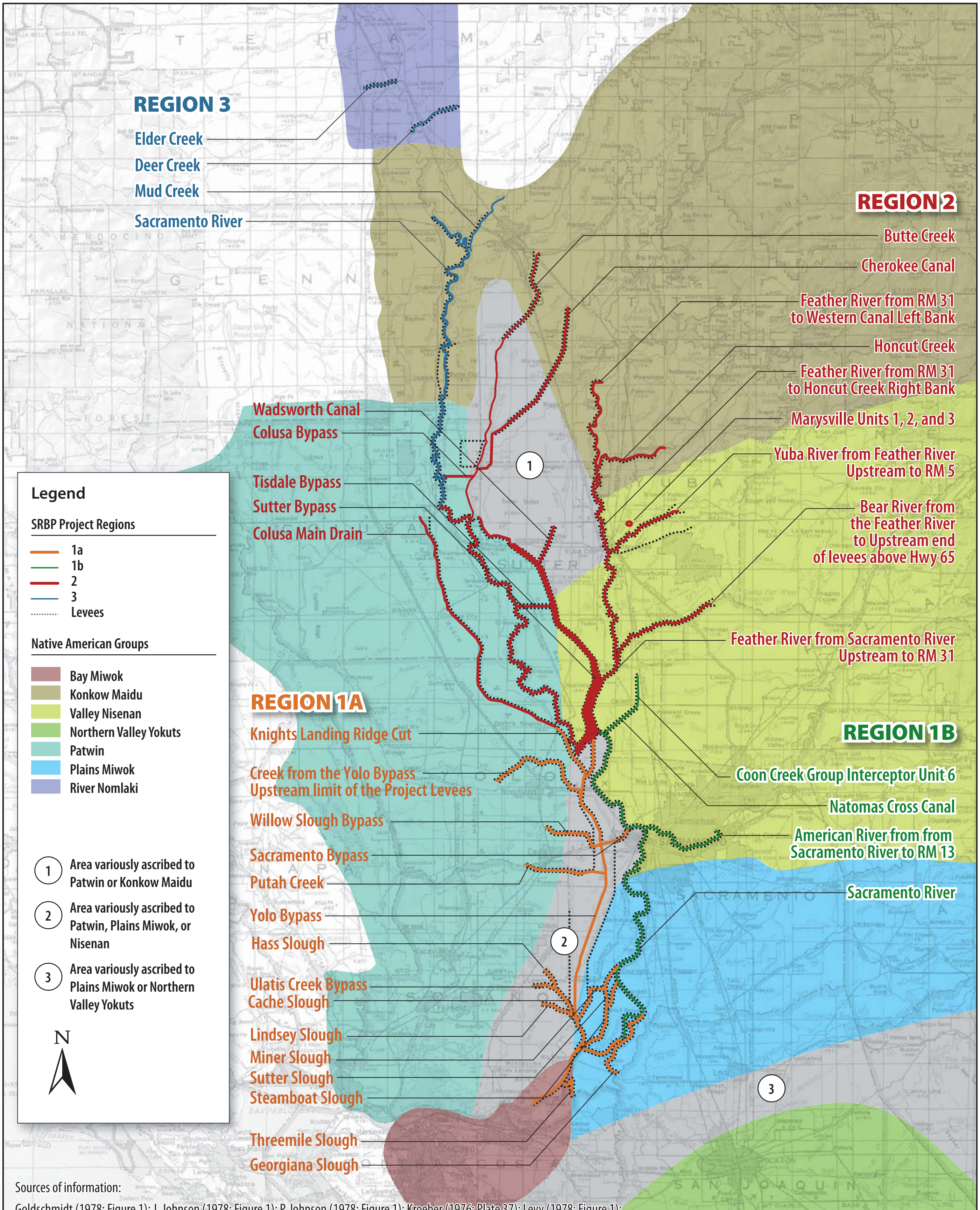
Region 1a

Region 1a was occupied by four Native Californian ethnolinguistic groups: the Patwin, Plains Miwok, Bay Miwok, and Northern Valley Yokuts. A summary of each group is provided below.

Patwin

The Undertaking APE is located within the historic territory of the Patwin (Johnson 1978:350; Kroeber 1976:Plate 34). *Patwin* is a collective Euroamerican referent for the speakers of one of the three languages in the Wintuan group, a part of the Penutian language family. One translation for the word is "people." Several politically autonomous tribelets in the southwestern part of the Sacramento Valley are known to have used the word in reference to their respective individual groups (Powers 1877). The approximate maximum extent of Patwin territory in the late eighteenth and early nineteenth centuries was from Princeton in Colusa County south to Suisun Bay, and from the Sacramento River west across the eastern slope of the Coast Ranges (Johnson 1978; McCarthy 1985a:37, Map 9).

The evidence for the chronology of the initial establishment and subsequent development of Patwin territory is equivocal. Glottochronological estimates for the internal divergence of Wintuan languages suggests a California entry for Wintuan speakers ca. 2000–2500 BP (McCarthy 1985b:31), although Moratto (1984) argues from archaeological data that the Wintuan entry into California occurred approximately between 1950 and 1450 BP Glottochronological and other linguistic



Sources of information:

Goldschmidt (1978: Figure 1); J. Johnson (1978: Figure 1); P. Johnson (1978: Figure 1); Kroeber (1976: Plate 37); Levy (1978: Figure 1); Milliken (1995: 235, 243, 246, 255, 259, Maps 4&5); Riddell (1978: Figure 1); Wallace (1978: Figure 1); Wilson and Towne (1978: Figure 1)

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Figure 3-3
Native American Groups in the Undertaking Area

evidence suggests that the Patwin were in the lower Sacramento Valley by approximately 1250 BP (Bennyhoff 1977; Whistler 1977, 1988), and that they began to move onto the eastern slope of the Coast Ranges after approximately 950 BP (Moratto 1984:571).

The character of the culture that developed in the Patwin region is known from ethnographic and historic sources that date from the late eighteenth century to early twentieth century. Most of these sources date to the latter end of this range, because the intense proselytization of the Patwin by the Missions San Francisco de Asís, San José de Guadalupe, and San Francisco Solano in the late eighteenth and early nineteenth centuries, in combination with the malaria epidemic of 1833 and smallpox epidemic of 1837, led to an apparent rapid decline in Patwin population and the abandonment, particularly in the south, of significant portions of former Patwin territory (Johnson 1978:351–352). Most of the actual ethnographic data from native Patwin informants dates to the late nineteenth and early twentieth centuries and postdates the cultural upheaval of the earlier period. It is unclear how well the available data represents Patwin culture before European contact.

The tribelet was the broadest apparent unit of political organization among the Patwin. Kroeber (1932:258–259) developed the term to describe what appears to have been the prevailing form of Native American political organization in central California from approximately the late eighteenth century through the late nineteenth century. A tribelet is small in size, on the order of 100–300 people, with a discrete territory. The territory typically includes a permanent principal settlement or village and a number of subordinate villages that may or may not have been permanently occupied. Principal Patwin villages with dance houses appear to have been the residences of tribelet head chiefs (Kroeber 1932:259). Each village in a Patwin tribelet also had a chief (Johnson 1978:354). The position appears to have been hereditary, but, in the absence of an heir, village elders could choose a chief. The chief was the primary trustee of the village's natural resources. The chief appears to have been responsible for the reification of the village's ownership of particular resources and for decisions about resource utilization. Despite the apparent weight of a village chief's authority, the foundation for that authority was always the consensus of the households in the village.

The Patwin economy was principally based on the utilization of natural resources from the riverine corridor, wetlands, and grasslands of the lower Sacramento Valley, and from the open woodlands on the eastern foothills of the Coast Ranges (Johnson 1978; Kroeber 1932, 1976). The family was the basic subsistence unit within the tribelet engaged in the exploitation of this resource mosaic (Johnson 1978:354). Tribelets with territory primarily on the floor of the Sacramento Valley were more reliant on riverine and wetland resources. Fish, shellfish, and waterfowl were important sources of protein in the diet of these groups (Johnson 1978:355; Kroeber 1932:277–280). Salmon, sturgeon, perch, chub, sucker, pike, trout, and steelhead were variously caught with nets, weirs, lines and fishhooks, and harpoons. Mussels were taken from the gravels along the Sacramento River stream channel. Geese, ducks, and mudhens were taken with the use of decoys and various types of nets. Tribelets with territory on the western margin of the Sacramento Valley were less reliant on riverine and wetland animal resources and more reliant on terrestrial game (Kroeber 1932:294–295). Deer, tule elk, antelope, bear, mountain lion, fox, and wolf were variously driven, caught with nets, or shot.

Most of the plant resources that were important factors in the Patwin diet came from the grasslands of the lower Sacramento Valley and woodlands of the Coast Range foothills (Johnson 1978:355; Kroeber 1932:275–276, 295–296). Acorns were a staple among all the Patwin tribelets. Two types of valley oaks and a variety of hill and mountain oaks were the primary sources of this foodstuff. As in many other native California cultures, the acorns were pulverized into meal and leached with water in a sand basin. The processed meal was then used to make a gruel or bread. A number of seed plants were important secondary food sources, including sunflower, wild oat, alfilaria, clover, and bunchgrass (Johnson 1978:355). The seeds from these plants were typically parched or dried, and then ground into meal for consumption. Manzanita and juniper berries were also typically dried and ground. Blackberries, elderberries, and wild grapes could be eaten raw, dried and ground into meal, or boiled. On the western margin of the Patwin culture area, sugar pine and foothill pine nuts were roasted and eaten whole (Kroeber 1932:296).

Plains Miwok

The Plains Miwok are part of the larger Eastern Miwok group that forms one of the two major divisions of the Miwokan subgroup of the Utian speakers. The Plains Miwok lived in the Central Valley along the Sacramento, Cosumnes, and Mokelumne rivers. Like their neighbors to the north, the Plains Miwok, out of necessity, built their homes on high ground, with major villages concentrated along the major waterways. Conical homes were constructed with poles and thatching of brush, grass, or tule, and semisubterranean earth-covered homes were built as well. Major villages contained an assembly house, which was a semisubterranean structure with a diameter of 40 to 50 ft, as well as a sweathouse, which was a scaled-down version of the assembly house. (Levy 1978:408–409, Figure 1.)

The Plains Miwok gathered food resources as the seasons varied. As with most California tribes, the Plains Miwok relied heavily on the acorn for subsistence. Other gathered foods included nuts, seeds, roots, greens, berries, and mushrooms. Animal foods included tule elk, pronghorn antelope, jackrabbits, squirrels, beaver, quail, and waterfowl. Salmon was the dominant animal food resource, ranking above other river resources, such as sturgeon. Salt, nuts, basketry, and obsidian were obtained through trade with the Sierra Miwok to the east, for shells, basketry, and bows obtained in turn through trade from the west. (Levy 1978:402–405, 411–412.)

Technological items of the Plains Miwok are similar to those of the Valley Nisenan (see below). Wooden digging sticks, poles, and baskets were used for gathering vegetal resources, while stone mortars, pestles, and cooking stones were used for processing. Items used for obtaining animal resources included nets, snares, seines, bows, and arrows. Arrow points were made primarily of basalt and obsidian. (Levy 1978:405–406.)

Like the Valley Nisenan, the Plains Miwok practiced the Kuksu religion, with its ceremonies and dances, initiation rites, and ranking deity. The Plains Miwok also held ceremonies for girls' maturity, and held beliefs that explained their natural world. (Kroeber 1976:449–452.)

Bay Miwok

Bay Miwok territory encompassed the southeastern portion of the Montezuma Hills near Rio Vista and extended west to encircle what is now Walnut Creek. The southern part of Bay Miwok land included Mount Diablo and extended east as far as Plains Miwok territory in the vicinity of Sherman Island. (Levy 1978:Figure 1.)

The social organization of the Bay Miwok is similar to that of many other California Indian groups: they distributed themselves into tribelet groups that consisted of a village or groups of villages that shared linguistic and/or kinship affinities. Theodoratus et al. (1980:78) estimated the average population of Bay Miwok tribelets at 300 persons. Settlements were located on permanent watercourses and intermittent streams in drier areas and on high ground in areas near the Delta (Theodoratus et al. 1980).

To subsist adequately, the Bay Miwok followed a seasonal round to acquire necessary food and other materials. The Ompin tribelet in particular, would have visited the Montezuma Hills in spring and summer to hunt pronghorn antelope, jackrabbit, and possibly tule elk (Theodoratus et al. 1980). Seed-bearing grasses and sedges may have been available during this period as well. Resources available in the Delta and surrounding marshlands included deer, pronghorn antelope, tule elk, rodents, waterfowl, freshwater mussels, freshwater clams, fish, and various insects.

The Bay Miwok constructed several types of structures. Conical thatch structures covered with tule mats were commonly used as residences both along the Delta and in uplands such as the Montezuma Hills. The Bay Miwok constructed semisubterranean earth-covered lodges that served as winter homes. Other structures included acorn granaries, menstrual huts, sweathouses, and assembly houses of two types: a semisubterranean earth lodge and a circular brush enclosure. The Bay Miwok made the earth lodge a ritual and social focal point. The brush enclosure provided space for ceremonies. (Levy 1978:408–409.)

Miwok technology included bone, stone, antler, wood, and textile tools. Hunting was accomplished with bow and arrow, as well as traps and snares. Basketry items included seed beaters, cradles, sifters, rackets for ball games, and baskets for storage, winnowing, parching, and carrying burdens. Other textiles included mats and cordage. Tule rafts were constructed for navigation on rivers and in the Delta. (Levy 1978:406.)

First contact between the Bay Miwok and Europeans transpired in the second half of the eighteenth century, when Spanish explorers entered the area. The first baptisms took place in 1794 and the last in 1827. A majority of the Bay and Plains Miwok converts were taken to Missions San Francisco de Asís and San José. It appears that many Bay and Plains Miwok tribelets disappeared through the combined effects of population removal to the missions and epidemics. Accounts exist of Miwok individuals who resisted missionization and fled to their villages. As a consequence, the Spanish formed military expeditions to recapture the fugitives. (Levy 1978:400; Milliken 1995:256.)

The initial Miwok defense strategy was to remain hidden in Delta lands, but eventually included counterattacks in the form of raids on missions and ranchos (Heizer 1941). With the arrival of trappers, gold miners, and settlers in California, the Miwok suffered exposure to newly introduced diseases. Although this early contact with settlers had a destructive impact on the Miwok population, specific tribal relationships with settlers varied.

Northern Valley Yokuts

Yokuts is a term applied to a large and diverse number of peoples inhabiting the San Joaquin Valley and Sierra Nevada foothills of central California. The Yokuts cultures include three primary divisions, corresponding to gross environmental zones: the Southern Valley Yokuts, Foothill Yokuts, and Northern Valley Yokuts. (Kroeber 1976:477; Silverstein 1978:446.)

There was no Yokuts tribal organization that encompassed the whole of the peoples speaking Yokutsan languages, or even a tribal organization that encompassed an entire primary division, such as the Foothill Yokuts. These are linguistic and geographic designations only. Similar to most Indian groups in California, the largest political entity among the Yokuts was the tribelet. A tribelet consisted of a large village and a few smaller surrounding villages. Larger villages and tribelets had a chief or headman, an advisory position that was passed from father to son. (Wallace 1978:466.)

The Yokuts languages, of which there are three subdivisions, belong to the Yokutsan language family of the Penutian stock (Shipley 1978). Each primary division included several dialects. The Northern Valley Yokuts lived in the northern San Joaquin Valley from around Bear Creek north of Stockton to the bend in the San Joaquin River near Mendota (Wallace 1978). The Undertaking Area was inhabited by the Northern Valley Yokuts tribelet known as the Cholbones (also Chulamni), which includes groups of Yokuts designated Nototemes, Jusmites, and Fugites or Tugites (Schenck 1926:137–138, Figure 1; Wallace 1978:469, Figure 1).

In general, the Yokuts were seasonally mobile hunter-gathers with semipermanent villages. Seasonal movements to temporary camps would occur to exploit food resources in other environmental zones. The primary difference between the various Yokuts groups rests largely on the differences in available resources in their territory. The Northern Valley Yokuts relied heavily on acorns as a food staple, which was processed into a thick soup, along with salmon and other fish, grass seeds and tule roots (which were processed into meal), and probably water fowl, tule elk, and pronghorn. (Wallace 1978:466.)

Principal settlements were located on the tops of low mounds on or near the banks of the larger watercourses. Settlements were composed of single-family dwellings, sweathouses, and ceremonial assembly chambers. Dwellings were small, lightly constructed, semisubterranean, and oval. The public structures were large and earth covered. Sedentism was fostered by the abundance of riverine resources in the area. (Wallace 1978:466.)

The Yokuts first came into contact with Europeans when Spanish explorers visited the area in the late 1700s, followed by expeditions to recover Indians who had escaped from the missions. The loss of individuals to the missions, influence of runaway neophytes, various epidemics in the 1800s, and arrival of settlers and miners inflicted major depredations on the Yokuts peoples and their culture. (Wallace 1978:468–469.)

Region 1b

Region 1b was occupied by three Native American ethnolinguistic groups: the Valley Nisenan, Plains Miwok, and Northern Valley Yokuts. The Valley Nisenan are described below; the Plains Miwok and Northern Valley Yokuts cultures are summarized under *Region 1a* above.

Valley Nisenan

The Undertaking APE is also located within the lands occupied and used by the Nisenan, or Southern Maidu. The language of the Nisenan, which includes several dialects, is classified within the Maiduan family of the Penutian linguistic stock (Kroeber 1976:392; Shipley 1978:89). The western boundary of Nisenan territory was the western bank of the Sacramento River. The eastern boundary was "the line in the Sierra Nevada mountains where the snow lay on the ground all winter" (Littlejohn 1928:13).

Nisenan settlement locations depended primarily on elevation, exposure, and proximity to water and other resources. Permanent villages were usually located on low rises along major watercourses. Villages ranged in size from three houses to 40 or 50. Houses were domed structures covered with earth and tule or grass, and measured 3.0 to 4.6 m in diameter. Brush shelters were used in summer and at temporary camps during food-gathering rounds. Larger villages often had semisubterranean dance houses that were covered in earth and tule or brush, with a central smoke hole at the top and an east-facing entrance. Another common village structure was a granary, which was used for storing acorns. (Wilson and Towne 1978:388.) A Nisenan village, Holloh, was located 2.4 kilometers (km) west of the Undertaking APE's crossing of Bear River (Wilson and Towne 1978:Figure 1).

The Nisenan occupied permanent settlements from which specific task groups set out to harvest the seasonal bounty of flora and fauna that the rich valley environment provided. The Valley Nisenan economy involved riparian resources, in contrast to the Hill Nisenan, whose resource base consisted primarily of acorn and game procurement. The only domestic plant was native tobacco (*Nicotiana* sp.), but many wild species were closely husbanded. The acorn crop from the blue oak (*Quercus douglasii*) and black oak (*Q. kelloggii*) was so carefully managed that its management served as the equivalent of agriculture. Acorns could be stored in anticipation of winter shortfalls in resource abundance. Deer, rabbit, and salmon were the chief sources of animal protein in the aboriginal diet, but many other insect and animal species were taken when available. (Wilson and Towne 1978:389–390.)

Religion played an important role in Nisenan life. The Nisenan believed that all natural objects were endowed with supernatural powers. Two kinds of shamans existed: curing shamans and religious shamans. Curing shamans had limited contact with the spirit world and diagnosed and healed illnesses. Religious shamans gained control over the spirits through dreams and esoteric experiences. (Wilson and Towne 1978:393, 395.) The usual mode of burial was cremation (Faye 1923:37).

Region 2

Three Indian ethnolinguistic groups resided in Region 2: the Konkow Maidu, Patwin, and Valley Nisenan. The Patwin and Valley Nisenan are discussed under "Region 1a" and "Region 1b" above.

Konkow Maidu

Ethnographically, the Konkow Maidu occupied the area northwest of their Nisenan neighbors, in the foothills east of Chico and Oroville, as well as a portion of the Sacramento Valley (Riddell 1978). Konkow is one of three languages comprising the Maiduan language family of the Penutian linguistic stock. Several dialects of Konkow were spoken from the lower extent of the Feather River Canyon to the surrounding hills and in the adjacent parts of the Sacramento Valley (Shipley 1978).

The Konkow lived in village communities of three to five villages, in round semisubterranean houses covered with earth. It is estimated that a typical village consisted of about 35 people during ethnographic times. Villages were made up of smaller groups. Family units usually comprised two to five people. A major village with a large assembly structure and subterranean ceremonial lodge served as the central ceremonial and political focus for affiliated villages in the vicinity. This central village was not necessarily the most populous village, but likely served as the residence of the chief, who lived in the ceremonial lodge. The chief's primary roles were as an advisor and spokesman. The individual villages were self sufficient, not under the control of a headman. (California Department of Water Resources 2004; Riddell 1978.)

In winter, the Konkow settled in widely dispersed patterns along river canyons, usually on ridges high above rivers and generally on small flats on the crest of the ridge, or halfway down the canyon side. A village community owned and defended a known territory, which served as a communal hunting and fishing ground. Some villages were strategically located atop isolated knolls in regard to attack and defense considerations. The Konkow followed an annual gathering cycle that made it necessary for them to leave their winter settlements on the river ridges. In summer, they traveled into the mountains to hunt. In spring, they ventured into the valley areas to collect grass seeds. (Riddell 1978.)

The Konkow economy was a mixture of hunting, fishing, and gathering. They managed their food resources skillfully, which made it possible for them to have a surplus during the nonharvest times. During harvest times, families gathered greens, tubers, roots, seeds, nuts, and berries. Although wild rye was common in their diet and pine nuts were highly valued, the most important harvested food was acorns, from black oak in particular. The Konkow managed their environment with a method of burning, which enhanced favorable ecozones. The Feather River provided a wealth of fish resources, mainly in the seasonal salmon runs. Lamprey eels were also abundant and favored by the Konkow in ethnographic times. Hunting was also an important source of food for the Konkow. Deer were the main game animal, but others included elk, rabbits, squirrels, and birds such as quail, pigeons, and ducks. (California Department of Water Resources 2004; Riddell 1978.)

Because the Konkow had no authoritarian political organization, the shaman was an important figure in their society. With his mysterious powers and spiritual communication, he provided a sense of unity among the village community. He functioned in ceremonies and festivals, and also served as a medical doctor. The office of shaman was an inherited one, falling to the shaman's sons after his death. (Riddell 1978.)

The Konkow held an annual mourning ceremony, the Keruk, for the recently deceased, which reenacted the death of the creator, Kukumat. For this ceremony, a male and female effigy were created, clothed, and burned. Other things, such as food, money, and blankets, were given to the god by burning. The Maidu participated in the Kuksu cult, also practiced by the Patwin, Pomo, northern Costanoans, and Coast and Sierra Miwok. Kuksu, "the South God," renews the world each year. The ritual was celebrated in round dance houses by dancers with elaborate costumes that included large feather headdresses. (Riddell 1978.)

Konkow life was little affected by European contact until the Gold Rush in 1849, which was particularly devastating for them. The Feather River and surrounding foothills were abundant in gold, which lured hordes of miners to the area. The miners brought diseases that were deadly to the native peoples, decimating the population. The miners also destroyed the landscape with their mining techniques and violently drove the surviving Konkow from their lands. When the mining craze was over, the miners settled in the area and turned large tracts of land into agricultural fields. Because the miners wanted their land, the Konkow were driven off their traditional lands twice. In 1853, the Konkow and other Native American groups were rounded up and sent to the Nome Lackee Reservation in Tehama County. This was not a successful reservation, and most families returned to their original lands. In 1863, the Konkow were again rounded up by the militia and driven, in what is now remembered as the "Death March," across the Coast Ranges to the Round Valley Reservation in northern Mendocino County. Many of these families remain in Round Valley today. Around the turn of the twentieth century, several small rancherias were created, finally establishing a legal land base for them and formalizing their tribal status with the federal government. Today, the Konkow are very active in cultural preservation in and around the Palermo/Feather River area. (California Department of Water Resources 2004.)

Region 3

Before Euroamerican incursions into California, Region 3 was home to three California Indian ethnolinguistic groups: the Konkow Maidu, Patwin, and River Nomlaki. The Patwin and Konkow are discussed under “Region 1a” and “Region 2” above, respectively.

River Nomlaki

At the time of Euroamerican contact, most of the western side of the Sacramento Valley north of Suisun Bay was inhabited by Wintuan-speaking people. Powers (1877) had recognized early linguistic and cultural distinctions between the southern membership of this large group (i.e., the Patwin) and the peoples occupying the northern half of the western valley. Subsequent linguistic analyses resulted in the present division of Wintuan into three stocks: southern (Patwin), central (Nomlaki), and northern (Wintu) (Shipley 1978:82). Clearly, however, the central and northern Wintuans were very closely related (Shipley 1978:82) and shared numerous cultural traits and attributes.

Two major divisions existed among the Nomlaki: the Hill and River Nomlaki (Goldschmidt 1978:Figure 1). The Hill Nomlaki occupied adjacent foothill lands to the west, extending to the summit of the North Coast Ranges in what are now Tehama and Glenn Counties. The River Nomlaki occupied the Sacramento Valley, primarily in present eastern Tehama County, and are the subject of this ethnographic summary.

Nomlaki subsistence was based on three main staples: deer, acorns, and salmon. All three were abundant within the western Sacramento Valley, particularly along the Sacramento River and its primary tributaries, although acorns and salmon were available only seasonally. These staples were supplemented with an immense array of less abundant resources, some available seasonally and some procurable year round.

Salmon was such a crucial food resource to the River Nomlaki that the availability of this food source has been used as an important variable in assessing prehistoric population levels (Baumhoff 1963) and is considered a major determinant of site distribution in portions of the Redding area (Raven et al. 1984). Other important riverine resources included trout, lamprey, whitefish, suckers, mussels, and clams. Fish poisons were used in some of the small streams and in still pools in securing various aquatic resources (Goldschmidt 1978:347).

Deer constituted a major dietary staple because they were abundant and available essentially year round. Deer were often hunted individually with bow and arrow, but also communally by being driven into snares. Many other animals were hunted with bows or slings, snared, clubbed, or shot in communal drives, including bear, rabbit, quail and other birds, rodents, and certain reptiles. (Goldschmidt, 1978:347.)

Acorns constituted the third primary staple of the Nomlaki, a food resource that was seasonally abundant and storable. Prepared during late prehistoric time periods with a hopper mortar and pestle into a meal for soup or flour for bread, acorns were available for immediate consumption or winter storage. Black and valley oak acorns were preferred for breads. Buckeye, which like acorns had to be leached, was an important vegetal resource, and other vegetal foods, including herbs, nuts, berries, fruits, seeds, and roots, were consumed in large quantities in early spring and summer. (Goldschmidt 1978:347.)

The available ethnographic information documents a complex pattern of land use, settlement, and subsistence orientation. The salmon runs, locations of seasonally available big game (especially deer), and distribution of acorn-yielding oak trees, which together supplied the primary staples for these Native Americans, required major forays from the home base because all three were concentrated in different areas. Moreover, the collection of exotic raw materials, such as obsidian and certain other utilitarian materials, often involved long, arduous trips (Goldschmidt 1978:345). Because the locations and availability of these resources could not be modified by the Native Americans, it was necessary for the Nomlaki to arrive at a particular resource locality during its peak of production and ease of attainment. By appropriately arranging their patterns of movement, they were able not only to ensure an adequate supply of the primary staples in most years, but also to supplement these staples by hunting and collecting virtually every type of animal and plant food available within their territorial range. In addition to serving dietary needs, many of the collected animals, hundreds of varieties of plants, and inorganic minerals were sought for medicinal, technical, and magico-religious purposes. This form of resource exploitation required not only that permanent villages be established, but also that seasonal use be made of a wide variety of less-permanent villages and camps. (Jones & Stokes 1996:II-30–31.)

Although the nuclear family was the basic face-to-face interaction group of the Nomlaki, the social culture of both groups was centered on the village, or tribelet, as originally described by Kroeber (1932). Village authority was vested in a headman whose succession was inherited patrilineally, subject to approval by other male elders. Perpetuation of this role was particularly dependent on the ability of the individual to maintain social preeminence through organizational talents and accumulation of wealth. The primary duties of a chief or headman were to lead rather than to rule and included giving advice, settling disputes, and redistributing food resources, the latter being of particular significance in terms of maintaining stable and equal food supplies throughout the village over long periods. In sum, the economic cooperation effected through the chief's office served as the focal point for the social and political organization of the clusters of nuclear families, which in turn constituted a village or tribelet. (Goldschmidt 1978:343–344.)

According to Goldschmidt (1978), the external relationships of the Nomlaki were far reaching. The Nomlaki traded salt and food surpluses to the Wintu and Shasta for skins, obsidian, and yew wood for bows. Some Nomlaki individuals apparently specialized in trade, although as Goldschmidt points out, this profession was potentially very dangerous. Frequently, such specialists used the clamshell beads that had become a medium of exchange and standard of value throughout much of central California, although direct barter was also used when appropriate. (Goldschmidt 1978:344–345.)

The assimilation of Nomlaki culture into that of Euroamericans has been well documented. Their earliest contacts with Euroamericans were probably with hunters, trappers, and explorers who sporadically entered and crossed the northern Sacramento Valley during the 1820s and 1830s. A malaria epidemic in 1833 killed an estimated 75% of the Sacramento Valley Indians. Many Nomlaki villages were completely depopulated at this time (Cook 1955). The Sacramento Valley Indians never overcame the devastating effects of this epidemic and were ineffective in their efforts to resist the onslaught of miners and settlers into the region from the early 1850s through the 1880s. Following the arrival of miners and settlers, the Nomlaki suffered further catastrophic reductions in population, followed by the collapse in the economic and social bases for perpetuation of their traditional lifestyle. Eventually, the surviving members were moved to coastal and other reservations and camps. By the 1930s, there were three Nomlaki rancherias of six households each, with the men serving primarily as casual or migratory laborers (Goldschmidt 1978:342).

Historic Context

The following sections address the broad historical themes appropriate to the Undertaking Area: settlement/agriculture, flood control, and reclamation.

Settlement and Agriculture

The Sacramento River begins in the northern part of California near Mount Shasta in the Cascade Range and traverses southward for approximately 447 mi. Along the way, it meets with the Feather and American rivers just north of Sacramento. The river continues to flow southward, where it empties into the Delta (O'Neill 2006a:77–78). After the 1848 gold discovery in the Sierra Nevada, California's population increased, and settlements and towns were eventually established up and down the Sacramento River.

Region 1a

Solano County

Solano County is one of California's original 27 counties and retains its original boundaries (Munro-Fraser 1879:49–50). Euroamerican settlers began to arrive and set down roots within the boundaries of Solano County in the 1840s and 1850s (Munro-Fraser 1879:59–60). Towns such as Benicia, Vacaville, Suisun City, Fairfield, and Rio Vista were formed in the early years of Solano County's history. By 1878, an estimated 20,750 people resided within the county (Munro-Fraser 1879:80).

Throughout much of the latter part of the nineteenth century, wheat cultivation and ranching dominated the pursuits of Solano County agricultural producers. Later, parts of Solano County became major centers of fruit cultivation, a development spurred in part by local and national railroad development in the 1860s and 1870s (Delaplane 1999:5–7, 28–32; Keegan 1989:49–51, 58–60).

During the first half of the twentieth century, the local economy of Solano County was dominated by fruit production, processing, and marketing, which were hit hard by the Great Depression in the 1930s. Migrants from the Dust Bowl region arrived in the area and worked as fruit pickers and processors in the 1930s. Some of them acquired land and began farming. The local economy rebounded dramatically during World War II thanks to increased national demand for fruit products, but the county also experienced dramatic agricultural labor shortages (Delaplane 1999:6–8, 33–34; Keegan 1989:74–77). Solano County continued to grow and undergo development after World War II. By the 1980s, 8,000 personnel served at Travis Air Force Base and lived in and around the base with their 10,000 family members.

Yolo County

Yolo County is located in the northern part of the Central Valley. It is bounded on the west by Lake and Napa Counties, to the south by Solano County, to the north by Colusa County, and to the east by Sutter and Sacramento Counties. The Sacramento River spans the entire length of its eastern border. The western portion of the county features rolling hills and steep mountains, and the eastern part is composed of nearly flat alluvial plains and basins. During the early 1800s, the region was explored by hunters and trappers such as Jedediah Strong Smith, Ewing Young, and a group of Hudson's Bay Company trappers. The hunters found the banks of the rivers and streams rich with beaver, otter, and other animals whose pelts were a highly valuable commodity in the worldwide trade of the time (Hoover et al. 1990:533). Like Solano County, Yolo County was one of the original 27 counties created when California became a state in 1850. Initially, the county's territory was nearly twice as large as it is now, including a large portion of present-day Colusa County. By 1923, the boundaries were redrawn to their current configuration. At one time, the region abounded with fields of tule rushes, as well as swamplands, marshes, and sloughs (Alta California 1850:2:5; Coy 1973:296; Gudde 1969:370).

Yolo County's first town was Fremont, founded in 1849 near the confluence of the Sacramento and Feather rivers (south of present-day Knights Landing). It became the first county seat in 1849. After the damaging flood of 1851, the county seat was moved to Washington (now part of present-day West Sacramento). Between 1857 and 1861, the county seat moved from Washington to Cacheville (present day Yolo) and then back to Washington. Finally, in 1862, more flooding episodes motivated the community voters to select centrally located Woodland as the permanent county seat (Hoover et al. 1990). Today, the county is home to incorporated cities such as West Sacramento, Davis, and Winters, and several unincorporated cities such as Clarksburg, Dunnigan, and Knights Landings.

The decline of the Gold Rush resulted in disenchanted miners who realized they could make a greater fortune through farming and ranching rather than gold prospecting, and they helped transform Yolo County from an isolated farming community into a booming agricultural region. Through both the mid-nineteenth and twentieth centuries, Yolo County commerce was generally agrarian in focus; the main crops were wheat, barley, and other grains. Commercial enterprises related to agriculture and livestock also sprang up during this period, furthering the development and growth of the region (Larkey and Walters 1987).

Region 1b

Sacramento County

On the eastern banks of the Sacramento River, Sacramento County was established. The first well-documented European exploration of the general region occurred in 1808, when Spanish explorer Gabriel Moraga led an expedition from Mission San José to the northern Sacramento Valley (Hoover et al. 1966). The earliest Euroamerican settlement in the region coincided with the establishment of land grants by the Mexican government in the 1840s. John A. Sutter obtained the first such grant in 1841 at his New Helvetia Rancho, which encompassed lands on the east banks of the Feather and Sacramento rivers (Beck and Haase 1974). The Gold Rush of 1848–1849 ensued shortly thereafter.

Agriculture and ranching were the primary industries in the present-day Sacramento County during the early historic period. Regional ranching originated on the New Helvetia Rancho in the early 1840s. The Gold Rush precipitated growth in agriculture and ranching because ranchers and farmers realized handsome returns from supplying food and other goods to miners. Frequent floods plagued the residents of the region, however, and posed a significant threat to the viability of agricultural interests and further settlement.

In addition to these agricultural pursuits, Sacramento had political pursuits. California's capitol was finally established in Sacramento in 1854. The foundation for the first capitol building was laid in 1860. Floodwaters, however, washed away the foundation, forcing two terraces to be constructed in an effort to protect the building from future flooding; the building was completed in 1874. (Hoover et al. 1990:292.) The completion of the transcontinental railroad in 1869 brought further immigration to California and Sacramento (McGowan 1961:402). Advances in agricultural techniques, equipment, and water management from the 1880s to the early twentieth century brought the Sacramento Valley into the “fruit epoch.” Agriculture replaced mining and cattle ranching as the valley’s most profitable industry. By 1894, 75% of fruit shipped from California to the east coast was from the Sacramento Valley. (Sacramento History Online 2004.)

The development of the Sacramento and American rivers as resources for hydroelectric purposes and as forces to control increased greatly from the 1890s to the twentieth century, starting with the construction of a transmission line from Folsom Dam to Sacramento in 1895. Levees containing flood areas of both rivers were raised and expanded often in coordination with rail line improvements (Sacramento History Online 2004). Current rail line berms are built on top of levees for flood containment and date from the mid-nineteenth century, with improvements built into the mid-twentieth century.

Placer County

Gold was discovered in Auburn Ravine in Placer County in May 1848, and the area soon attracted hordes of miners. Placer County is situated north of Sacramento County and was created from sections of Sutter and Yuba Counties in 1851. The county’s name is derived from placer mining, which was the county’s primary source of employment, and the placers of the area were the state’s grandest. (Hoover et al. 1990:257.) Throughout the 1880s, gold mining was the county’s chief industry. Farming, timbering and laboring for the SPRR were attractive opportunities for new residents.

During the first years of the Gold Rush, gold deposits were extracted primarily by individuals working alone, using pick, shovel, and gold pan. Later, ground sluicing, hydraulic mining, and drift mining were the most prevalent gold recovery systems. Ground sluicing used low-pressure natural or artificial water channels to excavate gold-bearing gravels. In the 1860s, hydraulic mining techniques were developed that used powerful jets of water to expose gold-bearing earth or gravel. (California Department of Transportation 2008:48–52.)

Many canal systems in northern California originated during the Gold Rush period. Mining ditches were constructed to provide a constant supply of controlled water for processing large quantities of placer gravels. The need became critical when mining operations moved away from streambeds in the mid-1850s. After years of lawsuits and quarrels over water rights, three principal water companies in Placer County—the Rock Creek, Deer Creek, and South Yuba Canal companies—agreed to consolidate their interests in 1854. These companies merged into one, which they named the South Yuba Water Company. By the 1860s, a network of more than 390 mi of interconnecting ditches and flumes wound through the Placer County foothills (Lardner and Brock 1924). By the 1870s, many high mountain lakes had been dammed to supply year-round water. In addition to large-scale waterworks, thousands of small ditches were constructed by individual miners to control the seasonal water supply and transport water from large ditches. The Feather and American rivers connect as the source and outflow for water systems within the county. Reclamation districts were created later to better manage the county’s water distribution.

Advancements in underground mining technology during the 1890s led to an increase in production for the gold mining industry. Because of both national and worldwide declines in gold values, however, this mining boom was short lived. A brief revival of mining activity took place in the 1930s, when many individuals who were feeling the effects of the Great Depression sought alternative sources of income. During World War II, mining was curtailed on a national level, and the mining industry has never again regained the success seen during the Gold Rush. (Clark 1970.)

Region 2

Sutter County

The area that now encompasses Sutter County was first explored by Gabriel Moraga in 1808 during his second expedition into the inland valley of California. Subsequent visitors include Luis Argüello, who came to the area in 1817 in search of possible mission sites, and the American frontiersman and trapper Jedediah Strong Smith, who passed through the region in 1828. Hudson's Bay Company trappers also traversed the land that forms Sutter County on their expeditions south during the 1830s and 1840s. (Gordon 1988; Hoover et al. 1990.)

The first permanent settlement in Sutter County was Hock Farm, established in 1841 by John A. Sutter. Located approximately 8 mi south of Yuba City, Hock Farm was one of Sutter's several ranchos and became the principal stock ranch for his sprawling New Helvetia settlement. Under the management of Sutter's employee, John Bidwell, Hock Farm eventually included a home, orchards, gardens, and more than 5,000 head of cattle, which grazed freely on Sutter's lands between the Sacramento and Feather rivers. The Gold Rush (1848–1852) and the resultant pillaging of his fort at Sacramento prompted Sutter to make Hock Farm his primary residence between 1850 and 1868. Sutter continued the agricultural diversification of his lands by importing cuttings and seeds from abroad, which served as the nucleus for the extensive orchards, gardens, and grain fields that support Sutter County's economy today. The agricultural opportunities generated by Sutter's land improvements soon attracted hundreds of new settlers to the region. In 1850, Sutter County was officially incorporated. (Gordon 1988; Hart 1978; Hoover et al. 1990.)

With the decline of the Gold Rush, farming and ranching became the predominant economic activities in Sutter County. By the mid-1850s, farmers were producing large quantities of wheat and other grains for local markets and for export. Land improvement projects in the Sutter Basin during the 1860s opened up new lands for the cultivation of barley, corn, rice, prunes, and the Thompson seedless grape, which was first introduced to the region in 1870. The success of fruit orchards led to the development of canning and packing operations that continue to support the economy of Sutter County today. (Gordon 1988; Hart 1978.)

The growth of commercial agriculture in Sutter County necessitated more effective means of transport to various markets in the Sacramento Valley and other parts of the state. Steam navigation between Yuba City and Sacramento via the Feather and Sacramento rivers began in the 1850s, but was continually hampered by awkward bridge transport and debris from hydraulic mining operations that filled the rivers. Rail transport effectively replaced water bound commerce with the coming of the California Northern Railroad in 1864, the California Central Railroad in 1869, the San Francisco–Marysville Railroad in 1871, and the Western Pacific Railroad in 1910. (Gordon 1988; Hart 1978.)

Sutter County experienced 15 major flood events during the twentieth century. There are more than 200 linear miles of levees countywide, 70 mi of which protect Yuba City and Live Oak alone. The last time levee breaks occurred during a flood event was in 1955 at Yuba City and Nicolaus. However, the most recent major flood event occurred on the Feather River in 1997 in Yuba City and also affected nearby municipalities in Yuba County. Twenty-four thousand residents were evacuated. (Sutter County 2010.)

Yuba County

Yuba County was founded in 1850 with Marysville as its seat. By 1850, the permanent population of Marysville reached about 500. During the winter of that year, the town's leaders formed a committee to draw up official incorporation papers to present to the new state legislature that was set to convene in January 1851. The committee also discussed a variety of names for the new city, including Yubaville, Sicardville, Scardoro, and Circumdoro, before they settled on Marysville, in honor of Mary Murphy Covillaud. In January 1851, the new California legislature approved the charter for the City of Marysville with the official incorporation occurring the following month. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.) Over the next decade, Marysville grew rapidly and the population increased steadily. Between 1851 and 1855, nearly 140 brick buildings were erected in the commercial area of town. By 1853, the city was the third largest in the state. Gold remained the center of the economy and in 1857 alone, more than $10 million in gold was shipped from Marysville's banks to the U.S. mint in San Francisco. The population reached nearly 4,000 permanent residents by the end of the decade. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

For the remainder of the nineteenth century, as gold production declined, Marysville's economic base shifted to agriculture. As was true in most regions of the state, wheat became the most profitable and therefore most popular crop during the 1860s and 1870s. The arrival of the Southern Pacific Railroad (SPRR) in the mid-1860s diverted traffic from the river and made transportation of goods to market easier and more reliable. During this time, the population of Marysville changed in character with women and children replacing single men. Although the city's population rose to nearly 5,000 in 1870, repeated flooding and the depression that followed the collapse of the international wheat market resulted in a slow decrease in population during the 1880s and 1890s. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

The construction of large-scale irrigation projects created a boom in Marysville's economy during the early part of the twentieth century. Dry-farmed wheat gave way to irrigated orchard crops as farmers subdivided their large former wheat tracts into 20 to 40 ac parcels on which to grow a variety of fruits, including peaches, plums, and grapes. Other profitable crops included beans and rice. By the 1920s, Marysville was once more the vital economic hub for the region. The Western Pacific and Sacramento Northern railroads established links to serve Marysville. Several large corporations, including Pacific Gas and Electric Company and Standard Oil, established regional headquarters in the city. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

The revitalized economy led to a 65% increase in Marysville's population between 1900 and 1930. It was also during this period of expansion that many of Marysville's most recognizable architectural landmarks were constructed. During the late 1920s, more than 20 major new buildings, valued at well over one million dollars, were erected in the city. Two of the most notable are the seven-story Hart Building and the Marysville Hotel. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

Butte County

Butte County is situated on the east side of the Sacramento Valley and is bounded by the Sacramento River to the west and the Sierra Nevada to the east. Early exploration of the county began in the 1800s, when Gabriel Moraga guided an expedition up north, along the Calaveras, Mokelumne, Cosumnes, American, and Sacramento rivers, in search of potential inland mission sites. Shortly after, hunters and trappers, such as Jedediah Strong Smith and a group of Hudson's Bay Company trappers, explored the present-day Butte County. The hunters found the banks of the rivers and streams rich with animals whose pelts were highly valuable commodities in the worldwide trade of the time. The region remained outside the mainstream of both Mexican and American settlement until the Gold Rush of 1848, which brought an influx of gold seekers to the region. Transitory encampments, such as Bidwell Bar, Long Bar, and Hamilton, were established. During the next 70 years, gold mining in some form remained the primary economic activity in Butte County. The county's present limits were established in 1923. The original county seat was Hamilton, a former mining town. In 1853, the seat moved to Bidwell Bar (another mining camp). In 1856, it moved again to its current location of Oroville. (Coy 1923; Gudde 1969; Hoover et al. 1990:35.)

During the 1850s and 1860s, much of Butte County was settled with small farms, where settlers raised wheat; vegetables; livestock; and cultivated orchards that included apples, peaches, pears, figs, citrus, and olives. Wheat became the prevalent crop during this period and dominated the agriculture of the county for much of the remainder of the century, until the state experienced an overall decline in the 1890s as a result of the wheat bust. Citrus colonies were organized in Butte County between 1886 and 1895, the most prominent of which were Thermalito, Palermo, and Rio Bonito. (Frederich 1974:13.) By the early twentieth century, Butte County served as a major fruit- and nut-producing region. During this period, land holdings increased in number but declined in overall acreage. While the number of farms increased from 1,179 to 2,603, the average farm size decreased from 574.3 ac to 238 ac. (Walker et al. 2005.)

Butte County remains basically a rural county, with Biggs, Chico, Gridley, Durham, Paradise, and Oroville representing (roughly) six of the largest communities. The lack of any real major mineral deposits, such as coal or iron, and the county's distance from major commercial centers have contributed to the overall rural development of the county.

Colusa County

Monroeville served as the original county seat of Colusa County. By 1853, the seat had moved to Colusa. In 1891, a portion of Colusa County was removed to become part of Glenn County (Coy 1923; General Land Office 1855a–c, 1856a, 1856b, 1867a, 1867b, 1879; Robinson 1948).

The Spanish explored this region of California as early as 1808. Fur trappers passed through the valley over the next few decades, and by the mid-1840s, a handful of ranchos ranging from 6,880 to 10,522 hectares (ha) had been established in the area. The ranchos were primarily used for cattle ranching. Following the Mexican War in 1846, California was ceded to the United States and became a state in 1850. Gold Rush miners who had limited success in the gold fields traveled north and settled in the area to take advantage of the temperate climate and abundant land, which was well suited for ranging and agriculture. Dry farming of wheat and barley, and cattle ranching remained the predominant activities in the region until the early part of the twentieth century (McGie 1970).

World Wars I and II were especially profitable years for the county because there was an increase in demand for grains. In the post–World War II years, agriculture continued to be the major industry in Glenn and Colusa Counties, and the region enjoyed a period of growth with the addition of several new farmsteads. Gross receipts in Colusa County in 1965 were $29,786,500 from field crops, followed by fruits and nuts at $6,123,000, and livestock at $5,431,000 (Colusa County Chamber of Commerce 1966).

Region 3

Tehama County

Tehama County was organized in 1856 from parts of Colusa, Butte, and Shasta Counties (Hoover et al. 1990:495). The county took its name from the centrally located town of Tehama, which likely was named for the Indian word for "low land" or "high water." The county seat was originally in Tehama; however, in 1857, it moved to Red Bluff, where it has remained to the present (Hoover et al. 1990:526–527).

Euroamericans entered the Tehama area beginning in the early nineteenth century. The first Euroamerican to traverse the area was likely Luis Arguello, who entered the region in 1821 and proceeded as far north as Cottonwood Creek. In 1828, Jedediah Strong Smith, who opened the Sacramento Trail (for fur trapping) in the late 1820s, passed through the region. Smith reported to the Hudson's Bay Company about the quantity and quality of furs available in California. In 1828, the company sent its first trapping expedition from the north. Other hunters and trappers entered the region along the Sacramento Trail from the south. By the mid-1800s, the Sacramento Trail had developed into a well-defined path, used by trappers such as Ewing Young, Lieutenant George Emmons and the Wiles expedition, Joseph Gale, John Bidwell (1843), Robert Hasty Thomes, and Albert G. Toomes, who were among the earliest settlers in Tehama County (Hoover et al. 1990: 526–527).

During the 1840s, Tehama County land was deeded under Mexican land grants. Five large land grants were distributed in the Tehama region: Rancho de la Barrana Colorado; Rancho de las Flores, Rancho de los Berrendos; Rancho de los Saucos, which was granted in 1844 to Robert Thomes; and Rancho del Rio de los Molinos, where settler Albert Toomes set up a ranch. Other landowners who received these grants included Dr. Stokes and his wife, and the children of Thomas O. Larkin (Jackson 2010).

Tehama County remained largely unsettled by Euroamericans during the Spanish and Mexican periods. By 1849, gold seeking settlers entered portions of the Tehama region in search of the precious metal along Feather River. Little gold was discovered in the Tehama area, and by the mid-1850s, settlers had turned to ranching and farming private operations. During the 1870s, railroads began laying down tracks throughout the state. In 1872, the Oregon and California Railroad was completed to Red Bluff, spurring fast growth in the small town and in the Tehama area at large as the railroad provided access, goods, and employment throughout the region. Beginning in the late nineteenth century, regional industry consisted of logging, agricultural, and ranching practices. These practices declined during the early twentieth century as residential development increased in the county. (Elliott & Moore 1880:14; Hoover et al. 1990:530–531.)

During the early to mid-twentieth century, transportation expansion, water distribution improvements, and other economic developments resulted in continued residential development in Tehama County. Although railroads continued to expand throughout the county during the 1910s and 1920s, automobile popularity and increased access to the county led to a decline of railroad use and development. By the late twentieth century, Tehama County had an established residential community with a population of close to 60,000 residents (U.S. Census Bureau 2010).

Glenn County

Glenn County was created in 1891 from the northern section of Colusa County and named after Dr. Hugh James Glenn. Willows is the country seat and it was named after willows growing next to the only watering hole between Stony Creek to the north and Cache Creek in Yolo County to the south. Dr. Glenn operated the largest wheat farm in California during his lifetime (Hoover et al. 1990:93).

The Feather and Sacramento rivers run through the county. Near the Feather River, John Bidwell discovered gold on what he named the Bidwell Bar. Granville Swift amassed a fortune on the lode and is reputed to have worked the claim with Stony Creek Indians as laborers.

East of the Sacramento River, in Glenn County, Butte City is an agricultural center. Also, in the eastern portion of the county north of Elk Creek, the first grindstones for milling were cut and shipped by canoe down the Sacramento River to Sutter's Fort and to San Francisco (Hoover et al. 1990:97–101).

Although the county remains mostly rural, extensive road and irrigation development greatly increased agricultural and residential development throughout the twentieth century. The extensive Mendocino National Forest extends well into eastern Glenn County.

Flood Control and Reclamation

The Sacramento River is well known for its associated large, fast-rising floodwaters that are caused by a combination of snowmelt from the Sierra Nevada, rainfall that occurs primarily during a 5-month period (Henley 2006:7; O'Neill 2006b:69), and the steep incline of the mountain range. The Sacramento River drains a watershed area of more than 58,000 square miles (Isenberg 2005:60). The land surrounding the Sacramento River was a source of an abundance of alluvial soil, which was excellent for agricultural pursuits and attracted settlers (O'Neill 2006a:77). This fertile soil, however, was often inundated by floodwaters.

Mining

The discovery of gold in 1848 brought a massive migration that propelled California into statehood in 1850. In the early stages of the Gold Rush, most men were engaged in placer mining. This changed in 1852, with the introduction of hydraulic mining, which washed away entire hillsides (Starr 2005:89–90). The mining operations along the Feather, Bear, Yuba, and American rivers were extensive, and each of these rivers flows into the Sacramento River (Isenberg 2005:70). As the debris collected in the Sacramento River, it caused the riverbed to rise and thereby affected the scale and frequency of seasonal flooding.

Mined material remained California's leading export during the early 1860s, and the mines constituted some of the top employers in the state. This same period saw improvements in hydraulic mining technology that resulted in even further hillside erosion, and silt and rock buildup in the rivers. As debris collected in the Sacramento River, it affected navigation and reduced the depth of the river. The floods of 1861–1862 were particularly devastating to places like Sacramento, where levees on the American River failed and a levee on the Sacramento River was cut to help drain the water (O'Neill 2006a:80–84). Communities along the Sacramento River felt the impacts of hydraulic mining as floods and debris ruined vast amounts of agricultural lands (Crawford and Herrick 2006:138). Farmers began concentrated efforts to halt hydraulic mining. Lawsuits were brought against the mining companies, but the lobbying efforts and political clout of the mining companies were too strong, particularly after the formation of the Hydraulic Miners Association in 1876. In 1878, the Sacramento River flooded, and only Sacramento and Marysville were not underwater (O'Neill 2006a:80–84). That same year, the Office of the State Engineer was created; for the first 2 years of the office's existence, its focus was on debris and drainage questions (Crawford and Herrick 2006:138, 140). In 1884, Judge Sawyer of the U.S. Circuit Court in San Francisco filed a permanent injunction against hydraulic mining companies that failed to properly restrain their debris. The 1884 decision basically ended hydraulic mining in California, but extensive damage to the Sacramento River had already been done, and the effects continued to be felt into the twentieth century (O'Neill 2006a:85, 92).

Flood Control

The impacts from hydraulic mining were felt by most communities and farmers along the Sacramento River. In the early years of statehood, the Sacramento Valley experienced extensive flooding. In response, private landowners constructed small levees—between 3 and 4 ft high—near their farms. This was a pattern repeated by most landowners along the Sacramento River. These levees, however, proved ineffective and failed during the catastrophic floods from this early period (Crawford and Herrick 2006:138; McGowan 1961:287; O'Neill 2006b:74). As the floods worsened, landowners attempted to build higher levees, but these too proved ineffective (McGowan 1961:288).

California was included in the federal Swamp Land Act of 1850, which allowed for the state to reclaim its wetlands through the construction of levees. The program, however, was riddled with corruption and problems that compounded levee construction (O'Neill 2006b:48–50, 52, 73; U.S. Geological Survey 2006). In the early 1860s, as hydraulic mining increased and flooding continued to be a significant problem for farmers along the Sacramento River, a concentrated effort at levee construction began. The state legislature tried to coordinate a levee system and control levee construction by creating the Swamp Land Commission. Modeled after districts in Mississippi, the legislation gave California drainage districts the power to construct levees. It would become the responsibility of state engineers to design the levees for each district, which by the end of the first year included 28 districts. For a multitude of reasons, including more flooding, landowners refusing to pay levee fees, and others unable to pay, the system produced only minor tangible results. The legislature enhanced levee district powers in 1864, which spurred more levee construction (O'Neill 2006b:81).

However, by 1866, after complaints for local control over the districts, the state was no longer planning for a centralized levee system. The following year, the region suffered from another catastrophic flood when the American River rose so high that it flowed across the Sacramento River and breached the levees on the west side of the river, north of present-day West Sacramento in Yolo County (McGowan 1961:289). Levee construction and flood control management got a boost in 1868 with the Green Act. The act eliminated the limit on the number of swampland acres allowable under the federal swampland program and transferred to landowners the task of creating levee districts. Between 1868 and 1871, almost all remaining swampland passed into the hands of private owners (O'Neill 2006b:82). During this period, private owners constructed extensive levee systems that were much larger and, combined with the reclamation of swamplands, made flooding more serious (O'Neill 2006b:82; McGowan 1961:287).

Levee construction and flood control were compounded in the 1880s and 1890s as the fight between miners and farmers continued. There was also disagreement between USACE and the state about USACE's role and authority in the matter. This hindered federal involvement. Local reclamation districts continued to build levees piecemeal, including levees on the west bank of the Sacramento River. These raised the floodplain, protected the local lands, and blocked natural outlets. This created flood problems for residents farther down the river during the first part of the twentieth century.

In 1903 and 1904, the Sacramento River once again flooded. In 1904, a statewide lobbying organization was created for the purpose of generating more work from the state government on river improvement in cooperation with landowners and other government agencies. The governor created a Board of River Engineers composed of engineers with extensive experience with river management on the Mississippi River. The recommendation was that the stress on the levees could be relieved by constructing weirs that would temporarily allow for excess water to bypass the river channel until a proper channel depth could be achieved. The proposal was rejected by the California Board of Trade, which was pushing for the construction of more levees. This was ultimately the approach adopted by the legislature (O’Neill 2006b:94, 104, 106–107).

California continued to lobby the federal government for help. Another devastating flood in 1907 increased pressure for more federal funding, but plans for a comprehensive flood control plan stalled after it was learned that the driving force behind the plan was private landowners. It would take until 1911 for a California Debris Commission member, Thomas H. Jackson, to design a flood control plan that was more comprehensive than just constructing levees. This approach was acceptable to the federal government, and a special session of the state legislature approved California’s support and participation in the new flood plan (O’Neill 2006b:111, 114–115). Lobbying efforts continued to press the federal government and finally were successful when the 1917 Flood Control Act was passed. Among other things, the act required USACE to work with state governments and local levee districts and gave $5.6 million to construct flood control facilities on the Sacramento River (O’Neill 2006b:125). The act authorized the SRFCP, which provided for the construction of more levees and the Yolo and Sutter bypasses. The Sacramento project was the first complete proposed federal project (Bailey 2007:24; California Central Valleys Flood Control Association 1960; O’Neill 2006b:125).

Changes to the act were made in 1928, 1937, and 1941. The projects on the Sacramento River were further affected by Further Flood Control Acts of 1944, 1950, 1958, and 1960. The SRFCP resulted in 980 mi of levee construction (California Central Valleys Flood Control Association 1960). In 1955, another devastating flood occurred in the Sacramento region when the Sacramento River overflowed its levees. A subsequent investigation exposed structural and functional deficiencies in the levees that could not have been foreseen or tested until a flood occurred. The levees on the Sacramento River needed maintenance, which continued to be costly. One reason for the deterioration was thought to be erosion caused by increased pleasure boating on the river that caused wave crashing (California Central Valleys Flood Control Association 1960).

Reclamation

Beginning in the 1860s, the counties of the Sacramento Valley began relying heavily on agricultural pursuits. In 1861, the state legislature created the State Board of Reclamation Commissioners and authorized the formation of reclamation districts for flood control and drainage of surplus water for agricultural purposes. Throughout the Sacramento Valley, reclamation efforts were underway. Reclamation Districts (RDs) 900 and 537 were formed to protect the American and Yolo basins and lower Sacramento County from flooding and to allow for reclamation of agricultural lands in these regions. Swampland districts were also formed, and by 1865, 42 km of levees and 32 km of drainage canals had been constructed (Bouey and Herbert 1990; Thompson 1958).

Periodic droughts and the general decline of the wheat market at the turn of the twentieth century caused farmers in the area to focus on improving crop irrigation. William S. Green, one of the early settlers of Colusa, envisioned revolutionizing agriculture in the region by constructing an irrigation canal that would divert water from the Sacramento River to farms in the valley. Although his idea had some support, diversion efforts eventually led to conflict between those who were diverting the water and those who relied on the natural flow of water to their crops and livestock. The passage of the Wright Irrigation Act in 1887 catapulted Green's idea (URS Corporation 2006:6). The state legislature passed the act in an attempt to support irrigated farming and solve conflicts over water control. It also led to the formation of irrigation districts controlled by local landowners. Although wealthy landowners with riparian rights fought for the validity of the act, irrigation districts took shape nonetheless. Within a few years of 1887, more than 90 irrigation districts had formed. However, most of the districts were plagued by water rights issues, litigation, political opposition, and poor fiscal management, which led to most not surviving. Despite this, the 1897 Wright-Bridgeford Act streamlined the process for forming irrigation districts (Corbett and Bradley 2001:J-5).

During this same period, the state legislature passed additional legislation increasing the supervision over organization and financing of the irrigation districts, including the creation of the Bond Certification Commission. The commission rendered opinions on the viability of proposed districts and approved their bonds. After 1915, the overall number of organized irrigation districts increased. By 1929, there were 15 irrigation districts in the Sacramento Valley between Sacramento and Redding, and more than half of them were formed between 1916 and 1919, during the years of the great expansion of the rice industry. By the 1930s, the state had more than 607,029 ha of irrigated land in more than 94 districts throughout the Central Valley (JRP Historical Consulting and California Department of Transportation 2000:43–44).

On November 22, 1887, the Central Irrigation District formed in Colusa County (Glenn County was part of Colusa County until 1891) and construction on the Central Canal began (Rogers 1970:340). Because of ongoing litigation issues, construction on the canal was hampered and eventually stopped, leaving farmers with limited means to irrigate their fields. In 1903, the Central Canal and Irrigation Company purchased the works. Although it made some progress on the canal, the company also experienced financial troubles. Within 6 years, the Central Canal and Irrigation Company changed hands, when the Sacramento Valley Irrigation Company (founded by the Kuhn banking system) purchased the Central Canal and Irrigation Company (URS Corporation 2006:7). The bank failed in 1915, which led to the Sacramento Valley West Side Canal Company being in receivership and the State Railroad Commission fixing the rates.

By 1920, the Glenn-Colusa Irrigation District (GCID) had absorbed the system. In an effort to obtain water, the GCID began construction to complete the Glenn-Colusa Canal (originally known as the Central Irrigation Canal) and secondary canals and associated ditches built by the Central Canal and Irrigation Company and later the Sacramento Valley Irrigation Company. By the time the GCID completed work on the canal, the capacity of the water feature had nearly doubled. However, unfortunate events, such as heavy rains resulting in failed crops and the stock market decline coupled with the Great Depression, wreaked havoc on Glenn and Colusa Counties. As a result, county farmers faced financial difficulties as they fell behind on payments and taxes owed to the irrigation districts and the counties, which resulted in the farmers eventually losing their land. Ultimately, the irrigation and reclamation districts (including RD 2047) became land-rich, but were unable to collect fees. In the late 1930s, Charles Lambert reorganized the district lands, offering sale of property back to the farmers. Within a few years, the onset of World War II again provided high demand for grains, making local rice a lucrative crop for a second time (JRP Historical Consulting Services and California Department of Transportation 2000:23).

The Glenn-Colusa Canal functions as the main water distribution canal for the GCID and diverts water from the Sacramento River. The canal measures approximately 105 km and terminates just south of the town of Williams. Currently the irrigation district provides irrigation water to 70,820 ha of farmland in Glenn and Colusa Counties.

In Rio Vista, located among the Cache Slough districts of the Yolo Basin reclamation districts, reclamation and flood control were affected by improvements in the Egbert Tract (RD 536) to the north; the levees constructed in RD 536 provided some flood protection for Rio Vista. Between 1870 and 1890, sufficient levee protection existed in RD 536 to permit farming. Levee improvements made along Lindsey and Cache sloughs from 1892 to 1901 were demolished in the 1902 flood; new levees were not constructed until 1909. Large levees were also built by 1912 along Lindsey and Cache sloughs, as well as along the Sacramento River (Thompson 1958:507–508). These levees form the principal flood barrier for Rio Vista.

At the turn of the twentieth century, reclamation efforts continued with the 1902 Reclamation Act, which established the U.S. Reclamation Service (presently the U.S> Bureau of Reclamation). Within 5 years of the act's passage, a total of 24 projects had been approved nationwide, including those within the Central Valley (JRP Historical Consulting Services and California Department of Transportation 2000). Between 1911 and 1918, hundreds of miles of levees were constructed to control flooding in the Sacramento Valley. As early as 1892, farmers of Yolo County had come together to construct levees along the Sacramento River from the town of Washington to roughly 9 mi downstream. In March 1911, the Sacramento Land Company (formerly the West Sacramento Land Company) assisted with the establishment of RD 900 in what is now West Sacramento. The formation of this district created a framework for using public funds through bonds, levies, and taxes to drain the land (Corbett 1993; Larkey and Walters 1987). Presently, RD 537 consists of portions of West Sacramento, including the Sacramento bypass and weir, as well as a pumping plant. Both reclamation districts operate and maintain a network of canals, ditches, lakes, and pump stations throughout the city.

Under the direction of civil engineers Haviland & Tibbetts, formation of RD 900 began. The district spanned 11,500 ac from the east–west line of the SPRR tracks, south to the vicinity of Riverview. Construction involved installing drainage canals, levees, and pump houses. The canals carried drainage to the pump houses, which in turn moved the water over the levees into the Yolo Bypass. As the land was drained of water, the fields of tules were removed, establishing acres of agricultural land. (Corbett 1993.)

Among the major projects proposed during this period was the comprehensive reclamation of the Sutter Basin, which annually received overflow from the Sacramento River. The California Debris Commission plan of 1911 advanced the bypass concept as the most effective method for reclamation and flood control in the Sacramento Valley. The bypass concept involves the diversion of high flood flows from the main river channel into an auxiliary channel or bypass, while leaving enough water in the river channel to scour its bed. The bypass directs winter flood flows to previously dry areas while allowing for the reclamation of previously swampy lands. Additionally, the bypass area itself can be farmed in years when the flood flow does not persist beyond the planting period. The California Debris Commission plan immediately attracted the attention of private investors in Sutter County who intended to use the bypass concept for the reclamation of the Sutter Basin. (California Department of Water Resources 1978; McGowan 1961.)

In 1912, a group of landowners in Sutter County formed the Sutter Basin Company and proposed the construction of a bypass through the Sutter Basin. The Sutter Basin Company additionally proposed the creation of a 60,000 ac reclamation district on land on the east and west sides of the bypass. Sutter County landowners who lived outside the proposed reclamation district immediately protested the location of the project, which they argued would be paid for by their tax dollars but would primarily benefit the Sutter Basin Company. A legal controversy over the alignment of the Sutter Bypass eventually ended with the state ruling in favor the Sutter Basin Company, whose original alignment was deemed beneficial to the entire county. (California Department of Water Resources 1978; McGowan 1961.)

Construction of the Sutter Bypass began in 1918 and initially involved the digging of 18 mi of main canal, 54 mi of lateral ditches, and 190 mi of sub-lateral ditches to drain the land toward the Feather River. Expansion of the Sutter Bypass continued through the early 1920s and included the building of the West Levee in 1924. A major component of the Sutter Bypass, the West Levee was constructed privately by several reclamation districts and is still maintained and operated by them. The East Levee was constructed in 1924 under the direction of the Reclamation Board (now CVFPB) and was enlarged to its present size in 1942 by USACE. The present Sutter Bypass is a 30 mi system of canals, levees, weirs, and pumping plants that begins near State Route 20, 4 mi west of Sutter, and terminates opposite the Fremont Weir on the Sacramento River. Serving as an overflow for flood water in winter and a source of irrigation water during summer, the Sutter Bypass is a crucial component in the agricultural economy of Sutter County and the greater Sacramento Valley. (California Department of Water Resources 1978.)

Predicted Property Types

This section describes the historic property types that are expected in the Undertaking APE. These property type descriptions are based on information in Chapter 2, *Cultural Resources Study*: ethnographic research, archaeological inventories, submerged resources studies, and records searches conducted in support of the inventories.

The term *property type* refers to a grouping of properties that share similar important characteristics. For this HPTP, property types have been broadly categorized into groups based on their cultural and temporal associations. These two groups are subdivided as discussed below.

Prehistoric Archaeological Property Types

Previous studies in the vicinity of the Undertaking Area provide reasonable expectations of the range of prehistoric archaeological property types relevant to the Undertaking. These property types are classified here in terms of constituents and features. Five prehistoric archaeological property types have potential to be present in the Undertaking APE: midden sites, isolated burials and features, lithic scatters, bedrock milling features, and isolated artifacts. Each prehistoric property type is described under a separate heading below.

Midden Sites

Midden sites are anticipated to be the most structurally complex and to have the greatest artifact diversity of all the prehistoric property types. Middens are usually distinguished by a high organic content that causes soil to be noticeably darker, and they can vary greatly in size. Middens are found where people ate shellfish and other invertebrates, fish, birds, sea mammals, ungulates, small mammals, acorns, seeds, tubers, and other food resources. These food sources leave a large amount of debris, which customarily was piled up where the food was processed and eaten.

Middens in the Sacramento Valley were generally occupation sites, although some may have been used only on a seasonal basis. When deaths occurred, the middens sometimes were used as burial sites. Constituents may include flaked-stone debitage, bedrock mortars, ground-stone tools, marine shell, vertebrate remains, charcoal, baked clay, charred floral remains, and fire-affected rock. Non-utilitarian artifacts also may include charmstones, shell ornaments, and beads. Discrete features, including house floors, hearths, and human burials, also may be located within these deposits (Moratto 1984; Raven et al. 1984).

Isolated Burials and Features

Burial features can range in complexity from a simple isolated inhumation (burial or cremation) to more elaborate interments containing numerous bodies. These features may represent specially designated interment areas or remnants of larger archaeological sites. Burial associations often include *Olivella* beads, *Haliotis* ornaments, and ground and polished stone artifacts, such as charmstones and plummets.

Lithic Scatters

Lithic scatters are collections of flaked- and/or ground-stone debris, including tools and debitage that relate to post-quarry reduction and tool-manufacturing efforts. They are perceived primarily as daily or overnight task-oriented camps where a limited range of activities was conducted. These sites may or may not contain chronological information, depending on the presence and quantity of diagnostic items such as projectile points and pottery, or dateable materials such as obsidian. Lithic scatters can be perceived as simple, containing only flaked-stone debitage and tools, or complex, having primarily flaked-stone debris but some ground stone as well.

Bedrock Milling Features

Bedrock milling features are typically bedrock mortars and/or milling slicks. Milling features can be isolated features or can be grouped together in a cluster. These features were used for processing vegetal resources such as acorns and other seeds. Because of a dearth of exposed bedrock in the Central Valley, milling features are typically associated with the Sierra Nevada foothills, where exposed bedrock is much more common. These features often have associated artifacts such as pestles and manos. Flotation analysis of adjacent soils often can identify plant types that were processed at these sites.

Isolated Artifacts

Isolated finds are three or fewer artifacts that occur within a restricted spatial context, generally within an area 10 m in diameter. Information potential usually is limited to location, material type, style, and function of the individual artifact.

Native American Property Types

Native American property types, or traditional cultural properties (TCP), within the Undertaking APE are typically associated with resource procurement activities along the waterways of the Central Valley. Such properties derive their significance not from the property itself, but from the role the property plays in the cultural practices or beliefs of an extant community or identifiable social group. Examples of TCPs range from expansive geographic areas such as the Sutter Buttes to individual locations associated with beliefs or practices that are of traditional cultural significance. Examples of TCP types are described under separate headings below.

Plant Gathering

Many Native American groups gather the same plant resources that have been used by their people for centuries. Some gathered resources are used for subsistence or medicine, but Native Americans who currently practice traditional plant gathering focus more on materials for producing baskets and other items. Typical resources gathered for food include acorns, buckeye nuts, wild onion, and wild sweet potato. Resources gathered for materials include tule, willow, and various native grasses.

Fishing

Fishing played an important role in the lives of Native Americans within the Undertaking APE. Some Native American groups still procure fish (particularly salmon) using traditional methods, including weirs, nets, harpoons, and traps. There may be areas where Native American groups still practice these traditional procurement methods within the Undertaking APE.

Ceremonial and Sacred Sites

Some areas regarded as sacred by Native American groups are still used for ceremonial purposes. These areas are typically associated with an event or a viewshed of particular importance. Often, these are ancient village sites or meeting sites where tribal leaders from the region would gather, or sites with views of areas important to their religious beliefs.

Historical Archaeological Property Types

Previous studies in the vicinity of the Undertaking Area provide reasonable expectations of the range of historical archaeological property types relevant to the Undertaking. These property types are classified here in terms of function. Intensive historic-era use of waterways within the Undertaking APE coincides with the discovery of gold in 1848. The sudden influx of fortune seekers resulted in heavy use of waterways within the Undertaking APE for transportation of individuals and supplies. To accommodate the surge, cities and towns were established along the rivers. Both small- and large-scale mining endeavors were carried out within the Undertaking APE along the Feather, Bear, Yuba, and American rivers. Agricultural endeavors followed quickly, and overland transportation routes were developed that often paralleled waterways within the Undertaking APE. Historical archaeological resources within the Undertaking APE are mostly related to these events. Five categories of historical archaeological property types have been identified within the Undertaking APE and are described under separate headings below.

Mining Sites

This property type is typically found in the Sierra Nevada foothills and consists of features associated with placer mining, including prospect pits, tailings piles, ditches, and adits. There are often associated mining camps of varying size, which can include tent pads and domestic refuse deposits.

Building Foundations

This property type is typically related to either commercial or residential structures that have been demolished or burned down. Foundation materials can include stacked rock, wood, brick and mortar, and concrete. There are often associated structural remains such as plate glass, nails, and other hardware in the vicinity. Associated domestic refuse deposits are common, as well as subterranean wells and privy pits.

Refuse Scatters/Dumps

This property type can range from a single dumping episode to an established community dump. Associated artifacts include glass bottles and jars, ceramics, metal cans, and a multitude of other domestic items.

Transportation-Related Features

This property type includes roads, railroads, and landings for water vessels. Roads and railroad lines were often established on the crown of levees that parallel waterways within the Undertaking APE. Public landings were often established for towns, but many were associated with private properties. Landings associated with private property were typically used for loading and unloading of materials and livestock associated with agricultural endeavors.

Water Conveyance Systems

This property type consists of both small-scale systems, such as ditches, canals, and pump house foundations, and large-scale systems, such as levees, sloughs, and weirs. Small-scale water conveyance systems are typically associated with irrigation for agricultural endeavors, but they can also be associated with placer mining, particularly in the foothills.

Historic Structure Property Types

Historic structures include several different property types best classified as buildings, structures, and sites. Property types within these classifications can also be classified as a district. A district would contain a high concentration of buildings, structures, and sites united historically or aesthetically. Cultural landscapes include a combination of property types and are typically classified as either a site or district. Previous studies within the Undertaking APE indicate a high concentration of historic structure property types.

Buildings

Buildings are defined as being constructed primarily to shelter any form of human activity. Therefore, this property type can include residential, commercial, agricultural, civic, or social buildings. Residential buildings will include single- and multifamily residences. Agricultural buildings will include ranch complexes, sheds, barns, and associated outbuildings. Civic buildings may include government buildings such as a city hall or firehouse. Buildings that serve a social purpose can include fraternal/social halls or libraries. Typically, these buildings will be associated with the settlement and development of the particular regions.

Structures

Flood control and irrigation played an important role in the development of each region of the Undertaking APE. Structures related to these contexts include levees, weirs, slips, canals/ditches, pumping stations, water towers, and related water conveyance systems. Other possible property types within this category may include roads and bridges.

Sites

Sites are associated with significant historic events or activities. Most often, sites are places that have archaeological or cultural associations. Sites, however, can also include natural features and landscapes. Within the Undertaking Area, potential sites may include orchards, natural groves of trees, tree allées, and vernacular and rural landscapes.

Cultural Landscapes

Cultural landscapes are classified most often as sites or districts. Within the Undertaking APE, it is likely to find historic vernacular landscapes or rural landscapes. Property types that contribute to a cultural landscape may include ranch complexes with a farmhouse, associated outbuildings, and circulation paths. Under the context of flood control and irrigation, it is also possible to have a cultural landscape that includes levees, weirs, canals, levee roads, bridges, and agricultural fields/orchards.

Submerged Property Types

Previous studies in the vicinity of the Undertaking Area provide reasonable expectations of the range of submerged property types relevant to the Undertaking. These property types are classified here in terms of function because of the wide variation in form. Submerged resources are typically associated with historic-era activities, although there is a small possibility for submerged prehistoric resources. Use of the waterways within the Undertaking APE for commercial, military, and recreational endeavors has been intensive since the 1840s, resulting, for various reasons, in numerous submerged properties. Previous cultural resources studies within the Undertaking APE have identified several submerged property types. Submerged resource property types include the remains of landings, pilings, and modern and historic vessels (Panamerican Consultants 2010). Each property type is described under a separate heading below.

Landings

This property type includes wooden structures used for docking vessels for loading and unloading people, livestock, and materials. Public landings were often established for towns, but many were associated with private properties. Landings associated with private property were typically used for loading and unloading materials associated with agricultural endeavors. As overland transportation became more common, use of the waterways declined and landings fell into disrepair, often resulting in their collapse into the water.

Pilings

This property type was often associated with landings or structures built along the riverfront. Pilings are wood or concrete poles driven into the river bottom to provide support to the associated structure, but they were also sometimes used individually for the mooring of vessels. Many pilings within the Undertaking APE have fallen into disrepair and sunk, although some are still intact and being used for mooring.

Vessels

A wide range of submerged vessels dating from the 1840s to the present can be found within the Undertaking APE. The earliest vessel types were typically wooden hulls with metal hardware and included small and large sailing vessels and barges. These vessels were usually associated with commercial endeavors because recreational boating was not common until the 1930s. Wooden barges within the Undertaking APE were typically "dumb" barges (i.e. no built-in means of propulsion) and were used for transporting produce while tethered to a wind- or steam -powered vessel (Lydecker 2010). Steel hulls became more prominent after the 1860s and are typically steamboats, barges, fishing vessels, or military vessels. Modern vessels are most often recreational and are made of fiberglass and wood or steel composite.

Chapter 4
General Standards and Procedures

Standards and Procedures

This chapter of the HPTP identifies the professional and legal standards under which HPTP activities are to be conducted, as well as procedural requirements for activities such as permit acquisition for fieldwork on properties not owned or managed by USACE. This chapter discusses the requisite professional qualifications of cultural resource management personnel, permitting requirements, and applicable federal, state, and local curation standards. Standards for documentation are discussed by property type in Chapter 5, *Identification of Historic Properties*.

Professional Qualifications

Professional Standards and Guidelines

All activities implementing this HPTP will be carried out under the authority of USACE by or under the direct supervision of a person or persons meeting, at a minimum, the Secretary of the Interior's Professional Qualifications Standards (36 CFR 61; 48 Federal Register [FR] 44716). According to 48 FR 44716:

> These qualifications define the minimum education and experience required to conduct cultural resources identification, evaluation, registration, and treatment activities. In some cases, additional areas or levels of expertise may be needed, depending on the complexity of the task and the nature of the historic properties involved. In the following definitions, a year of full-time professional experience need not consist of a continuous year of full-time work but may be made up of discontinuous periods of full-time or part-time work adding up to the equivalent of a year of full-time experience.

Archaeology

The minimum professional qualifications in archaeology are a graduate degree in archaeology, anthropology, or a closely related field, plus *each* of the following:

- At least 1 year of full-time professional experience or equivalent specialized training in archaeological research, administration, or management
- At least 4 months of supervised field and analytic experience in general North American archaeology
- Demonstrated ability to carry research to completion

In addition to the minimum qualifications, a professional in prehistoric archaeology shall have at least 1 year of full-time professional experience at a supervisory level in the study of archaeological resources of the prehistoric period.

Architectural History

The minimum professional qualifications in architectural history are 1) a graduate degree in architectural history, art history, historic preservation, or a closely related field, with coursework in American architectural history; or 2) a bachelor's degree in architectural history, art history, historic preservation, or a closely related field, plus *one* of the following:

- At least 2 years of full-time experience in research, writing, or teaching in American architectural history or restoration architecture with an academic institution, historical organization or agency, museum, or other professional institution
- Substantial contribution through research and publication to the body of scholarly knowledge in the field of American architectural history

Ethnography (Cultural Anthropology)

The minimum professional qualifications in ethnography (cultural anthropology) include two options. One is a graduate degree in anthropology with a specialization in applied cultural anthropology, or a closely related field, plus *each* of the following:

- A minimum of 2 years of full-time professional experience (including at least 6 months of fieldwork supervised by a professional cultural anthropologist) applying the theories, methods, and practices of cultural anthropology that enables professional judgments to be made about the identification, evaluation, documentation, registration, or treatment of historic, prehistoric, or traditional cultural properties in the United States and its territories
- Products and activities that demonstrate the successful application of acquired proficiencies in the discipline to the practice of historic preservation

The other is an undergraduate degree in anthropology or a closely related field, with a specialization in applied cultural anthropology, plus *each* of the following:

- A minimum of 4 years of full-time professional experience (including at least 12 months of fieldwork supervised by a professional cultural anthropologist) applying the theories, methods, and practices of cultural anthropology that enables professional judgments to be made about the identification, evaluation, documentation, registration, or treatment of historic, prehistoric, or traditional cultural properties in the United States and its territories
- Products and activities that demonstrate the successful application of acquired proficiencies in the discipline to the practice of historic preservation

History

The minimum professional qualifications in history are a graduate degree in history or a closely related field; or a bachelor's degree in history or a closely related field, plus *one* of the following:

- At least 2 years of full-time experience in research, writing, teaching, interpretation, or other demonstrable professional activity with an academic institution, historic organization or agency, museum, or other professional institution
- Substantial contribution through research and publication to the body of scholarly knowledge in the field of history

Historic Architecture

The minimum professional qualifications in historic architecture are a professional degree in architecture or a state license to practice architecture, plus *one* of the following:

- At least 1 year of graduate study in architectural preservation, American architectural history, preservation planning, or a closely related field
- At least 1 year of full-time professional experience on historic preservation projects

Such graduate study or experience shall include detailed investigations of historic structures, preparation of historic-structure research reports, and preparation of plans and specifications for preservation projects.

Architecture

The minimum professional qualifications in architecture are 1) a professional degree in architecture and at least 2 years of full-time experience in architecture, or 2) a state license to practice architecture.

Permits and Rights of Entry

Property owners within the Undertaking Area are private individuals and public agencies. In some cases, before conducting fieldwork on lands owned by state agencies, including the SLC, DWR, and California Department of Transportation (Caltrans), the state agency must grant an Encroachment Permit. If fieldwork will be conducted on properties owned by any of the above state agencies, USACE or its agents will submit the appropriate permit applications.

USACE must receive written permission from landowners before conducting cultural resource investigations on private property. Once parcels that must be accessed are identified and landowner information is obtained, the USACE Real Estate Division will send letters requesting access to each landowner, along with a form to be sent back to USACE granting or denying access. Request letters will have a brief project description and a timeframe of when access will be needed. Access request letters will be sent out at least 3 months before conducting fieldwork.

California State Lands Commission

If submerged historical or archaeological resources on state lands under the jurisdiction of the SLC will be disturbed or if artifacts are to be collected during archaeological investigations, a permit must be obtained from the SLC. The application can be obtained from the SLCs Submerged Cultural Resources Unit or it is available online at the SLC website: http://www.slc.ca.gov/Online_Forms/Surface_Leasing_Application_Home_Page.html. Additional information specific to submerged cultural resources as generally described in the "California State Lands Commission, General Application Guidelines for Marine Salvage Permits" would also be requested. The permit application must be approved at a public meeting of the SLC. The SLC meets approximately every other month. To be included on the SLC meeting agenda, the permit application must be processed at least six to eight weeks before the meeting date. A sample permit application, "General Application Guidelines for Marine Salvage Permits," and sample permit are provided in Appendix D.

California Department of Water Resources

Before any fieldwork is conducted, the DWR requires submission of a request for a Temporary Permit for Entry onto State-Owned Land. A formal letter request with appropriate parcel numbers must be submitted to the appropriate DWR Field Division at least 30 days before the start of fieldwork. A sample permit is presented in Appendix E.

California Department of Transportation

Access to Caltrans property requires submission of a Standard Encroachment Permit Application. The application must be submitted to the appropriate Caltrans District that holds jurisdiction over the proposed encroachment area. Caltrans will respond to the application within 60 days of submittal. A sample permit application is presented in Appendix F.

Curation

Artifacts collected from archaeological sites during survey or excavation require curation as part of the overall management of archaeological properties. Typically, artifacts would only be collected during excavation. A *collection* refers to material remains excavated or collected during a cultural resources survey, excavation, or other study of a prehistoric or historic site, as well as the associated records and field notes that were produced during the study. Collections are curated in an effort to ensure that they are preserved and managed so that they may be accessed for research, examination, and education at a later date. This section outlines the regulatory and professional requirements of curation under the Undertaking.

Selecting the right curation facility requires not only considering the facility's capability to preserve and manage the collection, but also whether the facility is appropriate for the collection. Whenever possible, a collection should go to a repository in the locality or state of the site or area from which the collection was obtained. Ideally, the facility will house other collections from the same site, project location, geographic region, or cultural area. Collections should not be subdivided except to meet special storage, conservation, or research needs. Collections and associated records should be housed in the same repository because this serves to maintain the integrity and research value of the collection.

As the lead federal agency, USACE must comply with the standards and guidelines for the curation of federally administered archaeological collections, established by the Secretary of the Interior and published in the CFR. Similar standards are encouraged by CEQA (13 PRC 15126.4[b][3][C]) and the Governor's Office of Planning and Research (1994). 36 CFR 79 states that collections obtained as a result of a survey, excavation, or other study conducted in connection with a federal action, assistance, license, or permit be appropriately curated at a qualified curation facility. Also, 36 CFR 79.4(a) states that the regulations apply to collections that are excavated or removed under the authority of the Antiquities Act, the Reservoir Salvage Act, Section 110 of the NHPA, or the Archaeological Resources Protection Act and do not apply to private lands (see "Private Property" below). The curation of materials recovered from state, and private property is discussed below under separate headings.

State Property

Submerged resources on lands under SLC jurisdiction are state property (PRC 6313(a)) and shall be in the custody of the state of California. Guidelines for the Curation of Archaeological Collections have been established by the State Historical Resources Commission (SHRC) pursuant to its authority in PRC 5020.5(b), which calls for the SHRC to develop guidelines for the "reasonable and feasible collection, storage, and display of archaeological specimens." These guidelines were written to supplement 36 CFR 79 (discussed below) and address the following:

- Procedures to assemble, prepare, manage, and preserve collections
- Criteria to determine when a repository has the capability to provide permanent curation services
- Procedures for the use of collections
- Terms and conditions for contracts, memoranda, and agreements by which archaeological collections are acquired by repositories

State laws and regulations concerning collections and resources from submerged sites under the jurisdiction of the SLC will be followed. However, the SLC may transfer title of such collections to a recognized scientific or educational organization or institution upon request.

Private Property

Archaeological collections obtained on private land are the property of the landowner. To ensure protection and future preservation of such collections, it is recommended that USACE enter into an agreement with the appropriate landowner of artifacts collected from private property. Such an agreement would stipulate that USACE assume ownership and responsibility of the recovered materials and proceed with curation as administered by 36 CFR 79 and in accordance with applicable state laws and codes.

Chapter 5

Identification of Historic Properties

This chapter describes the methods by which historic properties in the Undertaking APE will be identified, including the processes and responsible parties for consultation, inventory of Undertaking APEs, standards for evaluation of expected property types, and documentation requirements. As a guide both to the PA signatories and consultants to whom the PA signatories might delegate identification tasks, the structure of Chapter 5 is intended to mirror the process by which cultural resource managers typically conduct cultural resource inventories under Section 106. In this way, the stipulations of the PA and this HPTP can be easily coordinated throughout the life of the Undertaking. This chapter starts with an overview of general historic properties identification methods (research, consultation, survey, and evaluation), and then provides detail concerning the application of each method to broad property types: prehistoric archaeological, Native American, historic archaeological, historic structures, submerged, and cultural landscape properties. The overview leads off with a discussion of screened Undertaking activities.

General Methods

Research

Research is a critical component of historic properties identification and should, to a reasonable extent, be conducted throughout the process of complying with the SRBPP PA's stipulations and this HPTP for any given Undertaking activity. Conducted prior to fieldwork or consultation with knowledgeable parties, it informs the resource manager of the variety, number, and character of properties that may be present in an Undertaking activity's APE. Moreover, research might reveal that historic properties are located in the Undertaking APE and have been evaluated for NRHP eligibility. Research may also point USACE toward potential consulting and knowledgeable parties (see "Consultation").

USACE will sometimes find it necessary to conduct additional research subsequent to fieldwork to evaluate a potential historic property (see "Evaluation") or to solve another problem of identification.

Research to identify historic properties should commence with a comparison of the Undertaking activity's APE map with USACE's GIS records search database and mapping (see Chapter 2, *Cultural Resources Study*, for a description of this resource). This search will enhance USACE's prospect for early identification of historic properties and will assist in framing the level of effort warranted to consider the effects the Undertaking activity may have on historic properties.

Following the SRBPP GIS database search, USACE will conduct a records search at the appropriate CHRIS information center. Essential sources to consult at the CHRIS information centers are:

- The CHRIS maps of previous cultural resource studies and known cultural resources
- Previous studies and cultural resource record forms
- The Archaeological Determinations of Eligibility

- The Historic Property Data File
- Historic maps
- The NRHP
- The CRHR and local registers
- Other secondary sources

Research beyond the CHRIS sources should be conducted as well, before potential historic properties have been identified. A good rule of thumb for identifying historic properties is to obtain historic map coverage of the Undertaking activity's APE in a minimum of 10-year intervals, which allows cultural resource managers to locate individual properties as well as understand patterns of community development and landscape change.

Research conducted after fieldwork is complete will generally focus on specific properties identified in the field. Such research typically focuses on primary sources to permit evaluations of NRHP eligibility.

Consultation

Consultation with knowledgeable and concerned communities, organizations, and individuals is an important aspect of historic properties identification. USACE is responsible to ensure that such parties, irrespective of consulting party status under the SRBPP PA, are identified and consulted early in the planning phase of Undertaking activities.

For Indian Tribes and non-federally recognized Native American groups and individuals, McCarthy (2010) identifies several tribes, organizations, and individuals by county, each of which USACE may confer with regarding the identification of historic properties in the Undertaking APE. This list doubtlessly will be refined as more precise relationships between Native Americans and particular portions of the Undertaking APE become known. The list is reproduced in McCarthy 2010, which is provided in Appendix G of this document.

In addition, USACE will engage, as appropriate, historical organizations, local governments, and concerned communities to identify pertinent historic properties and management issues. Attachment 2 to the SRBPP PA lists the historical organizations consulted during preparation of the PA and will provide a useful guide for future consultation.

Survey

Surveys of Undertaking activity APEs are necessary and critical components of historic properties identification because research and consultation are unlikely to identify all historic properties in the Undertaking APE. Survey methods will vary with the types of historic properties expected in the Undertaking APE. Survey methods may entail windshield surveys (historic structure survey), intensive pedestrian survey, reconnaissance survey, or sample survey. Survey may also include field visits with consulted parties to address specific property concerns. Survey methods are discussed in the "Evaluation" section, with specific attention to property types.

Evaluation

The NRHP was authorized under the NHPA. It contains the list of buildings, structures, objects, and sites that are significant in American history, architecture, engineering, archaeology, and culture. To be eligible for listing in the NRHP, a property must meet one of the four NRHP criteria and retain integrity sufficient to convey that significance. It is possible for a property to meet more than one criterion, particularly in the case of a historic district. The registration criteria are:

- **Criterion A.** Properties associated with events that have made a significant contribution to the broad patterns of history
- **Criterion B.** Properties associated with persons significant in our past
- **Criterion C.** Properties that embody distinctive characteristics of a type, period or method of construction, or are the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction
- **Criterion D.** Properties that yield, have yielded, or are expected to yield information important to history

To evaluate a property's eligibility, its period of significance must be defined. The period of significance represents that time period in which the property established its historical associations with events or persons, or when the property achieved its defining physical characteristics. The period of significance may span several years or may be only a single year.

As mentioned above, in addition to meeting one of the NRHP criteria, a property must retain integrity. The NRHP evaluates integrity based on seven aspects:

- **Location.** The place where the historic property was constructed or where the historic event occurred
- **Design.** The combination of elements that create the form, space, structure, and style of the property
- **Setting.** The physical environment of a historic property
- **Materials.** The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property
- **Workmanship.** The physical evidence of the crafts of a particular culture or people during any given period in history
- **Feeling.** The property's expression of the aesthetic or historic sense of a particular period of time
- **Association.** The direct link between an important historic event or person and a historic property

It is not necessary for a property to retain all seven aspects of integrity. A property must simply retain those essential aspects necessary to convey its significance.

Properties Exempt from Evaluation

The Section 106 implementing regulations require a reasonable and good faith effort on the part of federal agencies to identify historic properties (36 CFR 800.4[b][1]). The procedures in this section concentrate USACE's efforts on properties that have the potential to qualify as historic properties.

A property should be evaluated only if USACE professionally qualified staff (PQS) reasonably determines that a property has a demonstrable potential for historic significance. Evidence of such potential consists of associations with significant historic events or individuals (NRHP Criteria A or B); engineering, artistic, design, or aesthetic values (Criterion C); information value (Criterion D); the presence of community concerns; or inclusion as a potential contributing element within a larger property requiring evaluation, such as a historic or cultural landscape, traditional cultural property, or historic district.

Appendix H defines categories of properties that do not warrant evaluation pursuant to Stipulation IV.E.1. This exemption process does not include archaeological sites, traditional cultural properties, or other cultural remains or features that may qualify as contributing elements of districts or landscapes. Exempted properties may be documented, if documentation is warranted, at a level commensurate with the nature of the property (e.g., DPR 523 Primary Record form and Location Map, Memo to File, or GIS cultural database).

Evaluation of Prehistoric Archaeological Property Types

Data Gathering

Research and consultation are used to determine the significance of prehistoric archaeological properties.

Research

USACE is responsible for ensuring that adequate research is conducted to accurately assess the NRHP eligibility of prehistoric archaeological properties. Such research will be conducted with recourse to published archaeological literature and gray literature covering the region, as well as applicable theoretical discussions and agency guidance concerning archaeological properties. USACE will develop a property-specific research design for determining the eligibility of prehistoric archaeological properties, tiering from the prehistoric research themes presented below. For those prehistoric archaeological properties that may be NRHP eligible under Criteria A, B, or C (rather than simply Criterion D), research will assume an even more prominent place in formulating the eligibility determination. Research is also useful for locating knowledgeable and concerned parties with which to consult about the eligibility determination (see "Consultation").

Consultation

USACE will confer with Indian Tribes, State- recognized tribes, the Native American Heritage Commission (NAHC), and cultural resource managers familiar with prehistoric archaeological properties in the Undertaking APE. In the sense used here, "confer" or "consultation" refers to government-to-government consultation, communication with consulting parties, and attempts simply to obtain knowledge of the property from informed parties. Prehistoric archaeological properties are sometimes found eligible for listing on the NRHP under Criteria A, B, or C (typically in addition to Criterion D), usually for reasons advanced by Indian Tribes or other Native Americans. Such rationales for eligibility are not obvious or sometimes even discernable to cultural resource managers outside of the concerned descendant community, making consultation a key component of historic properties identification. Consultation with Indian descendant groups is also crucial for planning the excavation of many prehistoric property types because USACE should consider the views of such groups concerning the identification and treatment of human remains (Advisory Council on Historic Preservation 2007:2, 2009:4).

Archaeological Excavation

The specific methods to investigate archaeological sites vary greatly depending on a number of factors, including level of impact and effects, site type, materials present, size, density of materials, potential for human remains, and location in terms of topography, hydrology, and soil. In addition, archaeological methods evolve according to technological and scientific knowledge. Predicting these variations over the great expanse of the Undertaking Area and the projected time period of the Undertaking is not feasible. Specific methods to investigate archaeological sites will be determined at the time of investigation through testing and/or data recovery plans. With this understanding, however, the methods below are presented as examples that may be used in future investigations. It is also important to note that not all of the examples below are necessarily intended to be conducted at each site.

Surface Inspection and Collection

To better understand the distribution of archaeological material as exposed by construction and to assess the potential distribution of subsurface deposits, the following methods may be employed:

- Intensive pedestrian survey of exposed ground surfaces
- Documentation of selected surface artifacts, including location
- Field documentation and analysis of features or large artifacts
- Collect formal tools for subsequent analysis

Mechanical Trenching

Mechanical trenching employs a toothed bucket backhoe and is typically used to determine the presence or absence of buried archaeological deposits during initial investigations. The size (length, depth, width) and location of trenches should be determined according to the location and depth of proposed disturbance or the depth of sterile soil. Trenches that measure greater than 1.5 m in depth are reinforced by shoring, or graded to 1:1.5 slopes in accordance with the California Office of the Occupational Safety and Health Administration (Cal/OSHA) guidelines. Stratigraphic profiles of selected vertical exposures would be drawn and described. Sediments and artifact samples may be collected and labeled for future laboratory analysis.

Mechanical Area Exposure

The mechanical area exposure technique utilizes a toothed bucket backhoe to remove overlying non-cultural sediments (overburden) from a newly discovered cultural deposit. When intact areas or archaeological features are encountered, mechanical excavation would cease and hand excavation or a more refined mechanical method of excavation would typically commence.

Auger Boring

Auger boring employs a small hand auger to quickly determine the absence or presence of archaeological materials. Sediments sampled can be selectively screened or visually inspected. Stratigraphic results would be documented and locations mapped in relation to a permanent datum.

Hand Excavation Units

Hand excavated units typically measure 0.5 m by 0.5 m, 0.5 m by 1.0 m, or 1.0 m by 1.0 m. The size and placement of the unit is based on the specific investigation needs of the area or known site. Excavation units can be used as a more formal method to determine presence or absence of cultural materials, to determine the vertical and horizontal extent of a site's boundaries, to determine if a deposit has stratigraphic integrity, and to recover a variety and quantity of site materials sufficient to either determine NRHP eligibility or to recover important data. Units are typically excavated in arbitrary 10–20 cm levels unless intact stratigraphic sequences are present.

Exposure Units

Graduated area exposure units are useful in locations known to contain archaeological deposits deeper than the maximum depth allowed by Cal/OSHA guidelines for a single excavation unit. This strategy employs an initially large unit area that is reduced in size on all four-unit walls following a slope format of 1:1.5 from surface to base, allowing no sidewall to exceed 1 m in height. The resulting excavated area has the shape of an inverted pyramid. For deeply stratified deposits where the slope gradation cannot be maintained, excavation walls would be shored using hydraulic jacks or other means of earth stabilization.

Excavation of these units would utilize some combination of mechanical and hand excavation techniques. As with excavation units, hand excavation of subunits would be dug concurrently in 10–20 cm levels correlated with a permanent site datum. In areas with midden soils or high potential for features, subunits can be excavated entirely using hand tools, incorporating a combination of selective and control screening techniques.

The graduated area exposure strategy provides large surface exposures and samples of stratified deposits, maximizes samples of safe deposits under safe working conditions, and provides large stratigraphic wall profiles for analysis of sedimentary contexts.

Feature Excavation

When an archaeological feature (e.g., hearth, cairn, house pit, or trash pit) is encountered, excavation would proceed with refined excavation techniques and detailed field documentation. Upon discovery, each feature would be assigned a unique number. Feature contexts would be explored using hand tools to excavate in arbitrary or natural stratigraphic levels, and documented by a scaled drawing on graph paper. Selected constituents and special samples (e.g., radiocarbon, flotation, pollen, and fire-cracked rock) may be packaged separately from surrounding matrix for analysis by the various specialists. Standardized unit-level and feature records would be employed to document removal of the feature.

Special Studies Sampling

Special studies sampling, also known as "column sampling," includes the systematic collection of successive 0.25 m by 0.25 m soil samples from vertical exposures in middens or other contexts of archaeological interest. The collected sediment column would be analyzed for radiocarbon dates, faunal remains, plant macrofossil, fossil pollen, or other microconstituents. These data would allow, depending on the materials extracted and analyzed, for detailed study of prehistoric diet, paleoenvironment, and site chronology. Extraction methods will vary according to accepted standards for each type of analysis.

Screening Techniques

A number of screening techniques can be employed according to the nature of the property type. Screening usually involves processing excavated dry soils through shaker screens or by washing extracted matrix in screens using a high-pressure water nozzle. The 6 mm *selective* technique involves processing sediment through 6 mm mesh screen, and is used primarily for the collection of specific materials such as formed artifacts and bone. The 6 mm *controlled* technique also employs 6 mm mesh but, unlike the selective technique, all cultural materials remaining in the screen are collected. Likewise, the 3 mm controlled technique uses a 3 mm mesh screen, with all cultural materials collected. Smaller-sized mesh facilitates collection of materials that would normally pass through 6 mm mesh, such as late-stage pressure-flaking debris, fish bone, and small shell or glass beads.

Geoarchaeological Investigations

A qualified geoarchaeologist would thoroughly record a stratigraphic profile at the location of each discovery of buried archaeological deposits. At a minimum, the entire complement of archaeological strata truncated during construction of the Undertaking action will be recorded, as well as the strata immediately above and below identified archaeological deposits. In the absence of other locally viable chronometric techniques, the geoarchaeologist would obtain radiocarbon assays of soil humate samples from each stratum of a profile.

Field Documentation

Mapping

The location of archaeological deposits, features, and materials would be recorded using any one of a number of instruments, such as a compass, theodolite, or GPS unit. Deposits and any other pertinent information would be referenced to an established permanent datum.

Records

Information resulting from archaeological site investigation methods would be recorded on standardized forms that could include level records for each excavation unit level, an overall plan drawing for each level, and plans and section drawings for each feature encountered. Additional records will be maintained by documenting communication with Native Americans, news media, and the public.

Photographic Documentation

At a minimum, color slides and black-and-white prints would be used to document important artifacts and features encountered during fieldwork. Additional documentation may include digital photography and/or video recording. A record form would be maintained for each photograph, detailing the date, time, number, subject description, and view direction.

Wall Profiles

Stratigraphic profiles would be documented for at least one wall of each excavation unit, as well as selected sections of trenches. Profile documentation would include the site designation, unit number, wall orientation, and location of the section along the trench. Descriptions of each stratum would include Munsell color descriptions, textures, structures, natural inclusions, cultural inclusions, and contacts between strata.

Backfilling and Restoration

Open trenches and units would be covered and/or barricaded at the end of each workday. All trenches and excavation units would be backfilled upon the completion of fieldwork. The Contractor would restore the excavation area after construction in the immediate area is completed.

Remote Sensing

In addition to surface inspection and excavation of prehistoric archaeological properties, remote-sensing techniques may be employed during archaeological site investigation. Remote-sensing techniques applicable to evaluating a prehistoric archaeological property include ground-penetrating radar, electromagnetic survey, resistivity survey, and burial identification survey using cadaver dogs. However, remote sensing does not obviate the need for archaeological excavation as the results of remote-sensing investigations must be verified.

Artifact Processing and Analysis

All cultural materials will be cleaned before they are cataloged, with the possible exception of delicate or perishable materials such as bone, shell, textile, and fired clay. Artifacts will then be sorted by provenience and functional type. Artifacts will be labeled according to each unit/feature. Artifacts will then be permanently labeled with a sequential catalog number, which will be added during cataloging. Diagnostic artifacts will be arranged by provenience and/or material type (as suits the research design and management needs for particular properties) and photographed.

Based on the results of testing and data recovery a number of analyses may be performed, including:

- **Flaked stone** analysis of formed tools and debitage
- **Ground stone** analysis of artifacts that have been deliberately shaped or shaped as a byproduct of use wear
- **Vertebrate** and **invertebrate faunal** analyses, involving the identification of skeletal remains from mammal, bird, fish, reptile, amphibian, and shellfish species and the interpretation of the patterns that result from the identification
- **Archaeobotanical** analysis of plant remains contained in archaeological sediments
- **Soil** and **sediment** analyses to discern site formation processes and degree of differential preservation of archaeological materials
- Other techno-functional analyses

Research Themes

Prehistoric sites and materials within the Undertaking APE will be evaluated according to five broad research themes: cultural chronology, subsistence and settlement patterns, trade and exchange, technology, and the geoarchaeological master chronology. Within each theme, research questions appropriate to the predicted resource types within the Undertaking APE will be proposed. It is acknowledged that research questions are works in progress and will develop throughout the course of identification, evaluation, data recovery, and interpretation. Further, there may be considerable interconnections between research themes and subsequently identified overlapping applicability of research questions.

Cultural Chronology

Chronology is the central point upon which all other prehistoric archaeological research domains hinge. A thorough understanding of chronology is essential for defining the temporal persistence of archaeological patterns and for answering questions of cultural process and change. Establishing a site's position in time is the first step in assessing the research potential of the site, as well as its significance in terms of the NRHP and CRHR criteria.

Lower Sacramento Valley and Delta Sequence

The bulk of the Undertaking APE is located within areas where the lower Sacramento Valley and Delta sequence is thought to dominate the archaeological record. As a result, the temporal sequence developed for this region is provided below. This sequence was developed with a focus on the recognition of assemblage-based chronological units (Lillard et al. 1939:74–82).

Windmiller Pattern (approximately 4500–2800 BP)

Sites in the lower Sacramento Valley are clearly concentrated on low rises or knolls within the floodplains of major perennial watercourses, doubtless to obtain protection from seasonal flooding while maintaining proximity to riverine, marsh, and valley grassland biotic communities. Most sites include cemeteries, suggesting a degree of sedentism, in which skeletons are typically extended ventrally, oriented toward the west, and accompanied by abundant mortuary accoutrements. Subsistence apparently focused on hunting and fishing, as evidenced by large projectile (spear or spear thrower) points, clay net sinkers, bone fishhooks and spears, and abundant faunal remains. Procurement of plant resources is inferred from handstone and millingslab fragments recovered from a few of the sites; milling slabs appear more frequently than mortars from 4500–2500 BP Other characteristic artifacts include charmstones, quartz crystals, bone awls and needles, *Haliotis* spp. and *Olivella* spp. shell beads and ornaments. Trade is reflected in the material from which utilitarian, ornamental, and ceremonial objects were produced. (Beardsley 1948; Gerow 1974; Heizer 1949; Heizer and Fenenga 1939; Lillard et al. 1939; Ragir 1972; Schulz 1970.)

Berkeley Pattern (2800–1200 BP)

Sites are more widely distributed than Windmiller Pattern sites. Sites are typified by deep midden deposits, suggesting intensified occupation. The abundance of millingslabs, mortars, and pestles indicates a dietary emphasis on vegetal resources—especially the acorn, as evidenced by the greater frequency of mortars and pestles relative to millingslabs and handstones (Basgall 1987). Fishing technology improved and diversified, suggestive of greater reliance on riverine foodstuffs (Broughton 1994; Delacorte 2000). Artifacts similar to the Windmiller Pattern items include types of mortars and millingslabs, quartz crystals, charmstones, projectile point styles, shell beads, shell ornaments, and bone tools. New material culture items include steatite beads, tubes and ear ornaments and slate pendants. The dead were buried in flexed positions with variable orientation or cremations accompanied by fewer grave goods. (Beardsley 1948; Fredrickson 1973; Heizer and Fenenga 1939; Lillard et al. 1939; Moratto 1984.)

Augustine Pattern (1200–100 BP)

This pattern represents peoples engaged in intensified hunting, fishing, and gathering subsistence strategies. There is a possible affiliation with the southward expansion of Wintuan populations into the Sacramento Valley (Moratto 1984). An even greater number of sites than in the previous 1,600 years implies that regional population was large, with people participating in highly developed trade networks. Ceremonial and mortuary practices reach their height of elaboration and mortuary treatments evince social stratification. The base technology and specific manufactures of the preceding patterns are retained, but new elements appear in the material record: shaped mortars and pestles, bone awls for basketry, bone whistles and stone pipes, clay effigies, small notched and serrated projectile points—the latter evidence for the introduction of the bow and arrow, which occurs at this time throughout the western United States. Pottery is also found at a few sites. Burials were flexed with variable orientation and generally lacked grave goods. (Beardsley 1948; Fredrickson 1973; Moratto 1984; Ragir 1972.)

Hypothesized California Periods and Characteristics

To better characterize archaeological cultures in the North Coast Ranges, to resolve apparent temporal-spatial deficiencies in Lillard et al. (1939), and to characterize archaeological cultures using data that had been gathered since 1939, Fredrickson (1973, 1974) proposed a taxonomic system that consists of temporal, cultural, and spatial units. The time span of each period is arbitrary so that the period may function as a constant for the comparison of cultural and spatial units, although the subdivisions are distinguished by cultural developments that appear to have a broad distribution throughout northern California at a given time interval (Figures 5-1 and 5-2).

Fredrickson divided California prehistory into three temporal units termed “periods” (see bulleted list below): Paleoindian (approximately 12,000–8000 BP), Archaic (8000–950 BP), and Emergent periods (950–150 BP). The Archaic Period is commonly divided into Lower (8000–5000 BP), Middle (5000–2500 BP), and Upper (2500–950 BP) divisions. The Emergent Period contains two subdivisions, Lower (950–450 BP) and Upper (450–150 BP).

Paleoindian (12,000–8000 BP)

- First demonstrated entry and spread of humans into California
- Lakeside sites with a probable, but not clearly demonstrated, hunting emphasis
- No evidence for a developed milling technology
- Exchange probably ad hoc
- Extended family primary economic unit not heavily dependent upon exchange
- Resources acquired by changing habitat

Lower Archaic (8000–5000 BP)

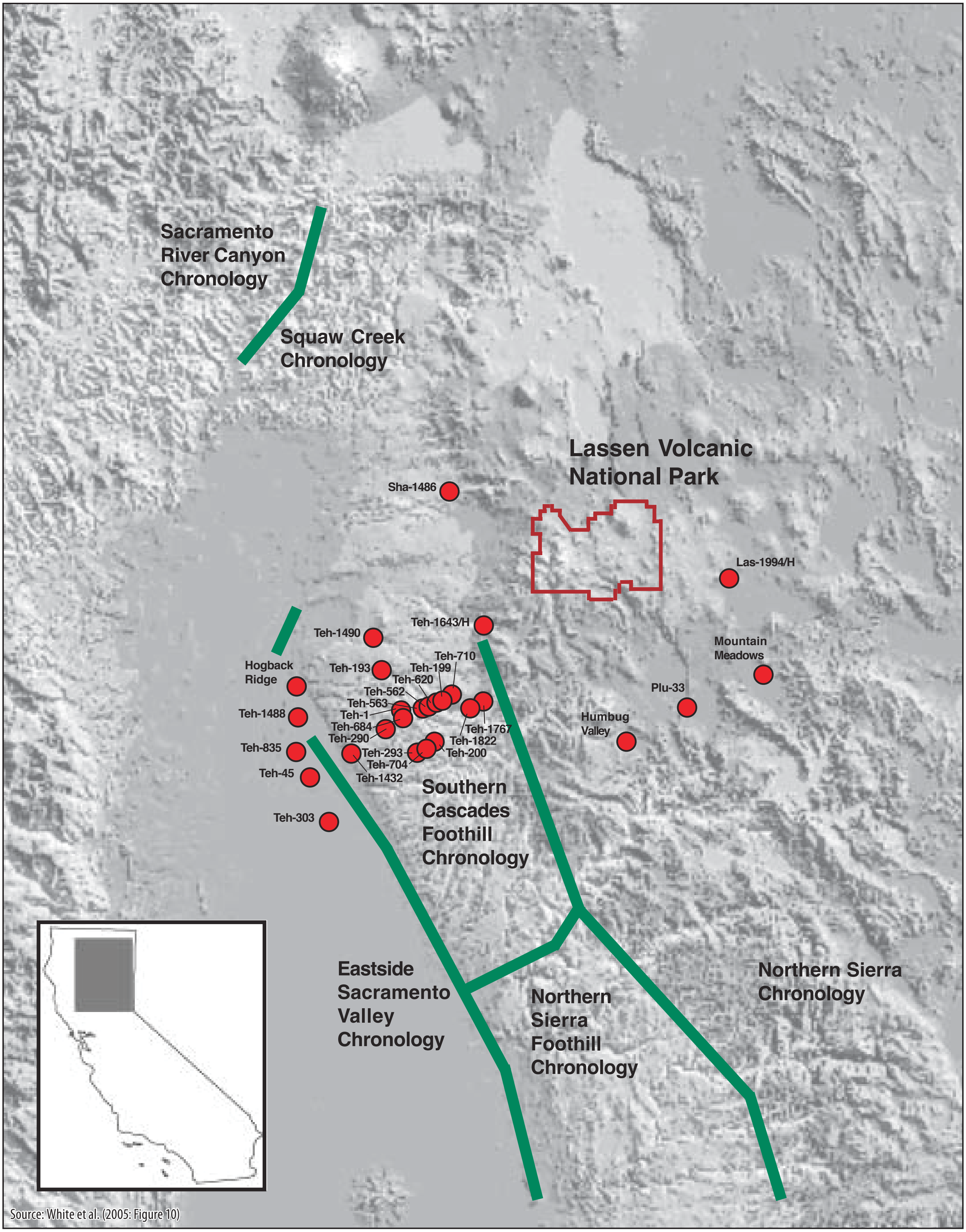
- Ancient lakes dry up as a result of climatic changes
- Millingslabs found in abundance
- Plant food emphasis, little hunting

	Northern Sierra		Lassen-Cascades			Shasta-Cascade	
Local Chronology	Northern Sierra Uplands	Northern Sierra Foothills	Lassen Volcanic National Park	Southern Cascade Foothills	Eastside Sacramento Valley	Sacramento River Canyon	Squaw Creek
AD 1500	Late Kings Beach Complex	Oroville Complex	?	Ethnographic Yana (<AD 1845) Mill Creek Complex	Chico Complex	Mosquito Creek Phase	Shasta Complex
AD 750	Early Kings Beach Complex	Sweetwater Complex	?	Dye Creek Complex	Pine Creek 2		
AD 1	Late Martis Complex	Bidwell Complex	?	Kingsley Complex	Pine Creek 1	Vollmers Phase	Monday Flat Phase
1000 BC	Middle Martis Complex	Mesilla Complex	?	Deadman Complex	Llano 2		
2500 BC	Early Martis Complex		?	?	Llano 1	Pollard Flat Phase	Squaw Creek Phase
5500 BC	Spooner Complex Tahoe Reach Complex	Bucks Lake?	?	?	?	?	Chirpchatter Phase
8500 BC		?	?	?	?	?	?
11500 BC	?	?	?	?	?	?	?

Source: White et al. (2005: Figure 15)

ICF INTERNATIONAL

Figure 5-1
Culture Chronologies of Northeastern California



ICF INTERNATIONAL

Figure 5-2
Location of Sites and Chronological Sequences Described in Figure 5-1

- Most artifacts manufactured of local materials
- Exchange similar to previous period
- Primary social unit remains the extended family

Middle Archaic (5000–2500 BP)

- Climate more benign during this time interval
- Mortars and pestle and inferred acorn economy introduced
- Hunting important
- Diversification of economy
- Sedentism begins to develop, accompanied by population growth and expansion
- Technological and environmental factors seem to be the primary impetuses for economic diversification, sedentism, and population growth; changes in exchange or social relations appear to have had little impact

Upper Archaic (2500–950 BP)

- Growth of sociopolitical complexity; development of status distinctions based on wealth
- Shell beads gain importance, possibly indicators of both exchange and status
- Emergence of group-oriented religious organizations; possible origins of Kuksu religious system at end of period
- Greater complexity of exchange systems; evidence of regular, sustained exchange between groups

Lower Emergent (950–450 BP)

- Bow and arrow replaces dart and atlatl
- Territorial boundaries well established
- Distinctions in social status linked to wealth increasingly common
- Regularized exchange between groups includes more, and more varied, materials

Upper Emergent (450–150 BP)

- Clam disk bead economy appears
- More goods moving farther
- Growth of local specializations involving production and exchange
- Interpenetration of southern and central Californian exchange systems

Numerous issues concerning Fredrickson's cultural chronology remain unresolved, the most important of which is the identification of local sequences that can be compared with the chronological and adaptive framework proposed for Northern California (ICF Jones & Stokes 2009b:3-14, 3-15; Rosenthal et al. 2007:163). Recent excavations and analyses of existing archaeological collections have produced valuable information regarding chronology and its articulation with Fredrickson's archaeological patterns. These same studies, however, have met with difficulty in isolating discrete temporal components at archaeological sites. For example, in their analysis of archaeological collections from CA-SAC-43, Far Western Anthropological Research Group concluded that, although the site clearly spanned an interval from 2400–600 BP, more discrete occupational episodes could not be distinguished because of a lack of spatial patterning in the recovered assemblages (Bouey 1995a:144). Without such temporal resolution, the dating of the behaviors subsumed under Fredrickson's patterns cannot be confirmed or refuted at CA-SAC-43.

Similar problems plague research at other prehistoric sites in the Sacramento Valley (SAC-85, SAC-86, SAC-87, and SAC-133) and progress in this area awaits further analysis (Tremaine 1997a, 1997b; Waechter and Bouey 1992). In addition, the chronological findings of recent archaeological investigations in the Sacramento area (Farris and Tremaine 2008; Tremaine 2008) have yet to be critically assessed and compared with the existing regional sequence.

Similar problems pertain to the other mentioned cultural chronologies. For example, the Eastside Sacramento Valley sequence in the Chico area is considered provisional because it is based on excavations at only four archaeological sites: CA-BUT-12, BUT-233, BUT-288, and BUT-294 (White et al. 2005:40). The Lake Oroville and southern Cascade Ranges–Dye Creek chronological sequences are comparatively well established, although the findings of recent work by the Archaeological Research Center (California State University, Sacramento) and the Anthropological Studies Center (Sonoma State University) need to be integrated into any consideration of regional culture history.

The Colusa Reach chronology, a local sequence in the vicinity of Colusa, on the west side of the Sacramento River, is based on 15 radiocarbon assays, 179 obsidian hydration readings, artifact cross dating, and correlation of assemblages in similar stratigraphic positions. The chronology currently consists of five distinct phases (White 2003:216, 219, 222–223, Tables 28, 29, 32). The Colusa Reach chronology is valuable not only for its basis in solid chronometrics, but also for its explicit construction as a series of cultural-historical units, an important research area that numerous California prehistorians have neglected (Rosenthal et al. 2007:163). Additional research is needed to determine the extent to which White's (2003) cultural-historical sequence applies to the Undertaking APE's archaeological record.

Subsistence and Settlement Patterns

For the purposes of reconstructing prehistoric hunter-gatherer subsistence-settlement patterns, the behavior of human groups is assumed to be the product of complex interactions between basic needs and goals of the group in question and the structure of the social and natural environment. Such environmental structures include temporal variations in the distribution, quality, and availability of important food resources; the quality, spatial distribution, and availability of tool stone sources; seasonal and more long-term changes in local climate; demography; internal sociopolitical structure; and intergroup relationships. Further, ethnographic and ethnoarchaeological studies have demonstrated that anthropologists can make valid generalizations regarding aspects of human behavior that are relevant to prehistoric settlement studies (Binford 1982; Kelly 1983, 1995; Thomas 1983). Among these are residential mobility, site location, and seasonality of site occupation.

The progress of archaeological research in the Sacramento Valley delayed the explication of settlement patterns in the Undertaking APE until recent years. Early research focused on mound sites, (which were often incompletely recorded and subject to vandalism or agriculturally related destruction) and subsequent urban development and extensive agriculture resulted in the neglect and destruction of less conspicuous archaeological properties. Inferences may be made nonetheless regarding the structure of prehistoric settlement patterns based on analyses of artifactual and floral/faunal assemblages. Studies at large riverside sites such as CA-SAC-43, SAC-133, and SAC-164 suggest that Middle [Archaic] and Emergent Period sites represent residential hubs in settlement systems that are best characterized as collector systems (Bouey [ed.] 1995; Simons and Tremaine 2001; Waechter and Bouey 1992).

It may be inferred on the basis of the collector model that task-specific groups regularly departed from residential bases and created more ephemeral, less obtrusive traces on the landscape, such as CA-SAC-65 (Bouey [ed.] 1995; Schulz et al. 1979). Beyond the lower Sacramento Valley, the basis for intraregional comparisons of settlement patterns exists in recent archaeological work from the Colusa Reach north along the Sacramento River as well as on the Feather River from its confluence with Bear River to Oroville (White 2003). Future research should focus on indicators of site seasonality and recovery of data from smaller, task-specific sites to provide a better empirical record on which to base settlement pattern studies.

Previous archaeological research in the Sacramento Valley regarding prehistoric subsistence strategies has focused on the inception of balanophagy, or acorn consumption, and the role of anadromous fish in Native American economies (Basgall 1987; Baumhoff 1963). Based on the presence or absence of mortars and pestles in archaeological assemblages, early researchers proposed that acorns were (or were not) a part of Early Horizon (Early/Archaic Period) diets. Combined with paleopathological data, however, it appears that Middle Archaic Period and earlier populations did not exploit acorns to a detectable degree (Bouey 1995b:31–32). Acorns purportedly became a staple in aboriginal economies in the Middle Period and exploitation of this resource reached its apex in the Emergent Period (Basgall 1987).

Recent research at CA-SAC-43 and SAC-133 upholds the assertion that acorns were a significant dietary constituent beginning with the Middle Archaic Period (Bouey [ed.] 1995; Waechter and Bouey 1992). Evidence for an intensive acorn-based economy, manifested by the presence of storage pits and significant plant (acorn) macrofossil assemblages, however, are lacking from these excavations. Future research should continue to focus on the recovery of plant macrofossils and the detection of storage features.

Due to their proximity to three major rivers (the American, the Cosumnes, and the Sacramento), archaeologists have historically assumed that anadromous fish (steelhead trout and salmon) should be well represented in faunal assemblages from archaeological sites throughout much of the Undertaking APE. Preservation issues aside, analysis of faunal assemblages demonstrates that anadromous fish were not well represented in the middens of sites located adjacent to major watercourses in the Sacramento vicinity (CA-SAC-43, SAC-65, SAC-145), suggesting that these fish were not important elements in Middle Archaic–Emergent Period subsistence economies. Instead, lentic fishes (e.g., thick-tail chub, hitch, Sacramento blackfish, and Sacramento perch), which favor slow-moving waters such as shallow lakes and marshes, form the bulk of aquatic faunal remains at sites in the Undertaking vicinity (Schulz 1995:276; Schulz et al. 1979; Tremaine 1994).

In addition to these trends, floral and faunal assemblages from excavated sites in the Sacramento Valley indicate that Middle Archaic–Emergent Period populations exploited a wide range of mammals, birds, freshwater shellfish, annual plants, berries, nuts, seeds, and bulbs (Bouey [ed.] 1995:348; Waechter and Bouey 1992:130). It is anticipated that archaeological sites in the Undertaking APE would yield similar subsistence data, which may be used in conjunction with artifactual indicators of mobility to infer the seasonality of site occupation.

Trade and Exchange

Comprehensive studies of prehistoric trade and exchange in the Undertaking APE are few and typically focus on single aspects of trade systems, such as shell beads or obsidian (see Bennyhoff and Hughes 1987; Jackson 1986). Accurate portrayal of trade and exchange systems depends on source and distribution analyses of exotic materials as well as an understanding of settlement patterns because the direction and character of exchange will be conditioned in part by mobility patterns. Recent research poses a number of interesting questions for the reconstruction of trade and exchange systems in Central California, especially regarding the role of shell beads in prehistoric economy, production of shell beads, the geographical provenance of *Olivella* shell beads with respect to northern or southern California waters, and patterns of obsidian procurement (Bouey 1995b; Eerkens et al. 2005; Hartzell 1991).

Based on the ethnographic literature, archaeologists have proposed, if not assumed, that Native Americans used shell beads as money before the historic period. If such conditions occurred during prehistory, shell beads should be more or less widely distributed in the midden or general deposit of Sacramento-area sites and in the mortuary components of sites. Limited data from recent analyses of archaeological materials at CA-SAC-43, SAC-85, and SAC-86, however, suggest that shell beads did not function as money during prehistory.

At CA-SAC-43, shell beads were recovered from 14 of 80 burials and are rare in the general site deposit. Such a restricted distribution would not be expected for an economy based on standard exchange values (Bouey [ed.] 1995:354). In addition, CA-SAC-43, SAC-85, and SAC-86 did not yield much evidence of bead manufacture—such evidence is wholly lacking for CA-SAC-43 and SAC-86, and only one obsidian drill (made from Napa Glass Mountain obsidian) was recovered from CA-SAC-85 (Bouey [ed.] 1995; Tremaine 1997a, 1997b). It should be noted, however, that the analyses presented by Bouey ([ed.] 1995) and Tremaine (1997a, 1997b) are largely based on excavations conducted by previous researchers. It is conceivable that the presence of bead-manufacturing waste was simply overlooked and not collected. Bead production at these sites cannot be ruled out or necessarily be taken as representative of bead production in the Undertaking vicinity.

Patterns of obsidian procurement in the Sacramento area and the Sacramento–San Joaquin River Delta are based on small samples of sourced obsidian. Investigations at CA-SAC-29 and SAC-38, both of which contain Early Period (Windmiller Pattern/Middle Archaic Period) manifestations, reveal that nearly 80% of recovered obsidian originated in Napa Valley (Dougherty 1990; Tremaine 2008:Figure 64). These findings are consonant with Jackson's (1986) study of obsidian procurement and trade among Upper Emergent Period Valley Nisenan and Plains Miwok sites.

Nevertheless, other lower Sacramento Valley sites, such as CA-SAC-85 and SAC-86, contain as much as 30%–40% obsidian from eastern Californian sources (Bodie Hills and Casa Diablo) (Tremaine 1997a, 1997b:16). During the Middle Period (Berkeley Pattern/Upper Archaic Period), the pattern of obsidian acquisition was purportedly reversed: obsidian from sources east of the Sierra Nevada dominated flaked-stone assemblages. Finally, Napa obsidian again dominated flaked-stone assemblages from the Late Period (Augustine Pattern/Emergent Period), to the near exclusion of other sources (Bouey 1995b:33). Bouey ([ed.] 1995), however, found that Napa obsidian dominates the source profile for CA-SAC-43, which spans the Middle Archaic–Emergent Periods.

Exotic material assemblages at CA-SAC-43, SAC-85, and SAC-86 are relatively small and exhibit little diversity. These sites do not appear to be production centers for regional exchange or trade systems. Excavation at sites in the Undertaking APE and comparison with archaeological data further afield has the potential to clarify the nature and scope of prehistoric trade and exchange in Central California and adjacent portions of the state.

Technology

The lands in much of the Undertaking APE presented a tool stone–poor environment to the native inhabitants of the valley. Accordingly, flaked-stone artifacts and debitage are not among the most abundant constituents recovered from archaeological contexts, despite the preservation bias that typically favors lithics. It is expected, therefore, that most stone tools recovered from sites in the Undertaking APE will be made from exotic materials or from stream-washed cobbles. In addition, stone tools should exhibit qualities common to curated artifacts: portable artifact forms, debitage profiles that predominantly reflect tool maintenance and use, and extensive use-wear on artifacts (Jones & Stokes 2001:29–30). Previous research indicates that stone tools, especially flaked- and ground-stone tools, should exhibit functional specificity, as tools manufactured from other materials (particularly bone and fired clay) appear to fill lacunae in stone tools assemblages from excavated sites (Dougherty 1990:93; Honeysett and Bouey 1995; Tremaine 1997a, 1997b).

Technological characteristics of archaeological assemblages permit inferences regarding group mobility, raw material procurement, and site function. For example, hunter-gatherer groups are frequently distinctive in terms of mobility patterns. Highly mobile groups, presumably relying on an encounter strategy for resource procurement, would tend to have produced multi-purpose tools geared toward the range of resources that may be encountered. Such tools should exhibit relatively little formalization. Conversely, logistical foragers (collectors) should have manufactured tools for specific resources or purposes, and greater formality and investment should have characterized artifacts (Ebert 1992).

Based on information obtained from previous studies, a few expectations for archaeological assemblages in the Undertaking vicinity appear reasonable. Ground-stone and flaked-stone artifacts recovered from residential sites should be limited in number during any time interval. Such artifacts should exhibit a marked degree of formality and investment, and were probably brought to the area in finished or nearly finished form. Task-specific sites, on the other hand, are likely to contain homogenous artifact assemblages. Artifact forms may be expedient or curated depending on the degree of planning required in its use-context and the availability of raw materials.

Geoarchaeological Master Chronology

Geoarchaeological methods permit the linkage of archaeologically derived chronologies to landscape area-level chronologies and related formation processes. Data yielded by geoarchaeological analyses can make useful contributions to fields such as paleolimnology, regional geomorphology, and paleoclimatology. In addition, and of specific relevance to archaeological research in the greater Sacramento area, geoarchaeological analyses provide the ability to identify the ages of various landforms in the Undertaking vicinity and the predilection of those landforms to preserve, destroy, or mix archaeological deposits (Bettis 1992; Butzer 1982; Schiffer 1987; Waters 2002).

Geoarchaeological studies evaluate the relationships between landscape areas and the location of archaeological sites, with the goal of estimating the potential for encountering buried sites in a study area or evaluating the completeness of the known archaeological record of a given locale (Waters 2002). One geoarchaeological method used by researchers to achieve this goal is termed the “Landform Sediment Assemblage” method (Bettis 1992; Stafford 2004). Researchers use this approach to determine the temporal relationships between landforms and deposits in the study area through analyses of stratigraphy, soil formation, and, if possible, radiometric dating. Presumably, archaeological remains are better preserved on stable landforms because these surfaces would have been most available and suited to human use over longer periods of time. Therefore, stable landforms with soils that formed during a particular geological period will more likely contain buried archaeological sites.

Two detailed geoarchaeological overviews by Meyer and Rosenthal (2007, 2008) cover much of the Undertaking APE. These overviews, particularly the latter (Meyer and Rosenthal 2008), contain detailed discussions of the age of geological formations, the general preservation bias of each, and maps estimating buried site potential throughout a considerable portion of the Undertaking APE.

Evaluation Criteria

Most prehistoric archaeological properties, if found eligible for listing in the NRHP, would be eligible under Criterion D for their information potential. Eligibility is possible under NRHP Criteria A, B, and C as well, although specific, relevant historic contexts have yet to be identified. For Criterion D eligibility, a prehistoric archaeological property would contain several, but not necessarily all, of these attributes:

- Artifact assemblages in contexts with chronological and stratigraphic integrity
- Types of features that contain dateable materials and that are associated with particular periods
- Diagnostic artifacts that can be placed chronologically in relation to similar artifacts types or that can be subjected to radiocarbon dating or obsidian hydration analysis
- Artifacts that are rare and unusual examples of their type
- Faunal remains and pollen samples in sufficient amounts to provide a useful sample for analysis

The goal of providing thresholds for assessing a property's data potential is to clearly identify the data a site must contain to be considered NRHP eligible. These thresholds also work to maximize efficiency; reduce the level of redundancy of field work; and result in the collection of a wide, varied, and comprehensive archaeological deposit sample by focusing on the relevant research questions and the ability of a deposit, feature, site, or artifact to address those questions. The thresholds of assessing data potential are crucial guidelines that enable the archaeologist to make meaningful decisions in the field and, immediately afterwards, in the laboratory. These decisions affect characterization of the property, its eligibility status, and future decisions about its treatment.

Assessing Integrity

Only properties with a sufficient level of archaeological integrity to convey their significance qualify as historic properties. Properties with attributes that can contribute to the research themes must satisfy at least one of two integrity-related criteria: 1) intact and well-preserved stratification or horizontal separation of multiple components or strata; or 2) well-preserved and minimally disturbed discrete single components. Properties with well-separated components or strata offer a readily available source for comparisons of assemblages associated with subsistence and other activities across space and time. These comparisons readily lend themselves to existing research themes regarding the timing and nature of settlement and subsistence changes.

Discrete, single-component sites cannot, in themselves, offer data contributing to change over time, but do contain "snapshot" assemblages for comparison with other studies and sites, thus revealing changes in subsistence and settlement over time. By exclusion, physically mixed, disturbed sites offer little data because they provide little opportunity for comparison of chronologically disparate components separated vertically or horizontally.

Most deposits that have been disturbed by ground-moving activities, such as grading, trenching, and looting, often lack the ability to address important questions because depositional relationships have been lost, deposits from widely divergent periods and associations have been mixed, or the contents of the deposit have been skewed by selective removal of materials. Nevertheless, some disturbed deposits may still retain the ability to address important research topics (Talmage and Chesler 1977), particularly if there are human remains and diagnostic artifacts. Disturbed sites may be subject to special treatment to recover disarticulated human bone and artifacts with high interpretive value, even if they do not otherwise meet eligibility criteria.

Data Requirements

As with the data requirements described throughout this chapter, the presence of the requisite data classes alone does not ensure NRHP eligibility. Rather, the necessary data must be present *and* shed light on important research questions stemming from the research themes identified herein.

Cultural Chronology

To address questions of cultural chronology, archaeological deposits should possess one or more of the following within relatively intact cultural contexts: temporally diagnostic artifact types or assemblage compositions; sufficient quantities of obsidian for hydration dating; carbon, bone, or other appropriate organic material, in association with features or artifacts, for radiocarbon dating; and deposits showing stratigraphic superposition.

Subsistence and Settlement Patterns

To address questions of subsistence and settlement patterns, archaeological deposits should contain one or more of the following in relatively intact cultural contexts: identifiable faunal and/or macrofloral remains of sufficient types and quantities to provide for statistical examination of procurement choices, intensification, and seasonality of resource exploitation; tools or debris related to resource procurement and processing activities; features containing the remains of resource processing or related to resource processing activities; material types (e.g., obsidian and carbon) or formal artifact types (e.g., temporally diagnostic projectile point types) appropriate for absolute or relative dating techniques in association with cultural deposits.

Trade and Exchange

To address questions of trade and exchange, archaeological deposits should contain one or more of the following in relatively intact cultural contexts: obsidian of sufficient quality and quantity for sourcing and hydration dating; artifacts and manufacturing debris of sufficient types and quantities to facilitate quantification and comparison of exotic and local materials; material types (e.g., obsidian and carbon) or formal artifact types (e.g., temporally diagnostic projectile point types, *Olivella* and clamshell beads) appropriate for absolute or relative dating techniques in association with cultural deposits.

Technology

To address lithic technology (flaked and ground stone) and the types of questions that lithics might elucidate—such as acorn use, chronology, seasonality of site use, the phasing of resource processing, and resource intensification—archaeological deposits should contain one or more of the following in relatively intact cultural contexts:

- Lithic materials of varying types in sufficient quantity for statistical analysis
- Artifacts and manufacturing debris from multiple stages in the reduction and/or manufacturing process
- Macrofloral or other remains indicative of acorn use
- Material types (e.g., obsidian and carbon) or formal artifact types (e.g., temporally diagnostic projectile point types) appropriate for absolute or relative dating techniques in association with cultural deposits

Analysis of the size, configuration, and wear patterns of any bedrock milling features present could provide data regarding prehistoric food preparation methods and diet.

Geoarchaeological Master Chronology

To contribute to the geoarchaeological master chronology for the Sacramento Valley, the Undertaking APE must contain archaeological deposits with intact surface and/or buried manifestations in geomorphological contexts for which a high resolution of local information is available. Material types (e.g., obsidian and carbon) or formal artifact types (e.g., temporally diagnostic projectile point types) appropriate for absolute or relative dating techniques may be valuable in refining the chronological associations of specific geomorphological features.

Native American Property Types

Data Gathering

There are three broad methods of identifying non-archaeological Native American property types or non-archaeological aspects of archaeological property types: research, consultation, and field review.

Research

USACE will scrutinize published and unpublished ethnographic, historical, and contemporary literature concerning California Indians in the Undertaking APE. This research will provide a framework for the identification and evaluation of traditional cultural properties. It will also assist USACE in determining which communities, organizations, and individuals to consult with concerning Native American properties.

Consultation

Consultation with concerned and descendant communities is the linchpin for identification of Native American properties. The mode of consultation undertaken by USACE will be conditioned by factors such as schedule, cost, and the preferences of consulted parties. Methods may include letters, electronic mail, telephone calls, and meetings. Consultation must be conducted in a manner that respects Native American values.

Field Review

Field reviews with knowledgeable individuals are vital to almost every attempt to identify Native American properties. USACE may elect to meet with Indian Tribes and others to determine whether traditional cultural properties are present in Undertaking activities.

Relevant Themes

Relevant evaluation themes for Native American properties mainly revolve around historical uses of particular places; these constitute the relevant themes. A given property, for example, may be used for vision questing, whereas another may be a long-standing fishing station. Native Americans also maintain plant-gathering areas and ceremonial gathering places throughout the state. The majority of California Indians also ascribe present-day geographical features with past spiritual or historical events and persons. The knowledge of traditional cultural properties associated with Native Americans may add considerably to the corpus of information on California Indians.

Evaluation Criteria

Applicable NRHP Criteria

Non-archaeological Native American properties may be eligible for listing in the NRHP under any of its four criteria and may be found eligible under more than one of the criteria. However, this type of property is most likely to be found eligible under Criterion A for association with spiritual or historical events, as well as traditional cultural practices. Native American properties are less likely to be eligible under Criterion B. Criterion C is not likely to be invoked or satisfied without a strong comparative base for the sort of property under consideration. Native American properties might contribute significantly to the understanding of California Indian history and culture. Indeed, traditional cultural properties have relatively low representation in the ethnographic literature. Native American properties, therefore, might qualify as historic properties under NRHP Criterion D.

Data Requirements

Data requirements for Native American properties are challenging to isolate. The lack of representation in ethnographic or historical literature is not to be viewed as an impediment to eligibility. Given the salvage nature of most California ethnography, it is highly probable that lack of information concerning a given property reflects the incompleteness of those records rather than illegitimacy of claims that a particular property should be regarded as significant (NRHP eligible). The claims of Indians regarding traditional cultural properties carry a tremendous weight in the evaluation process. The more widely known a given event or practice is among the group (together with a presence in oral history) the more likely it is that a Native American property will be found eligible for the NRHP under Criteria A and B.

Historic Archaeological Property Types

Data Gathering

Data-gathering methods for historic archaeological properties are similar in broad outline to those described earlier in this chapter for prehistoric archaeological properties (see “Research” and “Consultation” under “Prehistoric Archaeological Property Types”). It is more common, however, for archival research at historical document repositories (and other repository types) to figure prominently in pre- and post-field characterizations of historic archaeological properties. The parties consulted in regard to a historic archaeological property’s significance will usually differ from those concerned with prehistoric archaeological property types, although the rationales for such consultation are essentially the same.

Archaeological Excavation

Like data-gathering methods, the archaeological excavation methods employed at historic archaeological properties are broadly similar to those described for prehistoric archaeological properties. The major difference between the two excavation methods is the way in which different excavation levels are defined, recorded, and excavated. Although prehistoric archaeology recognizes and uses excavation based on an identified feature, the placement of excavation units is typically based on a stratified random strategy rather than placement over a feature that has been visually identified prior to excavation. In addition, while prehistoric archaeology recognizes stratigraphic sequences as a potential unit level of excavation, each stratigraphic sequence is typically very deep; therefore, arbitrary levels of 10 cm are more commonly used.

Although excavation at historic era sites utilizes the stratified random excavation unit placement method to identify site deposits, the emphasis is on the excavation of features that have been identified through some form of survey method. In practice, a unit of excavation at a historic site will be placed directly in association with a pre-identified feature and it may be skewed in terms of cardinal directions to account for the feature layout.

Historic site excavation also places a heavy emphasis on stratigraphic excavation as defined by Harris (1979). This method, however, entails more than simple stratigraphic excavation; it also defines different layers as events or “contexts” and treats the top of each layer as a potential surface that might have been exposed for a duration of time, just like the current surface of the ground we walk on. Emphasis in recording the layer in terms of photography and plan views, therefore, is made before the layer is excavated rather than after. The recording of contexts has subsequent ramifications on the recording and tracking methods of artifacts as they are collected, sorted, and analyzed.

Remote Sensing

The comments under “Prehistoric Archaeological Property Types” regarding remote-sensing methods are equally applicable to historic archaeological properties. Due to the frequently more robust structural remains at historic archaeological properties, remote sensing would likely return more conclusive data for historic sites than it would for many prehistoric sites.

Artifact Processing and Analysis

Historic-era artifacts recovered will be analyzed with two goals in mind: to allow the investigators to address questions identified in the research design, and to generate comparative data for other researchers to use.

Washing and Labeling

All artifacts will be washed with water except for these materials, which will be dry brushed:

- Bone
- Shell
- Textiles
- Leather
- Metal
- Items with paper labels or fugitive surface decoration
- Low-fired earthenware
- Structural materials such as plaster, mortar, or earthen wall material

Artifacts will be labeled according to each unit/feature. Artifacts will be sorted by material and subtypes according to each stratigraphic context within the unit/feature. Artifacts will then be permanently labeled with the provenience number (unit/feature letter and context/interface number). The sequential catalog number will be added during cataloging.

Unit/Feature Phasing

Artifacts fragments that are determined to be of the same single item would be cross-mended first within stratigraphic contexts, then throughout the unit or feature to determine the minimum number of individual items (MNIs) and to inform the final analysis of stratigraphic sequences.

Materials Analysis

Historical sites have the potential to contain a wide variety of material types, such as ceramics, glass, buttons, beads, metal, and faunal and botanical remains. Each of the material types requires research and analysis specific to the type. The general process for analysis, however, is essentially the same in that each material is separated into distinct subcategories. Each item's distinguishing morphology is described. For example, data from glass bottles would include functional category, color, type, design elements, and maker's marks. Additional documentary research is conducted for items such as ceramics, glass, buttons, beads, and metal. Botanical and faunal materials are identified by species, if possible, and additional meat weight analysis is conducted for butchered bone.

Research Themes

Class and Ethnic Identities

The term *class* is typically defined as the relationship among members of society that is continuously negotiated and is denoted through social practices, affiliations, and the symbolic use of cultural materials. It is often described as a discrete social or economic category or a relative and ranked category. Viewing class as an abstraction of ranked discrete units, however, ignores the very real relationships that are negotiated and relegates the study of class to a study of economic points along a continuum.

This ranked continuum bears a resemblance to discrimination-justifying social evolutionary perspectives. A departure from this paradigm is espoused by McGuire and Reckner (2002) and Wurst and Fitts (1999), who argue for a definition of class as a construct of perceived economic relationships. This approach defines classes by their relationship to the means of production and to each other. The key difference in this approach is that the relationship, not the economic rank, of the participants becomes the focus of study. By looking at class in this manner, classes may still be seen as categories, but these categories are fluid and have histories surrounding their formation (Wurst and Fitts 1999).

A fluid perspective of class as categories affects the way we analyze the material record, so that a simple analogy between the value of goods and the status of its user is no longer valid. A synthesis of the material record with the historical record is needed. Mullins (1999), for example, finds that African American household sites in post–Civil War Annapolis, Maryland contain half as many coarse stoneware and glass preserving jars (usually associated with cost-saving home preservation methods) as their Euroamerican counterparts. In addition, African American household sites contained more of the higher-priced brand goods then their Euroamerican counterparts.

A simple value and status analysis might find that African Americans had more money than their Euroamerican neighbors to spend on brand goods. The historical context, however, indicates that they did not have more money, but were discouraged from engaging in the personal interactions involved with purchasing locally made items, which were lower in price than the brand goods they could purchase anonymously from a catalog.

Some argue for the subsumption of other forms of inequality—such as gender, race, and ethnicity—under class. For example, the Latin American caste system—which superficially seems to be based on race—allowed a person born underprivileged, who then attained wealth, to obtain legal papers declaring him “white” and therefore of the privileged caste (Wolf 1959). Applying the subsumption perspective to this system would reveal that class, not race, was the underlying determining factor in assigning distinction in the caste system. Likewise, economic conflicts based in Ireland have been forged largely around the distinction between Catholics and Protestants.

The point is that conflicting groups distinguish themselves from one another by magnifying their differences. These distinguishing characteristics—such as nationality, ethnicity, gender, or religion—become the focus of attention and serve to conceal the complex mechanics of class. As a result, the existence of class relations becomes altogether denied (McGuire 1991:106).

Nationality, ethnicity, gender, and religion are ways in which we identify groups of individuals. Identity, however, is a much broader topic applicable to a multitude of types of human groupings. When groups interact, they identify themselves and others through perceived differences. When interacting groups express their identity, they do so as both active and responsive participants. Ethnicity as identity seems to be most apparent in situations where there is conflict. Spicer (1971:98) states that “what becomes meaningful is probably a function of the oppositional process.”

For example, in situations with the immigrant Chinese and the dominant host society, Coughlin (1960) and Glick (1942) see the Chinese reinforcing their traditional values, behaviors, and organizations when the host society is hostile. On the other hand, Amyot (1973) sees less noticeable aspects of Chinese ethnicity with the host community and Chinese relations are amicable. This paradigm is challenged, however, because key individuals, such as merchants, served as liaisons to the dominant host society. Omohundru (1978) sees this strategy as one of defense because Chinese merchants "advertise their ethnic distinctiveness and consequently shift the stress inherent in face-to-face commercial transactions at the ethnic group level." Merchants appear to be the most common group of individuals who held this position, interacting and negotiating with influential local entities such as local governments (Coughlin 1960:80; Glick 1938:74; Lai 1988:191).

Hodder (1979) suggests the most salient archaeological data applicable to the question of ethnicity exists when there is conflict. Ethnicity is an appropriate subject for archaeological studies if it is defined as the "mechanism by which interest groups use culture to symbolize their within-group organization in opposition to and in competition with other interest groups" (Hodder 1979:452). Barth (1969) and Spicer (1971) warn us that this mechanism or system is dynamic and that material aspects of a group may change without affecting that group's identity because ethnicity is a function of self identification and ascription, not objective identification from outside.

Recent work illustrates that what archaeologists perceive as ethnic boundaries may be fluid, permeable in part by ethnic individuals who served as liaisons to the external community. Farkas and Praetzellis (2000) relate such an example from the excavation of a portion of the Sacramento Chinatown, suggesting that merchants serve in this capacity and that the overall system affects the material record. Overseas Chinese communities are typically characterized as having a lesser degree of control over the production and distribution of resources (mode of production) and, as a result, having less power and status than the dominant society. Although this is undoubtedly true, applying the ideas of relations and subsumption to this over-generalized characterization may provide a fuller understanding of the economic negotiations between the two groups and suggest ways in which both groups were parts of a larger system.

The question is whether these interpretations are testable using archaeological data. Archaeological examinations of the relationship between ethnicity and material culture have indicated that ethnicity-based differences can be identified and studied in the archaeological record, but there must exist factual data regarding how each group was identified or how they identified themselves in a distinctive material way.

Gender and Family

Historical archaeology has the opportunity to offer valuable insights to questions regarding socially marginalized groups because the consumer products, food remains, and other materials recovered reflect the individual, personal choices of specific people in the past. According to Voss, gender is one area of study that has particular research potential because written records are often biased in their representations of men and women (Voss 2006). In fact, much of the primary historical data is a reflection of the male head of the household, while the women's materials, such as ceramic tableware and cooking utensils, often receive all of the analytical attention (Cook et al. 1996:51). Thus the archaeological record is critical for understanding the history of gender roles and relationships within the family.

Archaeological studies in New York City by Diana Wall (1994) were designed to test the notion that the division of home and workspace in the late nineteenth century was caused by economic changes tied to capitalism and that women were passive "victims" in this event. Wall focused her investigation on the organization and service of family meals. Her research discovered that by the mid-nineteenth century, the family meal was not only focused on food, but also on the dishes on which the meals were served. According to Wall, the dishes became symbols in the increasingly elaborate and ritualized mealtime. Wall concluded that this change in meal organization and service occurred prior to the economic changes of the late nineteenth century and argued that women must be regarded as active agents in the redefinition of gender.

Through the study of gender roles in the archaeological and historical record, researchers are better able to explore the ways in which women directly participated in the struggle for social change through their work within their households. For example, Margaret Wood studied the household refuse and mining landscape of Ludlow, Colorado, a coal mining town and the site of the 1914 Ludlow Massacre. Wood studied the mining families to determine the kinds of labor the housewives undertook and to examine the social relations built around this domestic labor (Wood 2002).

Patterns related to the use and disposal of material culture revealed how the relationships both within and between households were created (and re-created) through the productive activities of women and their consumptive choices (Wood 2002). According to Wood, archaeology has the potential to be a powerful tool for examining alternative forms of domesticity and household relations especially within working-class and ethnic households, where little is known of the complexity and variety of these groups compared to the middle class. In Ludlow, Wood argued, the men, women, and children created their own form of domesticity, which served their class-based needs, and did not simply conform to or resist middle-class patterns.

Voss argues that gender studies in archaeology should include men, children, and the elderly. Gender identities, roles, and ideologies vary across cultural groups over time and also intersect in powerful ways with race, ethnicity, and class (Voss 2006).

Consumer Behavior

The growth of the capitalist economy, specifically facilitated by nineteenth-century advances in transportation and industrial production, affected the global and national market economy, labor, social structure, and trade networks throughout the country. Industrialization in the United States brought increasing amounts and varieties of consumer goods to much of the population. Urban residents were flooded with mail-order catalogs, newspaper advertisements, and magazines with advertisements for foodstuffs, patent medicines, and personal goods. The focus on consumption can be seen as an outgrowth of the industrial revolution, along with the labor movement that brought workers more income, in the form of cash, and more time to spend it.

Although newly purchased goods often served subsistence functions, they also served non-subsistence functions by acting as symbols that conveyed information about their owners. Symbols were given mass public recognition by retailers through their catalogs and department stores, which became the source of influence about how one should dress, furnish a home, and spend leisure time.

The material record reflects how people were influenced by fashion and mass marketing, as well as how they prioritized cost, quality, popularity, and efficiency in their consumer choices. In addition, even though certain goods represented cultural strategies for living and success in certain ethnic or economic neighborhoods, individual variance or deviance from established ethnic, community, or gender-specific values can be identified in private households or similar residential groups.

Consumer behavior also became a mechanism for the lower classes to assert affiliation and moral equivalency to the elite upper class. Material culture became a symbol of increased status and social and economic achievement (Shackel 1993).

Consumer behaviors of the early twentieth century were transformed by marketing and advertisements geared toward convincing the consumer that abundance and the possession of material goods were the key to improving happiness. Corporations created false needs in consumers and ultimately began to manipulate fears and desires in order to elevate superficiality over substance (Peiss 1998).

Between 1890 and 1910, corporations targeted mass production, distribution, marketing, and advertising to transform the local patterns of buying and selling goods in urban and rural areas throughout the United States, and thus to create a culture of consumption that would increase corporate profits (Horowitz 1985). Specific materials mass-marketed in the early twentieth century included clothing, cosmetics, furniture, food products, pharmaceuticals, and household goods (tableware, stemware, food storage, and preparation tools, for example).

Personal Health and Hygiene

Concepts of health changed drastically through the years, particularly in the late nineteenth century. Historians have struggled to explain why these changes took place. While culture is identified as a main source of change, Haller (1981:xi) also saw changing medical practices as a contributing factor. Shryock (1953:108), in turn, identified changing “internal logic” as the critical factor within medicine. This internal conflict, characterized by Tomes (1997:21) as a raging debate in the 1870s, laid the foundation of the medical acceptance of the germ theory by the 1880s. Melosi (2000:423) described city-wide sanitary services, including the new city water supply and wastewater disposal systems, as intimately connected to these current medical practices and understandings of public health. Beyond medical practices, Bushman and Bushman (1988:1238) noted the influence of industrialists who “through advertising...propagated faith” in various health products.

In response to these threats, Tomes noted that nineteenth-century residents, particularly of the growing middle class, focused on the home as “an important vector of disease” (Tomes 1990:510), vigorously cleaning every nook and cranny to protect their families. But these efforts went beyond cleanliness, as Smyth (1993:64) described, and the home became a place of orderliness and sanctuary in a chaotic world that increasingly did not make sense to a traditionally agricultural people. Thus, as Hoy noted, the growing importance of health and hygiene in the latter part of the nineteenth century reflected “the triumph of middle-class ideals and habits” (Hoy 1995:xiv).

Many studies examined health-related structures such as privies and water sources. Rosenswig (1999) looked at change over time in the construction methods of privies in New York. Carnes-McNaughton and Harper (2000), working in North Carolina, developed predictability models to estimate construction dates for privies. However, Ford argued that “it is not possible to establish a specific chronologic timetable” (Ford 1993:12.4) for physical improvements to health and sanitary conditions because the existence of a municipal sewer system did not guarantee its use (Tarr 1975:601).

Many of these studies examined privies as an acceptance or dismissal of community-wide reforms because these privately constructed structures reflect household interpretations of the laws. Sanitary reforms during the late nineteenth century placed limits on the construction of privies, including depth and distance to homes and streets. In studies of excavated privy structures, some archaeologists found that residents resisted the sanitary reforms (Scharfenberger 2001:46; Stottman 2000:57) while others found an acceptance of sanitary codes, even as early as the mid-seventeenth century (Demeter 1994:18; Heck and Balicki 1998:35). Household sanitary preferences, although often confined to municipal codes, varied from house to house and may have reflected cultural background, occupation, and home ownership (Crane 2000:20; Demeter 1994:19; Scharfenberger 2001:46).

Another focus in health and hygiene studies has been biological studies of privy contents. These investigations involved analysis at both the household and the individual level. The vast majority of these types of studies have used archaeoparasitology to identify and interpret the various parasites present in archaeological contexts as a reflection of sanitation, health, and hygiene conditions. Reinhard (1994:62), examining parasitism at Harpers Ferry, West Virginia, determined that the high numbers of parasite eggs throughout all the studied privies reflected the resistance of the community as a whole to modernizing sanitation. On the other hand, Bain (2001:72), while studying a late nineteenth-century site in Québec City, found that steadily decreasing numbers of parasites between 1850 and 1900 reflected residents conforming somewhat to municipal sanitary reforms.

Other studies examined different biological features. Freeth (2002:21) examined the surfaces of human teeth as evidence of oral hygiene practices. Other archaeologists, such as Steyn and Henneberg (1995), who looked for evidence of syphilis in Iron Age Africa, examined the whole human skeleton for evidence of the disease. Mrozowski et al. (1989) sifted through the floral and faunal remains excavated from privies of the Boott Mills company town. They found that increasing pollen counts from weeds, the presence of rodent skeletons, and gnawed food bones reflected a decreasing cleanliness of the yards behind the boarding houses (Mrozowski et al. 1989:310–314).

Some studies merely described hygiene and health because they stumbled upon them when other research goals failed, such as with Parrington (1981). Instead of finding plentiful seeds reflecting a space used by the naturalist to store and process unique specimens, Parrington (1981:34, 38) found a late nineteenth- to early twentieth-century deposit of bottles reflecting the popularity of proprietary and patent medicines of the time.

Archaeological studies in health and hygiene used consumer goods to look at nineteenth-century culture. Many involving the material culture of health and hygiene were more descriptive and supported wide trends. For example, Flynn and McGowan, while studying glass bottles at a north Illinois farmstead excavation, determined that new technology made more products available to the family and that they were much “more likely to purchase highly perishable products...from local manufacturers” (Flynn and McGowan 2004:7). Carley, while working with early nineteenth-century bottles from Fort Vancouver, determined that the medicinal tools and treatments present were a “[reflection] of nineteenth-century medicine and responses to fever epidemics” (Carley 1981:33).

Evaluation Criteria

The eligibility criteria discussed under “Prehistoric Archaeological Property Types” applies equally well to historic archaeological properties, although there is an increased likelihood with historic-era archaeological properties that one or more of Criteria A, B, and C apply to the property under consideration.

Data Requirements

Class and Ethnic Identities

Documentary

Historical research avenues will focus on defined associations with the stratified and ethnic characteristics of society. Maps (including Sanborn maps), photographs, census data, tax assessor's records, and business records will be reviewed to develop information on class structure and ethnic composition in the area, and to ultimately address questions regarding class and ethnicity.

Archaeological

Archaeological concentrations from discrete contexts (hollow-filled features and sheet refuse) containing a sufficient quantity and variety of artifacts are needed to address research questions specific to ethnic display and boundary maintenance. Features should contain well-stratified temporally diagnostic deposits to assist researchers in documenting and understanding change over time. Features should retain integrity and have identifiable associations.

A large quantity and variety of domestic and personal items with maker's marks and datable styles or manufacturing techniques is necessary to attribute features to a specific socioeconomic class or social group.

Artifacts reflective of ethnic identities and origins, and items that are not attributable to a specific ethnicity but can be readily identifiable as to function and place of origin, will help researchers understand boundary maintenance. Medicines indicative of health, hidden items of surreptitious behavior, and evidence of modification of artifacts will assist with addressing research questions regarding traditional health and medicinal practices.

Well-stratified deposits may indicate a change over time in the access to materials, an alteration of preference, or a behavioral change in discard of materials. Closely dated deposits and features containing abundant and diverse cultural materials from residential properties associated with people of known racial/ethnic background will also assist in addressing Undertaking research questions.

Comparisons with deposits in households of other race/ethnicity will be valuable to discriminate differences. Examining the influence of race/ethnicity will also require consideration of the contributory influences of class and occupation. The ability to address changes through time will require properties from different periods. However, important conclusions will still be possible even if only some stages in the process of ethnic accommodation are discovered. Residential properties that meet the foregoing criteria are expected to contain many data sets useful for evaluating the specific questions. Traditional artifacts and food wastes, along with nontraditional ones, will afford insights into the retention of specific ethnic practices and adoption of new materials and cultural behavior.

Identifiable faunal remains with distinguishable cut marks and evidence of a specific meat cut should allow researchers to use species and meat cuts to understand class and ethnic identities. Faunal remains should differentiate between ethnically distinctive butchering patterns and retention of traditional dietary preferences in terms of species and/or meat cuts, as well as health and medicinal practices. Macro- and micro-botanical analysis (seeds, pollen, starch grain, etc.) may provide information on diet, traditional medicine, and health.

Gender and Family

Documentary

Tax assessor's records, Sanborn maps, census records and newspapers will be used to determine the demographic composition of the Undertaking APE and the surrounding area, and to identify specific residents or businesses that can be associated with archaeological features. Oral histories and newspaper editorials will also be utilized to determine popularized views of other groups, changes in these views, and any confrontations that took place in the Undertaking Area.

Archaeological

Archaeological concentrations from discrete contexts (hollow-filled features and sheet refuse) representing a sufficient quantity and variety of artifacts are needed to address Undertaking research questions. Features should contain well-stratified temporally diagnostic deposits to assist researchers in documenting and understanding change over time. Features should retain integrity and have identifiable associations. Specialized activity areas such as outdoor cooking areas, kitchen gardens, or gaming areas with artifacts that can be readily associated with gender and/or age will guide researchers in the interpretation of the spatial organization of the site.

A significant quantity and variety of domestic and personal items is necessary to attribute features to a specific gender or family group. Artifacts reflective of such groups—for example, dishes, tablewares, sewing/knitting materials, beauty products, jewelry, baby bottles, toys, and items that are not attributable to either gender or family groups but can be readily identifiable with a specific household or place of origin—will help researchers understand and further document these distinctions. Residential properties that meet the foregoing criteria are expected to contain many data sets useful for evaluating the specific questions.

Consumer Behavior

Documentary

Tax assessor's records, Sanborn maps, census records and newspapers will be used to identify specific residents or businesses that can be associated with archaeological features. Primary source material consisting of printed advertisements, household ledgers, and diaries would reveal patterns in consumer behavior.

Archaeological

Archaeological concentrations from discrete contexts (hollow-filled features and sheet refuse) containing a sufficient quantity and variety of artifacts are needed to address research questions specific to consumerism. Features should contain well-stratified, temporally diagnostic deposits to assist researchers in documenting and understanding change over time. Features should retain integrity and have identifiable associations.

Artifacts reflective of changes of consumer patterns in the early twentieth century would need to be readily identifiable and datable. A large quantity and variety of domestic and personal items may provide the most information for documenting consumer choices. Specifically, discrete depositional layers containing dense concentrations of mass produced food and beverage containers, toiletries, and other household materials would indicate participation into the mass consumption revolution that occurred in the late nineteenth and early twentieth century.

Analysis of pollen and faunal remains may provide information on food acquisition practices of households. Micro-botanical and macro-botanical studies may provide evidence of backyard gardens. Faunal analysis may assist researchers with understanding the role animal husbandry played in the diet of the household.

Personal Health and Hygiene

Documentary

As with many of the other research questions, establishing clear associations between features and the sites' specific occupants will be critical to addressing questions of public health. Census records, vital statistics, and a review of oral histories and other personal accounts may be fruitful toward this end.

Archaeological

Archaeological concentrations from discrete contexts (hollow-filled features and sheet refuse) representing a sufficient quantity and variety of artifacts are needed to address Undertaking research questions. Features should retain integrity, be temporally discrete, and have identifiable associations. Well-stratified deposits may indicate a change over time, an alteration of preference, or a behavioral change. Intact, health-related structural remains such as privies, sewers, or households will help reconstruct residents' responses to changing perceptions of health and cleanliness, as well as new public health regulations. Archaeological information from the Undertaking APE should be considered against those from comparative collections recorded for other similar environments.

Historic Structure Property Types

Data Gathering

Research

When a historic property is identified within the APE for an Undertaking activity, research should begin with an examination of the existing historic context represented in this HPTP. The context and information in this document will provide a foundation for additional research, if such is deemed necessary. As part of the data gathering, it will be helpful to examine the Undertaking records search and database relevant to the region (U.S. Army Corps of Engineers n.d.). Initial research will help determine the basic information about the subject property type, which will help determine significance and integrity. Research should focus on materials such as historic maps, plans, and photographs. The information gained from this research may reveal dates of construction, original materials, ownership, and, for linear features, their alignments and history of alteration. Intensive research also aids in establishing the property's period of significance. Table 5-1 lists suggested resources to be consulted based on the property type under investigation.

Table 5-1. Historic Structure Property Types and Research Materials

Property Type	Research Materials
Residences, commercial buildings, farm/ranch complexes, civic buildings, social buildings	USGS Topographic Maps County Recorder/Survey/Assessor Maps and Property Characteristics Historic property maps City Directories Recorded Deeds Local government meeting minutes Newspaper articles Historic photographs
Levees, weirs, slips, canals/ ditches, pumping stations, water towers, bridges, roads	USGS Topographic Maps BLM maps/surveys Bureau of Reclamation maps/records Engineering journals As-Builts Aerials

Survey

The intensity of survey and recordation will depend on the property type, its potential area of significance, the NRHP criteria under which it most likely would be eligible, retention of integrity, and the potential for the proposed Undertaking activity to have an adverse effect. Historic properties should be surveyed by means of physical observation and recorded with photographs and field notes.

The appropriate type of survey necessary to identify historic properties is determined by the historic context, predicted property types, and research. For certain areas of the Undertaking APE, a reconnaissance survey may be necessary to identify predicted and unknown property types. A reconnaissance survey does not include NRHP evaluations, but allows for decision-making about whether further study or survey is required in the area, the cost involved for such surveys, and those areas considered most sensitive. If a reconnaissance survey is conducted it should document:

- Types of properties surveyed
- Boundary of the surveyed area
- Methodology for the survey
- Identification of the types of historic properties found
- Specific properties identified
- Areas surveyed that did not contain historic properties. (National Park Service 1983)

The second survey option is an intensive survey. This is best used when it is a necessity to know exactly what historic properties are within the Undertaking APE. An intensive survey goes beyond the mere identification of properties: it also requires evaluation using the NRHP criteria (National

Park Service 1983). In addition to documenting the types of properties surveyed, the boundary of the surveyed area, and methodological approach to the survey, an intensive survey should also document:

- Recordation of the precise location (e.g., address, assessor parcel number, GPS point, UTM coordinates)
- Information pertaining to the property's physical appearance, significance, integrity, period of significance, and boundaries

Relevant Themes

Relevant themes help to identify potential NRHP significance of the property. Although not an exhaustive list, below is a list of potential areas of significance identified in the historic context for the expected property types.

- **Agriculture/Ranching:** Properties associated with the process and technology of cultivating soil, crop production, or raising livestock
- **Architecture:** Properties associated with the design and construction of buildings that shelter human activity
- **Engineering:** Properties associated with the design, construction, and operation of structures
- **Flood Control:** Properties associated with controlling rivers to reduce the occurrence of flooding
- **Irrigation/Reclamation:** Properties associated with the application of water to lands for the production of crops or those associated with the reclaiming of land for agricultural production
- **Settlement/Community Development:** Properties associated with the establishment and design of communities

Evaluation Criteria

Applicable NRHP Criteria

Using the historic context and the relevant themes established in this document, properties eligible under Criterion A must be associated with settlement, agriculture, flood control, or reclamation. This association is most likely going to be at the local level of significance, but in some instances may attain state level of significance. The expected property types identified in this HPTP that may be eligible under Criterion A include: farm/ranch complexes, civic and social-oriented buildings, levees, weirs, and water conveyance systems. It is possible for a predominant number of properties to be eligible under Criterion A.

Property types under the theme of flood control and reclamation will rarely be eligible under Criterion B. Within the contexts of settlement and agriculture, property types such as farm complexes and residences must demonstrate that the person associated with the property has gained importance within his or her profession or field of endeavor. It is also important to compare the work of the individual with contributions of others in the same field. Properties eligible under Criterion B must be directly associated with a person's productive life and be the property most closely associated with the individual. A mere association is not enough to meet Criterion B. For examples of persons that may be considered eligible at the local level of significance, evaluators should consult Grosvenor Boland (n.d.).

Property types may be found eligible under Criterion C for embodying distinctive characteristics of a type, period, or method of construction; work of a master architect or engineer; or whose components lack individual distinction but collectively convey a distinguishable entity. Properties, particularly those related to flood control and irrigation (e.g., levees, weirs, and canals) may demonstrate an aspect of important engineering technology or represent the work of a master engineer. Properties eligible for embodying distinctive characteristics will likely be eligible in the area of architecture (e.g., residences, commercial buildings, government or social buildings). Surveys may also identify properties that create a historic district under Criterion C. These potential districts may be as small as a ranch complex composed of a residence, sheds, barns and other farm-related outbuildings, or as large as that encompassing several water conveyance or flood control-related structures.

It is possible that some historic structure property types may yield information important to history under Criterion D. However, those properties must be the direct source or have been the source of important information. The important information associated with these properties may be related to the area of architecture or engineering.

In addition to meeting one of the four NRHP criteria, properties must retain integrity. The specific aspects of integrity required will depend on the property type and which of the NRHP criteria the property meets (Table 5-2). Although it is not necessary to retain all seven aspects of integrity, the property must have sufficient integrity to convey its significance. Any property that retains only integrity of feeling and association will not be eligible for listing in the NRHP. Table 5-4 indicates the aspects of integrity that are minimally necessary based on area of significance. However, integrity can be accurately assessed only when:

- The character-defining features of the property have been identified
- The determination has been made that the character-defining features are visible
- The determination whether a comparison of similar properties is necessary
- The historic context and area of significance for which the property represents has been identified

Table 5-2. Historic Structure Property Types and Applicable Aspects of Integrity

Area of Significance	Aspects of Integrity						
	Location	Design	Setting	Feeling	Association	Materials	Workmanship
Agriculture/ Ranching	√	√	√	√	√		
Architecture	√	√		√		√	√
Engineering	√	√	√		√	√	
Flood Control	√	√	√	√	√	√	
Irrigation/ Reclamation	√	√	√	√	√	√	
Settlement/ Community Development	√	√	√	√	√		

In some instances a lesser degree of integrity can be justified if the property is a rare example. However, the property must be compared with similar properties and a sufficient portion of the property must be intact.

When assessing integrity, it is important not to confuse *condition* with *integrity*. Properties considered to be in poor condition might still retain the essential aspects of integrity sufficient to convey significance.

Data Requirements

Data requirements translate to character-defining features. For historic structures, character-defining features include the building's overall mass, materials, craftsmanship, decorative detailing, openings, and fenestration. The building's architectural style will define the specifics for each of these elements. This is also true for structures. For levees, such features might include the levee's slope, crown, hinge point, height, width, and pyramidal shape. The design of canals and ditches will also be defined by the material used to construct the canal. Earthen canals, for example, tend to display a trapezoidal shape. Ultimately, the character-defining features of a property will vary depending on the property type.

Submerged Property Types

Submerged resource property types within the study area include the remains of landings, pilings, and modern and historic ships (Panamerican Consultants 2010). Like terrestrial cultural resources, submerged resources that are 50 years or older are presumed significant (PRC 6313).

Data Gathering

Data gathering for submerged property types consists of archival research and survey.

Archival Research

Archival research conducted for the identification of submerged properties will be conducted throughout the data gathering process. Pre-field research is a valuable tool that can be used for identification of submerged resources and, more particularly, for identifying specific areas where submerged resources may be located. Research may also be done during or after a field survey or identification of resources to provide more detailed information about the resource. Sources typically consulted for archival research include historical photographs, newspaper articles, historical maps, navigation charts, journals, books, periodicals, and reports documenting previous submerged resource studies. A number of museums and record-keeping agencies collect and manage these data sources. Other potential sources of information include local historical societies, the SLC's shipwreck database, the Bureau of Reclamation, USACE, and the local CHRIS.

Survey

Methods to identify submerged resources at each repair site will be determined on a location-by-location basis. Methods may include survey with or without the aid of instrumentation and strategic dives. Surveys for submerged resources would typically use a transect-based strategy similar to a terrestrial resource survey. These surveys may incorporate technological tools such as sidescan sonar, GPS, and magnetometer scanning. These tools, when used in concert, aid in the identification of submerged resources by effectively mapping the river bottom and detecting any unnatural anomalies that might be present. Data gathered by these tools can typically shed light on size, shape, and material type of identified anomalies.

Dive crews could be used independently or in concert with a survey. Dive crews would descend on targeted properties (identified through other means such as research or survey results) to gather information on integrity, to verify that survey data has been interpreted correctly, and to record details that were not evident as a result of survey methods. If the resource is found to have sufficient integrity, the data will be analyzed to determine if it is associated with a significant theme that would cause the resource to be NRHP eligible.

Data Recovery

If impacts to an eligible submerged resource cannot be avoided during construction, data recovery might be necessary. The goal for data recovery is to exhaust the data potential of the resource. Data recovery for the site would be conducted according to current professional standards for underwater archaeology, based on the results of consultation with appropriate agencies in reference to the research design. Carefully chosen artifacts, selected in advance, may be recovered if approved by the SLC, and sufficient funds and conservation laboratory resources are available to properly conserve the artifacts.

Artifact Processing and Analysis

If collected, cross sections of wood samples would be analyzed to determine wood type, age, and milling methods. Conservation of recovered material is often necessary if the recovered material has been moved from an underwater environment to a dry environment. Conservation methods will vary according to the type and number of artifacts collected. Artifacts are sometimes encased in encrustations that contain degraded iron artifacts, wood samples, samples of sheathing, ceramic artifacts, or glass artifacts, for example. These encrustations must be dissolved in order to be properly analyzed. Analysis methods for artifacts associated with a submerged resource will be similar to methods used for analysis of terrestrial historic era resources. Attributes, including material type, form, and function, will be recorded along with metrics such as weight and dimensions. All artifacts and pertinent attributes will be catalogued and entered into a searchable database.

Research Themes

Typical research themes associated with submerged properties in the study area include commercial, military, recreation, and to a lesser extent, exploration. The majority of submerged properties in the Central Valley are associated with various commercial endeavors, including agriculture and transportation of goods and individuals, beginning with the Gold Rush in the late 1840s. There has never been a large maritime military presence in the study area, although some military shipwrecks have been identified in the Delta. Numerous shipwrecks are associated with recreational pursuits. The vast majority of these date to the post-1930s.

Evaluation Criteria

Determining the significance of a submerged resource depends on establishing whether it 1) was involved in important maritime commercial, naval, recreational, or exploration activities; 2) is associated with a significant designer or builder; 3) is the sole, best, or a good representative of a specific vessel type; or 4) can yield or is likely to yield important information to history. The significance of a submerged resource can be determined only through a systematic investigation of its qualities, associations, and characteristics. According to National Register Bulletin 20, *Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places* (National Park Service 1992), a typical investigation for eligibility of a shipwreck should include:

1. Identification of the specific type of vessel and documentation based on a physical inspection of the vessel and a documentation of her history.
2. Identification of the historic context associated with the vessel based on a documentation of her history.
3. Determination that the characteristics of the vessel make it either the best or a good representative of her type.
4. Evaluation of the vessel’s integrity and a listing of features that the vessel should retain to continue to possess integrity.
5. Evaluation of a vessel’s special characteristics that might qualify it for NRHP listing even though it might be less than 50 years old or some aspect of its present condition generally would not qualify it for listing.

Applicable NRHP criteria

Under Criterion A, association with “events that have made a significant contribution to the broad patterns of history,” a submerged vessel may qualify through association in areas of significance such as those discussed in “Evaluation Criteria.”

Under Criterion B, association with “persons significant in our past,” a submerged vessel will possess significance if a historically significant person’s importance is tied directly to the resource. Application of this criterion is the least applicable for evaluation of submerged resources.

Under Criterion C, a submerged resource possesses significance if it embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction. Vessels, particularly intact vessels, are usually found to be eligible under Criterion C within the categories of architecture or engineering.

Under Criterion D, a resource is significant if it has yielded, or is likely to yield, information important to history. For example, if the remains of a submerged vessel can provide important information about its use, method of construction, and operation, it may be eligible under Criterion D.

Data Requirements

Once a submerged resource is located and general metrics are recorded, character-defining features should be identified. This includes the date of construction, the date the resource became submerged, the type of resource (i.e. a barge, ketch, paddle wheeler, etc.), the architect or builder (often a shipyard instead of an individual), construction material, method of construction, and the ship's use or function (i.e. military, transportation, or fishing). Ultimately, the details available for the character-defining features listed above will differ according to the resource's accessibility, state of deterioration, and availability of archival records.

Cultural Landscapes

Data Gathering

Research

Because the repair location APEs are likely to be relatively small in comparison to the areas that would contain a cultural landscape, it is likely that only contributing elements to a cultural landscape property type would be identified within these repair location APEs. When a potential contributor to a cultural landscape is identified within an Undertaking APE, research should begin with an examination of the existing historic context represented in this HPTP. Part of the data gathering for a cultural landscape requires a documentary examination of the landscape in its entirety. Specific sources of data to be investigated might include regional historical contexts, and primary sources such as historic maps and photographs. Site-specific research may be necessary to evaluate the integrity of the contributing element.

Survey

Survey methods for cultural landscapes essentially follow those described earlier in this chapter for historic structure properties.

Relevant Themes

The list below is not intended to be an exhaustive list. Rather, it is a sample of areas of significance for potential cultural landscapes within the Undertaking APE.

- **Agriculture/Ranching:** Properties associated with the process and technology of cultivating soil, crop production or raising livestock

- **Architecture:** Collections of vernacular buildings and associated outbuildings that by historical association, function, and spatial arrangements speak to the development of the land or the cultural traditions of a community
- **Engineering:** Properties associated with the design, construction, and operation of structures
- **Flood Control:** Properties associated with controlling rivers to reduce the occurrence of flooding
- **Irrigation/Reclamation:** Properties associated with the application of water to lands for the production of crops or those associated with the reclaiming of land for agricultural production
- **Settlement/Community Development:** Properties associated with the establishment and design of communities

Evaluation Criteria

Applicable NRHP Criteria

Using the historic context and the relevant themes established in this document, properties eligible under Criterion A are most likely to be associated with settlement, agriculture, flood control, or reclamation. This association is most likely going to be at the local level of significance but in some instances may attain state level of significance. Likely forms of cultural landscape expected to exist in the Undertaking APE and may be eligible under Criterion A include farm/ranch complexes, flood control systems, and water conveyance systems.

Properties eligible under Criterion B must be directly associated with a person's productive life and be the property most closely associated with the individual. A mere association is not enough to meet Criterion B. Designed landscapes significant for the landscape architect would generally qualify under Criterion C.

Most landscapes eligible under Criterion C will have components that lack individual distinction, but collectively convey a distinguishable entity. The most likely will be vernacular landscapes for which function plays an important role. The potential landscape properties may be farm/ranch complexes, water conveyance, and flood control-related structures. A landscape's contributing buildings and structures may also represent distinctive characteristics for a type, period, or method of construction. Smaller elements may even represent a designed landscape by a master architect or engineer.

Archaeological sites may be a component of a cultural landscape and lend the landscape eligibility under Criterion D. The site must demonstrate a contribution to the complete understanding of the property.

In addition to meeting one of the four NRHP criteria, cultural landscape properties must retain integrity. As with all historic properties, some aspects are more important than others. The character-defining features of the landscape must be present and retain integrity in order for a landscape to be eligible for the NRHP.

Data Requirements

Before identifying the character-defining features of a cultural landscape, the significance of the landscape must be understood and evaluated within its appropriate historic context. Spatial relationships and arrangement of specific features contribute to the landscape. Certain character-defining features must be present within the landscape, and those features must retain integrity. Determining the most important features will depend upon the type of landscape and area of significance. The National Park Service (NPS) has identified characteristics of a landscape that include processes that shaped the land and physical elements that exist on the land.

1. **Topography:** The shape of the ground, plane, height and depth of the land is a character-defining feature of a landscape. The topography will be naturally occurring or occurring as the result of manmade changes that shape the landscape.
2. **Spatial Organization:** Spatial organization is created between the landscape's natural and cultural elements. These elements create a relationship between the spaces of the landscape and include functional and visual association.
3. **Vegetation:** These features may be specific specimens of plants or crops. Vegetation is often tied to land use patterns and may include features naturally found in the area or those introduced by man for a specific purpose. Vegetation is also not static and must be assessed in relation to the land uses and activities of the landscape.
4. **Circulation Networks:** The circulation patterns of a landscape encompass roads, sidewalks, paths, footpaths, livestock trails, or canals. Alignment, surface materials, length and width must be understood when evaluating the integrity of circulation networks.
5. **Water Features:** These elements may be decorative or functional. They range from pools and fountains to irrigation systems and aqueducts.
6. **Clusters:** Groupings of buildings, structures and objects help define a landscape. The arrangement speaks to land and circulation patterns.

Documentation

Documenting the surveyed properties will require either a California Department of Parks and Recreation (DPR) 523 Form set or a Historic Properties Inventory Report. Regardless of which format is used to record and evaluate a historic property, efforts should be made to utilize the context and evaluation criteria contained in this HPTP to avoid duplication of effort.

DPR 523 Forms

An Inventory Record is used to capture property-specific information about the property's location, physical characteristics, significance and integrity. Recordation should follow the instructions found in the California Office of Historic Preservation's (OHP) *Instructions for Recording Historical Resources* (California Office of Historic Preservation 1995). At a minimum, a Primary Record (DPR 523A) and Location Map (DPR 523J) should be completed. This level of documentation is most often associated with reconnaissance surveys. Ideally, historic properties will be recorded using a Primary Record and a Building, Structure, and Object (DPR 523B), which will allow for physically recording the resource and evaluating the property for historic significance, as required by an intensive survey. Other DPR 523 forms may be required, depending on the property type. The OHP manual (California Office of Historic Preservation 1995) should be consulted.

Historic Properties Inventory Report

In instances when an Inventory Record is not adequate documentation, a Historic Properties Inventory Report will be prepared. An inventory report provides more detailed information about the methodology used to obtain property-specific information and synthesizes that information into a historic context and evaluation of significance. The inventory report will also include the appropriate DPR 523 forms used to record and evaluate specific properties.

Alternatively, a reconnaissance report will be prepared to identify the salient characteristics of a landscape, as described under reconnaissance surveys for historic structure properties. The purpose of such identification is to determine whether and how an Undertaking activity could be designed to avoid effects on the landscape.

Chapter 6
Native American Consultation Procedures

USACE will continue to consult with appropriate Native American organizations and individuals listed in Appendix C. If additional Native American organizations and individuals are identified by USACE as having an interest within the Undertaking Area, USACE will initiate consultation and invite them to participate in the consultation process.

Native American Organizations as Concurring Parties

Native American organizations acting as concurring parties to the PA will receive notification of all pending construction actions as outlined in the PA. If a map is provided by the Native American organization, USACE will consult when it proposes to repair erosion sites within the areas identified. In addition, USACE will consult in a manner consistent with the "General Consultation Procedures" listed below.

Native American Organizations and Individuals as Non-Concurring Parties

Native American organizations and individuals not acting as concurring parties to the PA will be contacted at the discretion of USACE. USACE will make a good faith effort to identify any Native American organizations and individuals with interest in the location of specific erosion sites. This may include contacting the NAHC, online databases, and personal knowledge. USACE will then contact each identified organization and individual by mail; inviting them to consult about the specific erosion site. If interest from the contacted parties is received by USACE, USACE will proceed to follow the "General Consultation Procedures" outlined below.

General Consultation Procedures

As early in the planning and development process as possible, USACE will notify appropriate Native American organizations and individuals of the exact location of each Undertaking activity and the nature and extent of the work to be done with respect to each erosion site within the Undertaking.

During the planning, design and construction phases of the Undertaking and before construction work at a specific erosion location proceeds, USACE will consult with the appropriate parties with respect to the potential cultural significance of the site at issue.

As early in the process as possible, USACE will request that Native American organizations and individuals, at their discretion, notify USACE of the presence of specific sites or areas considered to be culturally significant or sacred. USACE will evaluate these as outlined in Chapter 5, *Identification of Historic Properties*. To the extent allowed by law, USACE shall ensure that sensitive information provided by the Native American organizations and individuals will be protected and will not be released in a public forum without the express written consent of the Tribe in question. USACE commits to keep the locations of identified culturally significant, sacred, or sensitive sites or places confidential.

Consultation with Native American organizations and individuals may include, but is not limited to, the identification of historic, cultural, and archaeological sites and resources known to the Tribe; eligibility assessment and proposals for the resolution of potential adverse effects on such sites and resources (including alternatives, mitigation, and/or avoidance measures) caused by the project; and public notice, input, and participation.

Should USACE determine, at any time, that the Undertaking may affect a previously unidentified historic, cultural or archaeological site or resource or affect a known site or resource in a previously-unanticipated manner, USACE will invite the Native American organizations and individuals to reinitiate consultation. Should the Native American organizations and individuals object to the proposed course of action, they should provide their objections to USACE within the 15-day comment period as outlined in the PA. USACE will take their objections under consideration and will consider alternatives to lessen the effect to the resource.

Chapter 7
Assessment of Effects

This chapter expands on Stipulation V of the Undertaking PA. The consultation and documentation processes entailed in effects assessments for Undertaking activities are reiterated, followed by a detailed discussion of the Criteria of Adverse Effect.

Consultation and Documentation

Where USACE has consulted with signatory parties or other consulting parties concerning historic properties, USACE shall consult with those signatory parties or other consulting parties on the potential effects of the Undertaking activity. USACE will take their views into account in making its findings.

Where USACE has reviewed and agreed with a previous NRHP evaluation of a historic property, USACE will consult with signatory and consulting parties regarding the effects of Undertaking activities as described under "Finding of Effect."

Finding of Effect

Finding of No Historic Properties Affected, Pursuant to 36 CFR 800.4(d)(1)

If USACE finds either that no historic properties are present, or that historic properties are present but an Undertaking activity will have no effect on them, USACE will document such finding and retain records of that finding in accordance with Undertaking PA Stipulation VII. USACE will notify the signatory parties and any other consulting parties to the Undertaking activity of the finding and make documentation available to them unless they have indicated that they do not wish to receive such documentation. Following satisfactory completion of the steps prescribed herein, no further review pursuant to the Undertaking PA is required.

Finding of Historic Properties Affected

If USACE finds that historic properties may be affected by the Undertaking activity, USACE will apply the Criteria of Adverse Effect (see below).

Finding of No Adverse Effect

USACE may propose a Finding of No Adverse Effect if none of an Undertaking activity's anticipated effects meets the Criteria of Adverse Effect under 36 CFR 800.5(a)(1) or conditions outlined elsewhere in this HPTP, or if USACE imposes conditions that will avoid all adverse effects on historic properties. USACE shall document and retain records of that finding in accordance with Undertaking PA Stipulation VII. USACE shall notify the signatory parties and any other consulting parties to the Undertaking activity of the finding and make documentation available to them unless they have indicated that they do not wish to receive such documentation. Following satisfactory completion of the steps prescribed herein, no further review pursuant to the Undertaking PA is required.

Finding of Adverse Effect

USACE will propose a Finding of Adverse Effect if an Undertaking activity's anticipated effects meet the Criteria of Adverse Effect under 36 CFR 800.5(a)(1). USACE will document and retain records of that finding in accordance with Undertaking PA Stipulation VII. USACE will notify the signatory and concurring parties and consulting parties to the Undertaking activity of the finding and make documentation available to them unless they have indicated that they do not wish to receive such documentation. USACE must then resolve the adverse effect in accordance with Chapter 8, *Resolution of Adverse Effects*, of this HPTP.

Criteria of Adverse Effect

As part of the Section 106 process, an assessment of an Undertaking action's effects on historic properties is made by applying the Criteria of Adverse Effect (36 CFR 800.5[a]). An *adverse effect* is found when an Undertaking action "may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR 800.5[a][1]). Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the Undertaking action that may occur later in time, be farther removed in distance, or be cumulative. Examples of adverse effects include:

1. Physical destruction of or damage to all or part of the property.
2. Alteration of the property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (36 CFR 68) and applicable guidelines.
3. Removal of the property from its historic location.
4. Change in the character of the property's use or of physical features within the property's setting that contribute to its historic significance.
5. Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.
6. Neglect of the property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization.
7. Transfer, lease, or sale of the property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance. (36 CFR 800.5[2].)

Similar effect (impact) criteria are promulgated under CEQA. According to 14 California Code of Regulations (CCR) 15064.5(b)(1) and (2), a *significant impact* is defined as one with the potential to cause a substantial adverse change in the significance of a historical resource. A *substantial adverse change* in the significance of a historical resource means the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of the resource would be materially impaired. The significance of a historical resource is materially impaired when a project results in any of the following:

- Demolition or material alteration in an adverse manner of 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.
- Demolition or material alteration in an adverse manner of those physical characteristics that account for its inclusion in a local register of historical resources pursuant to California Public Resources Code (PRC) 5020.1(k) or its identification in a historical resources survey meeting the requirements of PRC 5024.1(g), 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.
- Demolition or material alteration in an adverse manner of 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. (14 CCR 15064.5[b][2].)

Chapter 8
Resolution of Adverse Effects

This chapter presents the process and example treatment measures for resolving adverse effects on historic properties. Consultation and avoidance are discussed first because they are applied generally to all historic property types. Following these initial discussions, treatment measures are provided for historic property types as follows: Archaeological Properties; Native American Properties; Historic Structure Properties; Submerged Properties; and Cultural Landscapes. This chapter also includes the process for treating inadvertent discoveries to ensure that adverse effects are properly resolved or otherwise treated.

Although these treatments are provided herein, site specific HPTPs will be developed to resolve unavoidable adverse effects to historic properties as necessary.

Consultation

USACE will consult with the Undertaking PA signatories to resolve adverse effects on historic properties. Consultation will proceed in the following manner, except in cases of unanticipated effects and inadvertent discoveries, which require separate procedures described later in this chapter. Once USACE has determined that an Undertaking activity will adversely affect a historic property, USACE will prepare a memorandum that describes the nature of the subject property, nature of the adverse effect, and proposed resolution of effects. USACE will submit the memorandum to the Undertaking PA signatories and concurring parties, as well as any community groups that attach importance to the historic property, for review and comment. It is expected that the inclusion of general treatment measures in this HPTP will expedite consultation concerning effects resolutions. Therefore, the recipients of USACE memorandum have 15 days from receipt in which to provide comments to USACE. USACE may elect to extend this review period at its discretion.

Upon receipt of comments, USACE will prepare a decision memorandum within 15 days. The decision memorandum will summarize USACE's proposed effects resolution, any comments received from reviewers, and USACE's planned resolution in consideration of all comments. USACE will provide a copy of the decision memorandum to the reviewing parties before proceeding with resolution of adverse effects. At USACE's discretion, it may revise the effects resolution to incorporate the reviewers' comments and open another 15-day consultation period with reviewers. If USACE and reviewers are unable to agree on the resolution of adverse effects, USACE may proceed with its proposal after furnishing a decision memorandum to the reviewers, as described above. Should any of the reviewers object to USACE's handling of consultation, the reviewer may issue an objection per Stipulation XI of the Undertaking PA.

Avoidance

The Secretary of Interior's Standards and Guidelines for Preservation Planning emphasizes the preference for preservation in place and avoiding harm when possible. In compliance with these standards and guidelines, avoidance of Undertaking effects on historic properties will typically be the preferred treatment method for all historic properties. Avoidance, however, will take different forms to adequately address the variety of effects on different property types. For the purposes of this discussion, Undertaking effects can be broadly classified as physical or atmospheric disturbances. Physical disturbances might include earth removal or excavation; demolition of buildings, structures, and objects; burial of historic properties via placement of fill or new structures; and addition of new structural elements. Atmospheric effects might include the introduction of features that are incompatible with a historic property's historic setting. An example of such an introduction would be the creation of noise or olfactory sources that might degrade the integrity of setting and feeling of ruins, particularly if they are eligible under NRHP Criterion A.

Archaeological, Historic Structure, and Submerged Properties

Some physical effects on historic properties may be avoided by establishing and maintaining environmentally sensitive areas (ESAs) along the perimeter of the property. USACE should ensure that ESA boundaries are marked on construction plans as an ESA with a numeric designation. The plans should not indicate that an archaeological or other cultural resource is present within the ESA unless USACE has a compelling reason to do so. Labeling the area as a cultural resource on construction plans may encourage some construction or survey personnel to collect materials from the resource if the nature of the ESA is disclosed.

Physical demarcation of ESAs will vary with the nature of the resource and potential for unlawful collection of cultural materials and construction-related damage. Typical materials used for establishing an ESA include T-stakes with orange safety fencing, wooden stakes, and nylon whiskers or other flagging. Whatever materials are employed, appropriate signage will accompany the ESA boundary markers reading "Environmentally Sensitive Area—Keep Out." In constrained areas subject to much heavy equipment traffic, T-stakes and orange safety fencing represent the most prudent option. Submerged resources may require the use of anchored buoys or other stable markers placed around the historic property. For submerged resources under SLC jurisdiction, USACE will consult with SLC staff to determine which avoidance measures to implement on a case-by-case basis. In cases where USACE wants to avoid drawing the public's attention to an ESA, silt fencing offers a reasonable alternative for boundary marking. Construction personnel will be instructed to maintain the integrity of all silt fencing.

USACE PQS, or qualified and authorized agent, will oversee the demarcation of ESA boundaries. USACE PQS will also monitor the ESA at levels of intensity specified for individual Undertaking activities.

Native American and Cultural Landscape Properties

Whereas physical avoidance is a viable treatment for some types of historic properties, such a strategy is sometimes less straightforward for nonarchaeological properties of importance to Native Americans or for archaeological properties that are eligible for listing in the NRHP under Criterion A, B, or C. Some Native American properties, for example, are very large (e.g., Hatchet Ridge, Buena Vista Peaks, Mt. Shasta), encompassing entire landscapes (Jones & Stokes 2005:3–33; Theodoratus et al. 2006:30–32; Tiley 2007:8). In such cases, avoidance is difficult or impossible, short of abandoning or moving a proposed Undertaking activity altogether. For other Native American properties, integrity of setting and atmospheric (olfactory, visual, and auditory) intrusions may be critical to manage. Amelioration of such effects may require creative treatment measures, such as vegetative screening, and must be determined in close consultation with the interested Native Americans.

Similar to large-scale Native American properties, physical avoidance of cultural landscapes, while not impossible, would frequently be untenable without considerable redesign of Undertaking activities. Avoidance would likely require some sort of visual screening to separate incompatible elements of an Undertaking activity from the cultural landscape.

Archaeological Property Treatments

Preservation in Place

If avoidance of adverse effects to an archaeological property is determined infeasible, preservation in place will be the preferred means of resolving adverse effects under the NHPA (Advisory Council on Historic Preservation 1999:3) and significant impacts under CEQA (14 CCR 15126.4[b][3][A]). Preservation is taken here to mean protection of a historic property's historic integrity via non-invasive (or non-destructive) means. Historic properties may be preserved via capping, and site stabilization, as described below.

Capping

Much precedent exists for capping archaeological properties as a treatment measure under the NHPA and CEQA (Environmental Laboratory 1988a, 1988b, 1988c, 1989a, 1989b, 1992a; 14 CCR 15126.4[b][3][B][2–4]). Capping an archaeological property under protective material is arguably a means to preserve it in place, shielding the property from effects such as looting, inadvertent construction and recreational damage, and exposure to the elements. Additionally, capping is often a less expensive alternative to data recovery excavation and does not result in the degree of damage to the property that archaeological excavation entails. A number of practical issues must be considered before USACE decides to cap an archaeological property.

The goal of capping is in-place preservation of the subject historic property. The type of protective covering selected will vary with the characteristics of the property, the property's environmental character, and the nature of known or anticipated effects on the property. The Environmental Laboratory (1989a:4–5, Figure 2) identifies a number of natural and cultural processes that affect the characteristics and potentially the historic integrity of archaeological properties (Table 8-1).

Effective capping programs depend on balancing and, where possible, maximizing the preservation of archaeological materials contained in the subject property. Priority must be given to those archaeological constituents that convey the archaeological property's historic significance. An effective capping program, therefore, hinges on appropriate identification efforts within archaeological sites. USACE must determine which constituents or components of the subject property require protection, and then consult Table 8-1 to determine the desired environmental changes for capping to impose on the property. It is likely that some archaeological constituents cannot be preserved except at the expense of other important characteristics of the property. In such instances, capping is probably not the best treatment measure. (Environmental Laboratory 1989a:7.)

Table 8-1. Archaeological Decay and Preservation Matrix

	Site Components												
Processes	Animal Bones	Shell	Plants	Charcoal	Crystalline Lithics	Granular Lithics	Ceramics	Archaeological Features	Soil Attributes	Metals	Context	Isotope Content	Topography
Acid Environment	A	A	E	N	N	A	N	N	A	A	N	A	N
Basic Environment	E	E	A	N	N	E	N	N	A	A	N	N	N
Dry (continuous)	E	E	E	E	N	E	N	N	N	E	N	E	N
Wet Anaerobic (continuous)	E	E	E	A	A	A	A	A	A	A	N	A	A
Compression	A	A	A	A	N	N	A	A	A	N	A	N	A
Movement	N	N	N	A	N	N	N	A	A	N	A	N	A
Wet–Dry Cycles	A	A	A	A	A	A	A	A	A	A	N	A	A
Microorganisms	A	N	A	A	N	N	N	N	N	A	A	A	N
Macro organisms	A	A	A	A	N	A	N	A	A	N	A	N	N
Wet Aerobic	A	A	A	A	N	A	A	A	A	A	N	A	N
Freeze–Thaw	A	A	A	A	A	A	A	A	A	N	A	A	A
Freeze	A	A	A	A	N	A	A	N	E	N	A	E	N
Thaw	N	N	N	N	N	A	N	N	A	N	A	A	N

Notes: E = enhances preservation; A = accelerates decay; N = neutral or no effect.

Once USACE has identified the archaeological constituents that require preservation and the desired conditions to effect preservation, USACE PQS should work with engineers and other specialists as needed to design a suitable cap for the archaeological property. USACE should incorporate a preservation monitoring program into the capping design to ensure that the capping design has the desired preservation outcome. USACE has tested a variety of capping and preservation monitoring programs, which should be consulted during design (Environmental Laboratory 1988a, 1988b, 1988c, 1989a, 1989b, 1992a).

Where capping is a feasible treatment measure, it is probably best employed on archaeological properties eligible for the NRHP under Criterion D and perhaps Criterion C. Capping may not protect important aspects of integrity for archaeological properties eligible under NRHP Criteria A and B.

Site Stabilization

Archaeological resources along river and levee systems are frequently exposed to erosion due to fluvial processes and human-induced erosion, such as water discharge into streams. Levee deficiencies also cause erosion at archaeological sites. In cases where an archaeological property is losing data potential to erosion, simple avoidance may not preserve the property in place in such a manner that its historic significance is maintained because archaeological materials would continue to erode. To effectively preserve in place an archaeological property that is threatened by erosion, USACE may need to implement stabilization methods to prevent further destruction. Site stabilization methods are often employed in concert with other preservation methods and are suitable for treatment of archaeological properties that are eligible for listing on the NRHP under any of the criteria, although properties eligible under Criterion C may suffer some loss of integrity with some stabilization methods.

USACE has tested a variety of site stabilization methods in streambank contexts. Such methods include protective structures (concrete retaining walls, fencing, revegetation, rock-filled log cribs, rock-filled gabion groins, riprap, flexible concrete revetment), benching and sloping streambanks, and drainage routing (Environmental Laboratory 1988d, 1988e, 1989c, 1989d, 1989e, 1992b). The results of these studies have implications for site stabilization within the Undertaking APE. For example, USACE protected the historic site and building of Chapel of Santa Rosa de Lima de Abiquiu (New Mexico) from fluvial erosion using three distinct methods: rock-filled log cribs, rock-filled gabion groins, and riprap. USACE examined the site after installation of the treatment measures and found that no visible erosion was present around the riprap and log cribs. The sediment surrounding the gabion groins, however, exhibited erosion. USACE determined that additional bank protection would be needed to adequately protect the site. (Environmental Laboratory 1988d:2–3.)

For the Whistling Elk Archaeological Site (39HU242) in South Dakota, USACE drafted four plans and cost estimates for preservation of the site in the face of erosion. The plans represented distinct approaches to preservation: data recovery excavation, bank sloping and data recovery excavation, installation of flexible concrete revetment, and riprap protection. USACE compared the plans with respect to cost effectiveness and preservation values. Data recovery and bank sloping (with data recovery for affected portions of 39HU242) were rejected because of high costs and the destruction of a considerable portion of the site. Flexible concrete revetment was the most cost-effective treatment, but is cited as having a short performance life and attendant maintenance costs. Protecting the eroding portion of 39HU242, on the other hand, was priced at less than twice the cost of flexible revetment and would require little maintenance while maximizing erosion protection. (Environmental Laboratory 1989c:4–6.)

Data Recovery

Where preservation in place is not a feasible treatment measure and an NRHP-eligible archaeological property will be damaged or destroyed by an Undertaking activity, the archaeological property may be subjected to data recovery. The approach to data recovery will vary with the property type and the information it contains. In the case of hollow-filled features, which likely will already have been cross sectioned during evaluative test excavation, an additional percentage of the features will be removed for analysis, representing complete data recovery. The Secretary of the Interior's Standards for Archeological Documentation encourage the use of noninvasive data recovery methods "if nondestructive methods are practical." Such methods may include ground-penetrating radar, electromagnetic survey, and satellite imaging, as described in Chapter 5, *Identification of Historic Properties*. For archaeological properties found eligible under NRHP Criterion A, B, or C, other treatment options may be necessary because data recovery is often applicable to Criterion D concerns only.

More varied considerations are required to conduct data recovery of middens, sheet refuse, and lithic scatters. The amount of data recovery excavation at these property types depends on the overall size of the resource, density and types of constituents present, and depth of the deposit, which affects its accessibility and the practicality of excavating large portions of the resource. Where the depth of deposit is not prohibitive of access, USACE PQS will determine the amount of excavation required to accomplish data recovery. A Data Recovery Plan will be developed in concert with the site specific HPTP. Excavation and laboratory methods employed in data recovery for the respective archaeological property types (prehistoric, historic, and submerged) are the same as described in Chapter 5, *Identification of Historic Properties*. The methods entailed in data recovery, unless otherwise specified in this chapter, differ from evaluative test excavation and analytical efforts primarily in terms of scale.

Analysis of Existing Archaeological Collections

Aside from avoidance, the most common approach to archaeological property treatment entails excavation to recover the important data. Data recovery excavation, however, is not always the most desirable treatment, even in cases where avoidance is not feasible. Whereas data recovery excavations often constitute the surest way to recover, analyze, and preserve (through documentation and dissemination of said documentation) significant archaeological data, site excavations permanently remove archaeological materials from their depositional context. Archaeological properties, therefore, are irrevocably altered through this treatment measure. Furthermore, archaeological research priorities and methods change over time; the removal of archaeological constituents from their depositional context has the potential to controvert the application of new analytical or excavation methods and the analysis of new or modified research questions. Finally, descendant groups that frequently attribute significance to archaeological properties (usually for reasons unrelated to NRHP Criterion D) typically prefer nondestructive treatments of archaeological properties (e.g., Tomaras 2008:5).

California contains numerous museums and curation facilities that hold collections from archaeological properties throughout the state. The state of the collection and documentation of such materials vary widely; some collections have been thoroughly analyzed, documented, and curated, while other collections constitute an assortment of artifacts and ecofacts still in field bags. In cases where an Undertaking activity would adversely affect a previously excavated archaeological property, existing archaeological collections may provide source material for documenting the site (Bouey [ed.] 1995). Analysis of existing collections would provide a viable alternative to data recovery excavation where the archaeological property is either undocumented or under documented. Analysis of existing collections has several important limitations:

- Archaeological properties that have not been investigated previously will not have existing collections
- The condition of the collections will vary
- The quality of field documentation will vary
- Previous excavations may have been made outside the portion of the archaeological property threatened by an Undertaking activity. Such collections may have limited applicability to the materials contained in the affected area of the property

Potential sources for existing collections can be ascertained via archaeological site records on file at CHRIS information centers; contract reports; publication series such as the University of California's *University of California Publications in American Archaeology and Ethnology*, *Anthropological Notes*, and *Archaeological Survey Reports*; articles in scholarly archaeological journals; and university museums.

Public Interpretation

Standard IV of the Secretary of the Interior's Standards for Archaeological Documentation mandates that "the results of archaeological documentation are reported and made available to the public" (48 FR 44734). Should excavations conducted in support of an Undertaking activity produce information that is determined to be of interest to the general public, the information would be made accessible through a public interpretation document such as a nontechnical pamphlet, website, interpretive board, plaque, or another format deemed appropriate prepared under the direction of USACE PQS and the Undertaking PA parties. USACE would propose particular interpretive products to all consulting and concurring parties of the Undertaking PA in a letter. Consideration would be given in any public interpretation to the need to maintain confidentiality of location, character, and ownership pursuant to Section 304 of the NHPA and 36 CFR 800.11(c).

Native American Property Treatments

Documentation and Public Interpretation

If avoidance is not possible, documentation and public interpretation may be an appropriate treatment measure for Native American properties and can be used in conjunction with other treatments, such as access (see above) and data recovery (for archaeological sites). If it is done with sensitivity to the needs and concerns of Native Americans, documentation can be an appropriate treatment for Native American properties. Documenting traditional cultural properties can serve descendant groups by providing additional avenues for preservation of culturally significant places for the posterity of the group. In addition, particular Native American properties are amenable to wider public interpretation, with the input of descendant groups (Lightfoot et al. 2004; Modzelewski and Gonzalez 2007). Documentation may be accomplished through various means, such as monographs, interpretive signs and fliers, oral interviews, or video presentations.

Historic Structure Treatments

If avoidance of adverse effects to a historic structure property is determined infeasible, the Secretary of Interior's Standards for the Treatment of Historic Properties provide four general treatment types: Preservation, Rehabilitation, Restoration, and Reconstruction. According to 36 CFR 68.3, the application of the Standards for the Treatment of Historic Properties depends on the particular property. Factors to be considered include the physical condition of the building, the property's significance, the amount of existing documentation, and the economic and technical feasibility of applying the Standards for the Treatment of Historic Properties.

Preservation allows for the retention of the historic qualities of the property, including its form, materials, and integrity. As a treatment, Preservation is the preferred method for historic properties. Preservation includes continued use of a building as it was used historically and retention of character-defining materials, elements, spaces, and spatial relationships. Exterior additions that have not already achieved historical significance are not allowed under this treatment. (36 CFR 68.3; Weeks 2001.)

Rehabilitation is the second preferred treatment. Rehabilitation allows for a property to be used as it was historically or in a compatible manner that will have minimal changes to the property. Rehabilitation can incorporate repairs, alterations, and additions that do not affect the character-defining features of a property. (36 CFR 68.3; Weeks 2001.)

As a treatment option, Restoration is the third choice. With this treatment, a historic property is accurately depicted as it was during a specific time period. Elements from other historic periods are removed, and other elements that reflect the desired time period are added. The restoration of those missing elements is based on historic documentation to provide an accurate depiction of the property and not give a false sense of history. As part of this treatment, materials that are removed are documented before removal. Restoration provides an option to use the building as it was used historically or give the property a new use to interpret the property during a specific period. (36 CFR 68.3; Weeks 2001.)

The last treatment under the Standards for the Treatment of Historic Properties is Reconstruction, which is the least desirable. This treatment is to be used with existing documentation and when physical evidence is available to allow an accurate depiction of a historic property that is no longer extant or is missing significant features from its historic period. Reconstruction requires that existing historic fabric be preserved. (36 CFR 68.3; Weeks 2001.)

Documentation

When an adverse effect cannot be avoided, measures should be taken to properly document the historic property before those activities that will cause the adverse effect. The necessary documentation will be influenced by the type of property and adverse effect. For those properties that are not going to be demolished, a Historic Structure Report (HSR) may be adequate documentation. An HSR may also be used a planning tool for those properties that are not expected to be adversely affected. An HSR is detailed documentation of the engineering and architecture of a structure that provides information from multiple disciplines and is helpful in selecting an appropriate treatment option under the Standards for the Treatment of Historic Properties (Slaton 2004).

Depending on the reasons for significance and the character-defining features, documentation of a historic structure in accordance with the Historic American Building Survey (HABS)/Historic American Engineering Record (HAER) standards may be an appropriate measure to resolve adverse effects. This documentation often provides the last means of the preservation of a historic resource.

The HABS/HAER program is a federal program within the NPS that is charged with creating a permanent public record of historic buildings, structures, sites, and objects that are significant in American history and the growth and development of the built environment. There are four levels of HABS/HAER documentation approved by NPS that are considered adequate for inclusion in these collections. Guidance for the HABS/HAER is found in the *Secretary of the Interior's Standards and Guidelines for Architectural and Engineering Documentation: HABS/HAER Standards* (National Park Service 2000).

Public Interpretation

Standard IV of the Secretary of the Interior's Standards for Historical Documentation recommends that research results be made available to the professionals in the industry of cultural resources management and historic preservation, as well as the public. Making such documentation available allows for decisions to be made concerning treatment, preservation planning, and interpretation of the historic property. Interpreting historically significant properties encourages an understanding of the mission and goals of public agencies striving to protect historic properties. It also promotes preservation and protection of historic properties. The Multiple Property approach discussed in earlier chapters of this HPTP can be used to give a broad context to a specific property. There are many options for interpretation of a historic property (Thomson and Harper 2000), but consideration for sensitive information must always be taken into account.

Submerged Property Treatments

Data Recovery

Where avoidance or preservation in place is not a feasible treatment measure and an NRHP-eligible submerged property will be damaged or destroyed by an Undertaking activity, the submerged property may be subjected to data recovery.

Data recovery methods for submerged properties are different from nonsubmerged archaeological properties, although overall goals are similar. Implementation of data recovery on submerged properties is typically restricted to shipwrecks. Data recovery methods are relatively limited and usually focus on precise mapping, measured drawings, photographs, and sometimes “salvaging” pieces of the shipwreck that can provide valuable information on the resource, including construction, cargo, ownership, origin, form, and function. Carefully chosen artifacts, selected in advance, may be recovered if approved by the SLC, and sufficient funds and conservation laboratory resources are available to properly conserve the artifacts. Artifacts are retrieved by divers, and provenience is recorded. Underwater metal detection is often used to recover metal artifacts that may be obscured by silt or vegetation. Silt is removed using a dredge vacuum. Wood samples are often collected from *in situ* elements of the shipwreck. They are taken from major elements of the hull where the use of differing types of woods might be anticipated, such as the stem or stern posts, keel, keelson, frames, planking, wales, or treenails. For archaeological properties found eligible under NRHP Criterion A, B, or C, other treatment options may be necessary because data recovery is often applicable to Criterion D concerns only.

Artifact Processing and Analysis

Cross sections of wood samples are typically analyzed to determine wood type, age, and milling methods. Conservation of recovered material is often necessary because it is being moved from an underwater environment to a dry environment. Conservation methods vary with the type and number of artifacts collected. Artifacts are sometimes encased in encrustations that contain degraded iron artifacts, wood samples, samples of sheathing, ceramic artifacts, glass artifacts, etc. These encrustations must be dissolved to be properly analyzed. Analysis methods for artifacts associated with a submerged resource are similar to methods used for analysis of terrestrial historic-era resources. Attributes including material type, form, and function are recorded, along with metrics such as weight and dimensions. All artifacts and pertinent attributes are catalogued and entered into a searchable database.

Public Interpretation

Standard IV of the Secretary of the Interior’s Standards for Archaeological Documentation mandates that “the results of archaeological documentation are reported and made available to the public” (48

FR 44734). Should data recovery conducted in support of an Undertaking activity produce information that is determined to be of interest to the general public, the information would be made accessible through a public interpretation document such as a nontechnical pamphlet, website, interpretive board, plaque, or another format deemed appropriate, prepared under the direction of USACE PQS and the Undertaking PA parties. USACE would propose particular interpretive products to all consulting and concurring parties of the Undertaking PA in a letter. Consideration would be given in any public interpretation to the need to maintain confidentiality of location, character, and ownership pursuant to Section 304 of the NHPA and 36 CFR 800.11(c).

Cultural Landscape Treatments

Just as with historic structures, the Standards for the Treatment of Historic Properties can be applied to cultural landscapes if avoidance is determined infeasible. Generally, there are four types of cultural landscapes: historic designed landscapes, historic vernacular landscapes, historic sites, and ethnographic landscapes. Archaeological constituents of cultural landscapes should be treated as discussed under "Archaeological Property Treatments" above, while considering its significance in the context of the cultural landscape. The treatment options will depend on the type of cultural landscape being affected by the Undertaking activity. (Birnbaum 1994.)

Documentation

The Historic American Landscape Survey (HALS) is the federal program within NPS that specifically pertains to cultural landscapes. The program's primary goal is to provide a permanent record of landscapes that portray the types, periods, and patterns of landscape development in American culture (Robinson et al. 2005:4). There are three levels of HALS documentation. Level I is the most comprehensive and is recommended for nationally significant properties. Level II is less exhaustive than Level I but provides a thorough historic report appropriate for landscapes that are significant at a national or state level. Levels I and II require comprehensive reports in conjunction with large-format photography and measured drawings. Level III requires the least amount of documentation and is used on less complex landscapes and those that are primarily of local significance. Level III requires only the completion of a HALS short format/inventory sheet. (Robinson et al. 2005:5.)

Public Interpretation

Education of the public is the primary goal of interpreting cultural landscapes. The implementation of interpreting the landscape, however, is derived from the type of landscape, level of significance, integrity, and whether there will be visitation. Decisions made about interpreting a cultural landscape will be dictated by which treatment is applied to the landscape. More detailed information on interpreting landscapes can be found in Birnbaum (1994).

Inadvertent Discoveries

This section of the HPTP explicates the manner in which unanticipated effects on, and inadvertent discoveries of, historic properties are resolved, pursuant to 36 CFR 800.13. The discussion begins with workforce training—an essential component to any discovery protocol that involves nonarchaeologists. The discussion then turns to inadvertent discovery procedures, the resolution of inadvertent effects, and treatment of human remains.

Workforce Training

To improve proper adherence to the procedures contained in this HPTP during implementation of Undertaking activities, USACE PQS or authorized archaeologists will provide training to construction personnel regarding proper procedures and conduct in the event that archaeological materials are encountered during construction. A preconstruction training session will be held before the beginning of construction for each Undertaking activity for all construction personnel, followed by periodic in-field training sessions as needed. These training sessions will be conducted as part of the comprehensive environmental training sessions attended by construction staff and other Undertaking personnel. USACE PQS or designated qualified archaeologists will provide in-field cultural resource education during major construction personnel changes. All training sessions will be conducted in person and in English. Construction personnel will be educated regarding the purpose for archaeological monitoring (if any is being conducted), cultural resource regulations, basic identification of archaeological resources, and proper discovery protocols during construction.

Procedures for Unanticipated Effects on Historic Properties

Should an Undertaking activity result in unanticipated effects on known historic properties, USACE shall determine actions that it can take to resolve adverse effects and notify the Undertaking PA signatories, as well as any Indian tribe that might attach religious and cultural significance to the affected property, within 48 hours of the discovery. The notification shall describe the effects and proposed actions to resolve the adverse effects. The Undertaking PA signatories and Indian Tribes shall respond within 48 hours of the notification. USACE shall take into account their recommendations regarding proposed resolutions and then carry out appropriate actions. USACE may take a lack of response within 48 hours as concurrence with proposed treatments of the historic property. The agency official shall provide the Undertaking PA signatories and Indian Tribes a report of the actions when they are completed.

Procedures for Inadvertent Discoveries

In the event of a discovery, USACE PQS is responsible for implementing all historic property and cultural resource mitigation measures incorporated in the Undertaking permits, EIS/EIR, PA, and HPTP. Specific discovery procedures for inadvertent historic property discoveries are described under three separate headings below, following logical divisions in the discovery process and keyed to the flowcharts in Figures 8-1 through 8-3. The first division, entitled *Unanticipated Discovery Procedures*, covers the initial discovery procedures leading up to a determination of whether a potentially NRHP-eligible resource was found and whether human remains are present (Figure 8-1). The second division, *Procedures for Determining Eligibility of an Unanticipated Find*, delineates the process for determining eligibility and consulting requirements for such determinations (Figure 8-2). Figure 8-3 summarizes the third division, *Procedures for Discovery of Human Remains*. Each flowchart cross-references the others at appropriate decision points.

Unanticipated Discovery Procedures

If USACE PQS, an archaeological monitor, another environmental monitor, or other Undertaking personnel discovers cultural materials (artifacts, such as human remains, animal bones, shell, stone tools, fire-cracked rock, historic buildings or remnants thereof, bottles, or ceramics), all construction shall immediately stop within 100 ft (30 m) of the discovery, the location of the discovery will be marked for avoidance, and efforts will be made to protect inadvertent destruction of the find. The contractor must notify the USACE PQS (if not on location), who will determine whether the discovery is a potential NRHP-eligible resource. If USACE PQS determines that the discovery is not a NRHP-eligible resource, the discovery will be documented in the daily Archaeological Monitoring Log and construction may proceed at the direction of USACE PQS.

If USACE PQS determines that the discovery is a potential NRHP-eligible resource, the USACE PQS would implement the procedures described below under *Procedures for Determining Eligibility of an Unanticipated Find* or *Procedures for Discovery of Human Remains*, respectively.

Procedures for Determining Eligibility of an Unanticipated Find

If USACE PQS determines that human remains are not present, that the discovery is not an isolated find, and that the discovery is eligible for the NRHP, the USACE PQS will notify the signatories and concurring parties of the PA and appropriate Indian Tribes and potential consulting parties of this determination within 48 hours of the discovery. Notification should include a description of the discovery, the circumstances leading to its identification, NRHP eligibility determination, and recommendations for further investigation or actions to resolve adverse effects. To be eligible, a property must meet one or more of the NRHP eligibility criteria and retain sufficient historic integrity for the property to convey its historic significance. To determine a property's eligibility, test excavations may be necessary, as determined in consultation between USACE, SHPO, and other parties that may ascribe significance to the property. This may involve one or more of the following methods: shovel test pits, backhoe trenching, augering, or hand-excavated control units.

Significance Determinations

Procedures for determining significance during construction are summarized in Figure 8-2. In construction contexts, visual inspection and excavation (in the sense of the excavation responsible for the initial identification of the resource) of properties usually reveal enough data to allow for a recommendation of potential NRHP eligibility (for eligibility and significance criteria, see Chapter 1, Introduction and Description of the Undertaking). If a property appears to meet the appropriate eligibility criteria, the property may be assumed to be eligible and efforts can subsequently focus on the resolution of adverse effects pursuant to 36 CFR 800.13(c).

If USACE PQS recommends that a property is eligible, the Contractor will be required to mobilize construction a minimum of 30 m (100 ft) away from the discovery area at the direction of USACE PQS. USACE has 48 hours from the time of the discovery in which to notify signatories and concurring parties of the PA and appropriate Indian Tribes and potential consulting parties. The consulted parties referred to in the previous sentence have 48 hours from the receipt of notification to present comments to USACE; USACE may regard lack of comment within 48 hours as concurrence with its recommendation of eligibility. (36 CFR 800.13[b][3].) In addition, USACE PQS, in preparing the notification, may develop an HPTP for the site. Notification will take into account the principles, standards, and guidance set forth in *Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines* (48 FR 44716–44742), as well as the context research themes contained in Chapters 3, *Context*, and Chapter 5, *Identification of Historic Properties*, of this document. Once consultation between USACE and the consulted parties is completed, treatment measures will be implemented as indicated in Figure 8-2.

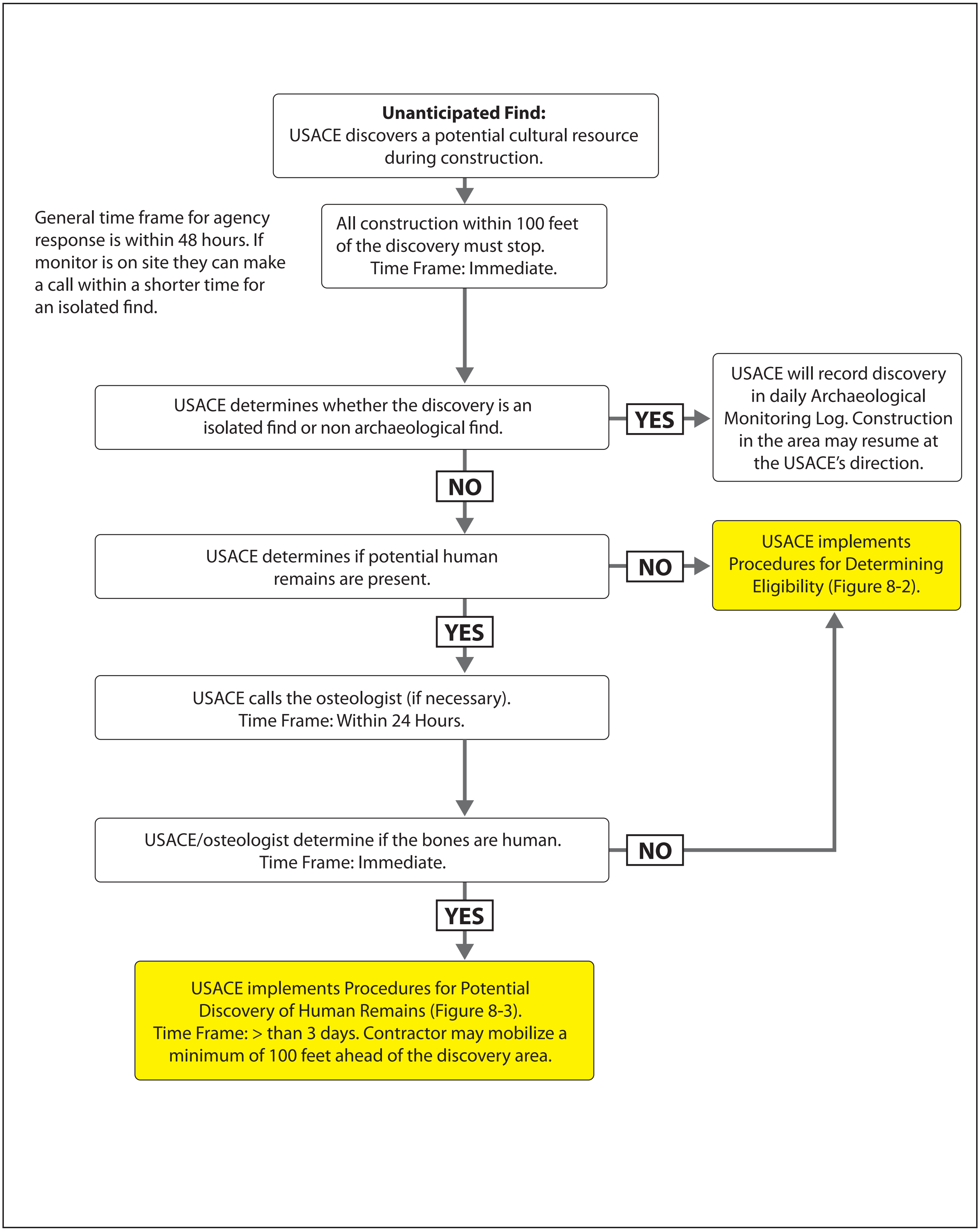


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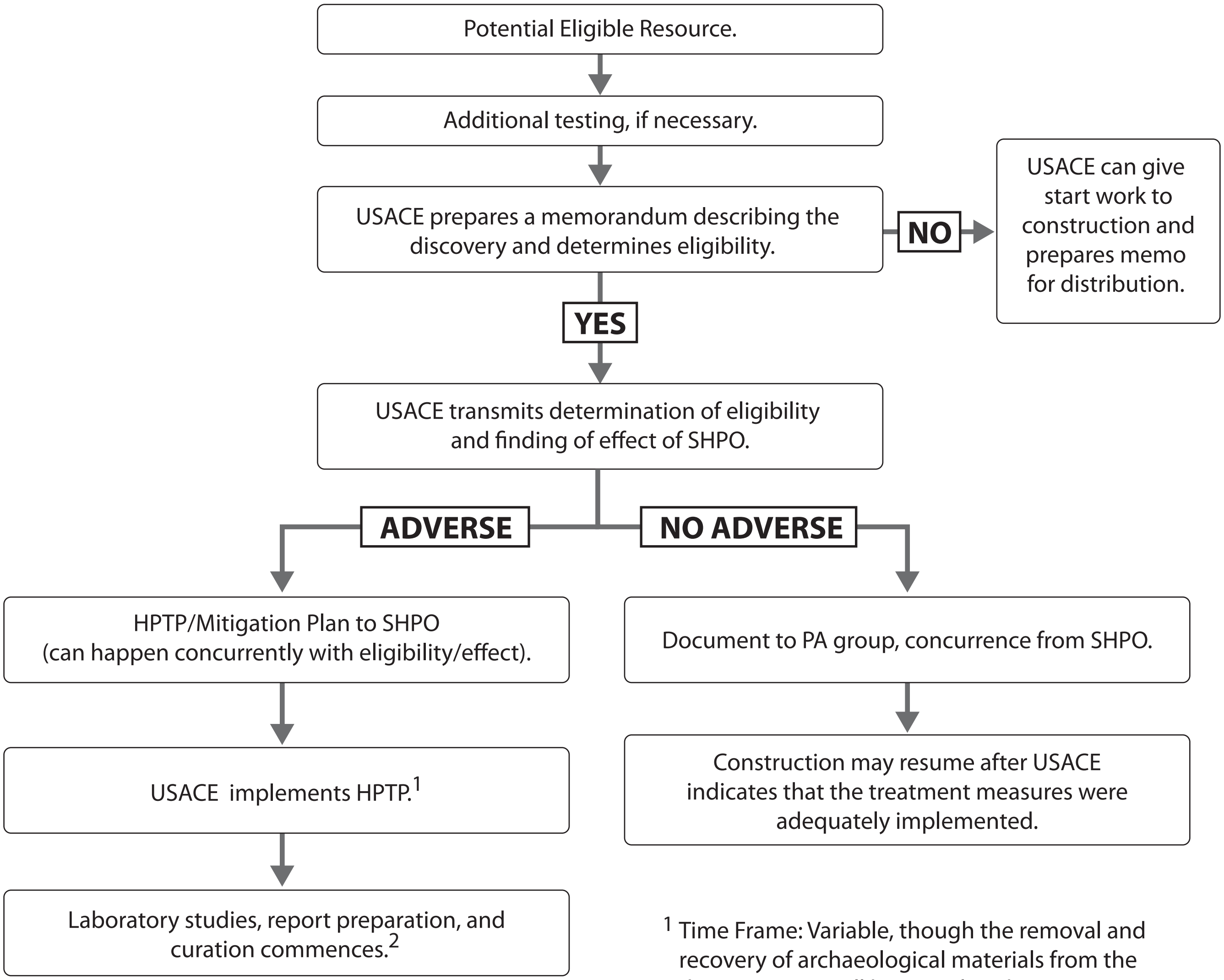
Figure 8-1
Unanticipated Discovery Procedures



[1] Time Frame: Variable, though the removal and recovery of archaeological materials from the discovery area will be completed prior to resumption of construction to the extent feasible.

[2] These actions have no effect on the construction schedule.

SHPO has 15 day review period in case of eligible find.

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Figure 8-2
Procedures for Determining Eligibility of an Unanticipated Find

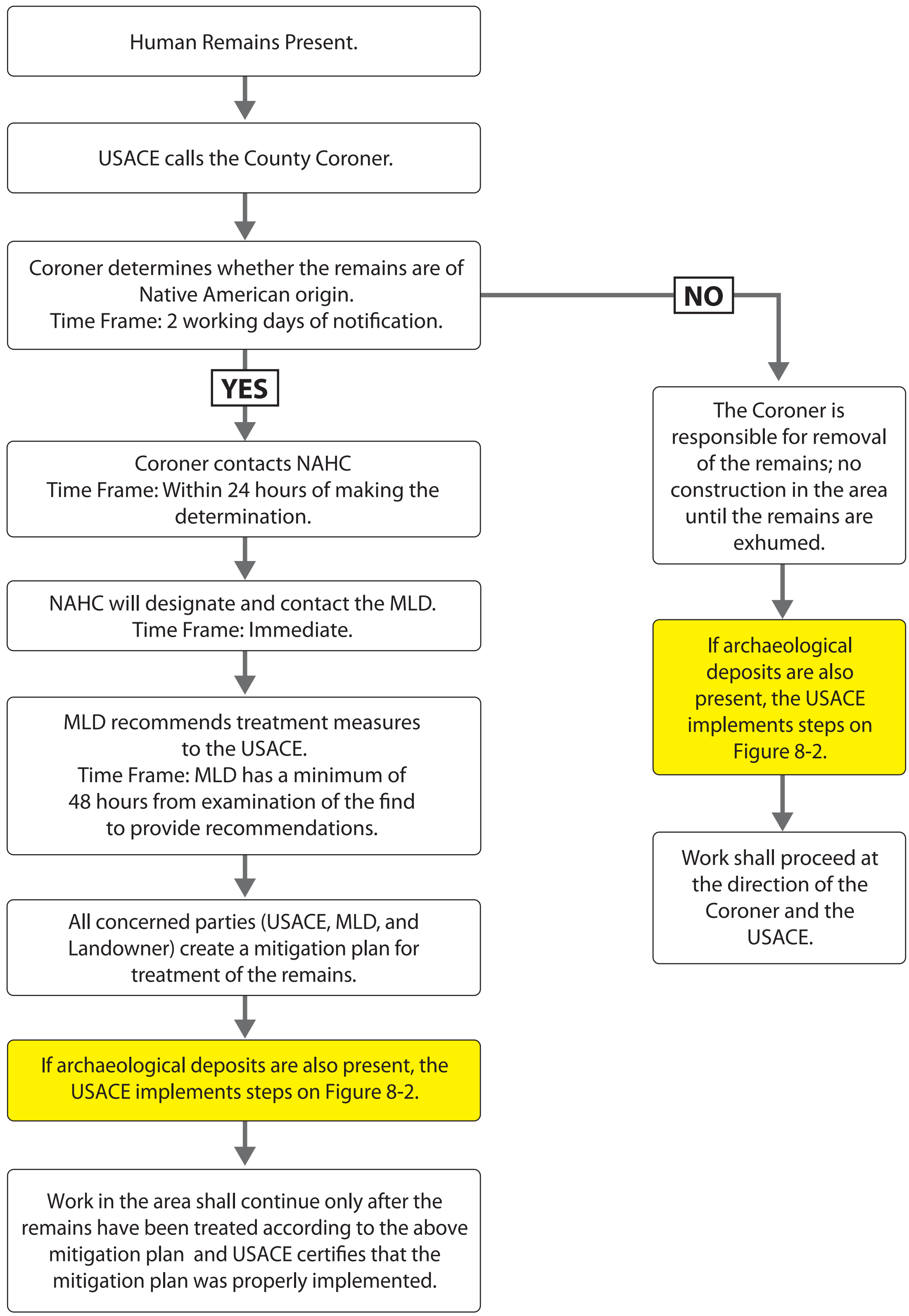

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Figure 8-3
Procedures for Discovery of Human Remains

Procedures for Discovery of Human Remains

No federal lands occur within the projected repair location APEs. Therefore, in the event of a human remains discovery, procedures for addressing such a discovery are governed by the California Health and Safety Code (HSC) and PRC. The procedures for potential human remains discoveries on nonfederal land are outlined in Figure 8-3 and described below. USACE PQS will determine whether the discovery includes potential human remains (Figure 8-1). If human remains appear to be present, USACE PQS will immediately notify the appropriate county coroner. The coroner, as required by HSC 7050.5, will make the final determination about whether the remains constitute a crime scene or are Native American in origin. The coroner may take two working days from the time of notification to make this determination.

If the coroner determines that the remains are of Native American origin, the coroner will contact the NAHC within 24 hours of determining that the remains are of Native American origin. Note that it will take 3 days or longer to determine the appropriate treatment measures for human remains, requiring the Contractor to mobilize construction at least 30 m (100 ft) away from the discovery zone at the direction of USACE PQS. The NAHC will immediately designate and contact the Most Likely Descendent (MLD), who has 48 hours from completion of their examination of the find in which to make recommendations for treatment of the remains, as required by PRC 5097.98(a). USACE will then contact the landowner. USACE, MLD, and landowner will then devise a mitigation plan for treatment of the remains. Work in the area will continue only after the remains have been treated according to the above mitigation plan and USACE certifies that the mitigation plan was properly implemented.

It is likely that if a Native American burial is found, it will be found in the context of a prehistoric archaeological property. For a prehistoric property associated with burials, decisions must be made about how the remainder of the property will be treated for its archaeological (and possibly other) values. Not only must the MLD make decisions about the burials, but a plan must be devised also for evaluation and—if determined to be eligible for listing in the NRHP—treatment of the property in consultation with the MLD and SHPO (see “Procedures for Historic Properties without Human Remains”).

If the remains are found not to be Native American in origin and do not appear to be in an archaeological context, construction shall proceed at the direction of the coroner and USACE PQS. It is likely that the coroner will exhume the remains. Once the remains have been appropriately and legally treated, construction may resume in the discovery area upon receipt of USACE’s express authorization to proceed and under the direction of USACE PQS.

Chapter 9
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Appendix A

Consultation with Historical Societies and Organizations

May 13, 2009

Sacramento Valley Museum
1491 E Street
Williams, CA 95987

Subject: Sacramento Riverbank Protection Project

Dear Sir or Madam,

ICF Jones & Stokes is assisting the U.S. Army Corps of Engineers with consultation and technical tasks associated with Section 106 of the National Historic Preservation Act. The proposed undertaking includes construction, emergency repair, and operations/maintenance activities of levees and associated structures along portions of the Sacramento River and several tributaries. Primarily, the Sacramento Riverbank Protection Project consists of 80,000 linear feet of bank protection/repair located within an approximately 100-mile stretch of the Sacramento River from approximately Chico to Rio Vista, as well as the lower reaches of adjacent tributaries including the American River, Feather River, Yuba River, Bear River, Elder Creek, Deer Creek, and portions of Three Mile, Steamboat, Sutter, Miner, Georgiana, Elk, and Cache Sloughs.

As part of our effort to identify cultural resources in the area of potential effects, all interested parties are being consulted to determine if any significant historic resources may be affected by the proposed project. Your effort in this process provides invaluable information for the proper identification and treatment of cultural resources. The location of the project site is depicted on the enclosed map.

Please do not hesitate to contact me with any questions. Thank you for your assistance.

Sincerely,

Melissa Cascella, M.A., RPA
Historical Archaeologist

Anderson Marsh State Historic Park
1416 9th Street
Sacramento, CA 94296

Association for Northern California
Records and Research
P.O. Box 3024
Chico, CA 95927

Auburn Joss House Museum
P.O. Box 9126
Auburn, CA 95604

Bale Grist Mill State Historic Park
1416 9th Street
Sacramento, CA 95814

Benicia Camel Barn Museum
2060 Camel Road
Benicia, CA 92799

Benicia Capitol State Historic Park
115 West G Street
Benicia, CA 94510

Benicia Historical Society
P.O. Box 773
Benicia, CA 94510

Benicia Historical Museum and
Cultural Foundation
2060 Camel Road
Benicia, CA 94510

Bernhard Museum Complex
291 Auburn-Folsom Road
Auburn, CA 95603

B.F. Hastings Building, Wells Fargo
Museum
1000 2nd Street
Sacramento, CA 95814

Bidwell Mansion State Historic Park
525 The Esplanade
Chico, CA 95814

Bothe-Napa Valley State Park
Visitor Center
1416 9th Street
Sacramento, CA 94296

Butte County Historical Society
1749 Spencer
Oroville, CA 95965

Butte County Pioneer Memorial
Museum
1735 Montgomery Street
Oroville, CA 95965

California Bear Flag Museum
7364 Windbridge Dr.
Sacramento, CA 95831

California Citrus State Historic Park
1416 9th Street
Sacramento, CA 95814

California Council for the Promotion
of History, California State
University, Sacramento
6000 J Street
Sacramento, CA 95819-6059

California Historical Building Safety
Board DSA Headquarters Office
1130 K Street, Suite 101
Sacramento, CA 95814

California Historical Resources
Commission, Office of Historic
Preservation
P.O. Box 942896
Sacramento, CA 91296

California Institute for Rural Studies
221 G Street, Suite 204
Davis, CA 95616-4550

The California Military Museum
1119 Second Street
Sacramento, CA 95814

The California State Archives
1020 O Street
Sacramento, CA 95814

California State Capitol Museum,
State Capitol Building
10th & L Streets
Sacramento, CA 95814

California State Indian Museum
2618 K Street
Sacramento, CA 95816

California State Library Foundation
P.O. Box 942837
Sacramento, CA 94287

California State Museum Resource
Center
2505 Port Street
Sacramento, CA 95691

California State Office of Historic
Preservation
1416 9th Street
Sacramento, CA 94296

California State Railroad Museum
2nd and I Streets, Old Sacramento
Sacramento, CA 95814

Center for California Studies,
California State University,
Sacramento
6000 J Street
Sacramento, CA 95819

Cherokee Museum
1084 Montgomery Street
Oroville, CA 95965

Cherokee Museum Association
4221 Cherokee Road
Oroville, CA 95965

Chico Museum
141 Salem Street
Chico, CA 95928

Chinese Temple
1500 Broderick St.
Oroville, CA 95965

Chumash Painted Cave State Historic Park
1416 9th Street
Sacramento, CA 95814

Citizen Soldier's Museum Guard Historical Society
1119 2nd Street
Sacramento, CA 95814

The Crocker Art Museum/Foundation
216 O Street
Sacramento, CA 95814

Colfax Area Historical Society
P.O. Box 185
Colfax, CA 95713

Colusa County Historical Records Commission
c/o Colusa County Free Library
738 Market Street
Colusa, CA 96932

Community Memorial Museum of Sutter County
1333 Butte House Road
Yuba City, CA 95992

Discovery Museum of Sacramento
101 I Street Old Sacramento
Sacramento, CA 95814

Discovery Museum Science & Space Center
3615 Auburn Blvd.,
Sacramento, CA 95821

Donner Memorial State Park
1416 9th Street
Sacramento, CA 95814

E Clampus Vitus
c/o Alan Wilson
1615 Markham Way
Sacramento, CA 95818

Effie Yaw Nature Center
P.O. Box 579
Carmichael, CA 95609

Ehmann Home and Butte County Historical Society
1480 Lincoln Street
Oroville, CA 95965

El Presidio de Santa Barbara State Historic Park
1416 9th Street
Sacramento, CA 95814

Emigrant Trail Museum
1416 9th Street
Sacramento, CA 95814

Fair Oaks Historical Society
P.O. Box 2044
Fair Oaks, CA 95628

Folsom Historical Society
823 Sutter Street
Folsom, CA 95630

Forbestown Museum/Yuba-Feather Historical Association
P.O. Box 54
Brownsville, CA 95919

Forest Hill Divide Museum and Historical Society
P.O. Box 646
Foresthill, CA 95631

Fort Ross State Historic Park
1416 9th Street
Sacramento, CA 95814

Fort Tejon State Historic Park
P.O. Box 895
Lebec, CA 93243

Gatekeeper's & M. Steinbach Museum
130 West Lake Blvd.
Tahoe City, CA 96145-6141

Gold Country Museums
101 Maple Street
Auburn, CA 95603

Golden Drift Museum
101 Maple Street
Auburn, CA 95603

Golden State Museum
1020 O Street
Sacramento, CA 95814

Governor's Mansion State Historical Park
1526 H Street
Sacramento, CA 95814

Griffith Quarry Museum
101 Maple Street
Auburn, CA 95603

Jack London State Historic Park
1416 9th Street
Sacramento, CA 94296

The Janet Turner Print Collection and Gallery
400 W. 1st Street
Chico, CA 95929

Kelly-Griggs House Museum/Association
311 Washington Street
Red Bluff, CA 96080

La Raza/Galeria Posada
704 O Street
Sacramento, CA 95814

Lake Oroville State Recreation Area
400 Glen Drive
Oroville, CA 95965

Leland Stanford Mansion State Historic Park
802 N Street
Sacramento, CA 95814

Limekiln State Park
1416 9th Street
Sacramento, CA 95814

Mare Island Historic Park Foundation
328 Seawind Dr.
Vallejo, CA 94590

Mary Aaron Memorial Museum Association
704 D Street
Marysville, CA 95901

Marysville Mainstreet Board
106 C Street
Marysville, CA 95901

McArthur-Burney Falls Memorial State Park
1416 9th Street
Sacramento, CA 95814

McClellan Aviation Museum
3204 Palm Ave
McClellan AFB, CA 95660

Mission la Purisima Concepcion de Maria Santisima
1416 9th Street
Sacramento, CA 95814

Museum of Anthropology
301 Langdon Hall
Chico, CA 95929

Native American Heritage Commission
915 Capitol Mall
Room 288
Sacramento, CA 95814

Nelson Gallery University of California, Davis
One Shields Ave.
Davis, CA 95616

North American Indian Annex
1225 Lincoln Way
Auburn, CA 95603

North Central Information Center, California State University, Sacramento
6000 J Street
Adams Building, Suite 208
Sacramento, CA 91819

North Lake Tahoe Historical Society
P.O. Box 6141
Tahoe City, CA 96145

Northern California Association of Museums
301 Langdon Hall
Chico, CA 95929

Northeast Information Center
California State University, Chico
Building 25, Suite 204
Chico, CA 95928

Office of Historic Preservation, Planning Services Office
1231 I Street, Suite 300
Sacramento, CA 95814-3699

Paradise Fact and Folklore
P.O. Box 1696
Paradise, CA 95967

Petaluma Adobe State Historic Park
3325 Adobe Road
Petaluma, CA 94954

Placer County Department of Parks and Museums
101 Maple Street
Auburn, CA 95603

Placer County Historical Society
PO Box 5643
Auburn, CA 95604

Placer County Museum
101 Maple Street
Auburn, CA 95603

Plumas Eureka State Park
1416 9th Street
Sacramento, CA 95814

Portuguese Historical and Cultural Society
P.O. Box 161990
Sacramento, CA 95819

Red Rock Canyon State Park Visitor Center
1416 9th Street
Sacramento, CA 95814

Rio Vista Museum Associations
16 North Front Street
Rio Vista, CA 94571

Sacramento Archives and Museum Collection Center
551 Sequoia Pacific Blvd.
Sacramento, CA 95814

Sacramento County Historical Society
PO Box 160065
Sacramento, CA 95816

The Sacramento Old City Cemetery
1000 Broadway
Sacramento, CA 95865

Sacramento Valley Museum
1491 E Street
Williams, CA 95987

Sacramento Zoo
3930 West Land Park Drive
Sacramento, CA 95822

Santa Cruz Mission State Historic Park
1416 9th Street
Sacramento, CA 95814

Shasta State Historic Park
1416 9th Street
Sacramento, CA 95814

Sierra Nevada Virtual Museum
Sierra College
5000 Rocklin Road, LRC 442
Rocklin, CA 95677

Solano County Genealogical Society
P.O. Box 2494
Fairfield, CA 94533

Solano County Historical Society
P.O. Box 922
Vallejo, CA 94590

Stansbury Home Preservation Association
307 W. 5th Street
Chico, CA 95928

Sutter County Historical Society
P.O. Box 1004
Yuba City, CA 94086

Sutter's Fort State Historic Park
2701 L St
Sacramento, CA 95816

Tehama County Genealogical and Historical Society
P.O. Box 415
Red Bluff, CA 96080

Tehama County Museum
P.O. Box 273
Tehama, CA 96090

Tomo-Kahni Project: Kawaiisu Native American Village
1416 9th Street
Sacramento, CA 95814

Towe Auto Museum, Library and Archive Center
2200 Front Street
Sacramento, CA 95818

Vacaville Museum
213 Buck Avenue
Vacaville, CA 95688

Vallejo Naval and Historical Museum
734 Marin Street
Vallejo, CA 94590

Wells Fargo History Museum
400 Capitol Mall
Sacramento, CA 95814-4407

West Sacramento Historical Society
P.O Box 1202
West Sacramento, CA 95691

West Sacramento Museum and Visitor Center
324 Third Street
West Sacramento, CA 95605

Western Railway Museums
5848 State Highway 12
Suisun, CA 94585

Wilder Ranch State Park
1416 9th Street
Sacramento, CA 95814

William B. Ide Adobe State Historic Park
21659 Adobe Road
Red Bluff, CA 96080

Yankee Hill Historical Society
P.O. Box 4031
Yankee Hill, CA 95965

Yolo County Historical Museum
Gibson House
512 Gibson Road
Woodland, CA 95695

Yuba County Library Local History Room
303 2nd Street
Marysville, CA 95901

Appendix B

Dive Targets

NOT FOR PUBLIC DISTRIBUTION—CONTAINS CONFIDENTIAL SITE LOCATION DATA

Appendix C
Consultation with Native Americans

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEER
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

February 2, 2009
Environmental Resources Branch

Redding Rancheria
Ms. Barbara Murphy
Tribal Councilperson
2000 Rancheria Road
Redding, CA 96001

Subject: Sacramento Riverbank Protection Project
U.S. Army Corps of Engineers

Dear Ms. Murphy:

The U.S. Army Corps of Engineers, Sacramento District (Corps) is proposing to repair 80,000 feet of the levees along the Sacramento River and its tributaries. The repairs will occur at various locations along a 100-mile stretch of the Sacramento River between Chico and Rio Vista. A map of the general project area is included with this letter (Enclosure 1).

In accordance with Section 106 of the National Historic Preservation Act (36 CFR Part 800) that requires Federal agencies to consult with Native American Tribes during projects which may affect Tribal historic and cultural sites, we are contacting your Tribe to provide information about this project, including locations and details concerning this upcoming work.

The Corps is planning meetings in January and February of 2010 with Tribes to discuss this project and to seek input and participation from Tribal representatives. There will be at least one informational meeting in the northern section of the project and one in the southern section. You will receive a phone call from our consultant asking if you are interested in attending these meetings in the next few weeks. Subsequently, you will receive a more detailed letter with the meeting date, time and location. Please feel free to call or contact our Native American Outreach Consultant, Helen McCarthy, by phone, 530-756-4612, or e-mail hmccarthy@ca-ethnography.com if you have any questions at this time. Please let our consultant know who your contact person is and how you would prefer to be contacted: e-mail, phone, or letter.

Sincerely,

Francis C. Piccola
Chief, Planning Division

Enclosure:
1. map of project area

Berry Creek Rancheria of Tyme Maidu Indians
Mr. Jesse Brown
EPA Officer
5 Tyme Way
Oroville, CA 95966

Berry Creek Rancheria of Tyme Maidu Indians
Mr. Jim Edwards
Chair
5 Tyme Way
Oroville, CA 95966

Berry Creek Rancheria of Tyme Maidu Indians
Mr. Thomas Dingman
Cultural Coordinator
5 Tyme Way
Oroville, CA 95966

Buena Vista Rancheria
Ms. Donnamarie Potts
Chair
4650 Coalmine Road
Ione, CA 95640

Butte Tribal Council
Mr. Ren Reynolds
Chairman
1693 Mt. Ida Road
Oroville, CA 95966

Cachil DeHe Band of Wintun Indians of the Colusa Indian Community
Mr. Oscar Serrano
3730 Highway 45
Colusa, CA 95932

Cachil DeHe Band of Wintun Indians of the Colusa Indian Community
Mr. Wayne Mitchem
Chair
3730 Highway 45
Colusa, CA 95932

Cachil DeHe Band of Wintun Indians of the Colusa Indian Community
Ms. Tammy Fullerton
Environmental Coordinator
3730 Highway 45
Colusa, CA 95932

California Valley Miwok Tribe
Ms. Debbie Grimes
10601 Escondido Pl
Stockton, CA 95212

California Valley Miwok Tribe
Ms. Silvia Burley
10601 Escondido Pl
Stockton, CA 95212

Colfax Miwok
Ms. Rose Enos
15310 Bancroft Road
Auburn, CA 95603

Colfax-Todds Valley Consolidated Tribe
Mr. Richard Prout
P.O. Box 4884
Auburn, CA 95604

Cortina Band of Indians
Mr. Charles Wright
Chair
P.O. Box 1630
Williams, CA 95987

Cortina Band of Indians
Mr. David Jones
P.O. Box 1630
Williams, CA 95987

Cortina Band of Indians
Ms. Karen Flores
Vice Chair
P.O. Box 1630
Williams, CA 95987

Cortina Band of Indians
Ms. Thelma Brafford
Tribal Administrator
P.O. Box 1630
Williams, CA 95987

Cortina Rancheria
Mr. Kesner Flores
P.O. Box 1047
Wheatland, CA 95692

Enterprise Rancheria Estom Yumeka
Mr. Art Angle
Vice Chair
3690 Olive Hwy
Oroville, CA 95966

Enterprise Rancheria Estom Yumeka
Mr. Ren Reynolds
Cultural/EPA Officer
3690 Olive Hwy
Oroville, CA 95966

Enterprise Rancheria Estom Yumeka
Ms. Glenda Nelson
Chair
3690 Olive Hwy
Oroville, CA 95966

Grindstone Rancheria
Mr. Kenneth Swearinger Sr.
Chair
P.O. Box 63
Elk Creek, CA 95939

Grindstone Rancheria
Ms. Regina Dock
P.O. Box 63
Elk Creek, CA 95939

Ione Band of Miwok Indians
Mr. Matthew Franklin
Chair
P.O. Box 1190
Ione, CA 95640

Ione Band of Miwok Indians
Ms. Billie Blue
10720 Indian Hill
Auburn, CA 95603

Konkow Valley Band of Maidu Indians
Ms. Patsy Seek
Chair
1706 Sweem Street
Oroville, CA 95965

Mechoopda Indian Tribe of Chico
Mr. Dennis Ramirez
Chair
125 Mission Ranch Blvd
Chico, CA 95926

Mechoopda Indian Tribe of Chico
Mr. Mike DeSpain
EPA Coordinator
125 Mission Ranch Blvd
Chico, CA 95926

Mechoopda Indian Tribe of Chico
Ms. Paula Cuddeford
Tribal Administrator
125 Mission Ranch Blvd
Chico, CA 95926

Mooretown Rancheria of Maidu Indians
Mr. Gary Archuleta
Chair
1 Alverda Drive
Oroville, CA 95966

Mooretown Rancheria of Maidu Indians
Mr. Guy Taylor
1 Alverda Drive
Oroville, CA 95966

Mooretown Rancheria of Maidu Indians
Mr. James Sanders
Tribal Administrator
1 Alverda Drive
Oroville, CA 95966

Ms. Beverly Ogle
29855 Plum Creek Road
Paynes Creek, CA 96075

Paskenta Band of Nomlaki Indians
Mr. Everett Freeman
Chair
P.O. Box 398
Orland, CA 95963

Paskenta Band of Nomlaki Indians
Tribal Council
P.O. Box 398
Orland, CA 95963

Redding Rancheria
Mr. Jack Potter Jr.
Chairperson
2000 Rancheria Road
Redding, CA 96001

Redding Rancheria
Mr. James Hayward
Cultural Resources Program
2000 Rancheria Road
Redding, CA 96001

Redding Rancheria
Ms. Barbara Murphy
Tribal Councilperson
2000 Rancheria Road
Redding, CA 96001

Redding Rancheria
Ms. Tracy Edwards
CEO
2000 Rancheria Road
Redding, CA 96001

Shingle Springs Rancheria
John Tayaba
P.O. Box 1340
Shingle Springs, CA 95682

Shingle Springs Rancheria
Mr. Nicholas Fonseca
Chair
P.O. Box 1340
Shingle Springs, CA 95682

Strawberry Valley Rancheria
Mr. Calvine Rose
Chair
Post Office Box 667
Marysville, CA 95901

Tasmam Koyom Indian Sanctuary Foundation
Mr. Fred Mankins
President
Post Office Box 363
Gerber, CA 96035

Todd Valley Miwok-Maidu Cultural Foundation
Mr. Christopher Suehead
Cultural Representative
P.O. Box 1490
Foresthill, CA 95631

Tsi-Akim Maidu Tribe
Mr. Dan Ryburg
152 Mill Street Suite A
Grass Valley, CA 95959

United Auburn Indian Community of Auburn
Ms. Jessica Tavares
Chair, Tribal Preservation Committee
10720 Indian Hill
Auburn, CA 95603

United Auburn Indian Community of Auburn
Tribal Council
10720 Indian Hill
Auburn, CA 95603

Wilton Rancheria
Mr. Kenneth Counsil
4209 V St., #5
Sacramento, CA 95817

Wilton Rancheria
Mr. Leland Daniels
Cultural Resources Representative
7531 Maple Leaf Lane
Sacramento, CA 95828

Wintu Tribe of Northern California
Ms. Kelli Hayward
3576 Oasis Road
Redding, CA 96001

Wintun Environmental Protection Agency
Mr. Kesner Flores
P.O. Box 1047
Wheatland, CA 95692

Mr. Randy Yonemura
4305 39th Avenue
Sacramento, CA 95824

Yocha Dehe Wintun Nation
Mr. Marshall McKay
Chairman
P.O. Box 18
Brooks, CA 95606

Yocha Dehe Wintun Nation
Ms. Cynthia Clarke
Native Cultural Renewal Committee
P.O. Box 18
Brooks, CA 95606

Yocha Dehe Wintun Nation
Mr. Leland Kinter
Native Cultural Renewal Committee
P.O. Box 18
Brooks, CA 95606

Yocha Dehe Wintun Nation
Ms. Phoebe Bender
P.O. Box 18
Brooks, CA 95606

Appendix D

Application Guidelines and Sample Permit: California State Lands Commission

CALIFORNIA STATE LANDS COMMISSION

General Application Guidelines
for
Marine Salvage Permits

Background:

The State Lands Commission is the California agency entrusted with the responsibility for the preservation, protection and management of the State's 3.5 million acres of submerged lands, including the natural and cultural resources found on or in those lands. These lands consist of a strip, from the mean high tide line to three miles offshore, which extends eleven hundred miles along California's coastline and surrounds its offshore islands. They also include the beds of more than thirty navigable rivers, and forty navigable lakes.

A permit is required for salvage operations conducted on/in or over State submerged lands regardless of the ownership of the vessel, aircraft or other object to be recovered. Permits can be obtained by application to the State Lands Commission, in a format as outlined in these guidelines. Any shipwreck that lies on or is buried in the subsurface of State waters, which has been abandoned by its owner, should be considered to be the property of the State of California.

The Commission administers the California Shipwreck and Historic Maritime Resources Program. These guidelines describe the Program permitting process for conducting salvage or research activities on both historic and non-historic shipwrecks, aircraft or other objects. The guidelines are in accord with **Public Resources Code Sections 6309, 6313, 6314,** and the Commission's general permitting authority. **Permits granted are subject to the California Environmental Quality Act.(CEQA)**

The Commission does not license sport diving. Removal, by sport divers, of objects associated with abandoned shipwrecks, aircraft or other objects from the seabed is subject to penalty, although the removal of small objects without the use of mechanical devices, from sites which are not historically significant will not usually be prosecuted.

The Commission maintains a list of known shipwrecks in its waters, and upon request will provide known information about a ship, or the list, at cost. Site location of historically significant shipwrecks may be withheld in the interest of protecting the site. Various shipwrecks, aircraft or other objects are of archaeological or historic significance, and special permits are required for activities concerning them. Criminal and civil penalties can be imposed for removal of artifacts or disturbance of such sites. Any shipwreck, sunk more than 50 years, is presumed to be of archaeological or historic significance.

Types of Permits:

The Commission is authorized by law to issue two types of permits. A commercial/scientific permit, and a recreational permit.

Commercial/Scientific Permits : These permits are exclusive to the permittee and apply to specific site or area. They are issued for a one year period and are renewable. They can either be for a site which is historically significant or non-historically significant. The permits will normally be issued in phases, as the circumstance require. The phases are:

Search - a non site disturbing permit, to use electronic devices in the water to locate a ship or other object. The permit provides a finders "first option" to obtain a permit to salvage.

Exploratory - to verify or identify a ship or other objects from a known location. Allows the use of electronic devices and certain mechanical devices for limited site disturbance. Requires a plan for the activities contemplated and a description of the equipment to be used and its proposed use. If the ship or other object has archaeological or historic significance, requires a detailed archaeological research design which will be reviewed by the State Historic Preservation Office.

Excavation- to remove a ship or other objects, with the use of tools and mechanical devices and contemplates major site disturbance. For archaeological or historically significant sites, requires a very detailed archaeological research design, supervision by a qualified marine archaeologist, and appropriate removal, preservation and conservation. Review and recommendation of the research design by the State Historic Preservation Office is required.

Recreational Permits: These permits are non-exclusive and non-territorial. They are issued for one year, and allow the recovery, with small hand tools, but without the use of mechanical devices, of small objects from sites which are not archaeologically or historically significant. **(The Commission is not presently issuing recreational permits. The following information applies only to scientific /commercial permits)**

Permits from other State, Federal and Local Agencies

Applicant should be aware that other agencies may have approval authority over the activity contemplated. Approval of other agencies with jurisdiction is required prior to commencing activities.

Application:

Applications for salvage permits should contain the following:

1. <u>Cover Sheet</u>: The cover sheet, (1) containing the name, address, telephone number, and affiliation (if any) of the persons requesting the permit. If the applicant is a corporation, partnership or association information concerning it as an entity. (2) Name of the ship or identification of the object (if known or suspected). (3) Location of the site (as precisely as possible). (4) Evidence of the existence of the shipwreck, aircraft or other object. (5) Proposed dates/duration of the project. (6) Source of funding for the project. (7) Signature of applicant.

2. <u>Project Summary</u>: A short (250 word - maximum) description of the proposed project. For vessels, aircraft or objects of historical significance, it should include the research objectives and potential significance of the work. General types of equipment to be used should be discussed, as well as any unique problems foreseen with the project. This section should be suitable for release to the press.

3. <u>Technical Information</u>: This section should describe specific tasks to be accomplished and equipment and methods to be used to accomplish those tasks. Additional information should be provided depending upon the type of activity contemplated and type of permit requested. For **Search permits**, a listing of equipment types and search strategies will usually be sufficient. For **Exploratory permits** a research design will be required, including how the site will be studied, what measures will be taken to ensure that site integrity is maintained, a description of what artifacts might be taken for identification and how those artifacts will be conserved. More extensive discussion will be required for an **Excavation permit**, including a full archaeological research/recovery design drafted or reviewed by a professional marine archaeologist.

4. <u>Environmental Consequence</u>: Discuss the consequence of conducting the activity on the environment, including the subsurface, water, atmosphere, and marine life, and the impact the activity will have on fishing or marine navigation. The more complex the proposed project, the more extensive this section should be, as it will form the basis for the environmental documents required by the **California Environmental Quality Act (CEQA).**

5. <u>Personnel and Associated Organizations</u>: List and describe persons and organizations who will be involved in the contemplated operations, and provide information concerning their qualifications to undertake the activity. Specifically discuss the archaeological backgrounds of staff involved in exploration or excavation activities and provide qualifications of all divers. Provide information on supervision of the project, and in particular, how the archaeological staff will relate to and control the excavation and preservation activities.

6. <u>Financial Responsibility</u>: Provide sufficient data to substantiate the fiscal capability of the applicant (responsible party) to complete the activity proposed, regardless of any financial gain or loss from the project.

Archaeological or Historic sites:

For sites of Archaeological or Historic significance, the application should elaborate on the following:

(a) **Objectives:** A statement of the objective(s) of the project.

(b) **Project Significance:** Discuss previous scientific work concerning the archaeological site or historic resource and how the proposed project will contribute to the state of knowledge of the site or resource.

(c) **Method:** Any site disturbance will require a detailed plan which provides for the protection and preservation of the site or objects or materials removed from the site consistent with contemporary professional standards of archaeological data recovery.

If site disturbance is proposed, indicate the type, quantity, and method of recovery, and identify the proposed repository to conserve, curate and interpret the resulting archaeological collection. The applicant must submit sufficient documentation to demonstrate that required technical resources, including existing facilities and funding commitments, will be available to complete the project.

The applicant will be require to submit an archaeological research design that describes, 1) the archaeological theory and methods to be employed; 2) the problems towards which the research will be directed; and 3) the ways in which the researchers are seeking to answer such questions. The applicant will also be required to provide a map showing study location(s) and a description of the archaeological site of particular concern.

8. Treatment of Results: Describe the nature and extent of anticipated results. Indicate how the results will be treated (e.g., published in a reference journal, incorporated into academic curriculum, used in management program, published in the press, etc.)

Application Review Process:

Once an application is submitted, it will be reviewed for completeness in accord with Title 7, Chapter 4.5 of the Government Code. If the staff finds the application incomplete, the applicant will be notified within 30 days and advised of the information or action necessary to make it complete. Failure of the applicant to provide the requested information or take the necessary action within 60 days of request is a basis to recommend denial of the application.

Once an application is accepted as complete, the Commission staff will begin the CEQA process to produce and circulate the appropriate environmental documents. These can range from a negative declaration for simple projects without significant environmental impact to extensive EIR's for complicated projects which may have significant environmental impact and require extensive mitigation efforts. The applicant will be required to cover all costs of the CEQA process as explained below.

Approval or denial of all applications is done by motion and vote of the State Lands Commission at a public hearing at which the applicant will be given an opportunity to speak.

Fees and Costs:

Applicant will be required to submit a basic non-refundable application fee of $ 250.00. **Fees should not be submitted until requested.** A permit fee will be payable on issuance of the requested permit. Permit fees are payable annually upon request for renewal of the permit. Permit fees will be based on $500 per acre or fraction thereof with a $500 minimum. Electronic search (survey) permits for salvage purposes will be issued for a limited area on a minimum basis without regard to acreage.

Applicant will be requested to sign a reimbursement agreement to cover staff processing costs and the cost of compliance with CEQA, a shipboard monitor, and any other project costs. Deposit of costs which can reasonably be estimated will be required prior to expenditure of funds or any costs are incurred.

Terms of Salvage Agreements:

Terms of salvage of abandoned ships, cargo or other objects removed from State waters, is at the discretion of the State Lands Commission. With regard to State owned objects the Commission's practice has been to agree, after deduction of reasonable salvage costs, on a division of the net value of items salvaged as follows: 25% of the first $25,000.00 and 50% of all value exceeding that amount. The State has the first right of selection of objects, and may retain any or all of the items salvaged. If the State elects to retains more than its agreed share, it will reimburse the salvor to the extent of the agreed division of value. Details of an agreement will be negotiated once an application has been accepted as complete and the scope of the project is determined.

An application for a salvage permit may be filed with:

State Lands Commission
100 Howe Avenue, Suite 100 South
Sacramento, CA 95825
Att: Marine Salvage Permit Coordinator

Further information may be obtained by calling (916) 574-1854.

MARINE.GDL 051398

STATE OF CALIFORNIA
STATE LANDS COMMISSION

PERMIT NO. PRC 8843.9

SALVAGE PERMIT FOR SCIENTIFIC RESEARCH: INFORMATION COLLECTION

This Permit is issued by the **CALIFORNIA STATE LANDS COMMISSION (Commission or the State)**, under the authority of Division 6 of the Public Resources Code Sections 6309, 6313, and 6314, to the **U.S. Army Corps of Engineers (Corps)**, Cultural Resource Section, Sacramento District, 1325 J Street, Sacramento, CA 95814-2922.

PERMITTED ACTIVITY

The Corps is authorized to conduct scientific research as part of archaeological data recovery on the submerged Clarksburg Ferry shipwreck (Ferry) in the Sacramento River in the Permit Area as defined below, including collection of wood samples for testing and identification and the rudder. The Corps may conduct limited excavation and dredging of sediment to facilitate documentation of the Ferry. Additional historic artifact(s) may be recovered with prior approval from the Commission's Executive Officer, provided that sufficient funding is available from non-Commission sources to conserve the artifact(s) to accepted archaeological standards.

TERM OF THE PERMIT

A period of one year beginning August 11, 2009, upon issuance by the Commission. The Permit will not be executed on behalf of the Commission until the Corps has met all conditions. **This Permit is valid only when signed by an authorized representative of the Commission.**

PERMIT AREA

The permission granted under this Permit is limited to authorized activities within the area encompassing the wreck site as shown on the attached map (Attachment A, two pages), and hereinafter referred to as the Permit Premises.

CONDITIONS OF THE PERMIT

1. Activities authorized by this Permit shall be conducted in compliance with all federal, state and local laws, rules and regulations.

2. Other federal, state, or local agencies may have approval authority over the activities contemplated. The Corps shall submit copies of any other required approvals or permits from other agencies having regulatory authority over the activities prior to issuance of the Permit or prior to the start of in-water activities if issuance of the Permit is required prior to approval by other agencies.

3. All activities under this permit will be carried out under the direct supervision of a qualified maritime archaeologist.

4. The Corps will conduct its operations according to the information submitted in its application to the Commission, except as specifically provided in this Permit.

5. The Corps will notify the Commission's representative by e-mail or telephone a minimum of 48 hours prior to conducting activities contemplated by this permit.

6. The Corps will provide a written safety plan for informational purposes only to the Commission's representative before beginning in-water activities on the Permit Premises.

7. The Corps will submit two copies of a Site Report with 30 days of the completion of in-water activities, including representative photographs showing the site at the end of data recovery, and sample results within 6 months.

8. The Corps will submit to the Commission two copies of all published or unpublished reports, papers, and manuscripts resulting from the permitted work.

9. Fieldwork conducted under the authority of this Permit shall be carried out in such a way as not to impede other legitimate uses of State lands.

10. Disturbance will be limited to the minimum area consistent with the nature and purpose of the fieldwork.

11. The Corps will take precautions to prevent littering or pollution on State lands, waterways, and adjoining properties. Refuse shall be carried out and deposited in approved disposal areas.

12. All personal property, tools, or equipment taken onto or placed upon the Permit Premises shall remain the personal property of the Corps. Such personal property shall be promptly removed by the Corps at its sole risk and expense upon the completion of the authorized activities. The Commission does not accept any responsibility for any damage, including damages to any personal property, including any equipment, tools, or machinery on the Permit Premises.

13. No fueling activities or equipment repair and/or maintenance will take place on the Permit Premises.

DISPOSITION OF COLLECTED ARTIFACTS

Limited collection of wood samples for testing and identification and the rudder is authorized under this Permit. It is understood that the samples will be destroyed during testing. The rudder must be conserved to accepted archaeological standards.

Any other historic artifact(s) may be recovered only with prior approval from the Commission's Executive Officer, provided that sufficient funding is available from non-Commission sources to conserve the artifact to accepted archaeological standards.

Except for the samples collected and destroyed during testing, artifacts collected from the Permit Premises shall remain State property until further action by the Commission's Executive Officer. The transfer of title to the rudder or any other historic artifacts to a recognized display/curation facility must be approved in writing.

COMMISSION'S REPRESENTATIVE

The Commission may provide a representative (Onsite Observer) at its own expense to observe and monitor compliance with the terms of the Permit. The Corps will provide reasonable accommodation for the Onsite Observer aboard a boat used to conduct the authorized activities. The Onsite Observer shall have the right to observe all operations and activities including on-site planning and review and may visually inspect, photograph and record such activity. The Onsite Observer will not interfere with the operations so long as they are lawful and meet the requirements of this Permit.

VIOLATION OF TERMS OF PERMIT

A stop work order may be issued by the Executive Officer of the Commission at the request of the Onsite Observer if the Onsite Observer determines that the activities of the Corps are not within the permitted activity. A stop work order shall be issued after the non-permitted activity is brought to the attention of the person in charge of the onsite operation and that person fails or refuses after sufficient time and opportunity to change or correct the activity. Written notice of the stop work order shall be given to the person in charge of the onsite activity and a hearing by the Executive Officer or his or her designee shall be provided to the Corps within three business days. After the hearing the Commission may seek enforcement of, or the Corps may seek relief from, the stop work order in Sacramento County Superior Court. The relief may include damages for failure to comply with the stop work order.

CONSIDERATION

The public use and benefit with the State reserving the right at any time to set a monetary rent if the Commission finds such action to be in the State's best interest.

INDEMNIFICATION

The Commission shall not be liable and the Corps agrees to indemnify, hold harmless, and, at the option of the Commission, defend the Commission, its officers, agents, and employees against and for any and all liability, claims, damages or injuries of any kind and from any cause, arising out of or connected in any way with the issuance, enjoyment, or breach of this Permit or the Corps's use of the Permit Premises except for any such liability, claims, damage, or injury caused solely by the negligence of the Commission, its officers, agents and employees.

The Corps agrees to notify the Commission immediately in case of any accident, injury, or casualty on the Permit Premises.

In the exercise of the rights herein granted, the Corps is responsible for any damage, destruction, or loss occurring to the property of the Commission, its lessees, or other members of the public. The Corps shall indemnify and hold harmless the Commission for all such damage, destruction or loss, or at the option of the Commission, the Corps shall repair or replace said property to the satisfaction of the Commission.

INFORMATIONAL MATERIALS

All maps, drawings, photographs and videotapes or other electronic recording or images made as part of activities under this Permit or any items collected will be made available to the State, and the Commission will be entitled to view, copy, or photograph such items upon request, and that the Commission may use such material for scientific or educational purposes at no cost with appropriate attribution to the author or the Corps. Such review will be at a time and place mutually agreeable to the parties.

NOTICES

Any notice required under this Permit will be complete when delivered in person to the representative listed below, sent through the U.S. mail, sent via electronic mail, or sent by facsimile to the listed number if confirmed by voice telephone.

CALIFORNIA STATE
LANDS COMMISSION:

Pamela M. Griggs
Senior Staff Counsel
State Lands Commission
100 Howe Ave., Suite 100–South
Sacramento, CA 95825

(916) 574-1855 (facsimile)
(916) 574-1854 (voice)
E-mail: griggsp@slc.ca.gov

U.S. ARMY CORPS OF ENGINEERS

Daniel A. Bell
Archaeologist
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

(916) 557-7856 (facsimile)
(916) 557-6818 (voice)
E-mail: Daniel.A.Bell@usace.army.mil

North State Resources, Inc.
Attn: Mark Wuestehube,
Project Manager
5000 Bechelli Lane, Ste. 203
Redding, CA 96002

(530) 345-4805 (facsimile)
(530) 345-4552 ext. 203 (voice)
E-mail: wuestehube@nsmet.com

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

State of California

County of Sacramento

On 08 September 2009 before me, Linda A. Blue,
Date — Here Insert Name and Title of the Officer

personally appeared Francis Piccola
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

LINDA A. BLUE
COMM. #1813253
NOTARY PUBLIC • CALIFORNIA
SACRAMENTO COUNTY
Comm. Exp. SEPT. 14, 2012
MGC1

WITNESS my hand and official seal.

Signature Linda A Blue
Signature of Notary Public

Place Notary Seal Above

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of Attached Document

Title or Type of Document: ______

Document Date: ______ Number of Pages: ______

Signer(s) Other Than Named Above: ______

Capacity(ies) Claimed by Signer(s)

Signer's Name: ______
- ☐ Individual
- ☐ Corporate Officer — Title(s): ______
- ☐ Partner — ☐ Limited ☐ General
- ☐ Attorney in Fact
- ☐ Trustee
- ☐ Guardian or Conservator
- ☐ Other: ______

Signer Is Representing: ______

RIGHT THUMBPRINT OF SIGNER
Top of thumb here

Signer's Name: ______
- ☐ Individual
- ☐ Corporate Officer — Title(s): ______
- ☐ Partner — ☐ Limited ☐ General
- ☐ Attorney in Fact
- ☐ Trustee
- ☐ Guardian or Conservator
- ☐ Other: ______

Signer Is Representing: ______

RIGHT THUMBPRINT OF SIGNER
Top of thumb here

EFFECTIVE DATE

This Permit and agreement will be effective when approved by and executed on behalf of the Commission and a duly executed copy has been delivered to the Corps. This Permit will continue in effect until August 10, 2010, unless sooner abandoned by the Corps, terminated by the Commission for cause, or extended by further action of the Commission. **This Permit is valid only when signed by an authorized representative of the Commission.**

Agreed and accepted this 08 day of September 2009

U.S. Army Corps of Engineers	State of California State Lands Commission
By [signature] (Signature)	By [signature] (Signature)
Chief, Planning Division (Title)	*Chief, Division of Land Management* (Title)

(Attach Notary Acknowledgement of Signature)

Issued this date: 9/17/ 2009

This Permit was authorized by the California State Lands Commission on August 11, 2009 (Calendar Item No. C44)

Appendix E

Sample Permit: Temporary Permit for Entry onto State-Owned Land (DWR)

TEMPORARY PERMIT

NO PERMANENT CONSTRUCTION ON STATE PROPERTY IS PERMITTED UNDER THIS TEMPORARY PERMIT

FIELD DIVISION	COUNTY	PERMIT NUMBER

DATE ISSUED	TIME	EXPIRES	MILEPOST

Permission is hereby granted to the undersigned Permittee to enter upon the property of the Department of Water Resources, hereafter referred to as the "State", at: ______________________________
(the "Property") between the hours of: ______________________________
for the sole purpose of: ______________________________

1. Equipment to be used on the Property is limited to:

2. Reasonable precautions will be exercised by Permittee to avoid damage and to protect persons and property. Permittee shall be responsible for the injury, death, or damages of any member of the public, officer or employee of State, or any other person, arising out of the exercise of the rights herein granted, irrespective of fault or negligence excepting only such injuries or deaths as are caused by the sole negligence of willful misconduct of State, its officers or employees. State assumes no liability for loss or damage to property or injuries to or deaths of agents, contractors or employees of Permittee by reason of the exercise of privileges given under this Temporary Permit. To the fullest extent permitted by law, Permittee shall indemnify, and hold State, its affiliates and successors, and their respective directors, officers, employees, consultants, attorneys, agents and representatives, and each of them, free and harmless from any and all personal or property laws, injury, due damages, liability, claim, lien, cost, or expense, including reasonable attorney's fees and costs, to the extent arising from, or in connection with, Permittee's activities or performance of the work described, and any other activity of Permittee, on the Property as authorized by this Temporary Permit. This agreement to indemnify defendant and hold harmless shall survive any termination of this Temporary Permit

3. In the exercise of the rights herein granted, Permittee is responsible for any damage, destruction or loss occurring to the Property or facilities of State, its water contractors, licenses, Permittee, or members of the public. Permittee shall indemnify, defend, and save harmless State for all such damage, destruction or loss, or at the option of State, Permittee shall repair or replace said Property to the satisfaction of State.

4. This Temporary Permit is not valid for any activity that results in any temporary or permanent alteration to State property. **No unauthorized construction on State property is permitted under this Temporary Permit.** Construction is contingent upon the applicant completing the State's review process and obtaining an encroachment permit.

5. Either party, upon three (3) business days written notice to the other party may cancel this Temporary Permit.

6. This Temporary Permit must be present on site at all times when on State property. The Temporary Permit must be shown to any representative of Permittor or any law enforcement officer on demand.

7. Travel is limited to twenty (20) M.P.H. on the canal roads and right-of-way roads or as posted.

8. Permittee shall comply with all applicable federal, State, and local laws, including Division of Occupational Safety and Health (Cal/OSHA) requirements. Any environmental permits or other necessary permits shall be the sole responsibility of Permittee. Copies of all permits shall be provided to State.

9. Permittee must comply with the Field Division Security Requirements, including closing and locking all gates after opening.

10. State expressly does not give Permittee any permit or authorization to enter upon any portions of the Property other than those specified herein.

11. Permittee may enter the Property and all access areas leading thereto solely for the purpose of performing the activities and work described above.

12. Permittee shall be responsible for the lawful disposition of any and all waste and spoilage obtained from the Property resulting from the performance by Permittee of the work described herein.

13. Permittee shall keep the Property free and clear of all mechanic's, materialmen's and other liens resulting from the performance by Permittee of the work described herein.

14. This Temporary Permit shall not constitute or be construed or interpreted as a waiver of any defense by any party or as omission for any purpose by any party of any liability or responsibility of any past, present or future condition of the Property.

15. This Temporary Permit shall terminate when the work described herein has been completed. Permittee shall notify State immediately when the work is completed. Upon termination, Permittee shall promptly restore the Property to the same general condition and contours that existed at the time of execution of this Temporary Permit.

16. All notices to Permittee and State pursuant to this Temporary Permit shall be made in writing to the addresses listed below.

17. This Temporary Permit expires thirty (30) business days from the date of issuance and in no instance can extend beyond 90 working days from the date of issuance.

18. Permittee shall furnish to State a Certificate of Insurance, at the time the Temporary Permit is signed and returned to Permittor, stating that there is liability insurance presently in effect for Permittee with bodily and property damage limits of not less than $1,000,000 per occurrence. The liability insurance shall name State as additional insured and be in effect at all times during the term of this Temporary Permit.

19. Permittee shall notify the Field Division two (2) business days prior to starting work. Please contact ______________________________ at phone number ____________________ to provide notification.

20. If this Temporary Permit is for potholing the State Water Project underground pipeline and/or communication control cables, the following provisions also apply:

    a) Permittee shall notify Underground Service Alert (USA) at (800) 422-4133 for Southern CA or (800) 642-2444 for Northern CA two (2) business days prior to commencement of work.

b) The vacuum extraction method is preferred for potholing the marked underground facilities to verify existence and exact location. If trenching method is used, all trench excavation shall comply with the most recent occupational safety and health administration standards. All work within three (3) feet of State Water Project pipeline(s) and cable(s) shall be done using hand-held tools only. Backfill material shall be thoroughly compacted and the surface restored to its original grade and conditions. Trench backfill shall be placed in no greater than 4-inch lifts if hand compacted or no greater than 8-inch lifts if power compacted. Trench backfill compaction shall meet 95 percent (ASTM D1557.) Permittee shall provide written certification to the State that the compaction standard has been met.

c) Communication and control cables connected with the operation of the State Water Project are buried along either or both sides of the aqueduct/pipeline within State's right of way. All excavations within three (3) feet of the cable(s) and pipeline shall be done using hand-held tools only.

21. Other:
____
____
____
____

State of California
Department of Water Resources

By:______________________________

Print Name:______________________________

Title:______________________________

Phone:______________________________

ACCEPTED:

Permittee:______________________________

By:______________________________

Print Name:______________________________

Title:______________________________

Address:______________________________

Contact Phone:______________________________

Appendix F

Sample Permit Application: Caltrans Standard Encroachment Permit Application

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

STANDARD ENCROACHMENT PERMIT APPLICATION

TR-0100 (REV. 07/2007)

FOR CALTRANS USE
PERMIT NO.
DIST/CO/RTE/PM
SIMPLEX STAMP
DATE OF SIMPLEX STAMP

Permission is requested to encroach on the State Highway right-of-way as follows:
(Complete all BOXES [write N/A if not applicable])
This application is not complete until all requirements have been approved.

1. COUNTY		**2. ROUTE**	**3. POSTMILE**		
4. ADDRESS OR STREET NAME			**5. CITY**		
6. CROSS STREET *(Distance and direction from site)*			**7. PORTION OF RIGHT-OF-WAY**		
8. WORK TO BE PERFORMED BY ☐ OWN FORCES ☐ CONTRACTOR		**9. EST. START DATE**		**10. EST. COMPLETION DATE**	
11. EXCAVATION	MAX. DEPTH	AVG. DEPTH	AVG. WIDTH	LENGTH	SURFACE TYPE
12. EST. COST IN STATE HIGHWAY RIGHT-OF-WAY			**FUNDING SOURCE(S)** ☐ **FEDERAL**	☐ **STATE** ☐ **LOCAL** ☐ **PRIVATE**	
13. PIPES	PRODUCT TYPE	DIAMETER	VOLTAGE / PSIG	**14. CALTRANS PROJECT E.A. NUMBER**	

15. ☐ **Double Permit** **Parent Permit Number** ______________________

Applicant's Reference Number / Utility Work Order Number ______________________

16. **Have your plans been reviewed by another Caltrans branch?** ☐ **NO** ☐ **YES** (If "YES") **Who?**__________

17. **Completely describe work to be done within STATE highway right-of-way :**
Attach 6 complete sets of **FOLDED** plans (folded 8.5" x 11"), and any applicable specifications, calculations, maps, etc.
All dimensions shall be in U.S. Customary (English) Units.

18. **Is a city, county, or other agency involved in the approval of this project?**

☐ YES ***(If "YES", check type of project and attach environmental documentation and conditions of approval.)***

☐ COMMERCIAL DEVELOPMENT ☐ BUILDING ☐ GRADING ☐ OTHER__________

☐ CATEGORICALLY EXEMPT ☐ NEGATIVE DECLARATION ☐ ENVIRONMENTAL IMPACT REPORT ☐ OTHER__________

☐ NO ***(If "NO", please check the category below which best describes the project, and complete page 4 of this application.)***

☐ DRIVEWAY OR ROAD APPROACH, RECONSTRUCTION, MAINTENANCE, OR RESURFACING ☐ FENCE
☐ PUBLIC UTILITY MODIFICATIONS, EXTENSIONS, HOOKUPS ☐ MAILBOX
☐ FLAGS, SIGNS, BANNERS, DECORATIONS, PARADES AND CELEBRATIONS ☐ EROSION CONTROL
☐ OTHER__________ ☐ LANDSCAPING

19. Will this project cause a substantial change in the significance of a historical resource (45 years or older), or cultural resource? ☐ YES ☐ NO
(If "YES", provide a description)

20. Is this project on an existing highway or street where the activity involves removal of a scenic resource including a significant tree or stand of trees, a rock outcropping or a historic building? ☐ YES ☐ NO (If "YES", provide a description)

21. Is work being done on applicant's property? ☐ YES ☐ NO (If "YES", attach site and grading plans.)

ADA NOTICE: For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write to Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814

STANDARD ENCROACHMENT PERMIT APPLICATION

TR-0100 (REV. 07/2007)

PERMIT NO.

22. Will this proposed project require the disturbance of soil? ☐ YES ☐ NO

If "YES", estimate the area within State Highway right-of-way in square feet AND acres: ______ (ft^2) AND ______ (acres)

estimate the area outside of State Highway right-of-way in square feet AND acres: ______ (ft^2) AND ______ (acres)

23. Will this proposed project require dewatering? ☐ YES ☐ NO

If "YES", estimate total gallons AND gallons/month. ______ (gallons) AND ______ (gallons/month)

SOURCE*: ☐ STORM WATER ☐ NON-STORM WATER

(*See Caltrans SWMP for definitions of non-storm water discharge: http://www.dot.ca.gov/hq/env/stormwater/index.htm)

24. How will any storm water or ground water be disposed of from within or near the limits of this proposed project?

☐ Storm Drain System ☐ Combined Sewer / Storm System ☐ Storm Water Retention Basin

☐ Other (explain): ______

PLEASE READ THE FOLLOWING CLAUSES PRIOR TO SIGNING THIS ENCROACHMENT PERMIT APPLICATION.

The applicant, understands and herein agrees to that an encroachment permit can be denied, and/or a bond required for non-payment of prior or present encroachment permit fees. Encroachment Permit fees may still be due when an application is withdrawn or denied, and that a denial may be appealed, in accordance with the California Streets and Highways Code, Section 671.5. All work shall be done in accordance with Caltrans rules and regulations subject to inspection and approval.

The applicant, understands and herein agrees to the general provisions, special provisions and conditions of the encroachment permit, and to indemnify and hold harmless the State, its officers, directors, agents, employees and each of them (Indemnitees) from and against any and all claims, demands, causes of action, damages, costs, expenses, actual attorneys' fees, judgments, losses and liabilities of every kind and nature whatsoever (Claims) arising out of or in connection with the issuance and/or use of this encroachment permit and the placement and subsequent operation and maintenance of said encroachment for: 1) bodily injury and/or death to persons including but not limited to the Applicant, the State and its officers, directors, agents and employees, the Indemnities, and the public; and 2) damage to property of anyone. Except as provided by law, the indemnification provisions stated above shall apply regardless of the existence or degree of fault of Indemnities. The Applicant, however, shall not be obligated to indemnify Indemnities for Claims arising from the sole negligence and willful misconduct of State, its officers, directors, agents or employees.

DISCHARGES OF STORM WATER AND NON-STORM WATER: Work within State Highway right-of-way shall be conducted in compliance with all applicable requirements of the National Pollutant Discharge Elimination System (NPDES) permit issued to the Department of Transportation (Department), to govern the discharge of storm water and non-storm water from its properties. Work shall also be in compliance with all other applicable Federal, State and Local laws and regulations, and with the Department's Encroachment Permits Manual and encroachment permit. Compliance with the Departments NPDES permit requires amongst other things, the preparation and submission of a Storm Water Pollution Protection Plan (SWPPP), or a Water Pollution Control Program (WPCP), and the approval of same by the appropriate reviewing authority prior to the start of any work. Information on the requirements may also be reviewed on the Department's Construction Website at:

http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm

25. NAME of APPLICANT or ORGANIZATION *(Print or Type)*		E-MAIL ADDRESS	
ADDRESS of APPLICANT or ORGANIZATION WHERE PERMIT IS TO BE MAILED *(Include City and Zip Code)*			
PHONE NUMBER	FAX NUMBER		
26. NAME of AUTHORIZED AGENT / ENGINEER *(Print or Type)*	IS LETTER OF AUTHORIZATION ATTACHED? ☐ YES ☐ NO	E-MAIL ADDRESS	
ADDRESS of AUTHORIZED AGENT / ENGINEER *(Include City and Zip Code)*			
PHONE NUMBER	FAX NUMBER		
27. SIGNATURE of APPLICANT or AUTHORIZED AGENT	28. PRINT OR TYPE NAME	29. TITLE	30. DATE

PERMIT NO.

WORK ORDER/REFERENCE NUMBER

FEE CALCULATION -- FOR CALTRANS USE

☐ CASH ☐ CREDIT CARD NAME ON CARD ____________________ PHONE NUMBER ______________

☐ CHECK NUMBER ________ NAME ON CHECK ____________________ PHONE NUMBER ______________

☐ EXEMPT ☐ PROJECT EA _ _ _ _ _ _ ☐ DEFERRED BILLING (Utility)

CALCULATED BY	(1)		(2)		
REVIEW 1. _______ HOURS @ $_______ * 2. _______ HOURS @ $_______ *	1. FEE / DEPOSIT $____________	DATE	2. FEE / DEPOSIT $____________	DATE	TOTAL FEE / DEPOSIT $____________ $____________
INSPECTION 1. _______ HOURS @ $_______ * 2. _______ HOURS @ $_______ *	1. FEE / DEPOSIT $____________	DATE	2. FEE / DEPOSIT $____________	DATE	TOTAL FEE / DEPOSIT $____________ $____________
FIELD WORK _______ HOURS @ $_______ *	$____________		$____________		$____________
EQUIPMENT & MATERIALS	DEPOSIT $____________	DATE	DEPOSIT $____________	DATE	DEPOSIT $____________
CASH DEPOSIT IN LIEU OF BOND	$____________		$____________		$____________
TOTAL COLLECTED **CASHIER'S INITIALS**	$____________ ____________		$____________ ____________		$____________

** The current hourly rate is set annually by Headquarters Accounting. District Office staff do not have authority to modify this rate.*

PERFORMANCE BOND	☐	DATE	AMOUNT $
PAYMENT BOND	☐	DATE	AMOUNT $
LIABILITY INSURANCE REQUIRED?		☐ YES ☐ NO	AMOUNT $

PERMIT NO.

INSTRUCTIONS

for completing page 4

This page needs to be completed when the proposed project DOES NOT involve a City, County or other public agency.

Your answers to these questions will assist departmental staff in identifying any physical, biological, social or economic resources that may be affected by your proposed project within the State highway right-of-way. And, to determine which type of environmental studies may be required to approve your application for an encroachment permit.

It is the applicant's responsibility for the production of all required environmental documentation and supporting studies, in some cases this may be costly and time-consuming. If possible, attach photographs of the location of the proposed project.

Please answer these questions to the best of your ability. Provide a description of any "YES" answers (type, name, number, etc.)

1. Will any existing vegetation and/or landscaping within the highway right-of-way be disturbed?

2. Are there waterways (e.g. river, creek, pond, natural pool or dry streambed) adjacent to or within the limits of the project or highway right-of-way?

3. Is the proposed project located within five miles of the coast line?

4. Will the proposed project generate construction noise levels greater than 86 dBA (e.g. jack-hammering, pile driving)?

5. Will the proposed project incorporate land from a public park, recreation area or wildlife refuge open to the public?

6. Are there any recreational trails or paths within the limits of the proposed project or highway right-of-way?

7. Will the proposed project impact any structures, buildings, rail lines, or bridges within highway right-of-way?

8. Will the proposed project impact access to any businesses or residences?

9. Will the proposed project impact any existing public utilities or public services?

10. Will the proposed project impact existing pedestrian facilities, such as sidewalks, crosswalks, or overcrossings?

11. Will new lighting be constructed within or adjacent to highway right-of-way?

Appendix G

Native American Outreach and Consultation Process (Helen McCarthy, PhD)

NATIVE AMERICAN OUTREACH and CONSULTATION PROCESS

SACRAMENTO RIVER BANK PROTECTION PROJECT
US ARMY CORPS of ENGINEERS, SACRAMETNO DISTRICT

Submitted to:
ICF Jones&Stokes
630 K Street, Suite 400
Sacramento, CA 95814

Prepared for:
US Army Corps of Engineers
Sacramento District

Prepared by:
Helen McCarthy, PhD
Cultural Resource Research & Consulting
105 E Street, Suite 2i
Davis, California 95616

April 8, 2010

NATIVE AMERICAN OUTREACH and CONSULTATION PROCESS

SACRAMENTO RIVER BANK PROTECTION PROJECT
US ARMY CORPS of ENGINEERS, SACRAMENTO DISTRICT

Introduction

The U.S. Army Corps of Engineers-Sacramento District (Corps) has proposed to undertake a river bank protection program entailing construction of 80,000 linear feet in the Sacramento River Flood Control Project (SRFCP) area. This is an extensive area located along the Sacramento River and its tributaries and involves locations in 11 counties including Butte, Colusa, Contra Costa, Placer, Sacramento, Solano, Sutter, Tehama, Yolo and Yuba. South to north it extends from the town of Collinsville at river mile (RM) 0 upstream to Chico RM 194 plus tributaries including Cache Creek, lower reaches of the American, Feather, Yuba, and Bear rivers. The overall objective of the Native American Outreach and Consultation Process component of the project has been developed to identify any and all Native American Tribes that may have interests or concerns about sensitive sites, archaeological investigations, or river bank construction within the project area. This outreach effort is the initial step in the consultation process designed to comply with federal law, Section 106, 36 CFR Part 800, NHPA, that requires federal agencies to conduct government to government consultation with tribes during any undertaking, and state law, CEQA, that requires Native American involvement in the disposition of any human remains which may be discovered. The general strategy for the outreach program consisted of several phases. The first was to identify all the tribes and Native American groups that might have interests or concerns in the project area. These tribes would then be informed of the project by letter, and then they would be invited to attend an informational meeting where more detailed data could be exchanged.

Project Tasks

<u>Meetings with Corps, ICF Jones & Stokes, and Outreach Consultant, Tasks 1 and 2</u>

The kick-off meeting (Task 1) was held September 9, 2009 at Corps Headquarters in Sacramento. The project and its goals were outlined for the consultant and issues around the tribes that would be consulted. It was expressed by the Corps that the list should be inclusive of all tribes that might be interested. The list should include both federally recognized and non-federally recognized tribes, as well as any interested individuals who are on the Native American

Heritage Commission (NAHC) consultation list. A plan for action was developed. After identifying the potentially interested Native American entities, an initial informational letter would be sent to these groups or individuals. This letter would be followed up by a phone call from the Native American Outreach consultant in order to make sure the letter had reached the group and to identify the contact person for the group as well as the best means of contact, i.e., phone, e-mail, fax, or regular mail. When this information was in hand, two scoping meetings would be planned for the Native Americans in order to provide more detailed information about the project and hopefully establish a basis for further consultation about sensitive areas that the Native Americans have concerns about. Subsequent team meetings were held on the second Tuesday of each month, when progress and plans would be reviewed.

A special meeting (Task 2) was held January 14, 2010 was held with Mark Gilfillan, Corps Tribal Liaison Officer for the Sacramento District. Those in attendance included Dan Bell, Corps Archaeologist; Aaron Bryant, Corps Project Manager for the project; Christiaan Havelaar, ICF Jones & Stokes Archaeologist; and Helen McCarthy, Outreach Consultant. This was a very productive meeting during which Gilfillan outlined Corps consultation policies and answered our questions. He stressed government to government consultations that recognized Tribal Sovereignty with open, transparent and respectful discussions of the project prior to any decision making. He emphasized “due diligence” in contacting and informing tribes about what will be involved with the project. He was affirmative that the team should work with both recognized and unrecognized tribes. He reported that while he would not be able to be present at our meetings with the tribes, he could be available on the phone for advice on Corps policy on particular issues or problems. He also advised us that he was available to help with any questions we might have as the project went forward.

Identification of Potential Participants (Task 3)

A major effort was made to identify all the appropriate tribes, other Native American entities, and Native American individuals who might be considered interested parties. The first source of information was the NAHC list of contacts for the project area. This list is especially useful since it includes recognized and unrecognized tribes as well as individuals who regularly participate in cultural resource projects. This list was augmented by the most current – 2007- lists prepared by the State of California Department of Housing and Community Development. These lists also present both recognized and unrecognized tribes as well as Native American Education Centers; these lists often have more up to date addresses than the NAHC lists. Additionally, the Outreach Consultant checked with the CalTrans Native American Officer, Tina Biorn and received updated addresses and phone numbers for several individuals. Department of Water Resources cultural staff Janis Offermann was also consulted for the accuracy and inclusiveness of the list. Finally, the list was compared with the Stewardship Council lists, which have been prepared for extensive Native American consultations for PG&E. The completed list (see Appendix A) was e-mailed to ICF Jones & Stokes on October 21, 2009, and after review and some minor edits, it was presented to the project team at the meeting of November 10, 2009.

Contact: Initial Letter, Follow-up Phone Call, Second Letter (Task 3, con't)

A draft of the initial informational letter was prepared and e-mailed to team members at ICF Jones&Stokes and the Corps on November 17, 2009. After some deliberation and editing, the Corps issued the letter on December 18, 2009 to all tribes and entities on the list. It was printed on Corps letterhead, signed by Francis Piccola, Chief, Planning Division, and accompanied by a project map. Direct communications with the tribes began in late December and continued through mid-January by which time nearly all the tribes had been contacted and contact persons identified along with their preferred method of contact. Brief discussions were conducted with many of these contacts about the general nature of the project and some of their initial concerns. All expressed interest in attending the meetings that were to be held. Nearly all entities on the list were reached by this method. A new list was developed based on these communications of contact persons and their contact preferences (Appendix B).

A second letter, also on Corps letterhead, was sent in late January, 2010 to all the potentially interested tribes informing them of the dates and locations of the two scoping meetings. All the tribes were noticed about both meetings so they could make their own choice as to which one they would attend. The first meeting was planned for Saturday February 27, 2010, from 1-4 pm at the Sierra 2 Center, 2791 24th Street, Sacramento, and the second one was scheduled for Saturday March 6, 2010, from 1-4 pm at the Holiday Inn and Conference Center, 685 Manzanita Court, Chico.

<u>The Tribal Scoping Meetings, Task 3 (con't)</u>

Preparations for the two tribal scoping meetings included a power point presentation to be delivered by Corps staff and poster boards containing various graphics with project data. Representatives from three recognized tribes attended the meeting in Sacramento on February 27: Phoebe Bender from Yocha Dehe Wintu (Rumsey), Jeffery Flores from Cortina, and Oscar Serrano from Colusa Indian Community. They were all attentive to the prepared presentation, and Ed Ketchum, Native American Coordinator for the Corps, also addressed the group with some very useful information regarding the ways in which tribes could participate in the project and how the Corps could address meet their concerns. A productive discussion followed that ranged from construction to monitoring. It seemed clear that these representatives had integrated the information that the Corps and ICF Jones&Stokes team had hoped they would, and that these three tribes would be ready to go on to the next phases of the project. Additionally, the representative from the Colusa Indian Community reported that there is thought to be an old Indian cemetery in the vicinity of their rancheria that was incorporated into the levee during early historic construction– the Colusa rancheria is right behind the levee, though the representative did not know if the trust land extends onto the levee. He did not at this time request Corps assistance with this issue.

The second meeting on March 6 in Chico was very disappointing since no one showed up, in spite of a number of tribal contacts having declared a strong interest in the project and giving assurance that they would attend the scoping meeting. Several of these tribes are headquartered in Oroville and are very near close by the Feather River banks. There are a number of reasons to consider as to why the effort to begin the consultation process had such minimal success. The first and probably most important reason is that the project is still very ambiguous and diffuse, covering an immense area, making it hard for people to relate to, and there are no specific areas identified yet to discuss. It is not unusual for tribes to delay participation in projects until they see that something important or sensitive to them is going to be impacted. It is suggested that participation will increase when there are some specifics to discuss, although this will not necessarily meet the goal of planning construction to avoid sensitive locations. It is recommended that future consultations include specific information about the location(s) of the anticipated construction. Second, the meetings were scheduled for Saturday afternoons, which are a time when people have lots of other activities to attend to. The representative from Yocha Dehe commented that she would have preferred another time. A work week evening might have been more agreeable to some. A third reason might be that it is a Corps project. Many tribes in the Sacramento Valley have not yet established an on-going relationship with the Corps, and many have reservations about interacting with government agencies. Fourth, many tribes are very protective of their sovereignty, and this meeting was not going to be a formal government to government consultation. Tribes may be waiting for that opportunity, which would more likely occur in a meeting between the Corps and a single tribe. Finally, the invitation letter noted that there would be no travel reimbursement, and while there is usually no reimbursement for a scoping meeting at this level, nevertheless, some people had inquired about this issue, and lack of reimbursement may have kept some representatives away. Undoubtedly these considerations played into the decisions that various people made not to attend, but there may be additional unidentified issues also.

<u>Develop a Consistent Consultation Process, Task 4</u>

There are a number of strategies which may be recommended for an effective, continuing consultation process. Some of these are outlined in Task 4 and are worth discussion here but are too extensive to actually undertake under the in the current scope. One of these strategies is to determine which Tribes are interested in participating in the formal Section 106 consultations for the development of HPMPs for prehistoric or ethnographic resources. It is suggested here that the three tribes that attended the Sacramento meeting are the most likely to be interested in going forward at this time. A pilot project with Colusa might be the most suitable beginning, not only because their representative attended the scoping meeting, but also because they are the tribe that lives in closest proximity to the Sacramento River, and they must deal with levee and riverbank issues on a regular basis. Also, they have identified a particular potential problem with the cemetery that has been incorporated into the historic levee.

The strategies identified in Task 4 are all worth going forward with, *viz*, to develop agreements for treatment of human remains during archaeological work, including reburial agreements; to develop agreements for inadvertent discovery of human remains during any phase of the overall project; to develop protocols, monitoring and communication agreements appropriate during archaeological work or other earth moving activities; and to undertake ethnographic identification of TCPs and sacred sites. These could be addressed in a pilot project and improved upon for use throughout the project. Such a pilot project might be easily expanded to include Yocha Dehe and Cortina as well. It is suggest that experience with these three tribes would be an excellent proving ground for continuing consultations.

In spite of the disappointment relating to the lack of attendance shown at the Chico meeting, there have been some positive results from this phase of the consultation process. An extensive list of the potentially interested tribes has been developed and is available for future use. Since many of the tribes on this list are federally recognized, their contact information will remain fairly stable. The Corps has done its best – due diligence – to inform Native Americans about the Riverbank Project. Two letters, one with a map, have been sent, phone calls have been made, thus establishing direct contact with a number of tribes, and two scoping meetings have been held. It is a beginning that lays the groundwork for further consultation. Three tribes have been identified for further consultation, and it is recommended that a pilot project be undertaken that targets Colusa and perhaps Yocha Dehe and Cortina to develop the strategies listed above for continuation of the consultation process for the Sacramento River Bank Protection Project.

APPENDIX A. INITIAL LIST OF POTENTIAL NATIVE AMERICAN CONSULTING TRIBES

TRIBES to CONTACT for SACRAMENTO RIVER BANK PROJECT

WEST of THE SACRAMENTO RIVER, FROM THE NORTH: (Counties of Interest noted)

**Redding Rancheria 530-225-8979; Fx 530-241-1879
2000 Rancheria Road
Redding, CA 96001
Barbara Murphey, Chr, Tracy Edwards, CEO; James Hayward, Sr., Cultural Resources Program
Glenn, Tehama Counties

**Wintu Tribe of Northern California 530-245-0141; Fx 530- 245-0241
3576 Oasis Road
Redding, CA 96001
Kelli Hayward
Glenn, Tehama Counties

**Paskenta Band of Nomlaki Indians 530-865-2010; Fx 530-865-1870
P.O. Box 398
Orland, CA 95963
Everett Freeman, Chr
Glenn,Tehama, Colusa, Solano, Yolo Counties

**Grindstone Rancheria 530-968-5365; Fx 530-968-5366
P.O. Box 63
Elk Creek, CA 95939
Kenneth Swearinger , SR, Chr; Regina Dock
Glenn, Tehama, Colusa, Solano, Yolo Counties

**Cachil DeHe Band of Wintun Indians of the Colusa Indian Community (530)458-8231; fx 458-3866
3730 Highway 45
Colusa, CA 95932
Wayne Mitchem, Chair
Tammy Fullerton, Enviromental Coordinator
Colusa, Solano, Yolo Counties

**Cortina Band of Indians 530-473-3274/ 473-3190; Fax 530-437-3301
P.O. Box 1630
Williams, CA 95987
Charles Wright, Chair
Thelma Brafford, Tribal Administrator
Karen Flores, Vice Chair
Colusa, Solano, Yolo Counties

**Yocha Dehe (Rumsey) 530-796-3400; Fax: 530-796-2143
P.O. Box 18
Brooks, CA 95606
Marshall McKay, Chair
Native Cultural Renewal Committee: Leland Kinter; Cynthia Clarke
Colusa, Solano, Yolo Counties

EAST OF THE SACRAMENTO RIVER, FROM THE NORTH: (Counties of interest noted)

**Mechoopda Indian Tribe of Chico Rancheria 530-899-8922; Fx 530-899-8517
125 Mission Ranch Blvd
Chico, CA 95926
Dennis E. Ramirez, Chair ex 215
Paula Cuddeford, Tribal Admin ex 209
Mike DeSpain, EPA Co-ordinator ex 219
Butte, Sutter County

**Enterprise Rancheria, Estom Yumeka 530-532-9214; Fx 530-532-1768
3690 Olive Hwy
Oroville, CA 95966
Glenda Nelson, Chr;
Art Angle, ViceChr;
Ren Reynolds, Cultural/EPA Officer
Butte, Yuba Counties [listed for ??Glenn, Tehama Counties,
????Colusa,Solano, Yolo Counties]

**Mooretown Rancheria of MaiduIndians 530-533-3625; Fx 530-533-3680
1 Alverda Drive
Oroville, Ca 95966
Gary Archuleta, Chair
James Sanders, Tribal Adm
Butte, Sutter Counties

Berry Creek Rancheria of Tyme Maidu Indians 530-534-3859; Fx 530-534-1151
5 Tyme Way
Oroville, CA 95966
Jim Edwards, Chair
Thomas Dingman, Cultural Coordinator
Jesse Brown, EPA Officer
[Butte - not signed up with NAHC for cultural issues? not on list for project]

**Konkow Valley Band of Maidu# 530-533-1504

1706 Sweem Street
Oroville, CA 95965
Patsy Seek, Chair
Butte, Sutter Counties

**Strawberry Valley Rancheria# [no phone listed]
P.O. Box 667
Marysville, CA 95901
Calvine Rose, Chair
Yuba, Butte, Sutter Counties

T'si Akim# (Grass Valley) 530-265-4097
152 Mill Street, A
Grass Valley, CA 95959
Dan Ryburg
[?Yuba County, not listed by NAHC for project]

Colfax-Todds Valley Consolidated Tribe# [no phone listed]
P.O. Box 4884
Auburn, CA 95604
Richard Prout
Placer, Sacramento Counties [not listed by NAHC for project, ?same as below]

**Todd Valley Miwok-Maidu Cultural Foundation# [no phone listed ?same as above]
P.O. Box 1490
Foresthill, CA 95631
Christopher Suehead, Cultural Representative: tvmmcf@foothill.net
Placer, Sacramento Counties

**United Auburn Indian Community of Auburn 530-883-2390; Fax 530-883-2380

10720 Indian Hill Road
Auburn, CA 95603
Jessica Tavares, Chr; Tribal Preservation Committee
Placer, Sacramento Counties

Shingle Springs Rancheria 530-676-8010
P.O. Box 1340
Shingle Springs, CA 95682
Nicholas Fonseca, Chr
[? Sacramento County, Not listed by NAHC for cultural issues]

Ione Band of Miwok Indians 209-274-6636
P.O. Box 1190
Ione, CA 95640

Matthew Frankllin, Chr
[?Sacramento County/Rio Vista area; not listed for project by NAHC]

**Wilton Rancheria 916-689-7330
7531 Maple Leaf Lane
Sacramento, CA 95828
Leland Daniels, Cultural Resources Rep
Placer,Sacramento Counties
**Kenneth Counsil Miwok/Maidu 916-457-7144
4209 V St, #5
Sacramento, CA 95817
Placer, Sacramento Counties

INDIVIDUALS on the NAHC List:

**Rose Enos (Maidu/Washo) Colfax# 530-878-2378
15310 Bancroft Road
Auburn, CA 95603
Placer, Sacramento Counties

**Randy Yonemura Miwok [unaffiliated] 916-421-1600
4305 39th Ave
Sacramento, CA 95824
Placer, Sacramento Counties

** Kesner Flores Wintun/Patwin Cortina 925-586-8919
P.O. Box 1047
Wheatland, CA 95692

**Ren Reynolds Maidu [Enterprise] 530-589-1571
Butte Tribal Council
1693 Mt. Ida Road
Oroville, CA 95966
Butte, Sutter Counties

QUESTIONABLE

California Valley Miwok Tribe 209-931-4567
10601 Escondido Pl.
Stockton, CA 95212
Silvia Burley [? San Joaquin County)

Buena Vista Rancheria 209-274-6512
4650 Coalmine Road
Ione, CA 95640
Donnamarie Potts, Chr
[??Sacramento County - Rio Vista area; not listed by NAHC for project]

**Beverly Ogle# (?unaffiliated/Mt. Maidu/PitRiver) 530-597-2070
29855 Plum Creek Road
Paynes Creek, CA 96075
Glenn, Tehama Counties [she is pretty far north and in the mountains]

**Tasmam Koyom# (other/ Mt. Maidu?) 530-385-1683
P.O. Box 363
Gerber, CA 96035
Fred Mankins, President
Glenn, Tehama Counties

** Tribes, Organizations on the NAHC list
# Tribal name# : unrecognized tribe

APPENDIX B. REVISED LIST OF INTERESTED TRIBES: CONTACT PERSONS AND PRFERRED MEANS OF CONTACT

CONTACT INFORMATION FOR TRIBES POTENTIALLY INVOLVED IN THE SACRAMENTO RIVER BANK PROJECT

TRIBAL CONTACTS For Meeting Notice: SACRAMENTO RIVERBANK PROJECT

LETTERS TO BE SENT

Redding Rancheria
Tribal Council
2000 Rancheria Road
Redding, CA 96001

James Hayward, Sr., Cultural Resources Program
Redding Rancheria
2000 Rancheria Road
Redding, CA 96001

Kelli Hayward
Wintu Tribe of Northern California
3576 Oasis Road
Redding, CA 96001

Regina Dock
Grindstone Rancheria
P.O. Box 132,
Elk Creek, 95939

Mike DeSpain, EPA Co-ordinator
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Blvd
Chico, CA 95926

Patsy Seek, Chair
Konkow Valley Band of Maidu Indians
1706 Sweem Street
Oroville, CA 95965

Tribal Council
United Auburn Indian Community of Auburn

10720 Indian Hill Road
Auburn, CA 95603

Calvine Rose, Chair
Strawberry Valley Rancheria#
P.O. Box 667
Marysville, CA 95901

Leland Daniels, Cultural Resources Rep
Wilton Rancheria
7531 Maple Leaf Lane
Sacramento, CA 95828

Kenneth Counsil
Wilton Rancheria
4209 V St, #5
Sacramento, CA 95817

Rose Enos
Colfax Miwok
15310 Bancroft Road
Auburn, CA 95603

Randy Yonemura
4305 39th Ave
Sacramento, CA 95824

Kesner Flores
P.O. Box 1047
Wheatland, CA 95692

Beverly Ogle
29855 Plum Creek Road
Paynes Creek, CA 96075

FAX THIS TRIBE:

Tribal Council
Paskenta Band of Nomlaki Indians **Fx 530-865-1870**

E-MAIL THESE TRIBES:

oserrano@colusa-nsn.gov Oscar Serrano

Cachil DeHe Band of Wintun Indians of the Colusa Indian Community

Davidj@cortinawepa.org David Jones
Cortina Band of Indians

pbender@yochadehe-nsn.gov Pheobe Bender
Yocha Dehe (Rumsey)
renr@enterpriserancheria.org Ren Reynolds
Enterprise Rancheria, Estom Yumeka

grtaylor@mooretown.org Guy Taylor

jessebrown@berrycreekrancheria.com Jesse Brown
Berry Creek Rancheria of Tyme Maidu Indians

jtayaba@ssband.org John Tayaba
Shingle Springs Rancheria]

culturalheritage@ionemiwok.org Billie Blue
Ione Band of Miwok Indians

dmiwuk@aol.com Debbie Grimes
California Valley Miwok Tribe

Appendix H

Properties Exempt from Evaluation

Appendix H
Properties Exempt from Evaluation

Exempt Property Type 1: Archaeological Property Types and Features

1. Isolated prehistoric finds consisting of fewer than three items per 100 m^2
2. Isolated historic finds consisting of fewer than three artifacts per 100 m^2 (several fragments from a single glass bottle, and similar vessels are to be counted as one artifact)
3. Refuse scatters less than 50 years old (scatters containing no material that can be dated with certainty as older than 50 years old)
4. Features less than 50 years old (those known to be less than 50 years old through map research, inscribed dates, etc.)
5. Isolated refuse dumps and scatters over 50 years old that lack specific associations
6. Isolated mining prospect pits
7. Placer mining features with no associated structural remains or archaeological deposits

Exempt Property Type 2: Minor, Ubiquitous, or Fragmentary Infrastructure Elements

The following list does not apply to properties 50 years old or older that could be potentially important, nor does it apply to properties that may contribute to the significance of larger historic properties such as districts or cultural landscapes.

Water Conveyance and Control Features

- Natural bodies of water providing a water source, conveyance, or drainage
- Modified natural waterways
- Concrete-lined canals less than 50 years old and fragments of abandoned canals
- Roadside drainage ditches and secondary agricultural ditches
- Small drainage tunnels
- Flood storage basins
- Reservoirs and artificial ponds
- Levees and weirs
- Gates, valves, pumps, and other flow control devices
- Pipelines and associated control devices

- Water supply and waste disposal systems
- Rip-rap

Recent Transportation or Pedestrian Facilities

- Railroad grades converted to other uses, such as roads, levees, or bike paths
- Bus shelters and benches
- Vista points and rest stops
- Bike paths, off-road vehicle trails, equestrian trails, and hiking trails
- Parking lots and driveways

Highway and Roadside Features

- Isolated segments of bypassed or abandoned roads
- Retaining walls
- Highway fencing, soundwalls, guard rails, and barriers
- Drains and culverts, excluding culverts assigned a Caltrans bridge number
- Cattle crossing guards
- Roadside landscaping and associated irrigation systems
- Signs and reflectors
- Telecommunications services, including towers, poles, dishes, antennas, boxes, lines, cables, transformers, and transmission facilities
- Utility services, including towers, poles, boxes, pipes, lines, cables, and transformers
- Oil and gas pipelines and associated control devices

Adjacent Features

- Fences, walls, gates, and gateposts
- Isolated rock walls and stone fences
- Telephone booths, call boxes, mailboxes, and newspaper receptacles
- Fire hydrants and alarms
- Markers, monuments, signs, and billboards
- Fragments of bypassed or demolished bridges
- Temporary roadside structures, such as seasonal vendors' stands
- Pastures, fields, crops, and orchards
- Corrals, animal pens, and dog runs
- Open space, including parks and recreational facilities

- Foundations and mapped locations of buildings or structures more than 50 years old with few or no associated artifacts or ecofacts, and with no potential for subsurface archaeological deposits
- Building and structure ruins and foundations less than 50 years old

Movable or Minor Objects

- Movable vehicles
- Stationary vehicles less than 50 years old or moved within the last 50 years
- Agricultural, industrial and commercial equipment and machinery
- Sculpture, statuary, and decorative elements less than 50 years old or moved within the last 50 years

Appendix I

Programmatic Agreement Contacts

PROGRAMMATIC AGREEMENT
Contacts

Signatory Parties. All signatory parties agree to receive communications as outlined in Stipulation III.A.

CVFPB
c/o Benjamin Carter, President
P.O. Box 942836
Sacramento, CA 94236

SHPO
c/o Milford Wayne Donaldson, FAIA
1725 23rd Street, Suite 100
Sacramento, CA 95816

USACE
c/o Andrew B. Kiger, P.E.
Lieutenant Colonel, U.S. Army
District Engineer
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA 95814-2922
Cc: Nikki Polson, CESPK-PD-RC

Concurring Parties. Provided the parties listed in this subsection accept the invitation to act as a concurring party to and sign the Agreement, they agree to receive communications as outlined in Stipulation III.A. If they do not sign the document, USACE will continue to communicate with the party in accordance with applicable laws and regulations.

Cacil DeHe Band of Wintun Indians of the Colusa Indian Community
c/o Wayne R. Mitchum, Sr., Chairman
3750 Highway 45
Colusa, CA 95932
Cc: Oscar Serrano

DWR
c/o Dale Hoffman-Floerke
Deputy Director
Integrated Water Management
P.O. Box 942836
Room 1155-A
Sacramento, CA 94236-0001

and

DWR
Attention: Jody Brown
3500 Industrial Boulevard
West Sacramento, CA 95691-6521
Cc: Jody Brown

Shingle Springs Band of Miwok Indians
c/o Nick Fonseca, Chairman
P.O. Box 1340
Shingle Springs, CA 95682
Cc: Daniel Fonseca, THPO; AmyAnn Taylor

United Auburn Indian Community of Auburn Rancheria
c/o Jessica Tavares, Chair
Tribal Preservation Committee
10720 Indian Hill Road
Auburn, CA 95603
Cc: Marcos Guerrero

Yoche DeHe Wintun Nation
c/o Marshall McKay
Tribal Chairman
P.O. Box 18
Brooks, CA 95606
Cc: Reno Franklin, THPO

Attachment 2

Letter from Advisory Council on Historic Preservation

Preserving America's Heritage

August 15, 2011

Mr. Francis C. Piccola
Chief, Planning Division
Sacramento District, Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

Ref: Sacramento River Bank Protection Project, 80,000 linear feet

Dear Mr. Piccola:

The Advisory Council on Historic Preservation (ACHP) received your notification and supporting documentation regarding the adverse effects of the referenced undertaking on properties listed or eligible for listing in the National Register of Historic Places. Based upon the information you provided, we have concluded that Appendix A, Criteria for Council Involvement in Reviewing Individual Section 106 Cases, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to resolve adverse effects is needed. However, if we receive a request for participation from the California State Historic Preservation Officer, Tribal Historic Preservation Officer, affected Indian tribe, or other consulting party, we may reconsider this decision. Additionally, should circumstances change, and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final Programmatic Agreement (PA), developed in consultation with the California State Historic Preservation Office (SHPO) and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with your notification of adverse effect. If you have any questions or require our further assistance, please contact Dr. Tom McCulloch at 202-606-8554 or via e-mail at tmcculloch@achp.gov.

Sincerely,

Caroline D. Hall
Assistant Director
Federal Property Management Section
Office of Federal Agency Programs

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Appendix C
Regulatory Background

This appendix provides regulatory background for the proposed program in terms of federal, state, and local laws, ordinances, regulations, and planning guidance. This regulatory background indicates approvals that may be required for implementation of the proposed program or contextual information to be considered in environmental analysis. Table C-1 presents a list of acronyms and abbreviations found in this appendix.

Table C-1. List of Acronyms and Abbreviations

Acronym	Definition
AB 32	Assembly Bill 32, the California Global Warming Solutions Act of 2006
AC	FAA Advisory Circulator
APE	Area of Potential Effects
ARB	California Air Resource Board
BA	biological assessment
BAU	business as usual
BAAQMD	Bay Area Air Quality Management District
basin plans	water quality control plans
BMPs	best management practices
BO	biological opinion
Butte County MHMP	Butte County Multi-Jurisdictional All-Hazard Pre-Disaster Mitigation Plan
CAA	federal Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal-EPA	California Environmental Protection Agency
Cal-OHSA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CCAA	California Clean Air Act
CCR	California Code of Regulations
Central Valley Flood Protection Board	formerly California Reclamation Board
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CESPK	U.S. Army Corps of Engineers, Sacramento Division
CFGC	California Fish and Game Code
CFR	Code of Federal Regulations
CIWMP	countywide integrated waste management plan
CNEL	Community Noise Equivalent Level
CNPPA	California Native Plant Protection Act
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CPUC	California Public Utilities Commission

Acronym	Definition
CTR	California Toxics Rule
CVFPB	Central Valley Flood Protection Board
CWA	federal Clean Water Act
CWC	California Water Code
dBA	A-weighted decibel
dbh	diameter at a height of 4.5 feet above ground level
DFW	California Department of Fish and Wildlife
DOC	California Department of Conservation
DTSC	Department of Toxic Substance Control
DWR	California Department of Water Resources
EFH	essential fish habitat
EIS	Environmental Impact Statement
EM	Engineer Manual
EO	Executive Order
EPA	Environmental Protection Agency
ESA	federal Endangered Species Act
ETL	Engineering Technical Letter
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
FMMP	Farmland Mapping and Monitoring Program
FPPA	Farmland Protection Policy Act
FPPA	Farmland Protection Policy Act
General Construction Permit	NPDES General Permit for Construction Activities
GHG	greenhouse gas
Guidelines	Relocation Assistance and Real Property Acquisition Guidelines
HCD	Housing and Community Development Department
HCP	Habitat Conservation Plan
HPTP	Historic Properties Treatment Plan
HWCL	Hazardous Waste Control Law
lbs/day	pounds per day
LCFS	low carbon fuel standard
L_{eq}	equivalent continuous noise level
LESA	Land Evaluation and Site Assessment
LF	linear feet
LOS	level of service
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
MOU	memorandum of understanding
MT	metric tons
NAAQS	National Ambient Air Quality Standards
Natural Resources Agency	California Resources Agency (formerly)
NBHCP	Natomas Basin Habitat Conservation Plan
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act

Acronym	Definition
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NISC	National Invasive Species Council
NMFS	National Marine Fisheries Service
NO	nitrogen oxide
NO_2	nitrogen dioxide
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination Systems
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTR	National Toxics Rule
NWP	Nationwide permit
OES	Office of Emergency Services
OPR	Governor's Office of Planning and Research
OSHA	U.S. Department of Labor Occupational Safety and Health Administration
PA	Programmatic Agreement
Pb	lead
PL	Public Law
PM	particulate matter
PRC	Public Resources Code
PSM	Process Safety Management
RCRA	Resource Conservation and Recovery Act
Reporting Rule	final Greenhouse Gas Reporting Rule
RQ	reportable quantity
RWQCB	regional water quality control board
SAA	streambed alteration agreement
SACOG	Sacramento Area Council of Governments
SB	Senate Bill
SHPO	State Historic Preservation Officer
SIP	state implementation plan
SMARA	Surface Mining and Reclamation Act of 1975
SO_2	sulfur dioxide
SPCCP	Spill Prevention Control and Countermeasure Plan
SRBPP	Sacramento River Bank Protection Project
State Water Board	State Water Resources Control Board
Superfund	Comprehensive Environmental Response, Compensation, and Liability Act
SWPPP	Stormwater Pollution Prevention Plan
TQs	threshold quantities
Uniform Relocation Act	Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended in 1987
USB	Urban Services Boundary
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
WDR	waste discharge requirements
WHMP	Wildlife Hazard Management Plan

C.1 Federal Plans, Policies, and Regulations

C.1.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) (42 (United States Code [USC] Section 4321 et seq.) applies to all federal agencies and most of the activities they manage, regulate, or fund that have the potential to affect the environment. It requires federal agencies to disclose and consider the environmental implications of their proposed actions. NEPA establishes environmental policies for the nation, provides an interdisciplinary framework for federal agencies to prevent environmental damage, and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account.

NEPA requires the preparation of an appropriate document to ensure that federal agencies accomplish the law's purposes. The President's Council on Environmental Quality (CEQ) has adopted regulations and other guidance that provide detailed procedures that federal agencies must follow to implement NEPA.

As amended, NEPA (42 USC Sections 4321–4347) establishes the federal policy of protecting important historic, cultural, and natural aspects of our national heritage during federal project planning. All federal or federally assisted projects requiring action pursuant to Section 102 of NEPA must take into account the effects on cultural resources.

In addition, CEQ regulations require an Environmental Impact Statement (EIS) to consider the potential indirect effects of a proposed action. The indirect effects of an action include those that would occur later in time or farther away in distance, but are still reasonably foreseeable, and "may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate" (40 Code of Federal Regulations [CFR] Section 1508.8[b]).

C.1.2 Endangered Species Act

The federal Endangered Species Act (ESA) of 1973 and subsequent amendments (16 USC Sections 1531 et seq.) provide for the conservation of listed endangered or threatened species or candidates for listing and the ecosystems on which they depend. The U.S. Fish and Wildlife Service (USFWS) has jurisdiction over federally listed plants, invertebrates, wildlife, and resident fish, while the National Marine Fisheries Service (NMFS) has jurisdiction over anadromous fish and marine fish and mammals.

The ESA protects fish, wildlife, and plant species that are listed as threatened or endangered, as well as their habitats. "Endangered" species, subspecies, or distinct population segments are in danger of extinction through all or a significant portion of their range. "Threatened" species, subspecies, or distinct population segments are likely to become endangered in the near future. The ESA prohibits the take of endangered or threatened wildlife species. "Take" is defined to include harassing, harming (includes significantly modifying or degrading habitat), pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting wildlife species or any attempt to engage in such conduct (16 USC Section 1532, 50 Part CFR 17.3). Actions that result in take can result in civil or criminal penalties.

ESA Section 7 mandates that all federal agencies consult with USFWS and NMFS if the agencies determine that a proposed project may affect a listed species or its habitat. The purpose of consultation with USFWS and NMFS is to ensure that the federal agencies' actions do not jeopardize the continued existence of a listed species or destroy or adversely modify any critical habitat for listed species.

C.1.2.1 Endangered Species Act Authorization Process for Federal Actions

Section 7 of the Endangered Species Act (ESA) (16 USC Section 1536) provides a means for authorizing take of threatened and endangered species by federal agencies. This section applies to actions that are conducted, permitted, or funded by a federal agency. Under ESA Section 7, the lead federal agency conducting, funding, or permitting an action must consult with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), as appropriate, to ensure that the proposed action will not jeopardize the continued existence of an endangered or threatened species or destroy or adversely modify designated critical habitat. If a proposed action may affect a listed species or designated critical habitat, the lead agency is required to prepare a biological assessment (BA) evaluating the nature and severity of the expected effect. In response, USFWS or NMFS issues a biological opinion (BO), with a determination that the proposed action would have one of two results.

- May jeopardize the continued existence of one or more listed species ("jeopardy finding") or result in the destruction or adverse modification of critical habitat ("adverse modification finding").
- Will not jeopardize the continued existence of any listed species ("no jeopardy finding") or result in adverse modification of critical habitat ("no adverse modification finding").

The BO issued by USFWS or NMFS may stipulate discretionary "reasonable and prudent" conservation measures. If is determined the proposed program would not jeopardize the continued existence of a listed species, USFWS or NMFS would issue an incidental take statement to authorize the proposed activity. A programmatic BA was prepared for the Sacramento River Bank Protection Project (SRBPP) for the 2007 program area which focused on approximately 24,000 linear feet (LF) remaining Phase II authorization of proposed erosion repair sites (Stillwater Sciences 2007). An updated BA and subsequent BO will be prepared for the current program area, which contains approximately 80,000 LF of proposed erosion repair sites.

C.1.2.2 Endangered Species Act Prohibitions (Section 9)

Section 9 of ESA prohibits the "take" of any fish or wildlife species listed under ESA as endangered. *Take* means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harm" is defined as "any act that kills or injures the species, including significant habitat modification." Take of threatened species also is prohibited under Section 9 unless otherwise authorized by federal regulations.[1] Additionally, Section 9 prohibits removing, cutting, and maliciously damaging or destroying federally listed plants on sites under federal jurisdiction.

For plants listed as endangered under the ESA, Section 9(a)(2) of the act prohibits their import or export from the United States. Section 9(a)(2) also prohibits acts to remove, cut, dig up, damage, or

[1] In some cases, exceptions may be made for threatened species under ESA Section 4[d]; in such cases, USFWS or NMFS issues a "4[d] rule" describing protections for the threatened species and specifying the circumstances under which take is allowed.

destroy endangered plant species in nonfederal areas in knowing violation of any state law or in the course of criminal trespass.

Candidate species and species that are proposed or under petition for listing receive no protection under Section 9.

C.1.3 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 USC Sections 1801–1883) establishes a management system for national marine and estuarine fishery resources. In 1996, Congress passed the Sustainable Fisheries Act to amend the Magnuson-Stevens Act and require that all federal agencies consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect essential fish habitat (EFH). EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation states that migratory routes to and from anadromous fish spawning grounds should also be considered EFH. The phrase "adversely affect" refers to the creation of any effects that reduce the quality or quantity of EFH. Federal activities that occur outside an EFH but that may, nonetheless, have an effect on EFH waters and substrate must also be considered in the consultation process. Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered.

Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered. The Magnuson-Stevens Act states that consultation regarding essential fish habitat should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other federal statutes, such as NEPA, Fish and Wildlife Coordination Act, federal Clean Water Act (CWA), and ESA. EFH consultation requirements can be satisfied through concurrent environmental compliance if the lead agency provides NMFS with timely notification of actions that may adversely affect EFH and if the notification meets requirements for essential fish habitat assessments.

The Corps has prepared a BA to be submitted to USFWS and NMFS pursuant to obtaining a BO. The consultation process will include consideration of and compliance with the Magnuson-Stevens Act to determine effects on EFH. At this time, it is considered that no EFH would be affected.

C.1.4 Sustainable Fisheries Act

In response to growing concern about the status of United States fisheries, Congress passed the Sustainable Fisheries Act of 1996 (Public Law [PL] 104-297) to amend the Magnuson-Stevens Act. Under the Sustainable Fisheries Act, consultation is required by NMFS on any activity that might adversely affect EFH. EFH includes those habitats that fish rely on throughout their life cycles. It encompasses habitats necessary to allow sufficient production of commercially valuable aquatic species to support a long-term sustainable fishery and contribute to a healthy ecosystem. The program area is within the EFH for all four Chinook salmon runs.

C.1.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC Sections 703-712) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and Russia, and authorizes the

U.S. Secretary of the Interior to protect and regulate the taking of migratory birds. The MBTA establishes hunting seasons and capture limits for game species and protects migratory birds, their occupied nests, and their eggs (16 Section 703; 50 CFR Part 21; 50 CFR Part 10).

The current list of species protected by the MBTA includes several hundred species and essentially includes all native birds. Permits for take of non-game migratory birds can be issued only for specific activities, such as scientific collecting, rehabilitation, propagation, education, taxidermy, and protection of human health and safety and personal property.

Executive Order (EO) 13186 (January 10, 2001) directs each federal agency taking actions that have or may have a negative effect on migratory bird populations to work with USFWS to develop a memorandum of understanding (MOU) that will promote the conservation of migratory bird populations. Protocols developed under the MOU must include the following agency responsibilities:

- avoid and minimize, to the extent practicable, adverse effects on migratory bird resources when conducting agency actions;
- restore and enhance migratory bird habitats, as practicable; and
- prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

The executive order is designed to assist federal agencies in their efforts to comply with the MBTA, and does not constitute any legal authorization to take migratory birds.

C.1.6 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC Sections 668-668c) provides for the protection of the bald eagle and the golden eagle by prohibiting, except under certain specified conditions, the take, possession, and commerce of such birds.

The program study area does not contain bald eagle or golden eagle nesting habitat, and the proposed program would not result in the take of bald or golden eagles.

C.1.7 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 USC Sections 661-666c) requires federal agencies to coordinate with USFWS and the state fish and wildlife agencies whenever the waters of any stream or other body of water are proposed, authorized, permitted, or licensed to be impounded, diverted, or otherwise controlled or modified under a federal permit or license. This coordination is intended both to promote the conservation of wildlife resources by providing equal consideration for fish and wildlife in water project planning and to provide for the development and improvement of wildlife resources in connection with water projects. Federal agencies undertaking water projects are required to include recommendations made by USFWS and state fish and game agencies in project reports, and to give full consideration to these recommendations.

C.1.8 Executive Order 11990: Protection of Wetlands

EO 11990, signed May 24, 1977, directs all federal agencies to refrain from assisting in or giving financial support to projects that encroach on publicly or privately owned wetlands. It further requires that federal agencies support a policy to minimize the destruction, loss, or degradation of wetlands. A project that encroaches on wetlands may not be undertaken unless the agency has determined that: (1) there are no practicable alternatives to such construction, (2) the project includes all practicable measures to minimize harm to wetlands that would be affected by the project, and (3) the effect will be minor.

C.1.9 Executive Order 13112: Invasive Species

EO 13112, signed February 3, 1999, directs all federal agencies to prevent and control the introduction of invasive species in a cost-effective and environmentally sound manner. The order established the National Invasive Species Council (NISC), which is composed of federal agencies and departments, and the supporting Invasive Species Advisory Committee, which is composed of state, local, and private entities. The NISC's national invasive species management plan recommends objectives and measures to implement EO 13112 and to prevent the introduction and spread of invasive species (National Invasive Species Council 2008). EO 13112 requires consideration of invasive species in NEPA analyses, including species identification and distribution, their potential effects, and measures to prevent or eradicate them.

C.1.10 Clean Water Act

CWA is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. It operates on the principle that all discharges into the nation's waters are unlawful unless specifically authorized by a permit. The CWA is administered by the Environmental Protection Agency (EPA) and Corps. The Corps is responsible for regulating the discharge of fill material into waters of the United States (including lakes, rivers, streams, and their tributaries) and wetlands.

The discharge of dredged or fill material into waters of the United States is subject to permitting under CWA Section 404. The State Water Resources Control Board (State Water Board) is the state agency with primary responsibility for implementing the CWA. Typically, all regulatory requirements are implemented by the State Water Board through nine regional water quality control boards (RWQCBs) established throughout the state. The Central Valley RWQCB is responsible for regulating discharges to the Sacramento River and its tributaries.

Permit review is the CWA's primary regulatory tool. The following sections provide additional details on specific sections of the CWA.

C.1.10.1 Section 404: Permits for Fill Placement in Waters and Wetlands

Section 404 of the CWA (33 USC Section 1344) regulates the discharge of dredged and fill materials into "waters of the United States." Before any actions that may affect surface waters are implemented, a delineation of jurisdictional waters of the United States must be completed, following Corps protocols, to determine whether the project area contains wetlands or other waters of the United States that qualify for CWA protection. These areas include sections within the ordinary high water mark of a stream, including nonperennial streams with a defined bed and bank and any stream channel that conveys natural runoff, even if it has been realigned, and seasonal and perennial wetlands, including coastal wetlands. Riparian areas can fall both within and outside of areas regulated by CWA Section 404 depending on their proximity to the ordinary high water mark.

"Waters of the United States" consist of wetlands and lakes, rivers, streams, and their tributaries; they are defined for regulatory purposes, at 33 CFR Section 328.3 (a), as:

> (1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide; (2) All interstate waters, including interstate wetlands; (3) All other waters such as intrastate lakes, rivers, streams, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce; (4) All impoundments of waters otherwise defined as waters of the United States under the definition; (5) Tributaries of waters identified in paragraphs 1–4 in this section; (6) The territorial seas; and (7) Wetlands adjacent to waters identified in paragraphs 1–6 in this section.

Wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR Section 328(e)). For an area to be considered a wetland, it must exhibit positive indicators of all three federal wetland criteria (hydrophytic vegetation, hydric soils, and wetland hydrology).

Applicants must obtain a permit from the Corps for all discharges of dredged or fill material into waters of the United States, including wetlands, before proceeding with a proposed activity. As stated by the counsel for the EPA's January 19, 2001, determination in response to the *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* ruling, nonnavigable, isolated waters may not be regulated by the Corps. As part of the wetland delineation and verification process, the Corps will determine whether the wetlands in the program area are isolated and therefore not regulated under Section 404.

The Corps may issue either an individual permit evaluated on a case-by-case basis or a general permit evaluated at a program level for a series of related activities. General permits are preauthorized and are issued to cover multiple instances of similar activities expected to cause only minimal adverse environmental effects. Nationwide permits (NWPs) are a type of general permit issued to cover particular fill activities. Each NWP specifies particular conditions that must be met for the NWP to apply to a particular project. Potential waters of the United States in the program area are under the jurisdiction of the Corps Sacramento District.

Compliance with Section 404 requires compliance with several other environmental laws and regulations. The Corps cannot issue an individual permit or verify the use of a general permit until the requirements of NEPA, ESA, and the National Historic Preservation Act have been met (see the section under Chapter 19, Cultural Resources). In addition, the Corps cannot issue or verify any permit until a water quality certification or a waiver of certification has been issued pursuant to CWA Section 401.

Certain activities, listed below, are exempt from the Section 404 permitting process.

- Farming, ranching, and forestry activities that are considered normal and ongoing (as of 1985 conditions), such as plowing, harvesting, and minor drainage of upland areas to waters of the United States.
- Construction and maintenance of stock ponds and irrigation ditches.
- Maintenance of drainage ditches.

- Construction of temporary sedimentation basins in upland areas.
- Construction and maintenance of farm, forest, and mining roads in accordance with best management practices (BMPs).
- Other activities regulated by an approved program of BMPs authorized by CWA Section 208(b)(4).

Section 404 permits may be issued for only the least environmentally damaging practical alternative (i.e., authorization of a proposed discharge is prohibited if there is a practical alternative that would have fewer adverse effects and lacks other significant adverse consequences). Section 404 may apply to the proposed program if construction would occur within waters of the United States.

To the extent that the Corps undertakes erosion site repairs under the proposed program, no permit would be issued, but the substantive requirements of Section 404 will be met as necessary through NEPA compliance.

(Note: Section 404 does not apply to authorities under the Rivers and Harbors Appropriation Act of 1899, except that some of the same waters may be regulated under both statutes; the Corps typically combines the permit requirements of Rivers and Harbors Appropriations Act Section 10 and CWA Section 404 into one permitting process.)

C.1.10.2 Section 402: Permits for Discharge to Surface Waters

CWA Section 402 regulates discharges to surface waters through the National Pollutant Discharge Elimination Systems (NPDES) program, administered by the EPA. In California, the State Water Board is authorized by the EPA to oversee the NPDES program through the RWQCBs (see related discussion under Porter-Cologne Water Quality Control Act). The NPDES program provides for both general permits (those that cover a number of similar or related activities) and individual permits.

Construction Activities

Most construction activities that disturb 1 acre of land or more are required to obtain coverage under the NPDES General Permit for Construction Activities (General Construction Permit), which requires the applicant to file a notice of intent (NOI) to discharge stormwater and to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP includes a site map and a description of proposed construction activities, along with a demonstration of compliance with relevant local ordinances and regulations, and an overview of the BMPs that would be implemented to prevent soil erosion and discharge of other construction-related pollutants that could contaminate nearby water resources. Permittees are further required to conduct annual monitoring and reporting to ensure that BMPs are correctly implemented and effective in controlling the discharge of stormwater-related pollutants.

The Corps will require the contractor to submit a NOI to the RWQCB before construction activities begin and will develop and implement a SWPPP and a Spill Prevention Control and Countermeasure Plan (SPCCP). The SWPPP will include an erosion control and restoration plan, a water quality monitoring plan, a hazardous materials management plan, BMPs for discharges, and post-construction BMPs. The SPCCP will include measures to prevent, control, and remediate hazardous material spills. The BMPs will be maintained until all areas disturbed during construction have been adequately revegetated and stabilized.

C.1.10.3 Section 401: Water Quality Certification

Under CWA Section 401 (33 USC 1341) applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect the quality of the state's waters (including projects that require federal agency approval, such as the issuance of a Section 404 permit) also must comply with Section 401. Because the proposed program constitutes a federal action that may affect state water quality, a request for certification under Section 401 will be submitted. Any Section 401 permits issued for project-level actions may also include conditions or requirements pertaining to effects on designated beneficial uses of waters within project areas.

C.1.10.4 Section 303: Impaired Waters

California adopts water quality standards to protect beneficial uses of state waters as required by CWA Section 303 and the Porter-Cologne Water Quality Control Act. Under CWA Section 303(d), states, territories, and authorized tribes are required to develop a list of water quality–limited segments. In California, the State Water Board develops the list of water quality–limited segments and the EPA approves each state's list. Waters on the list do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. Section 303(d) also establishes the total maximum daily load process to guide the application of state water quality standards.

C.1.11 River and Harbors Appropriation Act of 1899

The River and Harbors Appropriation Act of 1899 addresses activities that involve the construction of dams, bridges, dikes, etc., across any navigable water, or placing obstructions to navigation outside established federal lines and excavating from or depositing material in such waters, require permits from the Corps. Navigable waters are defined in 33 CFR Section 329.4 as:

> [T]hose waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the water body, and is not extinguished by later actions or events which impede or destroy navigable capacity.

Navigable waters of the U.S. in the project area that are subject to the requirements of the River and Harbors Appropriation Act include Sacramento River, American River, Feather River, the Sacramento River Deep Water Ship Channel, and all waterways in the Sacramento–San Joaquin drainage basin affected by tidal action (U.S. Army Corps of Engineers 2012). Sections of the River and Harbors Act applicable to the proposed program are listed below.

C.1.11.1 Section 9

Section 9 (33 USC Section 401) prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the water body lie wholly within the limits of a single state, the structure may be built under authority of the legislature of that state, if the location and plans or any modification thereof are approved by the Chief of Engineers and by the Secretary of the Army.

C.1.11.2 Section 10

Section 10 (33 USC Section 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters, is unlawful unless the work has been authorized by the Chief of Engineers.

Rivers and Harbors Act Section 10 requires authorization from the Corps for the construction of any structure in or over any navigable waters of the United States. Tidal waterways within the Sacramento/San Joaquin River Delta are considered navigable waters. The law applies to any dredging, excavation, filling, or other modification of a navigable water of the United States, as well as to all structures, including bank protection (e.g., riprap) and mooring structures, such as those in a marina. Structures or work outside the limits defined for navigable waters of the United States require a Section 10 permit if the structure or work would affect the course, location, or condition of the water body.

C.1.11.3 Section 13

Section 13 (33 USC Section 407) provides that the Secretary of the Army, whenever the Chief of Engineers determines that anchorage and navigation would not be injured thereby, may permit the discharge of refuse into navigable waters. In the absence of a permit, such discharge of refuse is prohibited. While the prohibition of this section, known as the Refuse Act, is still in effect, the permit authority of the Secretary of the Army has been superseded by the permit authority provided the Administrator, EPA, and the states under Sections 402 and 405 of the CWA, respectively.

The proposed program would not affect waters of the United States under CWA Section 404 or navigable waters under the Rivers and Harbors Appropriation Act.

C.1.11.4 Section 14

Under Section 14 (33 USC Section 408) temporary or permanent alteration, occupation, or use of any public works, including levees, for any purpose is only allowable with the permission of the Secretary of the Army. Under the terms of 33 USC Section 408, any proposed levee modification requires a determination by the secretary that the proposed alteration, permanent occupation, or use of a federal project is not injurious to the public interest and will not impair the usefulness of the levee. The authority to make this determination and approve modifications to federal works under 33 USC Section 408 has been delegated to the chief of engineers for the Corps. 33 USC Section 408 also authorizes the Corps' district engineer to approve relatively minor, low impact alterations/modifications related to the operation and maintenance responsibilities of the nonfederal sponsors, provided these alterations and modifications do not adversely affect the functioning of the project and flood fighting activities.

C.1.12 National Flood Insurance Program

The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 were intended to reduce the need for large, publicly funded flood control structures and disaster relief by restricting development on floodplains. The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) to subsidize flood insurance to communities that comply with FEMA regulations limiting development in floodplains. FEMA issues Flood Insurance Rate Maps (FIRMs) for communities participating in the NFIP. These maps delineate flood hazard zones in the community. These maps are designed for flood insurance purposes only and do not necessarily show all areas subject to flooding. The maps designate lands likely to be inundated during a 100-year storm event and elevations of the base flood. They also depict areas between the limits affected by 100-year and 500-year events and areas of minimal flooding. These maps often are used to establish building pad elevations to protect new development from flooding effects.

C.1.12.1 Requirements for Federal Emergency Management Agency Certification

For guidance on floodplain management and floodplain hazard identification, communities turn to FEMA guidelines, as defined in CFR Title 44, Parts 59 through 77. In order for a levee to be recognized by FEMA under the NFIP, the community must provide evidence demonstrating that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood (1% or 100-year flood) exists. These specific requirements are outlined in 44 CFR Part 65.10, Mapping of Areas Protected by Levee Systems, and are summarized below.

- **Levee Height**—Riverine levees must provide a minimum freeboard (the height of the top of a levee above a given level of water in a river) of 3 feet above the water-surface level of the base flood. An additional 1 foot above the minimum is required within 100 feet of either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional ½ foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, also is required.
- **Closures**—All openings must be provided with closure devices that are structural parts of the system during operation and designed according to sound engineering practice.
- **Embankment Protection**—Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability.
- **Embankment and Foundation Stability**—Engineering analyses that evaluate levee embankment stability must be submitted to FEMA. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability.

- **Settlement**—Engineering analyses must be submitted that assess the potential and magnitude of future losses of levee height as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards.
- **Interior Drainage**—An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than 1 foot, the water-surface elevation(s) of the base flood.
- **Operation Plans**—For a levee system to be recognized, a formal plan of operation must be provided to FEMA. All closure devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operational manual, a copy of which must be provided to FEMA.
- **Maintenance Plans**—For levee systems to be recognized as providing protection from the base flood, they must be maintained in accordance with an officially adopted maintenance plan. All maintenance activities must be under the jurisdiction of a federal or state agency, an agency created by federal or state law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance. The plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.

C.1.13 Code of Federal Regulations, Title 40, Part 131, Water Quality Standards

This regulation establishes requirements for water quality, including activities related to in-channel construction, dredging, and long-term effects resulting in sediment transport and scouring.

C.1.14 U.S. Army Corps of Engineers Levee Design Criteria

A majority of the levees included in the program area are federally authorized and fall within the jurisdiction of the Corps. The levee evaluation for the program area conforms to the engineering criteria established by the Corps for the assessment and repair of levees. The Corps technical criteria in the following bullet list should be used as guidance unless noted otherwise.

- Overtopping of Flood Control Levees and Floodwalls (Publication ETL 1110-2-299, August 22, 1986).
- Structural Design of Closure Structures for Local Flood Protection Projects (Publication EM 1110-2-2705, March 31, 1994).
- Design of Coastal Revetments, Seawalls, and Bulkheads (Publication EM 1110-2-1614, June 30, 1995).
- Design Guidance on Levees (Publication ETL 1110-2-555, November 30, 1997).
- Conduits, Culverts, and Pipes (Publication EM 1110-2-2902, March 31, 1998).
- Guidelines on Ground Improvement for Structures and Facilities (Publication ETL 1110-1-185, February 1, 1999).

- Engineering and Design for Civil Works Projects (Publication ER 1110-2-1150, August 31, 1999).
- Design and Construction of Levees (Publication EM 1110-2-1913, April 30, 2000).
- Geotechnical Investigations (Publication EM 1110-1-1804, January 1, 2001).
- The Corps CESPK Levee Task Force, Recommendations for Seepage Design Criteria, Evaluation and Design Practices (2003).
- Slope Stability (Publication EM 1110-2-1902, October 31, 2003).
- Geotechnical Levee Practice (Publication SOP EDG-03, June 28, 2004).
- Engineering and Design—Design Guidance for Levee Underseepage (Publication ETL 1110-2-569, May 1, 2005).
- Quality Management (Publication ER 1110-1-12, September 30, 2006).
- Engineering Technical Letter (ETL) 1110-2-583 Guidelines For Landscape Planting And Vegetation Management At Levees, Floodwalls, Embankment Dams, and Appurtenant Structures.

C.1.15 Executive Order 11988 (Floodplain Management)

EO 11988, signed May 24, 1977, addresses floodplain issues related to public safety, conservation, and economics. EO 11988 requires federal agencies to prepare floodplain assessments for proposed actions located in or affecting floodplains. If an agency proposes to conduct an action in a floodplain, it must to the degree possible avoid short- and long-term adverse effects associated with the occupancy and the modification of a floodplain and avoid direct and indirect support of floodplain development whenever there is a reasonable and feasible alternative. If the only reasonable and feasible alternative involves siting in a floodplain, the agency must minimize potential harm to or in the floodplain and explain why the action is proposed in the floodplain.

C.1.16 Flood Control and Coastal Emergency Act

The Flood Control and Coastal Emergency Act (Public Law [PL] 84-99) was enacted for emergency management activities. Under PL 84-99, the Corps has authority to undertake activities including disaster preparedness, advance measures, emergency operations, rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storms, and provisions of emergency water due to drought or contaminated source. PL 84-99 establishes an emergency fund for emergency response preparations for natural disasters, for flood fighting and rescue operations, and for rehabilitation of flood control and hurricane protection structures. Preparedness activities include coordination, planning, training, and conduct of response exercises with local, state, and federal agencies. The Corps is also allowed to supplement state and local entities in flood fighting in urban and other non-agricultural areas. Under PL 84-99, an eligible flood protection system can be rehabilitated if damaged by a flood event. The Corps is responsible for coordinating levee repair issues with interested federal, state, and local agencies following natural disaster events where flood control works are damaged.

C.1.17 Wild and Scenic Rivers Preservation Act

The Wild and Scenic Rivers Act (16 USC Sections 1271 et seq.) establishes a National Wild and Scenic Rivers System for the protection of rivers with important scenic, recreational, fish and wildlife, and other values. Rivers are classified as wild, scenic, or recreational. The act designates specific rivers for inclusion in the System and prescribes the methods and standards by which additional rivers may be added.

The Lower American River, from Nimbus Dam to its junction with the Sacramento River (Region 1b of the program area), was designated in January 1981 by Secretarial Designation as a recreational river under the federal Wild and Scenic Rivers Act (U.S. Fish and Wildlife Service 2007). The American River Parkway Plan serves as the management plan that satisfies the requirements of the Wild and Scenic Rivers Act (Sec. 1274b-2). Any erosion sites located along the lower American River would be subject to the conditions of this act. The National Parks Service, working under the United States Department of the Interior, has the jurisdiction for determination of whether any violations occur.

C.1.18 Clean Air Act and National Ambient Air Quality Standards

The federal Clean Air Act (CAA) (42 USC Sections 7401 et seq.) enacted in 1963 and amended several times thereafter (including the 1990 amendments), establishes the framework for modern air pollution control. The CAA directs the EPA to establish ambient air standards for six pollutants: ozone, carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM), and sulfur dioxide (SO_2). The standards are divided into primary and secondary standards. Primary standards are designed to protect human health, including the health of “sensitive” populations such as asthmatics, children, and the elderly, within an adequate margin of safety. Secondary standards are designed to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Federal standards for a variety of pollutants are summarized in Table 8-2 in Chapter 8, Air Quality and Climate Change.

The primary legislation that governs federal air quality regulations is the CAA Amendments of 1990, which delegate primary responsibility for clean air to the EPA. The EPA develops rules and regulations to preserve and improve air quality, as well as delegating specific responsibilities to state and local agencies.

Areas that do not meet the federal ambient air quality standards are called “nonattainment” areas. For these nonattainment areas, the CAA requires states to develop and adopt State Implementation Plans (SIPs), which are air quality plans showing how air quality standards will be attained. The SIP, which is reviewed and approved by the EPA, must demonstrate how the federal standards will be achieved. Failing to submit a plan or secure approval could lead to denial of federal funding and permits for such improvements as highway construction and sewage treatment plants. In California, the EPA has delegated authority to prepare SIPs to the California Air Resource Board (ARB), which, in turn, has delegated that authority to individual air districts. In cases where the SIP is submitted by the state but fails to demonstrate achievement of the standards, the EPA is directed to prepare a federal implementation plan.

C.1.18.1 Federal General Conformity Requirements

The CAA Amendments of 1990 require that all federally funded projects come from a plan or program that conforms to the appropriate SIP. Federal actions are subject to either the Transportation Conformity Rule (40 CFR Parts 5, 51, and 93), which applies to federal highway or transit projects, or the General Conformity Rule (40 CFR Parts 5, 51, and 93), which applies to all other federal actions. Because the proposed program is not a federal highway or transit project, it is subject to the General Conformity Rule.

The purpose of the General Conformity Rule is to ensure that federal actions conform to applicable SIPs so that they do not interfere with strategies employed to attain the National Ambient Air Quality Standards (NAAQS). The rule applies to federal actions 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 actions, with these three exceptions.

- 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.
- Certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a proposed federal action's total direct and indirect emissions fail to meet any of the following two conditions.

- Emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are below the *de minimis* levels indicated in Tables B-2 and B-3.

If the above condition is not met, then a general conformity determination must be performed to demonstrate that total direct and indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform to the applicable SIP.

However, if the condition is met, then the requirements for general conformity do not apply, as individual construction projects under the proposed program are presumed to conform to the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required.

Table C-2. Federal *de minimis* Threshold Levels for Criteria Pollutants in Nonattainment Areas

Pollutant	Emission Rate (Tons per Year)
Ozone (ROG/VOC or NO_X)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
Other ozone nonattainment areas outside an ozone transport region[a]	100
Other ozone nonattainment areas inside an ozone transport region[a]	
ROG/VOC	50
NO_X	100
CO: All nonattainment areas	100
SO_2 or NO_2: All nonattainment areas	100
PM10	
Moderate nonattainment areas	100
Serious nonattainment areas	70
PM2.5	
Direct emissions	100
SO_2	100
NO_X (unless determined not to be a significant precursor)	100
ROG/VOC or ammonia (if determined to be significant precursors)	100
Pb: All nonattainment areas	25

Source: 40 CFR Part 93.153.

Note: *de minimis* threshold levels for conformity applicability analysis.

[a] Ozone Transport Region is comprised of the States of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, the Consolidated Metropolitan Statistical Area that includes the District of Columbia and northern Virginia (Section 184 of the Clean Air Act).

CO = carbon monoxide
NO_2 = nitrogen dioxide
NO_X = nitrogen oxide
Pb = lead
PM10 = large particulate matter
PM2.5 = fine particulate matter
ROG = reactive organic gas
SO_2 = sulfur dioxide
VOC = volatile organic compound

Table C-3. Federal *de minimis* Threshold Levels for Criteria Pollutants in Maintenance Areas

Pollutant	Emission Rate (Tons per Year)
Ozone (NO_X, SO_2 or NO_2)	
All maintenance areas	100
Ozone (ROG/VOC)	
Maintenance areas inside an ozone transport region[a]	50
Maintenance areas outside an ozone transport region[a]	100
CO: All maintenance areas	100
PM10: All maintenance areas	100
PM2.5	
Direct emissions	100
SO_2	100
NO_X (unless determined not to be a significant precursor)	100
ROG/VOC or ammonia (if determined to be significant precursors)	100
Pb: All maintenance areas	25

Source: 40 CFR Part 93.153.

Note: *de minimis* threshold levels for conformity applicability analysis.

[a] Ozone Transport Region is comprised of the States of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, the Consolidated Metropolitan Statistical Area that includes the District of Columbia and northern Virginia (Section 184 of the Clean Air Act).

CO = carbon monoxide
NO_2 = nitrogen dioxide
NO_X = nitrogen oxide
Pb = lead
PM10 = large particulate matter
PM2.5 = fine particulate matter
ROG = reactive organic gas
SO_2 = sulfur dioxide
VOC = volatile organic compound

One or more counties in the program area is classified as a federal nonattainment or maintenance area with respect to ozone, CO, PM10, and PM2.5~~The following counties in the program area are classified as federal nonattainment areas for the 8-hour ozone standard: Butte, Placer, Sacramento, Solano, Sutter, and Yolo. Sacramento County is classified as a nonattainment area for PM10. The following counties in the program area are classified as federal nonattainment areas for the PM2.5 standard: Butte, Placer, Sutter, Sacramento, Solano, Yolo, and Yuba. In addition, the following counties are designated as federal maintenance areas for CO: Butte, Placer, Sacramento, Solano, and Yolo~~. Consequently, to fulfill general conformity requirements, an analysis must be undertaken to identify whether the proposed program's total emissions of ozone, PM10, PM2.5, and CO, and their precursors, ~~are~~ would be below the appropriate *de minimis* levels indicated in Table C-4.

Table C-4. Program Area Federal *de minimis* Threshold Designations

County	Pollutant	Nonattainment	Maintenance	Applicable Threshold (Tons per Year)
Butte	Ozone	~~Severe[a]~~Marginal (P)	—	~~25~~100
	CO	—	Moderate	100
	PM10	—	—	N/A
	PM2.5	~~Nonattainment~~Moderate (P)	—	100
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Colusa	Ozone	—	—	N/A
	CO	—	—	N/A
	PM10	—	—	N/A
	PM2.5	—	—	N/A
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Glenn	Ozone	—	—	N/A
	CO	—	—	N/A
	PM10	—	—	N/A
	PM2.5	—	—	N/A
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Placer	Ozone	Severe (P)	—	25
	CO	—	Moderate (P)	100
	PM10	—	—	N/A
	PM2.5	~~Nonattainment~~Moderate (P)	—	100
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Sacramento	Ozone	Severe (P)	—	25
	CO	—	Moderate (P)	100
	PM10	—~~Moderate~~	—	N/A~~100~~
	PM2.5	~~Nonattainment~~Moderate	—	100~~100~~
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Solano	Ozone	~~Severe~~Marginal (P)	—	~~25~~100
	CO	—	Moderate (P)	100
	PM10	—	—	N/A

County	Pollutant	Nonattainment	Maintenance	Applicable Threshold (Tons per Year)
	PM2.5	~~Nonattainment~~Moderate (P)	—	100
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Sutter	Ozone	Severe (P)	—	25
	CO	—	—	N/A
	PM10	—	—	N/A
	PM2.5	—~~Nonattainment~~	Moderate (P)~~—~~	100
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Tehama	Ozone	—	—	N/A
	CO	—	—	N/A
	PM10	—	—	N/A
	PM2.5	—	—	N/A
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Yolo	Ozone	Severe	—	25
	CO	—	Moderate (P)	100
	PM10	—	—	N/A
	PM2.5	Moderate (P)~~Nonattainment~~	—	100
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A
Yuba	Ozone	—	—	N/A
	CO	—	—	N/A
	PM10	—	—	N/A
	PM2.5	—~~Nonattainment~~	Moderate (P)~~—~~	100
	SO_2	—	—	N/A
	NO_2	—	—	N/A
	Pb	—	—	N/A

Source: Adapted from: California Air Resources Board ~~2012~~2016; U.S. Environmental Protection Agency ~~2012~~2016

Notes: N/A = Not Available/Applicable

— = Area is unclassified/attainment

(P) = Designation applies to a portion of the county.

~~[a] On June 8, 2007, the United States Court of Appeals vacated the Subpart 1 portion of the Phase 1 Rule. The Subpart 1 areas in the Greenbook are listed as "Former Subpart 1" until reclassification of the areas is finalized. Proposed reclassifications were published on January 16, 2009 (74 FR 2936).~~

CO = carbon monoxide

NO_2 = nitrogen dioxide

NO_X	=	nitrogen oxide
Pb	=	lead
PM10	=	large particulate matter
PM2.5	=	fine particulate matter
ROG	=	reactive organic gas
SO_2	=	sulfur dioxide
VOC	=	volatile organic compound

C.1.19 Federal Action on Greenhouse Gas Emissions

C.1.19.1 Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, EPA released its final Greenhouse Gas Reporting Rule (Reporting Rule). The Reporting Rule is a response to the fiscal year 2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110-161), which required EPA to develop "… mandatory reporting of greenhouse gasses above appropriate thresholds in all sectors of the economy…." The Reporting Rule would apply to most entities that emit 25,000 metric tons (MT) of CO_2 equivalents (CO_2e) or more per year. Starting in 2010, facility owners are required to submit an annual greenhouse gas (GHG) emissions report with detailed calculations of facility GHG emissions. The Reporting Rule also would mandate recordkeeping and administrative requirements in order for EPA to verify annual GHG emissions reports.

C.1.19.2 President's Council on Environmental Quality ~~Draft~~ NEPA Guidance

On February 18, 2010, CEQ released draft guidance regarding the consideration of GHG in NEPA documents for federal actions. CEQ issued revised draft guidance in December 2014 and final guidance in August 2016 (White House Council on Environmental Quality 2016). The 2016 guidance contains the following provisions.

- Encourages agencies to draw from their experience and expertise to determine the appropriate level (broad, programmatic, or project- or site-specific) and type (quantitative or qualitative) of analysis required to comply with NEPA.
- Discusses methods to appropriately analyze reasonably foreseeable direct, indirect, and cumulative GHG emissions and climate effects.
- Recommends that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action.
- Recommends that agencies use projected GHG emissions (to include, where applicable, carbon sequestration implications associated with the proposed agency action) as a proxy for assessing potential climate change effects when preparing a NEPA analysis for a proposed agency action.
- Counsels agencies to use the information developed during the NEPA review to consider alternatives that are more resilient to the effects of a changing climate~~On February 18, 2010, CEQ issued draft NEPA guidance on the consideration of the effects of climate change and GHG emissions. This guidance advises federal agencies that they should consider opportunities to reduce GHG emissions caused by federal actions, adapt their actions to climate change impacts throughout the NEPA process, and address these issues in their agency NEPA procedures. Where applicable, the scope of the NEPA analysis should cover the GHG emissions effects of a~~

~~proposed action and alternative actions and the relationship of climate change effects on a proposed action or alternatives~~.

~~The draft guidance suggests that the effects of projects directly emitting GHGs in excess of 25,000 tons annually be considered in a qualitative and quantitative manner. The CEQ does not propose this reference as a threshold for determining significance, but as "a minimum standard for reporting emissions under the CAA." The draft guidance also recommends that the cumulative effects of climate change on the proposed project be evaluated. The draft guidance is still undergoing public comments and will not be effective until issued in final form (Council on Environmental Quality 2010).~~

C.1.20 The Farmland Protection Policy Act

The Farmland Protection Policy Act (FPPA) of 1984 requires federal agencies to consider how their activities or responsibilities may affect farmland, in particular financing or assisting construction of improvement projects and acquiring, managing, or disposing of federal land and facilities. To comply with the provisions of the FPPA, the federal agency responsible for NEPA compliance must consult with the Department of Agriculture's Natural Resources Conservation Service (NRCS) and complete a Land Evaluation and Site Assessment (LESA) for each affected site or area. The federal lead agency is also responsible for coordinating completion of the Farmland Conversion Impact Rating Form (Form AD-1006) with the NRCS as part of the LESA process.

LESA is a point-based approach that rates the relative importance of agricultural land resources based on specific measurable factors (California Department of Conservation 2007). Under the LESA system, proposed project sites receive scores based on several criteria, including soil quality and existing land use. The resulting score is an indicator of the quantitative impact that the proposed action or program may have on important farmland. The lead federal agency may consider this information when deciding on implementation or modification of certain actions or programs.

C.1.21 Farmland Protection Policy Act and Memoranda on Farmland Preservation

The Farmland Protection Policy Act (FPPA) (7 USC Sections 4201 et seq.) and the CEQ policy Memoranda on Farmland Preservation dated August 11, 1980 require federal agencies to include assessments of the potential effects of a proposed project on prime and unique farmland. Federal agencies must determine these effects before taking any action that could result in converting designated prime or unique farmland for nonagricultural purposes. If implementing a project would adversely affect farmland preservation, the agencies must consider alternative actions to lessen those effects. Federal agencies also must ensure that their programs, to the extent feasible, are compatible with state, local, and private programs to protect farmland. NRCS is the federal agency responsible for ensuring that these laws and policies are followed.

C.1.22 Uniform Relocation Assistance and Real Property Acquisition Policies Act

Federal, state, local government agencies, and others receiving federal financial assistance for public programs and projects that require the acquisition of real property, must comply with the policies and provisions set forth in the Uniform Relocation Assistance and Real Property Acquisition Policies

Act of 1970, as amended in 1987, (Uniform Relocation Act) (42 USC Sections 4601 et seq.), and implementing regulations (49 CFR Part 24). Relocation advisory services, moving costs reimbursement, replacement housing, and reimbursement for related expenses and rights of appeal are provided for in the Uniform Relocation Act.

Property acquisition and relocation services, compensation for living expenses for temporarily relocated residents, and negotiations regarding any compensation for temporary loss of business would be accomplished in accordance with the Uniform Act and California Government Code Section 7267 et seq.

In order to implement certain program alternatives, the Corps may need to acquire real property and provide relocation services, as required by the Uniform Relocation Act.

C.1.23 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) (42 USC Sections 9601 et seq.) was passed to facilitate the cleanup of the nation's toxic waste sites (40 CFR Part 302). CERCLA mandates hazardous materials release requirements and identifies hazardous substances, reportable quantities (RQs), and notification requirements. The National Response Center must be notified of an accidental release of a hazardous substance in excess of an RQ. CERCLA-listed hazardous substances and RQs are listed in 40 CFR Part 302.4. In 1986, CERCLA was amended by the Superfund Amendment and Reauthorization Act Title III (Public Law [Pub. L.] No. 99-499, 100 Statutes [Stat.] 1613 (1986)) (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of the cleanup, even if the material was dumped illegally when the property was under different ownership.

C.1.24 Environmental Protection Agency

EPA is the principal federal regulatory agency responsible for the safe use and handling of hazardous materials.

C.1.25 Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act planning requirements, a list of Extremely Hazardous Substances, threshold planning quantities, and emergency response planning requirements are codified in 40 CFR Part 355. The Chemical Accident Prevention Provisions (40 CFR Part 68) identifies regulated substances, threshold quantities (TQs), and requirements for preventing accidental releases of these substances. A risk management plan is required for any processes involving regulated substances in excess of their respective TQ.

C.1.26 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) address the handling, storage, and disposal of hazardous and nonhazardous wastes (42 USC Sections 6901 et seq.), and its implementing regulations govern the generation, transportation, treatment, storage, and disposal of hazardous waste through a comprehensive management system under (40 CFR Parts 260–272). These regulations also list the characteristics of hazardous wastes, including ignitability, corrosivity, reactivity, and toxicity. Subtitle D of these parts grants authority for regulating nonhazardous waste to the state.

C.1.27 Federal Aviation Administration, 14 CFR Part 139.337

The Federal Aviation Administration (FAA) rule pertaining to certification of airports was amended in February 2004 and effective in June 2004. 14 CFR Part 139.337 addresses wildlife hazard management. 14 CFR Part 139.337 (b) requires airports that provide scheduled commercial air service to conduct a wildlife hazard assessment if any of the following events occur on or near the airport.

- An air carrier aircraft experiences multiple wildlife strikes.
- An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component.
- An air carrier aircraft experiences an engine ingestion of wildlife.
- Wildlife of a size, or in numbers, capable of causing an event described in paragraphs (b)(1), (b)(2), or (b)(3) of this section is observed to have access to any airport flight pattern or aircraft movement area.

The wildlife hazard assessment must include information on observed wildlife species, their numbers, locations, local movements, and daily and seasonal occurrences, as well as wildlife attractants on or near the airport. The study must also analyze the events that prompted it and the overall wildlife hazard to air carriers. As required by 14 CFR Part 139.337(d), the wildlife hazard assessment is to be used by the FAA, in conjunction with other relevant information, to determine if there is a need for a Wildlife Hazard Management Plan (WHMP). The WHMP, which is submitted to and approved by the FAA, must provide "…measures to alleviate or eliminate wildlife hazards to air carrier operations" by outlining necessary habitat modifications and wildlife hazards to air carrier operations" by outlining necessary habitat modifications and wildlife control procedures and identifying those responsible for implementing the plan (Part 139.337(f)(1)).

C.1.28 Federal Aviation Administration Advisory Circular No. 150/5200-33B: Hazardous Wildlife Attractants on or Near Airports

FAA Advisory Circulator (AC) 150/5200-33B provides direction on where public-use airports should allow land uses that have potential to attract hazardous wildlife. The AC cautions that wildlife use of areas in an airport's approach or departure airspace, aircraft movement areas, loading ramps, or aircraft parking areas could cause conditions hazardous to aircraft safety. FAA recommends a distance of 10,000 feet separating wildlife attractants and aircraft movement areas. The FAA definition of wildlife attractants in AC 150/5200-33B includes human-made or natural areas, such as poorly drained areas, retention ponds, agricultural activities, and wetlands. AC 150/5200-33B recommends against the use of airport property for agricultural production within the separation distance of 10,000 feet unless the income from agricultural crops is necessary for the viability of the airport. In addition, the FAA recommends a distance of 5 miles between the farthest edge of the airport's air operations area and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.

C.1.29 Worker Safety Requirements

The U.S. Department of Labor Occupational Safety and Health Administration (OSHA) is responsible at the federal level for ensuring worker safety. OSHA sets federal standards for implementation of workplace training, exposure limits, and safety procedures for the handling of hazardous substances (as well as other hazards). OSHA also establishes criteria by which each state can implement its own health and safety program.

C.1.30 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) (16 USC Section 470f) requires that effects to historic properties, be taken into consideration in any federal undertaking. "Historic property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meet the NRHP criteria" [36 CFR Part 800.16(l)].

Implementing regulations at 36 CFR Part 800 outlines the process whereby federal agencies, in consultation with the State Historic Preservation Officer (SHPO) and other consulting parties, identify historic properties within the Area of Potential Effects (APE) of the proposed project and make a finding of effect. If the project is determined to have an adverse effect on historic properties, the federal agency is required to consult further with SHPO and the Advisory Council on Historic Preservation to develop methods to resolve the adverse effects. The Section 106 process has five basic steps.

1. Initiate the Section 106 process, including the identification of consulting parties, such as Native American tribes.
2. Identify the APE, in consultation with the SHPO and other consulting parties.
3. Assess the effects of the undertaking on historic properties within the APE.
4. If historic properties may be subject to an adverse effect, the federal agency, the SHPO, and any other consulting parties (including Native American tribes and the ACHP) continue consultation to seek ways to avoid, minimize, or mitigate the adverse effect. An Memorandum of Agreement (MOA) is usually developed to document the measures agreed upon to resolve adverse effects. Alternatively, the federal agency may prepare and execute a Programmatic Agreement (PA) with the aforementioned parties to comply with 36 CFR Part 800, particularly in the context of complex undertakings that entail years of implementation actions or where the undertaking's effects on historic properties cannot be well characterized during the planning phase.
5. Proceed in accordance with the terms of the MOA or PA.

C.1.31 American Indian Religious Freedom Act

The American Indian Religious Freedom Act of 1978 (Pub. L. No. 95-431, 92 Stat. 469 (1978), codified at 42 USC Section 1996) is also applicable to federal undertakings. This act established "the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites" (Pub. L. 95-431).

It is not anticipated that actions related to the proposed program will conflict with the American Indian Religious Freedom Act. As discussed in Chapter 19, Cultural Resources, the Corps and the California Department of Water Resources (DWR) have consulted with the Native American Heritage Commission and the Sacred Lands database was negative for findings in the project areas.

C.1.32 Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (104 Stat. 3048-3058) would apply if human remains of Native American origin are discovered on federal land during proposed program implementation. NAGPRA requires federal agencies and federally assisted museums to return "Native American cultural items" to the federally recognized Native American tribes or Native Hawaiian groups with which they are associated. Regulations (43 CFR Part 10) stipulate the following procedures be followed.

- If Native American human are discovered, the following provisions would be followed to comply with regulations:
- Notify, in writing, the responsible federal agency.
- Cease activity in the area of discovery and protect the human remains.
- Upon notification that human remains have been discovered on federal land, the responsible federal agencies (National Park Service and Presidio Trust) should take the following actions:
- Certify receipt of the notification.
- Take steps to secure and protect the remains.
- Notify the Native American tribes or tribes likely to be culturally affiliated with the discovered human remains within 1 working day.
- Initiate consultation with the Native American tribe or tribes in accordance with regulations described in 43 CFR Part 10(b)(10.5).

C.1.33 Programmatic Agreement and Historic Property Treatment Plan

The Corps and DWR determined that developing a PA for the program and an attending Historic Properties Treatment Plan (HPTP) is the most effective way to accommodate program requirements with compliance with NEPA, Section 106, and the California Environmental Quality Act (CEQA). The Corps is the lead federal agency and the DWR is the lead CEQA agency. Corps, SHPO, and the Central Valley Flood Protection Board (CVFPB) comprise the signatories to the PA, which is provided as Appendix F.

The PA describes a phased identification and evaluation process that defers portions of the cultural resources studies until after the environmental document is completed in accordance with 36 CFR Part 800.4(b)(2). The PA called for an historic properties treatment plan, which has since been prepared and finalized. The purpose of the HPTP is to direct cultural resource management activities during the life of the proposed program. ICF International and its subconsultant team conducted a pedestrian survey of 16 of the 106 critical erosion sites in the program area, a survey for submerged cultural resources, and assisted with Native American outreach. The HPTP documents the methods and results of these studies and outlines a phased approach to historic properties identification and management. It also describes how monitoring would be conducted and will include stipulations to be followed in the event of unanticipated discoveries during program implementation. A copy of the HPTP is available upon request.

C.1.34 Executive Order 12898

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, (59 Federal Register 7629) was signed February 11, 1994, following a 1992 report by EPA indicating that "[r]acial minority and low-income populations experience higher than average exposures to selected air pollutants, hazardous waste facilities, and other forms of environmental pollution." EO 12898 requires the federal agencies named in the order to identify and address disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, using all the statutory and regulatory authorities that already exist. The federal agency must ensure that its activities do not discriminate against persons or groups on the basis of race, national origin, or income.

EO 12898 requires each federal agency to make achieving environmental justice a part of its mission. The President specifically recognized the importance of using the procedures under NEPA to identify and address environmental justice concerns.

The EPA defines "environmental justice" as follows:

- Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.
- "Fair treatment" means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from the execution of federal, state, local, or tribal programs and policies.
- "Meaningful involvement" means that (1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health, (2) the public's contribution can influence the regulatory agency's decision, (3) concerns of all participants involved will be considered in the decision making process, and (4) decision makers must seek out and facilitate the involvement of those potentially affected (U.S. Environmental Protection Agency 2009).

The Corps has not issued specific policy or guidance related to environmental justice; however, its Civil Works Environmental Desk Reference (updated in 2002) serves as a desk top reference on environmental statutes and environmental executive policy for the Corps' Civil Works personnel. This desk reference contains summary profiles of environmental laws, and full text of a number of environmental executive orders, including E.O. 12898 pertaining to environmental justice (U.S. Army Corps of Engineers 2002).

C.1.35 Title VI of the Civil Rights Act

Title VI of the Civil Rights Act of 1964, as amended, prohibits discrimination in federally assisted programs. The act stipulates that no person in the United States shall, on the ground of race, color, national origin age, sex, or disability, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. All federal programs and projects are subject to this act. The general procedures to be followed are set forth in 49 CFR Part 21 and 23 CFR Part 200.

C.2 State Plans, Policies and Regulations

C.2.1 California Environmental Quality Act

CEQA requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. CEQA imposes both procedural and substantive requirements. At a minimum, an initial review of the project and its environmental effects must be conducted. CEQA's primary objectives are listed below.

- Disclose to decision makers and the public the significant environmental effects of proposed activities.
- Identify ways to avoid or reduce environmental damage.
- Prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures.
- Disclose to the public reasons for agency approval of projects with significant environmental effects.
- Foster interagency coordination in the review of projects.
- Enhance public participation in the planning process.

Unless a project qualifies for an exemption, CEQA applies to all discretionary activities proposed to be carried out or approved by California public agencies, including state, regional, county, and local agencies. The act requires that public agencies comply with both procedural and substantive requirements. Procedural requirements include the preparation of the appropriate public notices (including notices of preparation), scoping documents, alternatives, environmental documents (including mitigation measures, mitigation monitoring plans, responses to comments, findings, and statements of overriding considerations), completion of agency consultation and State Clearinghouse review, and provisions for legal enforcement and citizen access to the courts.

CEQA's substantive provisions require agencies to address environmental impacts disclosed in an appropriate document. When avoiding or minimizing environmental damage is not feasible, CEQA requires agencies to prepare a written statement of overriding considerations when they decide to approve a project that would cause one or more significant effects on the environment that cannot be mitigated. CEQA establishes a series of action-forcing procedures to ensure that agencies accomplish the purposes of the law. In addition, under the direction of CEQA, the California Resources Agency has adopted regulations, known as the State CEQA Guidelines, which provide detailed procedures that agencies must follow to implement the law.

A project normally has a significant environmental impact on biological resources if it substantially affects a rare or endangered species or the habitat of that species; substantially interferes with the movement of resident or migratory fish or wildlife; or substantially diminishes habitat for fish, wildlife, or plants. The State CEQA Guidelines define rare, threatened, or endangered species as those listed under the ESA and the California Endangered Species Act (CESA), and any other species that meet the criteria of the resource agencies or local agencies (e.g., California Department of Fish and Wildlife-designated species of special concern). The guidelines state that the lead agency preparing an EIR must consult with and receive written findings from the California Department of Fish and Wildlife (DFW) concerning project impacts on species listed as endangered or threatened. The effects of a proposed project on these resources are important in determining whether the project has significant environmental impacts under CEQA.

CEQA requires that public agencies that finance or approve public or private projects must assess the effects of the project on cultural resources. According to guidance published by the Office of Historic Preservation, any "physical evidence of human activities over 45 years old may be recorded for purposes of inclusion in the [Office of Historic Preservation's] filing system" (Office of Historic Preservation 1995:2). CEQA requires that projects resulting in significant effects to significant cultural resources consider alternative plans or mitigation measures.

Section 21100(b)(5) of CEQA requires an EIR to discuss how a proposed project, if implemented, may induce growth and the impacts of that induced growth (see also State CEQA Guidelines Section 15126). CEQA requires an EIR to discuss specifically "the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment" (State CEQA Guidelines Section 15126.2[d]).

C.2.2 California Endangered Species Act

California implemented the CESA in 1984. The act prohibits the take of listed endangered and threatened species. Section 2090 of CESA requires state agencies to comply with endangered species protection and recovery and to promote conservation of these species. DFW administers the act and authorizes take through Section 2081 agreements (except for species designated as fully protected).

CESA is similar to the ESA but pertains only to state-listed endangered and threatened species. CESA requires state agencies to consult with DFW when preparing documents under CEQA to ensure that the actions of the state lead agency do not jeopardize the continued existence of listed species. CESA directs agencies to consult with DFW on projects or actions that could affect listed species, directs DFW to determine whether there would be jeopardy to listed species, and allows DFW to identify "reasonable and prudent alternatives" to the project consistent with conserving the species. Agencies can approve a project that affects a listed species if the agency determines that there are "overriding considerations"; however, the agencies are prohibited from approving projects that would cause the extinction of a listed species.

Mitigating impacts on state-listed species involves avoidance, minimization, and compensation (listed in order of preference). Unavoidable impacts on state-listed species typically are addressed in a detailed mitigation plan prepared in accordance with DFW guidelines. DFW exercises authority over mitigation projects involving state-listed species, including those resulting from CEQA mitigation requirements.

CESA prohibits the unauthorized "take" of plant and wildlife species state-listed as endangered or threatened. Pursuant to California Fish and Game Code (CFGC) 2018 et seq., DFW may authorize, by permit, take of endangered, threatened, and candidate species if the take is incidental to otherwise lawful activities. The impacts of the authorized take of the species must be minimized and fully mitigated, and adequate funding must be ensured to implement all minimization and mitigation measures. In addition, DFW may issue a permit for take only if it determines that issuance of the permit would not jeopardize the continued existence of the species ~~if there is an approved habitat management plan or management agreement that avoids or compensates for impacts on listed species~~.

C.2.3 California Native Plant Protection Act

The California Native Plant Protection Act (CNPPA) prohibits importation of rare and endangered plants into California, and take or sale of rare and endangered plants. CESA defers to the CNPPA, which ensures that state-listed plant species are protected when state agencies are involved in projects subject to CEQA. In this case, plants listed as rare under the CNPPA are not protected under CESA, but, rather, under CEQA.

C.2.4 California Fish and Game Code

~~DFW provides protection from take for a variety of species under the~~The ~~California Fish and Game Code (~~CFGC~~). The CFGC~~ provides protection from take for a variety of species, referred to as fully protected species. ~~Section 5515 prohibits take of fully protected fish species.~~ The CFGC defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." Except for take related to scientific research, all take of fully protected species is prohibited. Protection of fully protected species is described in Sections 3511, 4700, 5050, and 5515 of the CFGC. These statutes prohibit take or possession of fully protected species and do not provide for authorization of incidental take of fully protected species. DFW has informed non-federal agencies and private parties that their actions must avoid take of any fully protected species.

~~Section 3511 prohibits take of fully protected bird species, and Section 3503 prohibits the killing of birds or the destruction of bird nests. Section 3503.5 prohibits the killing of raptor species and destruction of raptor nests. Many bird species could potentially nest in the study area or vicinity. These nests would be protected under these sections of the Fish and Game Code. Fully protected mammals are protected under Section 4700.~~

~~Under CFGC Sections 1601–1607, DFW regulates projects that affect the flow, channel, or banks of rivers, streams, and lakes. Sections 1601 and 1603 require public agencies and private individuals, respectively, to notify and enter into a streambed or lakebed alteration agreement with DFW before beginning construction of a project that will divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake, or use materials from a streambed. Section 1601 contains additional prohibitions against the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake.~~

~~Sections 1601–1607 may apply to any work undertaken within the 100-year floodplain of any body of water or its tributaries, including intermittent stream channels. In general, however, these sections are construed as applying to work within the active floodplain and/or associated riparian habitat of a wash, stream, or lake that provides benefit to fish and wildlife. Sections 1601–1607 typically do not apply to drainages that lack a defined bed and banks, such as swales, or to very small bodies of water and wetlands, such as vernal pools.~~

~~DFW also protects streams, water bodies, and riparian corridors through the streambed alteration agreement (SAA) process under FGC 1601–1606. The CFGC stipulates that it is "unlawful to substantially divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake" without notifying DFW, incorporating necessary mitigation, and obtaining an SAA. DFW's jurisdiction typically extends to the top of banks and often includes the outer edge of riparian vegetation canopy cover.~~

C.2.5 DFW Streambed Alteration Agreement

DFW regulates work that would substantially affect resources associated with rivers, streams, and lakes in California, pursuant to CFGC Sections 1600 to 1607. Any action from a public project that substantially diverts or obstructs the natural flow or changes the bed, channel, or bank of any river, stream, or lake, or which uses material from a streambed must be previously authorized by DFW in a lake or streambed alteration agreement under Section 1602 of the CFGC. This requirement may in some cases apply to any work undertaken within the 100-year floodplain of a body of water or its tributaries, including intermittent streams and desert washes. As a general rule, however, it applies to any work done within the annual high-water mark of a wash, stream, or lake that contains or once contained fish and wildlife, or that supports or once supported riparian vegetation. ~~Under Sections 1600–1616 of the CFGC, DFW regulates activities that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed. In practice, DFW marks its jurisdictional limit at the top of bank, or the outer edge of the riparian vegetation, where present, and sometimes extends its jurisdiction to the edge of the 100-year floodplain.~~ However, because the proposed action is a federal project, obtaining a ~~S~~streambed ~~A~~alteration ~~A~~agreement from DFW is not necessary.

C.2.6 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne Act [Water Code Section 13000 et seq.]~~Sections 13000–14958~~) articulates with the CWA. It established the State Water Board and divided the state into nine regions, each overseen by an RWQCB. The State Water Board is the primary state agency responsible for protecting the quality of the state's surface water and groundwater supplies, although much of its daily implementation authority is delegated to the RWQCBs, which are responsible for implementing CWA Sections 402 and 303(d). Pursuant to the Porter-Cologne Act, the State Water Board and RWQCBs are required to formulate and adopt water quality control plans. ~~In general, the State Water Board manages both water rights and statewide regulation of water quality, while the RWQCBs focus exclusively on water quality within their regions.~~When the State Water Board adopts a water quality control plan, that plan supersedes regional water quality control plans for the same waters to the extent of any conflict (Water Code Section 13170).

C.2.6.1 Central Valley Regional Water Quality Control Board

~~The Porter-Cologne Act provides for the development and periodic review of water quality control plans (basin plans), which designate beneficial uses of California's major rivers and groundwater basins and establish narrative and numerical water quality objectives for those waters. Beneficial uses represent the services and qualities of a water body (i.e., the reasons why the water body is considered valuable), while water quality objectives represent the standards necessary to protect and support those beneficial uses.~~ The RWQCBs have primary responsibility for formulating and adopting water quality control plans (basin plans) for their respective regions, and these plans become effective following approval of the State Water Board. Basin plans designate beneficial uses (e.g., agricultural beneficial uses, wildlife and fish beneficial uses) to be protected, and water quality objectives to protect those uses, as well as a program of implementation for achieving the water quality objectives. The Central Valley RWQCB is responsible for implementing ~~its~~ the ~~W~~water ~~Q~~quality ~~C~~control ~~P~~plan (Basin Plan) for the Sacramento River and its tributaries. This Basin Plan covers the Sacramento and San Joaquin River Basins. Numerical and narrative criteria are contained in the Basin Plan for several key water quality constituents, including DO, water temperature, trace metals, turbidity, suspended material, pesticides, salinity, radioactivity, and other related constituents.

One method the Central Valley RWQCB uses to implement the Basin Plan water quality objectives~~criteria~~ is ~~by~~ issuing waste discharge requirements (WDRs). WDRs are issued to any entity that discharges to ~~a surface water body~~waters of the state and does not meet certain water quality criteria such as those related to sediment. The WDR/NPDES permit also serves as a federally required NPDES permit (under the CWA) and incorporates the requirements of other applicable regulations. Any WDRs issued for project-level actions may also include conditions or requirements pertaining to effects on designated beneficial uses of waters.

C.2.6.2 Basin Plans and Water Quality Objectives

The Porter-Cologne Water Quality Control Act provides for the development and periodic review of basin plans that designate beneficial uses of California's major rivers and groundwater basins and establish narrative and numerical water quality objectives for those waters. Basin plans are implemented primarily by using the NPDES permitting system to regulate waste discharges so that water quality objectives are met (see discussion of the NPDES system under CWA above). Basin plans are updated every 3 years and provide the technical basis for determining WDRs and taking enforcement actions. The Central Valley RWQCB Basin Plan was last updated in 2011 (California Regional Water Quality Control Board 2011).

C.2.6.3 Water Quality Objectives by Region

The RWQCBs have set water quality objectives for all surface waters in their respective regions (including the Sacramento River basin) for the following substances and parameters: ammonia, bacteria, biostimulatory substances, chemical constituents, color, DO, floating material, oil and grease, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity.

C.2.6.4 State Implementation Plan

In 1994, the State Water Board and EPA agreed to a coordinated approach for addressing priority toxic pollutants in inland surface waters, enclosed bays, and estuaries of California. In March 2000, the State Water Board adopted a state implementation plan (SIP) for priority toxic pollutant water quality criteria contained in the California Toxics Rule (CTR). EPA promulgated the CTR in May 2000. The SIP also implements National Toxics Rule (NTR) criteria and applicable priority pollutant objectives in the basin plans. In combination, the CTR and NTR and applicable basin plan objectives, existing RWQCB beneficial use designations, and SIP compose water quality standards and implementation procedures for priority toxic pollutants in non-ocean surface waters in California including the Sacramento River.

Section 13260 of the California Water Code (CWC) requires “any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the waters of the state, other than into a community sewer system” to file a report of waste discharge (an application for waste discharge requirements).” Under the Porter-Cologne Water Quality Control Act definition, the term “waters of the state” is defined as “any surface water or groundwater, including saline waters, within the boundaries of the state.” Although all waters of the United States that are within the borders of California are also waters of the state, the converse is not true—in California, waters of the United States represent a subset of waters of the state. Therefore, the State of California retains authority to regulate discharges of waste into any waters of the state, regardless of whether the Corps has concurrent jurisdiction under CWA Section 404. If the Corps determines a wetland is not subject to regulation under CWA Section 404, water quality certification under CWA Section 401 is not required. However, the RWQCB may impose ~~waste discharge requirements (~~WDRs~~)~~ if fill material would be placed into waters of the state.

The Porter-Cologne Water Quality Control Act regulates wastes that have the potential to cause loss of a beneficial use of California’s waters. The act requires the RWQCB to establish reportable quantities of hazardous wastes and hazardous materials based on their potential to degrade the waters of the state. Any discharge of hazardous materials that is inconsistent with the discharge requirements of the facility must be reported to the appropriate authorities.

C.2.7 California Code of Regulations, Title 23

The Central Valley Flood Protection Board (CVFPB) (formerly the California Reclamation Board) of the State of California regulates the modification and construction of levees and floodways in the Central Valley defined as part of the Sacramento Valley and San Joaquin Valley flood control projects. Rules promulgated in Title 23 of the CCR (Title 23, Division 1, Article 8 [Section 111 through 137]) regulate the modification and construction of levees to ensure public safety. The CVFPB requires an encroachment permit for any nonfederal activity along or near federal flood damage reduction project levees and floodways or in CVFPB-designated floodways to ensure that proposed local actions or projects do not impair the integrity of existing flood damage reduction systems to withstand flood conditions. The rules further state that existing levees may not be excavated or left partially excavated during the flood season, which is generally November 1 through April 15 for the program area levees.

The following CVFPB guidance applies:

> The California Reclamation Board has primary jurisdiction approval of levee design and construction. The Reclamation Board standards are found in Title 23, Division 1, Article 8

> (Sections 111 through 137) of the California Code of Regulations (CCR), and constitute the primary state standard. Section 120 of the CCR directs that levee design and construction be in accordance with the USACE's Engineer Manual EM 1110-2-1913, Design and Construction of Levees. This document is the primary federal standard applicable to this project, as supplemented by additional prescriptive standards contained in Section 120 of the CCR. These additional standards prescribe minimum levee cross-sectional dimensions, construction material types, and compaction levels.

C.2.8 Central Valley Flood Protection Board

The CVFPB (formerly the California Reclamation Board) regulates the modification and construction of levees and floodways in the Central Valley defined as part of the Sacramento Valley and San Joaquin Valley flood control projects. Rules promulgated in Title 23 of the California Code of Regulations (CCR Title 23, Division 1, Article 8 [Sections 111 through 137]) regulate the modification and construction of levees to ensure public safety. The rules state that existing levees may not be excavated or left partially excavated during the flood season, which is generally November 1–April 15 for the Sacramento River system

The following Board guidance has been followed during the levee evaluation:

> The California Reclamation Board has primary jurisdiction approval of levee design and construction. The Reclamation Board standards are found in Title 23, Division 1, Article 8 (Sections 111 through 137) of the California Code of Regulations (CCR), and constitute the primary state standard. Section 120 of the CCR directs that levee design and construction be in accordance with the Corps' Engineer Manual EM 1110-2-1913, Design and Construction of Levees. This document is the primary federal standard applicable to this project, as supplemented by additional prescriptive standards contained in Section 120 of the CCR. These additional standards prescribe minimum levee cross-sectional dimensions, construction material types, and compaction levels.

C.2.9 Central Valley Flood Control Act of 2008

The Central Valley Flood Control Act of 2008, passed in 2007, recognizes that the Central Valley of California, which includes the planning area, is experiencing unprecedented development, resulting in the conversion of historically agricultural lands and communities to densely populated residential and urban centers. Because of the potentially catastrophic consequences of flooding, the Act recognizes that the federal government's current 100-year flood protection standard is not sufficient to protect urban and urbanizing areas within flood-prone areas throughout the Central Valley and declares that the minimum standard for these areas is a 200-year level of flood protection. To continue with urban development, cities and counties must develop and implement plans for achieving this new standard by 2025. With respect to flood risk reduction, the Central Valley Flood Control Act also calls upon the California Department of Water Resources (DWR) to develop a comprehensive Central Valley Flood Protection Plan (CVFPP) by the end of 2012 for protecting the lands currently within the Sacramento–San Joaquin River Flood Management System.

According to California Government Code Sections 65302.9 and 65860.1, every jurisdiction located within the Sacramento–San Joaquin Valley is required to update its General Plan and Zoning Ordinance in a manner consistent with the CVFPP within 24 months after the CVFPP's adoption, which occurred July 1, 2012. In addition, the locations of the state and local flood management facilities, locations of flood hazard zones, and the properties located in these areas must be mapped and consistent with the CVFPP.

C.2.9.1 Senate Bill 5, Senate Bill 17, and Assembly Bill 162

According to legislation as part of Senate Bill (SB) 5 (Machado and Wolk), SB 17 (Florez) and Assembly Bill (AB) 162 (Wolk), urban and urbanizing areas in the Sacramento Valley and San Joaquin Valley will be required to achieve, or make adequate progress toward achieving, 200-year protection by the year 2015 to continue to have development approved in the floodplain. Specifically, AB 162 requires that each local jurisdiction's Safety Element include 200-year floodplain maps. Maps must be based on the best available data on flood protection, including areas protected by state and federal project levees, and areas outside of these areas.

C.2.9.2 California Department of Water Resources Urban Levee Design Criteria

Pursuant to SB 5 (Government Code Section 65007(l)), the Urban Levee Design Criteria (ULDC) define the urban level of flood protection as the level of protection that is necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, DWR. While cities and counties located outside of the Sacramento–San Joaquin Valley are not required to make findings related to the urban level of flood protection, the ULDC can help inform engineering and local land use decisions for areas at risk of flooding anywhere in California. The ULDC was developed through a collaborative process with stakeholders from local government (including representatives from the Central Valley, San Francisco Bay Area, and Los Angeles Region), state government, and the federal government.

The ULDC provide criteria and guidance for design, construction, operation, and maintenance of levees and floodwalls in urban and urbanizing areas. When finalized, the ULDC will supersede Version 4 of the Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento-San Joaquin Valley (Version 4), dated December 15, 2010. The ULDC contain numerous revisions and refinements from Version 4.

C.2.10 Delta Protection Act of 1992

The Delta Protection Act of 1992 (California Water Code Section 12220) established the Delta Protection Commission. The commission has land use planning jurisdiction over the Delta Primary Zone, which generally consists of lands in the central portion of the Delta that were not within either the urban limit line or sphere of influence of any local government's general plan or currently existing studies as of January 1, 1992. The Primary Zone, which comprises 487,625 acres, or approximately 66%, of the Delta, encompasses portions of San Joaquin, Contra Costa, Solano, Yolo, and Sacramento Counties.

The Delta Protection Commission is charged with preparing a regional plan for the Primary Zone to address land uses and resources management, with particular emphasis on agriculture, which was designated by the Delta Protection Act as the primary use of this zone. Specifically, Land Use Policy P-2 and Agriculture Policies P-1 through P-10 address the role of local governments in preserving and protecting long-term agricultural viability and open space values in the Primary Zone through implementation of general plan policies and zoning codes.

This Delta Protection Act declares that the basic goals of the state for the Delta are, among other findings, to improve flood protection, and, therefore, to ensure an increased level of public health and safety, by structural and nonstructural means.

C.2.11 Safe, Clean, Reliable Water Supply Act

This act declares that the basic goals of the state for the Delta are, among other findings, to protect the integrity of the state's water supply system from catastrophic failure attributable to earthquakes and flooding.

C.2.12 Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621 *et seq*.) is intended to prevent the construction of buildings used for human occupancy on the surface trace of active faults. Local agencies must regulate most development in fault zones established by the State Geologist known as Alquist-Priolo Earthquake Fault Zones. The proposed program's improvements would not entail the construction of buildings for human occupancy. Therefore, this law is not applicable to the proposed program.

C.2.13 California Seismic Hazards Mapping Act

The California Seismic Hazards Mapping Act of 1990 (Public Resources Code Sections 2690–2699.6) addresses the exposure of development to seismic hazards other than surface rupture, such as liquefaction and induced landslides, and authorizes a lead agency for a project to withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards associated with seismicity and unstable soils. The proposed program's improvements would not entail the construction of buildings for human occupancy. Therefore, this law is not applicable to the proposed program.

C.2.14 California Surface Mining and Reclamation Act

The state Surface Mining and Reclamation Act of 1975 (SMARA) (Public Resources Code Section 2710 *et seq*.) addresses surface mining of minerals and requires mitigation to reduce adverse impacts on public health, property, and the environment. SMARA applies to an individual or entity that would disturb more than 1 acre or remove more than 1,000 cubic yards of material through surface mining activities, including the excavation of borrow pits for soil material. The Corps and CVFPB are not subject to SMARA requirements. Therefore, this law is not applicable to activities carried out by the lead agencies.

C.2.15 California Department of Transportation

Federal highway standards are implemented in California by the California Department of Transportation (Caltrans), which is responsible for planning, designing, constructing, operating, and maintaining all state-owned roadways in the program area. Caltrans enforces various policies and regulations related to the modification of, or encroachment on, state-owned roadways. Caltrans's construction practices require temporary traffic control planning any time the normal function of a roadway is suspended. Caltrans is also responsible for permitting uses and encroachments on state roads and highways. Oversized loads are also subject to permitting requirements.

C.2.16 California Clean Air Act and California Ambient Air Quality Standards

In 1988, the state legislature adopted the California Clean Air Act (CCAA), which established a statewide air pollution control program. The CCAA requires all air districts in the state to endeavor to meet the California Ambient Air Quality Standards (CAAQS) by the earliest practical date. Unlike the CAA, the CAAQS do not set precise attainment deadlines. Instead, the act establishes increasingly stringent requirements for areas that will require more time to achieve the standards. CAAQS are generally more stringent than the NAAQS and incorporate additional standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. State standards for a variety of pollutants are summarized in Table 8-2 in Chapter 8, Air Quality and Climate Change.

ARB and local air districts bear responsibility for achieving California's air quality standards through district-level air quality management plans that would be incorporated into the SIP. In California, EPA has delegated authority to prepare SIPs to ARB, which, in turn, has delegated that authority to individual air districts. ARB traditionally has established state air quality standards, maintaining oversight authority in air quality planning, developing programs for reducing emissions from motor vehicles, developing air emission inventories, collecting air quality and meteorological data, and approving SIPs.

The CCAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation control measures. The CCAA also emphasizes the control of "indirect and area-wide sources" of air pollutant emissions. The CCAA gives local air pollution control districts explicit authority to regulate indirect sources of air pollution and to establish traffic control measures.

C.2.17 State Action on Greenhouse Gas Emissions

A variety of legislation has been enacted in California that relates to climate change, much of which sets aggressive goals for GHG reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents pursuant to CEQA.

No local, state, or regional agency has promulgated binding regulations for the treatment of GHG analysis or mitigation in CEQA documents. The discussion below provides a brief overview of the documents discussed above as well as the primary legislation that relates to climate change, which may affect the emissions associated with the proposed program.

C.2.17.1 Executive Order S-3-05

Signed on June 1, 2005, EO S-3-05 asserts that California is vulnerable to the effects of climate change. To combat this concern, EO S-3-05 established the following GHG emissions reduction targets for state agencies.

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80% below 1990 levels.

Assembly Bill 32, California Global Warming Solutions Act of 2006, and the Climate Change Scoping Plan

In 2006, the California legislature passed Assembly Bill 32 (California Health and Safety Code Division 25.5, Sections 38500 et seq., or AB 32), also known as the California Global Warming Solutions Act. AB 32 requires ARB to implement emission limits, regulations, and other feasible and cost-effective measures such that statewide GHG emissions are reduced to 1990 levels by 2020.

Pursuant to AB 32, ARB adopted the Climate Change Scoping Plan (Scoping Plan) in December 2008, which outlines measures for meeting the 2020 GHG emissions reduction limits. The Scoping Plan must be updated every 5 years to evaluate AB 32 policies and ensure that California is on track to achieve the 2020 GHG emissions reduction goal. In 2014, ARB released the First Update to the Climate Change Scoping Plan (First Update), which builds upon the Scoping Plan with new strategies and recommendations. The First Update identifies opportunities to leverage existing and new funds and drive GHG emissions reductions through strategic planning and targeted low-carbon investments. This update defines ARB's climate change priorities for the next 5 years and sets the groundwork for reaching the long-term goals set forth in Executive Order S-3-05. The First Update highlights California's progress toward meeting the near-term 2020 GHG emissions reduction goals in the Scoping Plan. It also evaluates actions to align the state's longer-term GHG emissions reduction strategies with other state policy priorities for water, waste, natural resources, clean energy, transportation, and land use.

The ARB is currently working on the Second Update to the Scoping Plan, which will outline policies and actions to meet the state's 2030 GHG emission target, as outlined under Senate Bill (SB) 32 (discussed below). Release of the 2030 Scoping Plan is scheduled for fall of 2016~~Assembly Bill 32, the California Global Warming Solutions Act of 2006 (AB 32), establishes a cap on statewide GHG emissions and sets forth the regulatory framework to achieve the corresponding reduction in statewide emission levels. Under AB 32, ARB is required to take the following actions.~~

- ~~Adopt early action measures to reduce GHGs.~~
- ~~Establish a statewide GHG emissions cap for 2020 based on 1990 emissions.~~
- ~~Adopt mandatory report rules for significant GHG sources.~~
- ~~Adopt a scoping plan indicating how emission reductions would be achieved through regulations, market mechanisms, and other actions.~~
- ~~Adopt regulations needed to achieve the maximum technologically feasible and cost-effective reductions in GHGs.~~

~~AB 32 requires a return to 1990 emission levels (estimated as 427 million metric tons CO_2e) by 2020. ARB's most recent estimate of 2020 "business as usual" (BAU) emissions is 545 million metric tons CO_2e. In order to meet the AB 32 goal, there will need to be a reduction of 118 million metric tons (MT) CO_2e, or approximately a 22% reduction from the 2020 BAU condition (California Air Resources Board 2011)~~.

~~Climate Change Scoping Plan~~

~~On December 11, 2008, pursuant to AB 32, ARB adopted the Climate Change Scoping Plan. This plan outlines how emissions reductions from significant sources of GHGs will be achieved via regulations,~~

~~market mechanisms, and other actions. Six key elements, outlined in the scoping plan, are identified to achieve emissions reduction targets.~~

- ~~Expanding and strengthening existing energy efficiency programs as well as building and appliance standards.~~
- ~~Achieving a statewide renewable energy mix of 33%.~~
- ~~Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system.~~
- ~~Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets.~~
- ~~Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the a low carbon fuel standard (LCFS).~~
- ~~Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the state's long-term commitment to AB 32 implementation.~~

~~The Climate Change Scoping Plan also describes recommended measures that were developed to reduce GHG emissions from key sources and activities while improving public health, promoting a cleaner environment, preserving our natural resources, and ensuring that the impacts of the reductions are equitable and do not disproportionately affect low-income and minority communities. These measures put the state on a path to meet the long-term 2050 goal of reducing California's GHG emissions to 80% below 1990 levels.~~

CEQA Guidelines

Senate Bill (SB) 97 of 2007 required that the Governor's Office of Planning and Research (OPR) prepare guidelines to submit to the California Resources Agency (now Natural Resources Agency) regarding feasible mitigation of GHG emissions or the effects of GHG emissions as required by CEQA. The Natural Resources Agency adopted amendments to the State CEQA Guidelines for GHG emissions on December 30, 2009. The amendments became effective March 18, 2010.

The 2011 State CEQA Guidelines included a new section (Section 15064.4) that specifically addresses the significance of GHG emissions. Section 15064.4 calls for a good-faith effort to describe, calculate, or estimate GHG emissions. Section 15064.4 further states that the significance of GHG impacts should include consideration of the extent to which the project would increase or reduce GHG emissions, exceed a locally applicable threshold of significance, and comply with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions. The revisions also state that a project may be found to have a less-than-significant impact if it complies with an adopted plan that includes specific measures to sufficiently reduce GHG emissions (Section 15064(h)(3)). However, the revised guidelines do not require or recommend a specific analysis methodology or provide quantitative criteria for determining the significance of GHG emissions.

Executive Order S-01-07, Low Carbon Fuel Standards

Executive Order S-01-07 mandates (1) that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020, and (2) that a low carbon fuel standard for transportation fuels be established in California. The Executive Order initiates a research and regulatory process at ARB~~EO S-01-07 mandates: (1) that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020, and (2) that a low carbon fuel standard (LCFS) for transportation fuels be established in California. The executive order initiates a research and regulatory process at ARB. Based on an implementation plan developed by the California Energy Commission, ARB will be responsible for implementing the LCFS. On December 29, 2011, a federal judge issued a preliminary injunction blocking enforcement of the LCFS, ruling that the LCFS violates the federal regulation that says only Congress can regulate interstate commerce, as the LCFS discriminates against out-of-state fuel suppliers. In January 2012, ARB appealed that decision to the Ninth Circuit Court of Appeals, and then moved to stay the injunction pending resolution of the appeal. On April 23, 2012, the Ninth Circuit Court of Appeals granted the ARB's motion for a stay of the injunction while the court continues to consider ARB's appeal of the lower court's decision~~.

Senate Bill 32 and Assembly Bill 197

SB 32 requires ~~the~~ ARB to ensure that statewide GHG emissions are reduced to at least 40% below 1990 levels by 2030. The companion bill, AB 197, creates requirements to form a Joint Legislative Committee on Climate Change Policies, requires ARB to prioritize direct emission reductions and consider social costs when adopting regulations to reduce GHG emissions beyond the 2020 statewide limit, requires ARB to prepare reports on sources of GHGs and other pollutants, establishes 6-year terms for voting members of ARB, and adds two legislators as non-voting members of ARB.

C.2.18 California Farmland Mapping and Monitoring Program

The California Department of Conservation's (DOC's) Farmland Mapping and Monitoring Program (FMMP), administered by the Division of Land Resource Conservation, is responsible for mapping and monitoring Important Farmlands for most of the state's agricultural areas. The FMMP updates its farmland maps every 2 years based on information from local agencies. FMMP maps show five categories of agricultural lands and three categories of nonagricultural lands, described in the following sections.

C.2.18.1 Agricultural Lands

Following are descriptions of the farmland mapping categories used by the state's FMMP.

- "Prime Farmland" is defined by the state as "irrigated land with the best combination of physical and chemical features able to sustain long-term production of agricultural crops." Prime Farmland has the soil quality, growing season, and moisture supply needed to produce sustained high yields. To be designated as Prime Farmland, the land must have been used for production of irrigated crops at some time during the 4 years prior to the mapping date.

- “Farmland of Statewide Importance” is defined by the state as “irrigated land similar to Prime Farmland that has a good combination of physical and chemical characteristics for the production of agricultural crops.” However, this land has minor shortcomings, such as steeper slopes or less ability to store soil moisture than Prime Farmland. In order for land to be designated as Farmland of Statewide Importance, it must have been used for production of irrigated crops at some time during the 4 years prior to the mapping date.
- “Unique Farmland” is considered to consist of lower-quality soils but nonetheless is used for production of the state’s leading agricultural crops. Unique Farmland is usually irrigated, but may include non-irrigated orchards or vineyards in some climatic zones in California. To qualify for this designation, land must have been used for crops at some time during the 4 years prior to the mapping date.
- “Farmland of Local Importance” is land identified as important to the local agricultural economy by each county’s board of supervisors and a local advisory committee.
- “Grazing Land” is land on which the existing vegetation is suited to the grazing of livestock. This category was developed in cooperation with the California Cattlemen’s Association, the University of California Cooperative Extension, and other groups interested in the extent of grazing activities.

C.2.18.2 Nonagricultural Lands

Following are descriptions of the nonagricultural land mapping categories used by the FMMP. Mapping units for nonagricultural lands vary, as described below.

- “Urban and Built-Up Lands” consist of land occupied by structures with a building density of at least 1 structure to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This type of land is used for residential, industrial, commercial, construction, institutional, and public administration purposes; railroad and other transportation yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment facilities; water control structures; and other developed purposes.
- “Other Land” is land not included in any other mapping category. Examples include low-density rural developments and brush, timber, wetland, and riparian areas not suitable for livestock grazing. This category also includes vacant and nonagricultural land surrounded on all sides by urban development; confined livestock, poultry, or aquaculture facilities; strip mines; borrow pits; and water bodies smaller than 40 acres.
- “Water” includes perennial water bodies with an extent of at least 40 acres.

C.2.19 California Land Conservation Act of 1965 (Williamson Act)

The California Land Conservation Act of 1965 (Government Code 51200–51295), commonly known as the Williamson Act, provides incentives through reduced property taxes to encourage long-term agricultural and open space land uses. Cities and counties may designate agricultural preserves and may offer contracts to owners of land within the preserve that is dedicated to agricultural use. The contracts ensure a preferential property tax rate, and the landowner agrees not to convert the land to nonagricultural uses for a minimum 10-year period. Contracts are automatically renewed annually for an additional year unless a party to the contract files a notice of nonrenewal. Contracts may also be cancelled by the affected county or city prior to expiration of the 10-year period under certain circumstances. If land is proposed to be removed from Williamson Act coverage, the affected agency must notify DOC.

C.2.20 California Wild and Scenic Rivers Act

The Lower American River is designated as "recreational" from the ~~from~~ Nimbus Dam to its junction with the Sacramento River (Region 1b of the program area). This segment is protected under the California Wild and Scenic Rivers Act (California Public Resources Code (PRC) Sections 5093.50 *et seq*.). This act preserves certain designated rivers in their free-flowing state for the benefit and enjoyment of the public. These rivers must possess extraordinary scenic, recreational, fishery, or wildlife values. The Natural Resources Agency is responsible for coordinating activities of state agencies that may affect these designated rivers.

According to PRC 5093.54 (c) "recreational" rivers are "those rivers or segments of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past."

C.2.21 California Scenic Highway Program

State Route 160 in Sacramento County, from the southern city limit of Sacramento to the Contra Costa County line, is officially designated as a state scenic highway worthy of protection for maintaining and enhancing scenic viewsheds (California Department of Transportation 2009). This roadway is on top of the levees on both the east and west banks of the lower Sacramento River. The scenic corridor, defined as the area generally adjacent to and visible from the highway, is subject to protection, including regulation of land use, site planning, advertising, earthmoving, landscaping, and design and appearance of structures and equipment. Examples of visual intrusions that would degrade scenic corridors as stipulated by Caltrans, which are applicable to the proposed program, include dense and continuous development, highly reflective surfaces, development along ridge lines, extensive cut and fill, scarred hillsides and landscape, exposed and unvegetated earth, and dominance of exotic vegetation. Unsightly land uses would include actions that result in these conditions (California Department of Transportation 2007).

> **Streets and Highway Code—Division 1, Chapter 2, Article 2.5 Section 261 Planning and Design Standards; Complete Highway:** The standards for official scenic highways shall also require that local governmental agencies have taken such action as may be necessary to protect the scenic appearance of the scenic corridor, the band of land generally adjacent to the highway right-of-way, including, but not limited to (1) regulation of land use and intensity (density) of development; (2) detailed land and site planning; (3) control of outdoor advertising; (4) careful attention to and control of earthmoving and landscaping; and (5) the design and appearance of structures and equipment.

C.2.22 Relocation Assistance and Property Acquisition

Government Code Section 7260, et seq. brings the California Relocation Act into conformity with the federal Uniform Relocation Act. In the acquisition of real property by a public agency, both the federal and state acts seek to (1) ensure consistent and fair treatment of owners of real property, (2) encourage and expedite acquisition by agreement to avoid litigation and relieve congestion in the courts, and (3) promote confidence in public land acquisition.

The Relocation Assistance and Real Property Acquisition Guidelines (Guidelines) were established by 25 CCR 1.6. The Guidelines were developed to assist public entities with developing regulations and procedures for implementing Title 42, Chapter 61 of the United States Code—the Uniform Relocation Act, for federal and federally assisted programs. The Guidelines are designed to ensure that uniform, fair, and equitable treatment is given to people displaced from their homes, businesses, or farms as a result of the actions of a public entity.

Under the Uniform Relocation Act, persons required to relocate temporarily are not considered "displaced," but must be reimbursed for all reasonable out-of-pocket expenses. In accordance with these Guidelines, public entities must ensure that people do not suffer disproportionate injury as a result of action taken for the benefit of the public as a whole. Additionally, public entities must ensure consistent and fair treatment of owners of such property, and encourage and expedite acquisitions by agreement with owners of displaced property to avoid litigation.

Property acquisition and relocation services, compensation for living expenses for temporarily relocated residents, and negotiations regarding any compensation for temporary loss of business would be accomplished in accordance with the federal Uniform Relocation Act and the California Relocation Act.

C.2.23 California Public Utilities Commission

The California Public Utilities Commission (CPUC) regulates privately owned telecommunications, electric, natural gas, water, railroad, rail transit, and passenger transportation companies. The CPUC is responsible for ensuring that California utility customers have safe, reliable utility service at reasonable rates, protecting utility customers from fraud, and promoting the health of California's economy. The CPUC establishes service standards and safety rules and authorizes utility rate changes. It enforces CEQA for utility construction as well. The CPUC also regulates the relocation of power lines by public utilities under its jurisdiction, such as Pacific Gas & Electric. The CPUC works with other state and federal agencies in promoting water quality, environmental protection, and safety.

C.2.24 California Integrated Waste Management Act

Known as the Integrated Waste Management Act, AB 939 established the California Integrated Waste Management Board and set forth aggressive solid waste diversion requirements. Under AB 939, every California city and county is required to reduce the volume of waste sent to landfills by 50% through recycling, reuse, composting, and other means. AB 939 requires counties to prepare a countywide integrated waste management plan (CIWMP). An adequate CIWMP contains a summary plan that includes goals and objectives, a summary of waste management issues and problems identified in the incorporated and unincorporated areas of the county, a summary of waste management programs and infrastructure, existing and proposed solid waste facilities, and an overview of specific steps that would be taken to achieve the goals outlined in the components of the CIWMP.

C.2.25 Hazardous Materials Regulation

California regulations are equal to or more stringent than federal regulations. The EPA has granted California primary oversight responsibility to administer and enforce hazardous waste management programs. State regulations require planning and management to ensure that hazardous wastes are properly handled, stored, and disposed of, so that the risks to human and environmental health are reduced. Several key laws pertaining to hazardous wastes, emergency services, and mosquito abatement are discussed below.

Several state agencies regulate the transportation and use of hazardous materials to minimize potential risks to public health and safety. The California Environmental Protection Agency (Cal-EPA) and the Office of Emergency Services (OES) establish rules governing the use of hazardous substances in California. Within Cal-EPA, Department of Toxic Substance Control (DTSC) has primary responsibility, with delegation of enforcement to local jurisdictions, for regulating the generation, transport, and disposal of hazardous substances under the authority of the Hazardous Waste Control Law (HWCL). Regulations implementing the HWCL list hazardous chemicals and common substances that may be hazardous; establish criteria for identifying, packaging, and labeling hazardous substances; prescribe management of hazardous substances; establish permit requirements for hazardous substances treatment, storage, disposal, and transportation; and identify hazardous substances prohibited from landfills.

C.2.26 California Code of Regulations, Title 8

Title 8 of the CCR addresses the control of hazardous substances. Section 5189 of Title 8 sets forth the Process Safety Management (PSM) standard for processes involving a highly hazardous chemical in excess of certain quantities. PSM requires a process hazard analysis, current safety information, an employee participation program, written operating procedures, a mechanical integrity program, and other procedures.

Title 8 also contains the California Occupational Safety and Health Administration (Cal-OHSA) regulations for worker safety, including the storage and handling of hazardous materials. It identifies protective equipment for workers who handle hazardous materials and establishes requirements for general facility safety.

C.2.27 California Government Code Section 65962.5

Section 65962.5 of the Government Code requires that the Department of Toxic Substances Control (DTSC) compile and update the Cortese List of hazardous waste facilities subject to corrective action and lands designated as hazardous waste properties or border zone properties (California Environmental Protection Agency 2006).

C.2.28 Emergency Services Act

Under the Emergency Services Act, the state developed an emergency response plan to coordinate emergency services provided by federal, state, and local agencies. Rapid response to incidents involving hazardous materials or hazardous waste is an important part of the plan, which is administered by the OES. The office coordinates the responses of other agencies, including the California Environmental Protection Agency, the California Highway Patrol, RWQCBs, air quality management districts, and county disaster response offices.

C.2.29 Hazardous Materials Release Response Plans and Inventory Act of 1985

The Hazardous Materials Release Response Plans and Inventory Act, also known as the Business Plan Act, requires businesses using hazardous materials to prepare a plan that describes their facilities, inventories, emergency response plans, and training programs. Hazardous materials are defined as unsafe raw or unused material that is part of a process or manufacturing step. They are not considered hazardous waste. Health concerns pertaining to the release of hazardous materials, however, are similar to those relating to hazardous waste.

C.2.30 Hazardous Waste Control Act

The Hazardous Waste Control Act created the state hazardous waste management program, which is similar to but more stringent than the federal Resource Conservation and Recovery Act program. The act is implemented by regulations contained in Title 26 of the CCR, which describes the following required aspects for the proper management of hazardous waste:

- Identification and classification.
- Generation and transportation.
- Design and permitting of recycling, treatment, storage, and disposal facilities.
- Treatment standards.
- Operation of facilities and staff training.
- Closure of facilities and liability requirements.

These regulations list more than 800 materials that may be hazardous and establish criteria for identifying, packaging, and disposing of such waste. Under the Hazardous Waste Control Act and CCR Title 26, the generator of hazardous waste must complete a manifest that accompanies the waste from generator to transporter to the ultimate disposal location. Copies of the manifest must be filed with the DTSC.

C.2.31 Safe Drinking Water and Toxic Enforcement Act

The Safe Drinking Water and Toxic Enforcement Act (Proposition 65), was enacted as a ballot initiative in November 1986. The proposition was intended by its authors to protect California citizens and the state's drinking water sources from chemicals known to cause cancer, birth defects, or other reproductive harm, and to inform citizens about exposures to such chemicals. The act requires the Governor to publish, at least annually, a list of chemicals known to the state to cause cancer or reproductive toxicity.

C.2.32 Toxic Release Contingency Plan

The Toxic Release Contingency Plan (California Government Code Section 8574.16) requires that regional and local planning agencies incorporate within their planning the state's effort to respond to emergency toxic releases, and ensure the effective and efficient use of regional and local resources in the areas of traffic and crowd control, firefighting, hazardous materials response and cleanup, radio and communications control, and provision of medical emergency services.

C.2.33 Worker Safety Requirements

Cal-OSHA assumes primary responsibility for developing and enforcing workplace safety regulations in California. Cal-OSHA regulations pertaining to the use of hazardous materials at workplaces, as detailed in Title 8 of the CCR, include requirements for safety training; availability of safety equipment; accident and illness prevention programs; hazardous substance exposure warnings; and emergency action and fire prevention plan preparation. Cal-OSHA enforces hazard communication program regulations that contain training and information requirements, including procedures for identifying and labeling hazardous substances, communicating hazard information related to hazardous substances and their handling, and preparing health and safety plans to protect workers and employees at hazardous waste sites. The hazard communication program requires that material safety data sheets be available to employees and that employee information and training programs be documented. SAFCA will ensure that Cal-OSHA regulations are complied with through the development and implementation of a spill prevention, response, and cleanup plan.

C.2.34 Public Resources Code Section 5097, California Health and Safety Code, California Penal Code

If human remains are found, the Corps and DWR with comply with California Public Resources Code section 5097.98, which provides the framework for identifying the responsible parties and the process to move forward with the project.

C.2.35 California Public Resources Code Section 6313 subd. (c)

Sites with archaeological or historic significance shall be determined by reference to their eligibility for inclusion in the National Register of Historic Places or the California Register of Historical Resources. Any submerged archaeological site or submerged historic resource remaining in state waters more than 50 years shall be presumed to be archaeologically or historically significant.

C.2.36 Government Code Section 65040.12

Following the lead of federal EO 12898, the State of California passed a series of environmental justice laws in 2001. "Environmental justice" is defined in state planning law as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (Government Code section 65040.12(e)).

C.3 Local Plans, Policies, and Regulations

In addition to federal and state regulatory requirements, the project may be subject to certain zoning or other ordinances and general plans of counties and cities in the affected area. These are presented below by EIS/EIR chapter and resource topic.

C.3.1 Chapter 4, Flood Control and Geomorphology

C.3.1.1 Butte County

Both the Water Resources Element and the Health and Safety Element of the City of Butte County General Plan 2030 (Butte County 2010) contain goals and policies relevant to flood control. These goals and policies focus on minimizing risk and property damage from flooding, protection of surface water and groundwater resources and quality, and management of stormwater runoff.

The delineation of flood boundaries and adoption of county ordinances regulating development within identified floodplains/floodways are the basic flood management tools that the county uses to identify flood hazards and implement its own flood management program. FEMA's flood mapping program is a critical component of these efforts. A county ordinance adopted in March 1983 enforced flood hazard prevention, as set forth in Article IV in Chapter 26 of the Butte County Code.

The county's principal emergency response plan is the Butte County Multi-Jurisdictional All-Hazard Pre-Disaster Mitigation Plan (Butte County MHMP) (Butte County 2007), adopted in March 2007. In essence, the main goal of the Butte County MHMP with respect to flood control is to protect infrastructure and agriculture from long-term risks of flood, and this goal is to be achieved by implementation of the Flooding Mitigation Action Plan.

The county established the Flood Mitigation Plan (Wood Rodgers 2006) to provide guidance to agencies that protect life, property, and livestock; are involved in land use planning; administer FEMA's NFIP; and respond to flood emergencies in Butte County. The FMP will need to be updated to address new state flood control regulations described above.

C.3.1.2 Colusa County General Plan

The Safety Element, Conservation Element, Circulation Element and Agriculture Element of the draft Colusa County General Plan (Colusa County 2011) contain goals and policies relevant to flood control. These goals and policies focus on working with agricultural land owners to improve flood control practices, ensuring roadway design standards enhance flood control and reduce roadway flooding, balancing the needs of aquatic and riparian ecosystem enhancement with flood management objectives and promote awareness and preparedness in case of a flood emergency.

C.3.1.3 Glenn County General Plan

Flood hazards are discussed in Section 3.5 of the Environmental Setting Technical Paper and Section 6.0 of the Public Safety Issue Paper of the Glenn County General Plan (Glenn County 1993). The goals and policies of these papers focus on protection and reduction of loss of life and personal property due to flooding and on programs and ways to direct, enhance and serve new development to the County's benefit.

C.3.1.4 Placer County General Plan

The Public Facilities and Services and Health and Safety sections of the Placer County General Plan (Placer County 1994) contain goals and policies relevant to flood control. These goals and policies focus on protecting the lives and properties of the citizens of Placer County from hazards associated with development in floodplains and manage floodplains for their natural resource values.

C.3.1.5 Sacramento County

American River Parkway Plan

The Flood Control Policies in the American River Parkway Plan (Sacramento County 2008) call for flood management agencies to maintain and improve the reliability of the existing public flood-control system along the lower American River to meet the need to provide a high level of flood protection to the heavily urbanized floodplain along the lower American River consistent with other major urban areas.

Sacramento County General Plan

The Safety Element of the Sacramento County General Plan identifies and assesses the potential for hazards to occur in the County and to provide measures that adequately protect the public. Included in the Safety Element is the goal of minimizing the loss of life, injury, and property damage due to flood hazards. To achieve this goal, the element includes a policy of coordinating with the City of Sacramento, the Army Corps of Engineers, the Sacramento Area Flood Control Agency, and other federal, state, and local governments and agencies to develop a plan to finance and construct flood control improvement projects. The Safety Element also states that if levee construction is approved to reclaim floodplain for new development, 200-year flood protection is required.

C.3.1.6 Solano County General Plan

The Public Health and Safety section of the Solano County General Plan (Solano County 2008) contains goals and policies relevant to flood control.

C.3.1.7 Sutter County General Plan

The Public Health and Safety Element of the Sutter County General Plan (Sutter County 2011) contains goals and policies relevant to flood control. These goals and policies focus on minimizing risk and property damage from flooding, protection of surface water and groundwater resources and quality, and stormwater runoff management. They also presently reflect the requirements established by SB 5 pertaining to planning and other efforts necessary ultimately to provide for 200-year flood protection.

As a participant in the NFIP, Sutter County is required to adopt and enforce a floodplain management ordinance that minimizes future flood risks to new or existing construction. The current Floodplain Management Ordinance was adopted in October 2008.

The County's principal emergency response plan is the Final Yuba City–Sutter County, California Multi-Hazard Mitigation Plan (AMEC 2007), adopted in January 2008. The purpose of the plan is to meet the requirements of the Disaster Mitigation Act and thereby maintain continued eligibility for certain hazard mitigation (or disaster loss reduction) programs from FEMA. The plan lays out the strategy that will enable Sutter County to become less vulnerable to future disaster losses.

C.3.1.8 Tehama County General Plan

The Safety Element of the Tehama County General Plan (Tehama County 2009a) contains goals to minimize and reduce the risk of personal injury and property damage resulting from flooding. The policies to achieve these goals focus on discouraging new development located in an area that is likely to flood, requirement that adequate drainage facilities exist for both existing and new development, and the incorporation of flood control mitigation into County ordinance and procedures. Upon adoption of the Central Valley Flood Protection Plan, and this General Plan, the County shall review the consistencies of County flood-related planning documents for consistency.

C.3.1.9 Yolo County General Plan

The Health and Safety Element of the Yolo County General Plan (Yolo County 2009) provides goals, policies, and actions that guide Yolo County in ensuring adequate safety from flooding for Yolo County communities. The goals, policies and actions focus on protecting the public and reducing damage to property from flood hazards.

C.3.1.10 Yuba County General Plan

The Public Health and Safety Element of the Yuba County General Plan (Yuba County 2011) contains goals and policies that focus on reducing flood risk for the County's people and property.

C.3.2 Chapter 5, Water Quality and Groundwater Resources

C.3.2.1 Butte County General Plan

The Butte County General Plan provides information about water supply, water quality, stormwater management and water service in Butte County. The Water Resources Element contains goals, policies, and actions designed to protect, maintain and restore water resources. (Butte County 2010).

C.3.2.2 Colusa County General Plan

The Conservation Element of the draft Colusa County General Plan contains several policies concerning water quality and water availability. It encourages conservation, rather than preservation and contains objectives to ensure sustainable and long-term supply of safe and reliable water and to protect surface water quality in the County's lakes, streams, creeks and rivers. The water needs of the County are to be secured through a cooperative effort with state and federal agencies responsible for water projects (Colusa County 2011).

C.3.2.3 Glenn County General Plan

The Glenn County General Plan (Glenn County 1993) identifies the protection of water quality as a major goal. To meet this goal, it is the policy of the county to comply with all state and federal regulations and zone floodways in a manner that supports water quality.

C.3.2.4 Placer County General Plan

Section 6, "Natural Resources", of the Placer County General Plan establishes the goal of protecting and enhancing the natural qualities of Placer County's streams, creeks and groundwater. Water resources conservation policies included in the general plan include requiring the use of feasible and practical BMPs to protect streams from the adverse effects of construction activities and urban runoff; discouraging grading activities during the rainy season, unless adequately mitigated, to avoid sedimentation of creeks and damage to riparian habitat; requiring project proponents to restore "stream environment zones" that are modified by their project by channelization, fill, or other activities; and protecting groundwater resources from contamination and overdraft by identifying and controlling sources of potential contamination, protecting important groundwater recharge areas, encouraging the use of surface water to supply major municipal and industrial demands, and encouraging the use of treated wastewater for groundwater recharge (Placer County 1994).

C.3.2.5 Sacramento County

American River Parkway Plan

The goal of water quality polices in the American River Parkway Plan is to ensure that water quality in the lower American River is maintained "to provide for beneficial uses of the river, including: municipal and domestic water supply; industrial service water supply; irrigation; water contact and non-contact recreation; freshwater habitat; migration of aquatic organisms; spawning, reproduction, and/or early development of fish; and wildlife habitat" (Sacramento County 2008).

Sacramento County General Plan

Water resources policies contained in the Conservation Element of the Sacramento County General Plan are intended to provide direction regarding the conservation, development, and utilization of natural resources including water, soils, rivers, aquatic species and their habitats (Sacramento County 2011). Although the General Plan focuses primarily on urban development, its water quality protection policies, including erosion control and contaminants monitoring, ensure that the County will be able to provide a safe, reliable supply of quality water for its residents while protecting beneficial uses of waters of the state of California.

C.3.2.6 Solano County General Plan

Water resource policies identified in the Solano County General Plan are directed at the management of surface and groundwater resources via three strategies: watershed protection, preservation and improvement of water quality, and efficient management of water supply and demand (Solano County 2008). These policies include, but are not limited to, identifying, promoting, and seeking funding for the evaluation and remediation of water resource or water quality problems through a watershed management approach; requiring the protection of natural water courses; monitoring and managing the county's groundwater supplies in coordination with the Solano County Water Agency; preserving and maintaining watershed areas characterized by slope instability, undevelopable steep slopes, high soil erosion potential, and extreme fire hazards in agricultural use; protecting land surrounding valuable water sources and preserving open space lands to protect and improve groundwater quality; and reducing polluted surface runoff.

C.3.2.7 Sutter County General Plan

The Environment Resources and Infrastructure Elements of the Sutter County General Plan include goals and policies to preserve and protect the County's surface water and groundwater resources. To achieve these goals, the General Plan contains policies to guide new development, conserve renewable resources and encouragement of water conservation practices, and monitoring of agricultural water runoff (Sutter County 2011).

C.3.2.8 Tehama County General Plan

Ensuring that water supplies of sufficient quality and quantity will be available to serve the needs of Tehama County now and into the future is the stated goal pertaining to water and water quality in the Open Space and Conservation Element of the Tehama County General Plan (Tehama County 2009a). Included in this element are a number of policies to achieve this goal, including maintaining local water ordinances; adhering to state and federal regulations; protecting surface and ground water from major sources of pollution; establishing and requiring the use of BMPs to protect receiving waters from the adverse effects of construction activities, sediment, and urban runoff; and using Natural Resource Lands (and their land use subcategories) to indicate areas essential to the recharge of groundwater and to afford protection from streambank erosion.

C.3.2.9 Yolo County General Plan

The Conservation and Open Space Element of the Yolo County General Plan establishes a goal of ensuring an abundant, safe, and sustainable water supply to support the needs of existing and future generations residing in Yolo County (Yolo County 2009). Water resources conservation policies included in the General Plan include managing supplies to avoid long-term overdraft, water quality degradation, land subsidence, and other potential problems; improving and protecting water quality for municipal, agricultural, and environmental uses; and supporting mercury regulations that are based on good science and reflect an appropriate balancing of sometimes competing public values, including health, food chain, reclamation and restoration of Cache Creek, sustainable and economically viable Delta agriculture, necessary mineral extraction, flood control, erosion control, water quality, and habitat restoration.

C.3.2.10 Yuba County General Plan

The Public Health & Safety Element and the Natural Resources Element of the Yuba County General Plan contains goals to address water supply and water quality. These goals are to preserve, protect and improve the quality of regional water supplies, perform ongoing monitoring and corrective actions, improve standard and design guidelines and reduce water consumption and ensure reliable water supply. (Yuba County 2011).

C.3.3 Chapter 6, Geology, Seismicity, Soils, and Mineral Resources

The section under Chapter 4, Flood Control and Geomorphology, describes many of the applicable local policies that overlap with geology, seismicity, soils, and mineral resources.

Counties have grading and erosion control ordinances. These ordinances are intended to control erosion and sedimentation caused by construction activities. A grading permit typically is required for construction-related projects in most counties. As part of the permit, the project applicant usually must submit a grading and erosion control plan, project vicinity and site maps, and other supplemental information consistent with the local policies. Standard conditions in the grading permit include an extensive list of best management practices similar to those contained in a SWPPP.

Many counties have goals, policies, and implementation programs described in various sections of their county general plans that are aimed at reducing seismic risks, as well as reducing the effects of erosion, runoff, and sedimentation.

C.3.4 Chapter 7, Transportation and Navigation

The general plans for the counties in the program area contain goals, policies, and implementation programs for transportation systems and facilities within each county's jurisdictions and their spheres of influence. The focus of these goals and policies is long-term development and design of transportation facilities, improvements to existing roadways, interagency coordination, and encouragement of alternative transportation.

C.3.4.1 Butte County General Plan

The Butte County General Plan provides detailed circulation growth projections. The general plan also contains goals to provide for a road and highway network that meets the need of existing and anticipated movements of people and goods. The plan also sets forth policies regarding acceptable service levels for roadways within the county (Butte County 2010).

C.3.4.2 Colusa County General Plan

The Circulation Element of the draft Colusa County General Plan contains an objective to maintain safe and efficient operating conditions on all county roadways. Circulation Policy 6 states that the county shall maintain levels of service on state highways consistent with Caltrans standards, to the extent feasible (Colusa County 2011).

C.3.4.3 Glenn County General Plan

The Glenn County General Plan Policies CDP-54 and CDP-57 are designed to ensure that roadways are adequate to accommodate the traffic levels they serve, that potential impacts of proposed development projects are determined, and that the established level of service (LOS) is maintained (Glenn County 1993).

C.3.4.4 Placer County General Plan

The Placer County General Plan establishes the goal of providing for the long-range planning and development of roadway systems to ensure the safe and efficient movement of people and goods. Policy 3.A.7 establishes that a LOS C shall be maintained on rural and urban/suburban roadways, except within one-half mile of state highways where the standard shall be LOS D (Placer County 1994).

C.3.4.5 Sacramento County General Plan

The Circulation Element of the Sacramento County General Plan provides goals and policies for providing a balanced and integrated roadway system that maximizes mobility in the county. The general plan also requires that rural roadways maintain LOS D, and that urban roadways maintain LOS E (Sacramento County 2011).

C.3.4.6 Solano County General Plan

The Transportation and Circulation Element of the Solano County General Plan establishes policies that maintain and improve roadways, as well as designate and reserve adequate right-of-way to meet projected traffic volumes (Solano County 2008).

C.3.4.7 Sutter County General Plan

The Transportation and Circulation Element of the Sutter County General Plan establishes a goal of managing county roadway segments and intersections to maintain LOS D or better during peak hours, and LOS C or better at all other times (Sutter County 2011). The Circulation Element also requires ongoing coordination with Caltrans, the Sacramento Area Council of Governments, and other jurisdictions to address local and regional transportation issues.

C.3.4.8 Tehama County General Plan

The Transportation and Circulation Element of the Tehama County General Plan establishes the following polices regarding proposed and existing projects. For operations that generate a substantial number of large trucks and/or heavy load vehicles, the county shall explore options for the adoption of a roadway tonnage fee or oversized load fee to ensure that those projects or operations do not cause, or will adequately mitigate, significant deterioration of county roads. Proposed projects shall be required to reserve or dedicate sufficient rights-of-way. The Tehama County General Plan identifies LOS A–C as acceptable during non-peak hours and LOS D as acceptable during peak hours (Tehama County 2009a).

C.3.4.9 Yolo County General Plan

The circulation policies of the Yolo County General Plan address issues concerning the design and construction of the proposed levee repairs. The general plan states that the county and applicable reclamation districts will develop agreements to establish and maintain hiking, biking, and horse trails on levees and other rights-of-way; the county and the districts will also establish provisions for ensuring the safety of the public and the security of the adjoining land owners and users. Circulation Policy 7 requires that county roads maintain a stable flow of traffic and a relatively satisfactory operating speed (service level C). Circulation Policy 17 discourages truck traffic on residential streets (Yolo County 2009).

C.3.4.10 Yuba County General Plan

The Yuba County General Plan Circulation Element outlines planned circulation system improvements, and defines the functional classifications for the county's street and highway system. The general plan also contains goals and policies to maintain roadway levels of service that recognize differences between urban and rural environments and minimize congestion. Policy CD16.2 states that a LOS of D or better shall be maintained on county roads in rural areas during the p.m. peak hour (Yuba County 2011).

C.3.5 Chapter 8, Air Quality and Climate Change

C.3.5.1 Local Air Quality and Greenhouse Gas Laws and Regulations

The ARB and the local air districts are responsible for ensuring that state standards are met. As previously indicated, the local air districts of direct importance in the program area are Bay Area Air Quality Management District (BAAQMD), Butte County Air Quality Management District, Colusa County Air Pollution Control District, Feather River Air Quality Management District, Glenn County Air Pollution Control District, Placer County Air Pollution Control District, Sacramento Metropolitan Air Quality Management District, Tehama County Air Pollution Control District, and Yolo-Solano Air Quality Management District. Local air districts are responsible for implementing strategies for air quality improvement and recommending mitigation measures for new growth and development. At the local level, air quality is managed through land use and development planning practices, and is implemented in the county through the general planning process. The local air districts are responsible for establishing and enforcing local air quality rules and regulations that address the requirements of federal and state air quality laws. Local air districts, affected counties, and applicable thresholds relevant to the program area are summarized in Table C-5.

In addition to the thresholds and rules in Table C-5, the proposed program may be subject to additional rules, regulations, and thresholds of the local air districts.

Most air quality districts in the program area have not established significance thresholds for GHGs for evaluating climate change impacts under CEQA, except the BAAQMD and SMAQMD~~, which recommended the significance thresholds for operation-related GHG emissions~~. Table C-5 shows ~~the~~ SMAQMD's and BAAQMD's GHG thresholds~~ that is applicable to the proposed program~~.

~~Although no significance threshold was established, m~~Most districts recommend that GHG emissions associated with the project's construction and operational activities be quantified and disclosed using the most up to date calculation and analysis methods. Most districts also recommend that lead agencies provide a discussion of feasible construction and operational mitigation measures necessary to reduce GHG emissions

Table C-5. Air Quality Districts and Counties Affected by the Proposed Program and Associated Significance Thresholds

Air District	Affected Counties	Threshold Type	ROG	NO_X	PM10	PM2.5	CO	GHGs
Bay Area Air Quality Management District (BAAQMD)[a]	Solano	Construction	54 lbs/day	54 lbs/day	82 lbs/day (exhaust) BMP (dust)[b]	54 lbs/day (exhaust) BMP (dust)[b]	N/A	N/A
		Operational	54 lbs/day	54 lbs/day	82 lbs/day (exhaust)	54 lbs/day (exhaust)	Violation of CAAQS	1,100 MT CO_2e/year (land use); 1,100 MT CO_2e/year (Sources other than stationary sources)
Butte County Air Quality Management District (BCAQMD)	Butte	Construction	N/A[c]	N/A[c]	N/A[c]	N/A	N/A	N/A
		Operational	137 lbs/day[d]	137 lbs/day[d]	137 lbs/day[d]	N/A	N/A	N/A
Colusa County Air Pollution Control District (CCAPCD)	Colusa	Construction	25.0 lbs/day	25.0 lbs/day	80.0 lbs/day	N/A	500.0 lbs/day	N/A
		Operational	25.0 lbs/day	25.0 lbs/day	80.0 lbs/day	N/A	500.0 lbs/day	N/A
Feather River Air Quality Management District (FRAQMD)	Sutter Yuba	Construction	25 lbs/day[e]	25 lbs/day[e]	80 lbs/day	N/A	N/A	N/A
		Operational	25 lbs/day	25 lbs/day	80 lbs/day	N/A	N/A	N/A
Glenn County Air Pollution Control District (GCAPCD)	Glenn	Construction	N/A	N/A	N/A[f]	N/A[f]	N/A	N/A
		Operational	N/A	N/A	N/A	N/A	N/A	N/A
Placer County Air Pollution Control District (PCAPCD)	Placer	Construction	82 lbs/day	82 lbs/day	82 lbs/day	N/A	N/A~~550 lbs/day~~[g]	N/A[g]
		Operational	82 lbs/day[g]	82 lbs/day[g]	82 lbs/day[g]	N/A	N/A~~550 lbs/day~~[g]	N/A[g]
Sacramento Metropolitan Air Quality Management District (SMAQMD)	Sacramento	Construction	N/A	85 lbs/day	Violation of CAAQS	Violation of CAAQS	Violation of CAAQS	1,100 MT CO_2e~~N/A~~
		Operational	65 lbs/day	65 lbs/day	Violation of CAAQS	Violation of CAAQS	Violation of CAAQS	1,100 MT CO_2e/year (land use); 10,000 MT CO_2e/year (stationary sources)~~N/A~~
Tehama County Air	Tehama	Construction	137 lbs/day[d]	137 lbs/day[d]	137 lbs/day[d]	N/A	N/A	N/A

Air District	Affected Counties	Threshold Type	ROG	NO_X	PM10	PM2.5	CO	GHGs
Pollution Control District (TCAPCD)		Operational	137 lbs/day[d]	137 lbs/day[d]	137 lbs/day[d]	N/A	N/A	N/A
Yolo-Solano Air Quality Management District (YSAQMD)	Solano Yolo	Construction	10 tons/year	10 tons/year	80 lbs/day	N/A	Violation of CAAQS	N/A
		Operational	10 tons/year	10 tons/year	80 lbs/day	N/A	Violation of CAAQS	N/A

Source: Adapted from: Bay Area Air Quality Management District 2012; Butte County Air Quality Management District 2008; Chang pers. comm.; Feather River Air Quality Management District 2010; Gomez pers. comm.; Ledbetter pers. comm.; Sacramento Metropolitan Air Quality Management District 2011; Tehama County Air Pollution Control District 2009; Williams pers. comm.; Yolo-Solano Air Quality Management District 2007.

Notes: This table includes mass-emissions thresholds only. Thresholds for TACs and odors are not included.

N/A = Not Applicable; lbs/day = pounds per day; BMP = Best Management Practices; MT = metric tons.

[a] In March 2012, an Alameda County Superior Court ruled that BAAQMD needed to comply with CEQA prior to adopting their 2010 Air Quality CEQA Guidelines. As a result, the most recent guidelines are not formally adopted and are considered draft. The court ruling addressed the process of adoption of the guidelines, not the technical justification for the BAAQMD recommended thresholds. Although the most recent guidelines can only be considered draft, this document uses the recommended thresholds because the BAAQMD has provided evidence based justifications for all proposed thresholds that the City finds them to be well- grounded, based on the best available on scientific evidence and reasoning concerning air quality and greenhouse gas emissions, and therefore appropriate for use in CEQA evaluations.

[b] Construction activities would be required to implement the applicable dust control BMPs according to BAAQMD CEQA Guidelines.

[c] Operational emission thresholds apply to construction if construction will last 6 months to a year. (BCAQMD)

[d] The thresholds shown are the Level C Threshold for projects that may result in potential significant air quality impacts. (BCAQMD and TCAPCD)

[e] NO_X and ROG construction emissions may be averaged over the life time of the project, but may not exceed 4.5 tons/year. (FRAQMD)

[f] Although GCAPCD does not have specific construction and operational emission thresholds, they require water trucks onsite during construction, and they require any earth-moving activities to be suspended during wind events exceeding 15 mph.

[g] PCAPCD has published draft ROG and NOx thresholds of 55 pounds per day. The air district also proposes a construction GHG threshold of 10,000 MT CO_2e and tiered operational GHG thresholds of 1,100 MT CO_2e/year, 10,000 MT CO_2e/year, and various efficiency metrics. However, as of September 2016, these thresholds had not been adopted by the PCAPCD board~~If CO thresholds are exceeded, modeling can be done to demonstrate that state and federal criteria will not be exceeded. (PCAPCD)~~.

C.3.6 Chapter 9, Noise and Vibration

C.3.6.1 Butte County General Plan

The goals of the Health and Safety Element of the Butte County General Plan are to secure and maintain an environment free from annoying noise, to provide information concerning the community noise environment, and to make noise a consideration in the on-going planning process and the development of ordinances relating thereto (Butte County 2010). The county maintains a policy of restricting noise-generating construction activities located within 1,000 feet of residential uses to daytime hours between 7:00 a.m. and 6:00 p.m. on weekdays and non-holidays.

C.3.6.2 Colusa County General Plan

The Colusa County Noise Element contains goals, objectives, policies, and action items that seek to reduce community exposure to excessive noise levels by establishing noise level standards for a variety of land uses (Colusa County 2011). In Colusa County, noise is perceived as a relatively minor problem; therefore, the county has not adopted a noise ordinance and noise due to construction activity is not addressed.

C.3.6.3 Glenn County Noise Ordinance

The Glenn County noise ordinance (Chapter 15.560.100, Noise) sets the exterior noise standards of 57 A-weighted decibel (dBA) equivalent continuous noise level (L_{eq}) for daytime hours (7 a.m. to 10 p.m.) and 50 dBA L_{eq} for nighttime hours (10 p.m. to 7 a.m.) for receiving property or receptor that is a dwelling, hospital, school, library or nursing home. Construction operations conducted between 7 a.m. and 7 p.m. are exempted from the provisions of the county noise ordinance. Construction activity done outside that period must comply with the numerical noise limits (Glenn County 2009).

C.3.6.4 Placer County Code

Environmental noise in Placer County is regulated by Article 9.36 of the County Code (Placer County 2009). Daytime construction noise (6 a.m. to 8 p.m. Monday–Friday, and 8 a.m. to 8 p.m. on weekends) is exempted, provided noise control devices on the construction equipment are maintained in good working order. Construction performed outside those periods must comply with the county's numerical noise limits. The allowable 1-hour L_{eq} noise levels are defined as the background noise level plus 5 dBA. However, if the background ambient noise levels are less than 50 dBA (daytime) or 40 dBA (nighttime), then the allowable noise levels are set to 55 dBA (daytime) and 40 dBA (nighttime).

C.3.6.5 Sacramento County

City of Sacramento Noise Ordinance

The city noise ordinance is the primary enforcement tool for the operation of locally regulated noise sources, such as construction activity, and is set forth in Section 8.68.080 of the City Code (City of Sacramento 2009). The city's exterior noise standard is 55 dBA L_{eq} during the hours of 7 a.m. to 10 p.m. for residential and agricultural uses. Noise associated with the erection (including excavation), demolition, alteration, or repair of any structure occurring between 7 a.m. and 6 p.m., Monday through Saturday and between 9 a.m. and 6 p.m. on Sunday is exempted from the provisions of the city noise ordinance. Construction activity outside those periods must comply with the numerical noise limits.

Sacramento County Noise Ordinance

Sacramento County noise ordinance (Section 6.68.070, Exterior Noise Standards) sets daytime and nighttime limits for noise levels at residential and agricultural property (Sacramento County 2009). The ordinance states that a standard of 55 dBA for any cumulative 30-minute period is applied during the hours of 7 a.m. to 10 p.m., and a standard of 50 dBA or any cumulative 30-minute period is applied during the hours of 10 p.m. to 7 a.m. for residential and agricultural uses. However, daytime construction activities are exempt from the noise limits. Daytime construction is defined as Monday–Friday from 6 a.m. to 8 p.m., and weekends from 7 a.m. to 8 p.m. Construction operations conducted outside those hours are subject to the nighttime ambient noise limits. The ordinance further states that internal combustion engines in use on construction sites must be equipped with suitable exhaust and intake silencers in good working order.

C.3.6.6 Solano County

City of Rio Vista General Plan

The City of Rio Vista establishes its noise policies in the Safety and Noise Element of the General Plan, which specifies exterior noise standards for land use compatibility with various noise levels (City of Rio Vista 2002). However, according to the construction noise policy 11.15.B, noise associated with construction activities is exempt from the noise standards. According to the construction noise policy 11.15.C, the city should limit construction activities to between the hours of 7 a.m. and 5 p.m. unless an exemption is received from the city to cover special circumstances.

Solano County General Plan

The Solano County Noise Element has been incorporated into the Public Health and Safety Chapter of the General Plan (Solano County 2008). The general plan includes noise thresholds for construction-related activities. The specified allowable hourly L_{eq} levels are 55 dBA during daytime and 50 dBA during nighttime at residential property. The general plan does not include an exemption for temporary daytime construction activity.

C.3.6.7 Sutter County

Sutter County General Plan

Sutter County does not have a noise ordinance. Instead, it implements noise policies in Section 11 of its General Plan Policy Document. That document specifies allowable hourly L_{eq} and allowable maximum noise levels (Sutter County 2011). The specified allowable hourly L_{eq} levels are 55 dBA during daytime (7 a.m. to 10 p.m.) and 45 dBA during nighttime (10 p.m. to 7 a.m.). Sutter County policy does not include an exemption for temporary daytime construction activity.

Yuba City Municipal Code

The Yuba City Municipal Code sets its noise ordinance in the Chapter 4-17, Noise Regulation. Noise from the construction activities is regulated by the Section 4-17.10 of the ordinance, which specifies that it is unlawful to use construction equipment before 6 a.m. or after 9 p.m. daily except Sunday and state or federal holidays when the prohibited time shall be before 8 a.m. and after 9 p.m. (City of Yuba City 2009).

C.3.6.8 Tehama County General Plan

Tehama County establishes noise standards in the Noise Element of General Plan (Tehama County 2009a). The Noise Element specifies exterior noise limits at residential and noise-sensitive property. The specified allowable hourly L_{eq} levels are 50 dBA during daytime and 45 dBA during nighttime for residential uses. Tehama County policy does not include an exemption for temporary daytime construction activity. If the existing ambient noise level exceeds the standards, then the noise level standards shall be increased at 5 dB increments to encompass the ambient level.

C.3.6.9 Yolo County

City of West Sacramento Municipal Code

The West Sacramento Municipal Code sets its noise standards in the Chapter 17.32, Performance Standards (City of West Sacramento 2009). Noise from the non-transportation sources is regulated by the Section 17.32.030 of the ordinance, which specifies that the City's exterior noise standard is 50 dBA L_{eq} during the hours of 7 a.m. to 10 p.m. and 45 dBA L_{eq} during the hours of 10 p.m. to 7 a.m. for residential uses. The ordinance does not include an exemption for temporary daytime construction activity.

Yolo County General Plan

Yolo County establishes its noise policies in the Health and Safety Element of the General Plan, which specifies exterior noise standards for land use compatibility with various noise levels (Yolo County 2009). The General Plan recommends exterior noise levels of 55–70 dBA Community Noise Equivalent Level (CNEL) should be designated "conditionally acceptable." The General Plan recommends development of a noise ordinance that would include numerical standards for construction projects. Currently, Yolo County has not yet adopted a noise ordinance, and noise due to construction activity is not yet addressed.

C.3.6.10 Yuba County

City of Marysville Municipal Code

Chapter 9.09 of the Marysville Municipal Code lays forth procedural provisions for police response to loud and unreasonable noise (City of Marysville 2009). However, numerical noise level standards are not set and noise due to construction activity is not addressed.

Yuba County Noise Ordinance

The Yuba County Ordinance sets county noise standards in Chapter 8.20 (Yuba County 2009a). Noise during construction is regulated by the Section 8.20.310 of the noise ordinance, which states that it is unlawful for any person within a residential zone, or within a radius of 500 feet, to operate equipment or perform any outside construction or repair work between the hours of 10 p.m. and 7 a.m., provided that such activity occurs in such a manner that a reasonable person of normal sensitiveness residing in the area is caused discomfort or annoyance.

C.3.7 Chapter 10, Vegetation and Wetlands

C.3.7.1 Butte County

Butte County General Plan

The Butte County General Plan (Butte County 2010) Conservation and Open Space Element identifies vegetation types and wetland resources that are important wildlife resources/habitats within the county. The Conservation and Open Space Element addresses the conservation, development, and utilization of natural resources, including forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, water, and hydrology. Relevant goals in the General Plan include engaging in cooperative planning efforts to protect biological resources, conserving and enhancing habitat for protected species and sensitive biological communities, maintaining and promoting native vegetation, and protecting identified special-status plant and animal species.

Butte Regional Conservation Plan

The Butte County Association of Governments is currently preparing the Butte Regional Conservation Plan, which is both a Habitat Conservation Plan (HCP) and a Natural Community Conservation Plan (NCCP). The plan will provide comprehensive species, wetlands, and ecosystem conservation and contribute to the recovery of endangered species within the plan area while also providing a more streamlined process for environmental permitting. Plan goals that will support the conservation of vegetation and wetland resources include the following:

- Balance open space, habitat, agriculture and urban development.
- Allow for appropriate and compatible growth and development in the Butte County region.
- Preserve aquatic and terrestrial resources and provide habitat for threatened and endangered species through conservation partnerships with local agencies.
- Provide greater conservation values than a project-by-project, species-by-species review.
- Finalization and adoption of the plan is scheduled for 2013.

C.3.7.2 Colusa County General Plan

The draft Colusa County General Plan (Colusa County 2011) Conservation Element contains objectives and policies that pertain to vegetation and wetland resources. The Conservation Element objectives are as follows:

- **Objective Con-1A:** Protect, enhance, and manage the county’s ecosystems and habitats.
  - **Policy Con 1-6:** Focus conservation efforts on high priority conservation areas that contain suitable habitat for endangered, threatened, migratory or special-status species and that can be managed with minimal interference with nearby agricultural activities.
  - **Policy Con 1-7:** Preserve and enhance those biological communities that contribute to the county’s rich biodiversity including, but not limited to, blue oak woodlands, annual

grasslands, mixed chaparral, pine woodlands, wetlands, riparian areas, aquatic habitat, and agricultural lands.

- **Objective Con-1B:** Protect endangered, threatened and special-status plant and animal species, their habitats, and other sensitive habitats.
  - **Policy Con 1-13:** Sensitive habitats include oak woodlands, wetlands, vernal pools, riparian areas, wildlife and fish migration corridors, native plant nursery sites, waters of the United States, and other habitats designated by state and federal agencies and laws.
  - **Policy Con 1-14:** Require any proposed project that may affect special-status species, their habitat, or other sensitive habitat to submit a biological resources evaluation as part of the development review process. Evaluations shall be carried out under the direction of the Colusa County Department of Planning and Building and consistent with applicable state and federal guidelines. Additional focused surveys shall be conducted during the appropriate season, if necessary.
  - **Policy Con 1-15:** Require that impacts to wetlands and riparian habitat protected by state or federal regulations be avoided to the greatest extent feasible. If avoidance is not possible, fully mitigate impacts consistent with applicable local, state and federal requirements.
  - **Policy Con 1-17:** All discretionary public and private projects that identify special-status species or sensitive habitats in a biological resources evaluation shall avoid impacts to special-status species and their habitat to the maximum extent feasible. Where impacts cannot be avoided, projects shall include the implementation of site-specific or project –specific effective mitigation strategies developed by a qualified professional in consultation with state or federal resource agencies with jurisdiction.
  - **Policy Con 1-18:** where sensitive biological habitats have been identified on or immediately adjacent to a project site, the following measures shall be implemented:
    - Pre-construction surveys for species listed under the state or federal Endangered Species Act, or species identified as special-status by the resource agencies, shall be conducted by a qualified biologist;
    - Construction barrier fencing shall be installed around sensitive resources and areas identified for avoidance or protection;

Employees shall be trained by a qualified biologist to identify and avoid protected species and habitat.

C.3.7.3 Glenn County General Plan

The Glenn County General Plan (Glenn County 1993) contains goal and policies relevant to vegetation and wetlands in Sections 5.1.2, 5.1.3, and 5.1.4. Goal NRG-2 (Section 5.1.2) is to protect and maintain local water resources and is supported by policies NRP-22 through NRP-38. Goal NRG-3 (Section 5.1.3) is to preserve and enhance the county’s biological resources in a manner compatible with a sound local economy and is supported by policies NRP-39 through NRP-62. Goal NRG-4 is the preservation, maintenance, and restoration of forestry resources and is supported by policies NPR-63 through NRP-69.

C.3.7.4 Placer County

Placer County General Plan

The Placer County General Plan (Placer County 1994) contains goal and policy information relevant to vegetation and wetlands in Section 1 (Land Use) and Section 6 (Natural Resources). Goal 1.I in Section 1 is to establish and maintain interconnected greenbelts and open spaces for the protection of native vegetation and wildlife and for the community's enjoyment, and is supported by policies 1.I.1 and 1.I.2.

Section 6 contains goals and policies for water resources, wetland and riparian areas, fish and wildlife habitat, vegetation, and open space for the preservation of natural resources. Goal 6.A is to protect and enhance the natural qualities of Placer County's streams, creeks and groundwater, and is supported by policies 6.A.1 through 6.A.11. Goal 6.B is to protect wetland communities and related riparian areas throughout Placer County as valuable resources and is supported by policies 6.B.1 through 6.B.5. Goal 6.C is to protect, restore, and enhance habitats that support fish and wildlife species to maintain populations at viable levels and is supported by policies 6.C.1 through 6.C.14. Goal 6.D is to preserve and protect the valuable vegetation resources of Placer County and is supported by policies 6.D.1 through 6.D.14. Goal 6.E is to preserve and enhance open space lands to maintain the natural resources of the County and is supported by policies 6.E.1 through 6.E.5.

Placer County Tree Preservation Ordinance

Under the Placer County Tree Preservation Ordinance, "no person, firm, corporation or county agency shall conduct any development activities within the protected zone of any protected tree on public or private land, or harm, destroy, kill or remove any protected tree unless authorized by a tree permit." Protected trees are defined as follows:

- A tall woody plant native to California (excluding foothill pines and plants that are typically shrubs), with a single main stem or trunk at least 6 inches dbh (i.e., diameter at a height of 4.5 feet above ground level), or a multiple trunk with an aggregate of at least 10 inches dbh.
- All native trees regardless of size within riparian zones. A riparian zone is defined as any area within fifty feet from the centerline of a seasonal creek or stream, any area one hundred feet from the centerline of a year round creek, stream, or river, and any area within one hundred feet from the shoreline of a pond, lake or reservoir.
- All landmark trees. A landmark tree is defined as a tree or grove of trees designated by resolution of the board of supervisors to be of historical or cultural value, an outstanding specimen, an unusual species and/or of significant community benefit. Landmark trees may include non-native species.

A tree permit is required prior to the removal of any protected trees, and the permit application must include an arborist report that identifies the species, location, etc., of protected trees.

C.3.7.5 Sacramento County

American River Parkway Plan

The America River Parkway Plan (Sacramento County 2008) is intended to provide guidance for preservation, recreational use, development, and administration of the American River Parkway. The goals of the plan are as follows:

- To provide, protect and enhance for public use a continuous open space greenbelt along the American River extending from the Sacramento River to Folsom Dam.
- To provide appropriate access and facilities so that present and future generations can enjoy the amenities and resources of the Parkway which enhance the enjoyment of leisure activities.
- To preserve, protect, interpret and improve the natural, archaeological, historical and recreational resources of the Parkway, including an adequate flow of high quality water, anadromous and resident fishes, migratory and resident wildlife, and diverse natural vegetation.
- To mitigate adverse effects of activities and facilities adjacent to the Parkway.
- To provide public safety and protection within and adjacent to the Parkway.

The plan’s relevant policies for vegetation and wetlands are Polices 3.1 through 3.12.

Natomas Basin Habitat Conservation Plan

The Natomas Basin HCP (NBHCP) (City of Sacramento et al. 2003) applies to the 53,537-acre area interior to the toe of levees surrounding the Natomas Basin, located in the northern portion of Sacramento County and the southern portion of Sutter County. The purpose of the NBHCP is to promote biological conservation in conjunction with economic and urban development within the permit areas. The NBHCP establishes a multi-species conservation program to minimize and mitigate the expected loss of habitat values and incidental take of covered species that could result from urban development, operations and maintenance for irrigation and drainage systems, and reserve management activities. The special-status plant species that are covered by the plan are Boggs Lake hedge-hyssop (*Gratiola heterosepala*), Colusa grass (*Neostapfia colusana*), delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), legenere (*Legenere limosa*), Sacramento Orcutt grass (*Orcuttia viscida*), Sanford’s arrowhead (*Sagittaria sanfordii*), and slender Orcutt grass (*Orcuttia tenuis*).

Sacramento County General Plan

The Sacramento County General Plan (Sacramento County 2011) contains the following Open Space Element and Conservation Element major goals that pertain to vegetation and wetlands:

Objective: Mitigate and restore for natural habitat and special status species loss.

Policies:

- **CO-58.** Ensure no net loss of marsh and riparian woodland acreage, values or functions.
- **CO-59.** Ensure mitigation occurs for any loss of or modification to the following types of acreage and habitat function:
    - vernal pools,
    - wetlands,

  - riparian,
  - native vegetative habitat, and
  - special status species habitat.
- **CO-61.** Mitigation should be consistent with Sacramento County-adopted habitat conservation plans.
- **CO-62.** Permanently protect land required as mitigation.

Objective: Protect and maintain habitat for special status species.

Policies:

- **CO-75.** Maintain viable populations of special status species through the protection of habitat in preserves and linked with natural wildlife corridors.

Objective: Establish vernal pool preserves that enhance and protect the ecological integrity of vernal pool resources.

Policies:

- **CO-83.** Utilize proper vernal pool restoration techniques as approved by United States Fish and Wildlife Service, California Department of Fish and Game and the Army Corps of Engineers.

Objective: Manage riparian corridors to protect natural, recreational, economic, agricultural and cultural resources as well as water quality, supply and conveyance.

Policies:

- **CO-88.** Where removal of riparian habitat is necessary for channel maintenance, it will be planned and mitigated so as to minimize unavoidable impacts upon biological resources.
- **CO-89.** Protect, enhance and maintain riparian habitat in Sacramento County.
- **CO-90.** Increase riparian woodland, valley oak riparian woodland and riparian scrub habitat along select waterways within Sacramento County.
- **CO-92.** Enhance and protect shaded riverine aquatic habitat along rivers and streams.

Objective: Maintain levee protection, riparian vegetation, function and topographic diversity by stream channel and bank stabilization projects. Stabilize riverbanks to protect levees, water conveyance and riparian functions.

Policies:

- **CO-99.** Encourage habitat restoration and recreational opportunities as an integral part of bank and levee stabilization efforts.
- **CO-101.** Stabilize the banks of rivers and streams in a manner that increases flood protection and increases riparian habitat functions.
- **CO-114.** Encourage revegetation of native plant species and avoid nonindigenous species.

Objective: Conserve and protect the Sacramento, Cosumnes, Mokelumne, and American Rivers to preserve natural habitat and recreational opportunities.

Policies:

- **CO-102.** Promote and encourage habitat restoration efforts on and adjacent to our river floodways.

Sacramento County Tree Preservation Ordinance

Sacramento County's Tree Preservation Ordinance protects trees that meet the definition of landmark or heritage trees. According to the Sacramento County Code (Section 19.04.030), a landmark tree is defined as an especially prominent or stately tree on any land in Sacramento County, including privately owned land, that can be any native or nonnative tree that is exceptional for its type and in good health and structural condition. The Sacramento County Code (Section 19.04.030) also recognizes native California oak trees (e.g., valley oak, blue oak, interior live oak) growing on any land in Sacramento County, including privately owned land, that have a trunk diameter ≥ 19 inches dbh as heritage trees.

C.3.7.6 Solano County General Plan

The Solano County General Plan (Solano County 2008) contains a Resources Element that strives to ensure conservation, preservation, and enhancement of natural, cultural, and open space resources to ensure a high quality of life for current and future county residents. The Resources Element identifies the following goals which pertain to vegetation and wetlands:

- Preserving of the county's valued natural, cultural, and scenic resources.
- Enhancing and restoring the natural environment and the county's diverse landscapes.
- Ensuring sustainable provision of energy, water, and mineral resources.

The key policies that serve to carry out these goals are general resource policies RS.G-1 though RS.G-10 and biological resource policies RS.P-1 through RS.P-6.

C.3.7.7 Sutter County

Natomas Basin Habitat Conservation Plan

See discussion of the NBHCP under Sacramento County.

Sutter County General Plan

The Biological Resources and Open Space portion of the Environmental Resources Element contains several goals related to vegetation and wetlands (Sutter County 2011), which include the following:

Goal: Support a comprehensive approach for the conservation, enhancement, and regulation of Sutter County's significant habitat and natural open space resources.

Policies:

- **ER1.7:** Mitigate biological and open space effects that cannot be avoided in accordance with an applicable habitat Conservation Plan and federal, state, and local regulations.

Goal: Conserve, protect, and enhance Sutter County's significant natural wetland and riparian habitats.

Policies:

- **ER2.4** Encourage the creation and use of regional wetland mitigation banks to the extent that they do not conflict with Sutter County agricultural lands and flood control operations.

Goal: Conserve, protect, and enhance Sutter County's varied wildlife and vegetation resources.

Policies:

- **ER3.1** Preserve special-status fish, wildlife, and plant species and habitats consistent with an applicable Habitat Conservation Plan and federal, state, and local regulations.
- **ER3.6** Preserve important areas of natural vegetation and the ecological integrity of these habitats, where feasible, including but not limited to riparian, vernal pool, marshes, oak woodlands and annual grasslands.
- **ER3.8** Encourage the use of native and drought tolerant plant materials, including native tree species, in all public and private landscaping and revegetation projects.

Goal: Conserve, protect, and enhance Sutter County's unique natural open space lands and resources.

Policies:

- **ER4.1** Preserve natural landforms, natural vegetation, and natural resources as open space to the extent feasible.
- **ER4.3** Preserve the Sacramento, Feather, and Bear River corridors as important habitat, recreation and open space resources. Support efforts to increase public access and recreational uses along the County's river corridors. (VW)

Yuba-Sutter Habitat Conservation Plan/Natural Community Conservation Plan

Yuba and Sutter Counties are currently preparing a regional HCP/NCCP referred to as the "Yuba-Sutter HCP/NCCP," which encompasses Sutter County (with the exception of the portion of the Natomas Basin HCP within Sutter County) and western Yuba County. The plan will include conservation goals, objectives, and measures that aim to preserve covered wildlife species and important natural and agricultural communities that support these species.

C.3.7.8 Tehama County General Plan

Goal OS-3 of the Tehama County General Plan is to protect, preserve, and enhance fish and wildlife species by maintaining healthy ecosystems (Tehama County 2009a). This goal will be reached by the implementation of policies OS-3.1 through OS-3.7, which include: the designation of areas supporting habitat for sensitive animal and plant species as habitat resources and the designation of riparian habitats as resource lands under the Natural Resource Conservation Land Use Classifications; providing wildlife circulation around new developments; and working with state and federal agencies to control and eliminate invasive plants from the county. The General Plan has several goals (OS-4 through OS-7) and policies (OS-4.1 through OS-7.3) to encourage the protection and restoration of oak woodlands (Tehama County 2009a). Goal OS-8 encourages commercial resource development of the county's natural resources in areas where "environmental, aesthetic, and adjacent land use compatibility impacts can be adequately mitigated" and is supported by policies OS-8.1, OS-8.2, and OS-8.3. Goal OS-9 is to protect and enhance resource lands in the county for the benefit of agriculture, timber, grazing, recreation, wildlife habitat, and quality of life and is supported by policies OS-9.1 through OS-9.4.

The Tehama County General Plan does not specifically address rare, threatened, or endangered plants or animals. However, policy OS-3.1 states that the county will preserve and protect environmentally sensitive and significant lands and water valuable for their plant and wildlife habitat.

C.3.7.9 Yolo County

Yolo County General Plan

The Conservation and Open Space Element of the Yolo County General Plan includes the primary open space goal to provide a diverse, connected and accessible network of open space, to enhance natural resources and their appropriate use (Goal CO-1). The primary biological resources goal is to protect and enhance biological resources through the conservation, maintenance, and restoration of key habitat areas and corresponding connections that represent the diverse geography, topography, biological communities, and ecological integrity of the landscape (Goal CO-2). Relevant supporting policies include CO-1.14, CO-1.15, CO-1.16, CO-1.21, CO-2.1, CO-2.2, CO-2.3, CO-2.4, CO-2.9, CO-2.10, CO-2.11, CO-2.14, CO-2.22, CO-2.23, CO-2.24, CO-2.26, CO-2.27, CO-2.28, CO-2.31, CO-2.33, CO-2.34, CO-2.36, CO-2.37, CO-2.39, CO-2.41 (Yolo County 2009).

Yolo County Oak Woodland Conservation and Enhancement Plan

The Yolo County Oak Woodland Conservation and Enhancement Plan (Yolo County 2007) promotes voluntary efforts to conserve and enhance the county's existing oak woodlands to help minimize the effects of land conversion and other factors that disturb the health and longevity of existing oak woodlands.

Yolo Natural Heritage Program

The Yolo Natural Heritage Program is a county-wide NCCP/HCP. The program strives to conserve the natural open space and agricultural landscapes that provide habitat for many special status and at-risk species found within the habitats and natural communities in the county. The Yolo Natural Heritage Program describes the measures that will be undertaken to conserve important biological resources, including agricultural landscapes, while allowing urban growth and public infrastructure projects. The plan is anticipated to be finalized and adopted sometime in 2016 or 2017 (Marchand pers. comm. 2013).

C.3.7.10 Yuba County

See the description above of the Yuba-Sutter HCP/NCCP.

C.3.8 Chapter 11, Fisheries and Aquatics

C.3.8.1 Butte County

Butte County General Plan

The Butte County General Plan (Butte County 2010) contains a Conservation and Open Space Element that identifies important wildlife resources/habitats within the county. Within the Conservation and Open Space Element are recommendations for wildlife habitat protection which include encouraging the creation and expansion of conservation and natural wilderness areas, excluding urban development from occurring in Butte Sink, marshes along the Sacramento River, and the borrow area along the Feather River, and not allowing urban development that would increase sediment loads in prime fishing waters. Relevant goals in the General Plan include engaging in cooperative planning efforts to protect biological resources, conserving and enhancing habitat for protected species and sensitive biological communities, maintaining and promoting native vegetation, and protecting identified special-status plant and animal species.

Butte Regional Conservation Plan

The Butte County Association of Governments is currently preparing an HCP/NCCP that will provide comprehensive species, wetlands, and ecosystem conservation and contribute to the recovery of endangered species within the plan area while also providing a more streamlined process for environmental permitting. Plan goals that will support the conservation of wildlife resources include the following:

- Balance open space, habitat, agriculture and urban development.
- Allow for appropriate and compatible growth and development in the Butte County region.
- Preserve aquatic and terrestrial resources and provide habitat for threatened and endangered species through conservation partnerships with local agencies.
- Provide greater conservation values than a project-by-project, species-by-species review.

The finalization and adoption of the plan is scheduled for 2013.

C.3.8.2 Colusa County General Plan

The draft Colusa County General Plan (2011) contains objectives and policies which focus on preservation and managed production of natural resources. These objectives and associated policies are listed below.

- **Objective Con-1A:** Protect, enhance, and manage the County's ecosystems and habitats.
  - **Policy Con 1-6:** Focus conservation efforts on high priority conservation areas that contain suitable habitat for endangered, threatened, migratory or special-status species and that can be managed with minimal interference with nearby agricultural activities.
  - **Policy Con 1-7:** Preserve and enhance those biological communities that contribute to the County's rich biodiversity including, but not limited to, blue oak woodlands, annual grasslands, mixed chaparral, pine woodlands, wetlands, riparian areas, aquatic habitat, and agricultural lands.

- **Objective Con-1B:** Protect endangered, threatened and special-status plant and animal species, their habitats, and other sensitive habitats.
    - **Policy Con 1-13:** Sensitive habitats include oak woodlands, wetlands, vernal pools, riparian areas, wildlife and fish migration corridors, native plant nursery sites, waters of the U.S., and other habitats designated by state and federal agencies and laws.
    - **Policy Con 1-14:** Require any proposed project that may affect special-status species, their habitat, or other sensitive habitat to submit a biological resources evaluation as part of the development review process. Evaluations shall be carried out under the direction of the Colusa County Department of Planning and Building and consistent with applicable state and federal guidelines. Additional focused surveys shall be conducted during the appropriate season, if necessary.
    - **Policy Con 1-15:** Require that impacts to wetlands and riparian habitat protected by state or federal regulations be avoided to the greatest extent feasible. If avoidance is not possible, fully mitigate impacts consistent with applicable local, state and federal requirements.
    - **Policy Con 1-17:** All discretionary public and private projects that identify special-status species or sensitive habitats in a biological resources evaluation shall avoid impacts to special-status species and their habitat to the maximum extent feasible. Where impacts cannot be avoided, projects shall include the implementation of site-specific or project – specific effective mitigation strategies developed by a qualified professional in consultation with state or federal resource agencies with jurisdiction.
    - **Policy Con 1-18:** where sensitive biological habitats have been identified on or immediately adjacent to a project site, the following measures shall be implemented:
        - Pre-construction surveys for species listed under the state of federal Endangered Species Act, or species identified as special-status by the resource agencies, shall be conducted by a qualified biologist;
        - Construction barrier fencing shall be installed around sensitive resources and areas identified for avoidance or protection;
        - Employees shall be trained by a qualified biologist to identify and avoid protected species and habitat.
- **Objective Con-1C:** Protect and enhance local fisheries and riparian and aquatic habitat.
    - **Policy Con 1-20:** Protect, restore and enhance habitat for protected fish species in a manner that does not result in the conversion of agricultural lands or result in the loss of agricultural water supplies.
    - **Policy Con 1-21:** Protect riparian habitat along the Sacramento River in order to maintain suitable habitat for anadromous fish species, including salmon and steelhead trout, and for native sport-fishing species.
- **Objective Con-1D:** Protect surface water quality in the County's lakes, streams, creeks and rivers.
    - **Policy Con 1-24:** If a proposed project may result in impacts to wetlands or other Waters of the U.S., require the project proponents to consult with the appropriate regulatory agency and implement all applicable permit requirements as a condition of project approval.

  - **Policy Con 1-25:** Balance the needs of aquatic and riparian ecosystem enhancement efforts with flood management objectives.

C.3.8.3 Glenn County General Plan

The Glenn County General Plan contains goals and policies pertinent to protect biological resources such as creeks and riparian habitat which provides habitat for special-status fish species such as anadromous fish (Glenn County 1993). These goals and associated policies are summarized below.

- **NRP-41** – Biological resources: Preserve natural riparian habitat, especially along Stony Creek and the Sacramento River and Butte Creek.
- **NRP-46** – Promote protection of native biological habitats of local importance such as riparian forests, foothill oak woodlands, Stony Gorge and Black Butte Reservoirs.
- **NRP-49** – Coordinate with state and federal agencies, private landowners, and private preservation/conservation groups in habitat preservation and protection of rare, endangered, threatened and special concern species, to ensure consistency in efforts and to encourage joint planning and development of areas to be preserved.
- **NRP-50** – Recognize the Sacramento River corridor, the Sacramento National Wildlife Refuge, migratory deer herd areas, naturally occurring wetlands, and stream courses such as Butte and Stony Creeks as areas of significant biological importance.

C.3.8.4 Placer County

The Placer County General Plan (Placer County 1994) contains goals and policies pertinent to protect biological resources such as creeks and riparian habitat which provides habitat for special-status fish species such as anadromous fish. These goals and associated policies are summarized below.

Goal 6.A: To protect and enhance the natural qualities of Placer County's streams, creeks and groundwater.

Policies:

- **6.A.1.** The County shall require the provision of sensitive habitat buffers which shall, at a minimum, be measured as follows: 100 feet from the centerline of perennial streams, 50 feet from centerline of intermittent streams, and 50 feet from the edge of sensitive habitats to be protected including riparian zones, wetlands, old growth woodlands, and the habitat of rare, threatened or endangered species. Based on more detailed information supplied as a part of the review for a specific project, the County may determine that such setbacks are not applicable in a particular instance or should be modified based on the new information provided. The County may, however, allow exceptions, such as in the following cases:

Reasonable use of the property would otherwise be denied;

- The location is necessary to avoid or mitigate hazards to the public;
- The location is necessary for the repair of roads, bridges, trails, or similar infrastructure; or
- The location is necessary for the construction of new roads, bridges, trails, or similar infrastructure where the County determines there is no feasible alternative and the project has minimized environmental impacts through project design and infrastructure placement.

- **6.A.3.** The County shall require development projects proposing to encroach into a creek corridor or creek setback to do one or more of the following, in descending order of desirability:
  - Avoid the disturbance of riparian vegetation;
  - Replace riparian vegetation (on-site, in-kind);
  - Restore another section of creek (in-kind); and/or
  - Pay a mitigation fee for restoration elsewhere (e.g., wetland mitigation banking program).
- **6.A.5.** The County shall continue to require the use of feasible and practical best management practices (BMPs) to protect streams from the adverse effects of construction activities and urban runoff and to encourage the use of BMPs for agricultural activities.
- **6.A.7.** The County shall discourage grading activities during the rainy season, unless adequately mitigated, to avoid sedimentation of creeks and damage to riparian habitat.
- **6.A.8.** Where the stream environment zone has previously been modified by channelization, fill, or other human activity, the County shall require project proponents to restore such areas by means of landscaping, revegetation, or similar stabilization techniques as a part of development activities.

Goal 6.C: To protect, restore, and enhance habitats that support fish and wildlife species so as to maintain populations at viable levels.

- **6.C.1.** The County shall identify and protect significant ecological resource areas and other unique wildlife habitats critical to protecting and sustaining wildlife populations. Significant ecological resource areas include the following:
  - Wetland areas including vernal pools.
  - Stream environment zones.
  - Any habitat for rare, threatened or endangered animals or plants.
  - Critical deer winter ranges (winter and summer), migratory routes and fawning habitat.
  - Large areas of non-fragmented natural habitat, including Blue Oak Woodlands, Valley Foothill Riparian, vernal pool habitat.
  - Identifiable wildlife movement zones, including but not limited to, non-fragmented stream environment zones, avian and mammalian migratory routes, and known concentration areas of waterfowl within the Pacific Flyway.

Important Spawning Areas for Anadromous Fish

- **6.C.5**. The County shall require mitigation for development projects where isolated segments of stream habitat are unavoidably altered. Such impacts should be mitigated on-site with in-kind habitat replacement or elsewhere in the stream system through stream or riparian habitat restoration work.
- **6.C.9.** The County shall require new private or public developments to preserve and enhance existing native riparian habitat unless public safety concerns require removal of habitat for flood control or other public purposes. In cases where new private or public development results in modification or destruction of riparian habitat for purposes of flood control, the

developers shall be responsible for acquiring, restoring, and enhancing at least an equivalent amount of like habitat within or near the project area.

C.3.8.5 Sacramento County

American River Parkway Plan

The American River Parkway Plan's goal is: To preserve, protect, interpret and improve the natural, archaeological, historical and recreational resources of the Parkway, including an adequate flow of high quality water, anadromous and resident fishes, migratory and resident wildlife, and diverse natural vegetation (Sacramento County 2008).

The American River Parkway is a unique regional asset that shall be managed to balance the goals of controlling flooding; preserving and enhancing native vegetation, native fish species, the naturalistic open space and environmental quality within the urban environment; maintaining and improving water flow and quality; providing adequate habitat connectivity and travel corridors to support migratory and resident wildlife; providing recreational opportunities; and ensuring public safety.

The following are the Aquatic Communities policies:

- The parkway shall be managed to preserve, protect and/or restore riparian and in-channel habitat necessary for spawning and rearing of fish species, including native Chinook salmon (fall-run), steelhead, and Sacramento splittail, and recreational non-native striped bass and American shad. Priority shall be on providing diversity and complexity of habitat, consistent with recreational safety needs.
- In-stream woody material shall be managed to provide fish habitat in the lower American River consistent with recreational safety needs.
- Agencies managing the parkway shall identify, enhance and protect: areas where maintaining riparian vegetation will benefit the aquatic and terrestrial resources; current shaded riverine aquatic habitat; and other areas that can support a shaded riverine aquatic habitat, as time and resources permit, especially as associated with flood control or federally/state mandated species protection projects.

Sacramento County General Plan

The Sacramento County General Plan (2011) contains objectives and policies pertinent to protect biological resources such as creeks and riparian habitat which provides habitat for special-status fish species such as anadromous fish. These objectives and associated polices are summarized below.

The objectives and policies of the Sacramento County general plan that pertain to conservation are:

Objective: Mitigate and restore for natural habitat and special status species loss.

Policies:

- **CO-58.** Ensure no net loss of marsh and riparian woodland acreage, values or functions.
- **CO-59.** Ensure mitigation occurs for any loss of or modification to the following types of acreage and habitat function:
    - vernal pools,

  - wetlands,
  - riparian,
  - native vegetative habitat, and
  - special status species habitat.
- **CO-61.** Mitigation should be consistent with Sacramento County-adopted habitat conservation plans.
- **CO-62.** Permanently protect land required as mitigation.

Objective: Protect and maintain habitat for special status species.

Policies:

- **CO-75.** Maintain viable populations of special status species through the protection of habitat in preserves and linked with natural wildlife corridors.

Objective: Manage riparian corridors to protect natural, recreational, economic, agricultural and cultural resources as well as water quality, supply and conveyance.

Policies:

- **CO-88.** Where removal of riparian habitat is necessary for channel maintenance, it will be planned and mitigated so as to minimize unavoidable impacts upon biological resources.
- **CO-89.** Protect, enhance and maintain riparian habitat in Sacramento County.
- **CO-90.** Increase riparian woodland, valley oak riparian woodland and riparian scrub habitat along select waterways within Sacramento County.
- **CO-92.** Enhance and protect shaded riverine aquatic habitat along rivers and streams.

Objective: Maintain levee protection, riparian vegetation, function and topographic diversity by stream channel and bank stabilization projects. Stabilize riverbanks to protect levees, water conveyance and riparian functions.

Policies:

- **CO-99.** Encourage habitat restoration and recreational opportunities as an integral part of bank and levee stabilization efforts.
- **CO-101.** Stabilize the banks of rivers and streams in a manner that increases flood protection and increases riparian habitat functions.
- **CO-114.** Encourage revegetation of native plant species and avoid nonindigenous species.

Objective: Conserve and protect the Sacramento, Cosumnes, Mokelumne, and American Rivers to preserve natural habitat and recreational opportunities.

Policy:

- **CO-102.** Promote and encourage habitat restoration efforts on and adjacent to our river floodways.

Objective: Provide and protect high quality in-stream habitat, water quality and water flows to support fisheries propagation, development, and migration.

Policies:

- **CO-130.** Protect, enhance and restore riparian, in-channel and shaded riverine aquatic habitat for:
  - Spawning and rearing of fish species, including native and recreational non-native, non-invasive species, where they currently spawn;
  - Potential areas where natural spawning could be sustainable; and
  - Supporting other aquatic species.

C.3.8.6 Solano County General Plan

The Solano County General Plan (2008) contains policies pertinent to protect biological resources. Chapter 4 of the Solano County General Plan identifies the following policies with respect to biological resources:

- **RS.P-1:** Protect and enhance the county's natural habitats and diverse plant and animal communities, particularly occurrences of special-status species, wetlands, sensitive natural communities, and habitat connections.
- **RS.P-5:** Protect and enhance wildlife movement corridors to ensure the health and long-term survival of local animal and plant populations.

C.3.8.7 Sutter County General Plan

The Sutter County General Plan (2011) contains goals and policies pertinent to protect fish and wildlife habitat. These goals and associated policies are summarized below.

Goal: Support a comprehensive approach for the conservation, enhancement, and regulation of Sutter County's significant habitat and natural open space resources.

Policies:

- **ER1.7:** Mitigate biological and open space effects that cannot be avoided in accordance with an applicable habitat Conservation Plan and federal, state, and local regulations.

Goal: Conserve, protect, and enhance Sutter County's varied wildlife and vegetation resources.

Policies:

- **ER3.1:** Preserve special-status fish, wildlife, and plant species and habitats consistent with an applicable Habitat Conservation Plan and federal, state, and local regulations.
- **ER3.2** Coordinate with federal, state, and local resource agencies to protect special-status species.
- **ER3.3** Support the preservation and re-establishment of fisheries in the rivers and streams within Sutter County.
- **ER3.6** Preserve important areas of natural vegetation and the ecological integrity of these habitats, where feasible, including but not limited to riparian, vernal pool, marshes, oak woodlands and annual grasslands.

- **ER3.8** Encourage the use of native and drought tolerant plant materials, including native tree species, in all public and private landscaping and revegetation projects.

C.3.8.8 Tehama County General Plan

The Tehama County General Plan contains goals and policies pertinent to protect fish and wildlife habitat (Tehama County 2009a). These goals and associated policies are summarized below.

Goal:

OS-3. To protect, preserve, and enhance fish and wildlife species by maintaining healthy ecosystems.

Policies:

- **OS-3.1.** The County shall preserve and protect environmentally-sensitive and significant lands and water valuable for their plant and wildlife habitat, natural appearance, and character.
- **OS-3.2.** The County shall protect areas identified by the California Department of Fish and Game and the California Natural Diversity Data Base as critical riparian zones.
- **OS-3.3.** The County shall support and coordinate County plans with inter-jurisdictional programs for Best Management Practices of riparian resources in the County.
- **OS-3.7.** The County shall promote best management practices of natural resources that will enhance wildlife habitat.

C.3.8.9 Yolo County General Plan

The Yolo County General Plan (2009) contains policies pertinent to protect fish and wildlife habitat. These policies are summarized below.

Policies:

- **CO 2.3.** Preserve and enhance those biological communities that contribute to the county's rich biodiversity including blue oak and mixed oak woodlands, native grassland prairies, wetlands, riparian areas, aquatic habitat, agricultural lands, heritage valley oak trees, remnant valley oak groves, and roadside tree rows.
- **CO 2.4.** Protect, restore and enhance habitat for sensitive fish species, so long as it does not result in the large-scale conversion of existing agricultural resources.
- **CO 2.23.** Support efforts to coordinate the removal of non-native, invasive vegetation within watersheds and replacement with native plants.
- **CO 2.28** Balance the needs of aquatic and riparian ecosystem enhancement efforts with flood management objectives.

C.3.8.10 Yuba County General Plan

The Natural Resources Element of the Yuba County General Plan (2011) contains policies pertinent to protect fish and wildlife habitat. These policies are summarized below.

Policies:

- **NR5.7** New developments and public investments near Yuba County's streams and rivers shall be designed to avoid tree removal, erosion, or other modifications that would adversely affect salmonid habitat.

In addition, the Yuba County General Plan requires buffers to protect wetlands and riparian areas near public projects. Setbacks are expected to range from 33 to 150 feet in width. Where stream courses are contained within levees, required setbacks shall be measured from the outside toe of the levee (Yuba County 2011).

C.3.9 Chapter 12, Wildlife

C.3.9.1 Butte County

Butte County General Plan

The Butte County General Plan (Butte County 2010) contains wildlife conservation and open space elements that identify important wildlife resources/habitats within the county. The focus of these goals, policies and actions is to engage in cooperative planning efforts to protect biological resources, conserve and enhance habitat for protected species and sensitive biological communities, maintain and promote native vegetation, protect identified special-status plants and animal species, and facilitate the survival of deer herds in winter and critical winter migratory deer herd ranges.

Butte Regional Conservation Plan

Butte County is currently preparing a regional HCP/NCCP that will provide comprehensive species, wetlands, and ecosystem conservation and contribute to the recovery of endangered species within the plan area while also providing a more streamlined process for environmental permitting. Finalization and adoption of the plan is scheduled for 2013.

C.3.9.2 Colusa County General Plan

The Conservation Element and the Open Space and Recreation Element of the draft Colusa County General Plan (Colusa County 2011) contain goals and policies that pertain to wildlife resources/habitats within the county. These goals and policies aim to protect, enhance, and manage the county's ecosystems and habitats, to protect endangered, threatened and special-status plant and animal species, and to balance open space preservation with economic development needs.

C.3.9.3 Glenn County General Plan

The Glenn County General Plan (Glenn County 1993) contains the following two natural resources goals that pertain to wildlife resources.

- Goal NRG-2—protect and maintain local water resources.
- Goal NRG-3—preserve and enhance the county's biological resources in a manner compatible with a sound local economy.

Glenn County is currently in the process of preparing an updated general plan. The updated plan will also contain goals and policies that support wildlife resources.

C.3.9.4 Placer County General Plan

The Placer County General Plan (Placer County 1994) contains land use and natural resources sections that contain goals and policies pertinent to wildlife resources. These goals and polices focus on establishing and maintaining interconnected greenbelts and open spaces for the protection of native vegetation and wildlife and for the community's enjoyment.

C.3.9.5 Sacramento County

American River Parkway Plan

The American River Parkway Plan (Sacramento County 2008) seeks to "preserve, protect, interpret and improve" the ability of the parkway to support migratory and resident wildlife and diverse natural vegetation.

Natomas Basin Habitat Conservation Plan

The NBHCP applies to the 53,537-acre area interior to the toe of levees surrounding the Natomas Basin, located in the northern portion of Sacramento County and the southern portion of Sutter County (City of Sacramento et al. 2003). The purpose of the NBHCP is to promote biological conservation in conjunction with economic and urban development within the permit areas. The NBHCP establishes a multi-species conservation program to minimize and mitigate the expected loss of habitat values and incidental take of Covered Species that could result from urban development, operations and maintenance for irrigation and drainage systems, and reserve management activities. The key target wildlife species of the plan are giant garter snake, tricolored blackbird, northwestern pond turtle (*Emys marmorata marmorata*), burrowing owl, and Swainson's hawk, though numerous other species are covered by the plan.

Sacramento County General Plan

The Conservation Element and the Open Space Element of the Sacramento County General Plan (Sacramento County 2011) contains goals, objectives, and policies that pertain to wildlife resources. The focus of these goals, objectives, and policies is to preserve and manage natural habitats and their ecological functions and to permanently protect open space lands in Sacramento through coordinated use of regulation, education, acquisition, density transfer, and incentive programs.

The main objectives are to mitigate and restore natural habitat and special-status species loss; establish and manage preserve system with large core and landscape level preserves connected by wildlife corridors throughout Sacramento County to protect ecological functions and species populations; and review development plans and projects to ensure a balance between essential growth and protection and preservation of natural habitats and special-status species.

C.3.9.6 Solano County General Plan

The Solano County General Plan (Solano County 2008) contains a Resources Element that strives to ensure conservation, preservation, and enhancement of natural, cultural, and open space resources to ensure a high quality of life for current and future county residents. The resources chapter of the General Plan focuses on preserving the county's valued natural, cultural, and scenic resources, enhancing and restoring the natural environment and the county's diverse landscapes, and ensuring sustainable provision of energy, water, and mineral resources.

C.3.9.7 Sutter County

Natomas Basin Habitat Conservation Plan

See discussion of the NBHCP under Sacramento County.

Sutter County General Plan

The Environmental Resources chapter of the Sutter County 2030 General Plan (Sutter County 2011) contains conservation and open space goals and policies to support a comprehensive approach for the conservation, enhancement, and regulation of the county's significant habitat and natural open space resources and to conserve, protect, and enhance natural wetland, and riparian habitats, varied wildlife and vegetation resources and unique natural open space lands and resources.

Yuba-Sutter Habitat Conservation Plan/Natural Community Conservation Plan

Yuba and Sutter counties are currently preparing a regional HCP/NCCP referred to as the Yuba-Sutter HCP/NCCP, which encompasses Sutter County (with the exception of the portion of the Natomas Basin HCP within Sutter County) and western Yuba County. The plan will include conservation goals, objectives, and measures that aim to preserve covered wildlife species and important natural and agricultural communities that support these species as well as other local native and migratory wildlife within the plan area.

C.3.9.8 Tehama County General Plan

The Tehama County General Plan Open Space and Conservation Element contains three main goals and supporting policies that serve to promote the protection of wildlife resources within the county (Tehama County 2009a). These goals and polices aim to protect, preserve, and enhancing fish and wildlife species by maintaining healthy ecosystems and to protect and enhance resource lands in the county for the continued benefit of agriculture, timber, grazing, recreation, wildlife habitat, and quality of life.

C.3.9.9 Yolo County

Yolo County General Plan

The Conservation and Open Space Element of the Yolo County General Plan (Yolo County 2009) contains goals, objectives, and policies relevant to wildlife resources in the study area. These goals, objectives and policies focus on protecting and enhancing biological resources through conservation, maintenance, and restoration of key habitat areas and corresponding connections that represent the diverse geography, topography, biological communities, and ecological integrity of the landscape.

Yolo Natural Heritage Program

The Yolo Natural Heritage Program is a county-wide NCCP/HCP. The program strives to conserve the natural open space and agricultural landscapes that provide habitat for many special status and at-risk species found within the habitats and natural communities in the county. The Yolo Natural Heritage Program describes the measures that will be undertaken to conserve important biological resources, including agricultural landscapes, while allowing urban growth and public infrastructure projects. The plan is anticipated to be finalized and adopted sometime in 2016 or 2017 (Marchand pers. comm. 2013).

C.3.9.10 Yuba County

Yuba County General Plan

The Natural Resources Element of the Yuba County General Plan (Yuba County 2011) contains goals, objectives and actions that focus on protecting and restoring habitat for special-status species that have the potential to occur in Yuba County.

Yuba-Sutter Habitat Conservation Plan/Natural Community Conservation Plan

See discussion under Sutter County.

C.3.10 Chapter 13, Land Use and Agriculture

Land use planning is the province of local governments in California. All cities and counties within California are required by the State to adopt a general plan establishing goals and policies for long-term development, protection from environmental hazards, and conservation of identified natural resources (Government Code Section 65300). Local general plans lay out the pattern of future residential, commercial, industrial, agricultural, open-space, and recreational land uses within a community.

Local jurisdictions implement their general plans by adopting zoning, subdivision, grading, and other ordinances. Zoning identifies the specific types of land uses that may be allowed on a given site and establishes the standards that will be imposed on new development. Zoning regulations vary from jurisdiction to jurisdiction. However, typical standards in zoning ordinances include the siting of structures relative to parcel boundaries; architectural design (including height limitations); and the percentage of building coverage allowed relative to the overall square footage of a parcel.

The general distribution and location and the extent of allowable uses for agricultural lands within a given city or county is typically designated by the land use element in the general plan. In California, the trend is for local planning documents to include goals and policies aimed at balancing the preservation of existing agricultural land with the increasing demands for housing and other types of urbanization. Of particular relevance to the analyses in this chapter, irrigated and/or agricultural activities are typically considered permitted uses under agriculture land use designations. Grazing activities may be permitted uses under multiple land use designations, including but not necessarily limited to agricultural, grassland, and open space.

For each affected county or city within the program area, there are specific goals and policies guiding the use or preservation of land. The following goals and policies apply to the program study area.

C.3.10.1 Regional and Local Habitat Conservation Plans and Natural Community Conservation Plans

Pursuant to the requirements of ESA and California's Natural Community Conservation Planning Act respectively, HCPs and NCCPs are developed and implemented for a wide variety of projects and programs. Projects and programs covered by HCPs and NCCPs and the actions enabled under such plans can vary greatly in geographic scope. Following are brief descriptions of the four conservation plans that cover areas within the program area.

- **Butte Regional Conservation Plan.** Butte County is currently preparing an HCP/NCCP that will provide comprehensive species, wetlands, and ecosystem conservation and contribute to the recovery of endangered species within the western Butte County, while also providing a more streamlined process for environmental permitting.
- **Natomas Basin HCP.** The NBHCP applies to the 53,537-acre area interior to the toe of levees surrounding the Natomas Basin, located in the northern portion of Sacramento County and the southern portion of Sutter County (City of Sacramento 2003). The purpose of the NBHCP is to promote biological conservation in conjunction with economic and urban development within the permit areas. The NBHCP establishes a multi-species conservation program to minimize and mitigate the expected loss of habitat values and incidental take of covered species that could result from urban development, operations and maintenance of irrigation and drainage systems, and reserve management activities. The key target wildlife species of the plan include giant garter snake, tricolored blackbird, Northwestern pond turtle, burrowing owl, Swainson's hawk, though numerous other species are covered by the plan.
- **Yuba-Sutter HCP/NCCP.** Yuba and Sutter Counties are currently preparing a regional HCP/NCCP referred to as the Yuba-Sutter HCP/NCCP, which encompasses Sutter County (with the exception of the portion of the Natomas Basin HCP within Sutter County) and western Yuba County. The plan will include conservation goals, objectives, and measures that aim to preserve covered wildlife species and important natural and agricultural communities that support these species as well as other local native and migratory wildlife within the plan area.
- **Yolo Natural Heritage Program.** This county-wide HCP/NCCP is intended to conserve the natural open space and agricultural landscapes that provide habitat for many special status and at-risk species. The Yolo Natural Heritage Program will describe the measures that will be undertaken to conserve important biological resources including agricultural landscapes while allowing urban growth and public infrastructure projects. This HCP/NCCP and the associated environmental document for the HCP/NCCP are currently in progress.

C.3.10.2 Butte County General Plan

The Butte County General Plan (Butte County 2010) contains land use and agricultural elements that identify historic, current, and future development patterns and land use trends within the county, as well as polices that guide the compatible development of urban and agricultural uses. The Butte County General Plan contains the following goals and policies that pertain to land use and agricultural resources.

Land Use Goals and Policies

- **Goal LU-1.** Continue to uphold and respect the planning principles on which the County's land use map is based.
    - **Policy LU-P1.1.** The County shall protect and conserve land that is used for agricultural purposes, including cropland and grazing land.
    - **Policy LU-P1.2.** The County shall promote economic development and job-generating industry in unincorporated areas.

- ○ **Policy LU-P1.6.** The County shall conserve important habitat and watershed areas, while protecting the public safety of County residents.
- **Goal LU-6.** Provide adequate land for the development of public and quasi-public uses, as a means to provide necessary public services and facilities in support of existing and new residential, commercial, and industrial land uses.
- **Goal LU-12.** Coordinate planning efforts within the county and region.
  - **Policy LU-P12.4.** The County shall coordinate planning efforts with those of special districts and school districts.

Agricultural Goals and Policies

- **Goal AG-1.** Maintain, promote, and enhance Butte County's agriculture uses and resources, a major source of food, employment, and income in Butte County.
  - **Policy AG-P1.1.** The County supports State and federal legislation designed to conserve soil and protect agricultural land.
  - **Policy AG-P1.3.** Continue to work with landowners in establishing new and maintaining existing Williamson Act contracts.
- **Goal AG-2.** Protect Butte County's agricultural lands from conversion to non-agricultural uses.
  - **Policy AG-P2.1.** The county shall work with the Local Agency Formation Commission to create and maintain a consistent approach to the conservation of agricultural land through the designation of reasonable and logical sphere of influence boundaries.
  - **Policy AG-P2.2.** The County supports private conservation organizations that utilize voluntary conservation easements as a tool for agricultural conservation, continued agricultural use, agricultural supportive uses, tax breaks and similar goals.
- **Goal AG-6.** Provide adequate infrastructure and services to support agriculture.
  - **Policy AG-P6.1.** The County supports the efforts of private landowners and public agencies to protect farmers from catastrophic and uncontrolled flooding of permanent crops, such as orchards, nurseries and other major agricultural investments.

C.3.10.3 Colusa County General Plan

The draft Colusa County General Plan (Colusa County 2011) contains land use, community planning, and resource conservation goals and objectives that seek to concentrate the County's growth in existing communities and prevent encroachment into viable agricultural areas. As discussed in the Land Use Element, the county has adopted a Land Use Plan that focuses future growth in and around the communities that provide urban services, including Arbuckle, College City, Colusa, Grimes, Maxwell, Princeton, Stonyford, and Williams. The plan promotes the development of the vacant gaps within each town before allowing growth to encroach into farm areas. In keeping with the plan, the county has adopted general development policies that promote orderly and compact development around the existing communities, with minimal impacts on existing agricultural areas (Policies LU 1-10 through LU 1-18). Additionally, the Agriculture Element contains policies specific to the creation and management of habitat on agricultural lands. Habitat management cannot be considered legitimate use of agricultural land in Colusa County and requires a general plan amendment to change the land use designation to "Resource Conservation." These policies are listed below.

- **Policy AG-14.** Resource conservation activities such as habitat creation and active habitat or species management on lands designated for agricultural uses shall require a General Plan Amendment to Resource Conservation unless the following criteria are met:
  - The resource conservation activities involve active and on-going agricultural activities on the majority of the site.
  - The resource conservation activities are compatible with agricultural activities on the majority of the site and existing or potential agricultural activities in the vicinity.
  - There would not be a concentration of resource conservation lands in the immediate area.

  If the above conditions are met, the resource conservation activities shall require a Conditional Use Permit.
- **Policy AG-15.** Habitat management without active and ongoing agricultural activities is not considered an agricultural use, and shall require a General Plan Amendment to designate such lands Resource Conservation.

C.3.10.4 Glenn County General Plan

The Glenn County General Plan (Glenn County 1993) includes land use goals and policies that promote agricultural land preservation and protect these lands from urban encroachment. To further protect agricultural lands from urban development, urban limit lines have been established around the cities of Orland and Willows, the unincorporated communities of Hamilton City, Artois, Elk Creek and Butte City. Glenn County is currently in the process of preparing an updated general plan, the Glenn County General Plan 2007–2027. The existing Glenn County General Plan contains the following policies that pertain to land use and agricultural land preservation.

- **NRP-1.** Maintain agriculture as a primary, extensive land use, not only in recognition of the economic importance of agriculture, but also in terms of agriculture's contribution to the preservation of open space and wildlife habitat.
- **NRP-14**. Consult Important Farmland Maps and other sources of information on the relative value of agricultural lands when planning areas of growth, in order to direct growth and development toward lesser value agricultural lands.
- **NRP-15.** Recognize that, in order to realistically provide for the necessary diversity and growth required in the local economy, some lands presently committed to agriculture may be consumed by other development activities, and plan for and monitor such conversion to assure that it does not hinder or restrict existing agricultural operations. Priority shall be given to industries related to agriculture.
- **NRP-17.** Recognize that limited conversion of grazing lands to other uses may be less harmful to agriculture than conversion of cropland, if the new uses are properly planned and serviced.
- **NRP-19.** Support the erosion control programs, resource management programs, and agricultural conservation efforts of the Glenn County Resource Conservation District that benefit the county as a whole.
- **NRP-24**. Recognize the following local priorities when dealing with questions of ground and surface water use:
  - Household/Domestic.

- Agriculture.
- Industrial/Commercial.
- Wildlife/Conservation.
- Exportation.

- **CDP-10.** Encourage the preservation of agricultural lands, including those lands in production, and those which are potentially productive.
- **CDP-11**. Direct nonagricultural development to marginal agricultural lands, avoiding Important Farmlands, wherever feasible alternative sites have been identified.

C.3.10.5 Placer County General Plan

The Placer County General Plan (Placer County 1994) contains goals and policies pertinent to land use and agricultural resources. These goals and associated polices are summarized below.

- **6.E.1.** The County shall support the preservation and enhancement of natural land forms, natural vegetation, and natural resources as open space to the maximum extent feasible. The County shall permanently protect, as open space, areas of natural resource value, including wetlands preserves, riparian corridors, woodlands, and floodplains.
- **6.E.2.** The County shall require that new development be designed and constructed to preserve the following types of areas and features as open space to the maximum extent feasible:
    - High erosion hazard areas.
    - Scenic and trail corridors.
    - Streams, streamside vegetation.
    - Wetlands.
    - Other significant stands of vegetation.
    - Wildlife corridors.
    - Any areas of special ecological significance.
- **Goal 7.A:** To provide for the long-term conservation and use of agriculturally-designated lands.
- **7.A.1.** The County shall protect agriculturally designated areas from conversion to non-agricultural uses.
- **7.A.2.** The County shall ensure that unincorporated areas within city spheres of influence that are designated for agricultural uses are maintained in large parcel sizes of 10-acre minimums or larger.
- **7.A.3.** The County shall encourage continued and, where possible, increased agricultural activities on lands suited to agricultural uses.

C.3.10.6 Sacramento County

American River Parkway Plan

The American River Parkway (Sacramento County 2008) is a unique regional facility which shall be managed to balance the goals of: a) preserving naturalistic open space and protecting environmental quality within the urban environment, and b) contributing to the provision of recreational opportunities in the Sacramento area. Overall guidance on the approach to preservation and management of the Parkway are embodied in both the plan's goals and the concept policies. The Goals and Policy chapter of the plan identifies the following goal that pertains to land use:

Goals

- To provide, protect and enhance for public use a continuous open space greenbelt along the American River extending from the Sacramento River to Folsom Dam.

Key land use policies in the plan that serve to carry out this goal include the following:

- **7.1.** Facilities and improvements shall not be installed within the parkway unless consistent with an adopted parkway area plan.
- **7.4.** Human developments and facilities, including but not limited to, buildings, fences, trails, sprinkler systems, and gates shall be prohibited in the Open Space preserve Areas, except as necessary to protect the public health, safety, welfare, or for the purposes of habitat restoration.
- **7.17.** Habitat restoration, local drainage, public utilities, and public flood control facilities, as determined to be appropriate to, and permitted within, a wild and Scenic Rivers corridor, are permitted in all land use categories.
- **7.18.** Adverse impacts on adjacent land, such as dust, traffic congestion or noise, caused by parkway uses shall be eliminated or mitigated.
- **7.19.** Jurisdictions shall use their authority to reduce, eliminate, and/or mitigate potential adverse impacts upon the parkway caused by adjacent land uses and activities.

Sacramento County General Plan

The Sacramento County General Plan (Sacramento County 2011) addresses growth and development in the unincorporated areas of the county through 2036. With respect to land use, portions of the plan contain policies for urban development including urban communities and the infrastructure necessary to serve them. Other portions of the plan describe strategies to recognize and preserve areas of open space, natural resources, and agricultural resources. The following goals and policies from the plan pertain to the preservation of open space and agricultural land uses:

Open Space Policies

- **GOAL:** Open space lands in Sacramento permanently protected through coordinated use of regulation, acquisition, density transfer and incentive programs.
- **OS-1.** Actively plan to protect, as open space, areas of natural resource value, which may include but are not limited to wetlands preserves, riparian corridors, woodlands, and floodplains associated with riparian drainages.

Agricultural Policies

- **GOAL:** Protect important farmlands from conversion and encroachment and conserve agricultural resources.
- **AG-1.** The County shall protect prime farmlands and lands with intensive agricultural investments from urban encroachments.
- **AG-5.** Projects resulting in the conversion of more than fifty (50) acres of farmland shall be mitigated within Sacramento County, except as specified in the paragraph below, based on a 1:1 ratio, for the loss of the following farmland categories through the specific planning process or individual project entitlements requests to provide in-kind or similar resource value protection (such as easements for agricultural purposes):
    - prime, statewide importance, unique, local importance, and grazing farmlands located outside the Urban Services Boundary (USB);
    - prime, statewide importance, unique, local importance, and grazing farmlands located inside the USB

    The Board of Supervisors retains the authority to override impacts to Unique, Local, and Grazing farmlands, but not with respect to Prime and Statewide farmlands.

    However, if that land is also required to provide mitigation pursuant to a Sacramento County endorsed or approved Habitat Conservation Plan (HCP), then the Board of supervisors may consider the mitigation land provided in accordance with the HCP as meeting the requirements of this section including land outside of Sacramento County.
- **AG-10.** The County shall balance the protection of prime, statewide importance, unique and local importance farmlands and farmlands with intensive agricultural investments with the preservation of natural habitat so that the protection of farmland can also serve to protect habitat.
- **AG-12.** The County will cooperate with landowners of agriculturally zoned properties to promote the placing of natural preserve/mitigation amenities on land, such as trees and other biota enhancing improvement, by making sure amenities are assets to both the natural preserve/mitigation areas and agriculture practices.
- **AG-15.** The County shall pursue opportunities to create mitigation banks, environmental mitigation sites, wildlife refuges, or other natural resource preserves wherein substantial agricultural activities that are compatible with protection of high habitat values continue, but incompatible activities and conversion for development are precluded by conservation easements.
- **AG-21.** The County encourages the preservation of prime agricultural land as open space, including opposing any residential or commercial development for the Cosumnes River or Deer Creek riparian areas which is not compatible with agricultural use.

C.3.10.7 Solano County General Plan

The Solano County General Plan (Solano County 2008) contains a land use, agriculture, and resource elements that identify how land is used throughout the county for agriculture, housing, business, community facilities, transportation, recreation, and open space. The following goal from the general plan pertains to land use and agricultural resources.

- **LU.G-4:** Encourage land use development patterns and circulation and transportation systems that promote health and wellness and minimize adverse effects on agriculture and natural resources, energy consumption, and air quality.

In support of this goal, Policy LU-1 encourages the county to collaborate with cities to implement sustainable development patterns, and Policies LU-2 and LU-3 direct growth towards municipal centers and away from lands and water bodies considered to have value as natural, agricultural, and/or open space resources. Policies AG.P-18, AG.P-23, and AG.P-25 support appropriate development of agricultural lands within the Delta and encourage compatible open space and recreational activities and ongoing habitat conservation efforts.

Portions of the program area are located adjacent to Sandy Beach Park, a county park located on the Sacramento River near the city of Rio Vista. Consequently, the program activities would be subject to the applicable land use policies of the general plan's Parks and Recreation Element. The Park and Recreation Element contains one objective (Objective 4) aimed at ensuring the compatibility of surrounding land uses with those of regional parks. Supporting Policies 4.A and 4.B stipulate that "areas surrounding regional parks should be maintained in open space or other compatible uses to protect the natural setting and environment of the park site," and proposed land uses should be "reviewed for compatibility with natural and recreational features and uses of the park."

The Solano County General Plan also contains policies that are specific to the Delta area. Policies RS.P-20, RS.P-21, RS.P-24, RS.P-25, and RS.P-27 are relevant to the proposed program and are intended to be consistent with the with the goals, policies and provisions of the Delta Protection Commission's *Land Use and Resource Management Plan for the Primary Zone*. In particular, RS, P-27 is relevant to the restoration goals of the proposed program because the policy encourages the county to "support the improvement and long-term maintenance of Delta levees to preserve land areas and channel configurations in the Delta" and give "levee rehabilitation and maintenance priority over other uses of levee areas."

The county has adopted two area plans to address areas of potential land use change, including the Collinsville-Montezuma Hills Area Plan and Program and the White Slough Specific Area Plan. The program area borders a portion of the Collinsville Special Study Area, and thus is subject to the Collinsville Special Study Area Land Use Plan, which is incorporated as part of the county's general plan. The land use plan for Collinsville is "intended to maintain the residential character of Collinsville and Birds Landing, retain the possibility for future industrial development outside of the existing community, and protect the condition of Suisun Marsh and other natural resource areas" (Solano County 2008). Policy SS.P-27 in the Land Use Plan is particularly relevant to the restoration goals of the proposed program because the policy encourages the county to "protect existing historic communities from floodwaters by supporting the ongoing maintenance of levees and other flood control mechanisms."

C.3.10.8 Sutter County General Plan

The Sutter County General Plan (Sutter County 2011) contains land use policies that serve to guide the physical development of the land within the jurisdictions' boundaries. Sutter County is currently preparing an updated general plan, which includes a long-range plan for land uses in the county. The existing Sutter County General Plan contains the following goals and policies that pertain to urban growth, agricultural land preservation, and conservation of open space.

Land Use Goals and Policies

- **Goal LU 1** Promote the efficient and sensitive use of lands to protect and enhance Sutter County's quality of life and meet the needs of existing and future residents and businesses.
- **Policy LU 1.5.** Avoid/minimize conflicts between land uses and ensure that new development maintains the viability of adjacent agricultural, open space, and rural uses and minimizes impacts upon existing residents, businesses, and resources.

Open Space Goals and Polices

- **Goal LU 2.** Preserve Sutter County's agricultural heritage and natural resources.
- **Policy LU 2.1.** Promote the long-term conservation of agricultural and opens space lands in accordance with the goals and policies of the Agricultural Resources and Environmental Resources elements.

Agricultural Resources Goals and Policies

- **Goal AG 1.** Preserve and protect high-quality agricultural lands for long-term agricultural production.
- **Policy AG 1.6**. Permit agriculturally designated lands to be used for habitat conservation and/or mitigation with approval of a development agreement, provided such use does not interfere or adversely affect existing or planned agricultural uses or impact County flood control operations.

C.3.10.9 Tehama County General Plan

The Tehama County General Plan (Tehama County 2009a) Land Use Element Plan divides the county into five planning areas, two of which—the Central I-5 Corridor and the South I-5 Corridor—contain portions of the program area. The General Plan contains the following countywide goals and polices that pertain to urban growth, agricultural land preservation, and conservation of open space.

Land Use Goals and Policies

- **Goal LU-1.** To plan development within the County in a manner which will provide opportunities for current and future residents to enjoy rural, community oriented living environments that are similar to those currently found in the County. Encourage higher densities, where appropriate, and promote in-fill development to discourage agricultural land conversion demands.
- **Policy LU-1.4.** The County shall ensure that zoning and subdivision regulations protect agricultural lands, open space, and natural resources which include: grazing, timber, and wildlife lands, by not allowing land divisions intended for residential use to be developed in areas which are not specifically designated as residential in the General Plan, or for which appropriate long-term planning has not been completed as outlined within the General Plan.

Open Space Goals and Policies

- **Goal OS-9.** To protect and enhance resource lands in the County for the continued benefit of agriculture, timber, grazing, recreation, wildlife habitat, and quality of life.

- **Policy OS-9.1.** The County shall strive for the protection and enhancement of resource lands for the continued benefit of agriculture, timber, grazing, recreation, waterfowl, wildlife habitat, watersheds, and quality of life.

Agricultural Resources Goals and Policies

- **Goal AG-1.** To preserve and protect agricultural lands.
- **Policy AG-1.1.** The County shall provide for the protection of agricultural lands from nonagricultural development pressures and uses that will adversely impact or hinder existing or foreseeable agricultural operations through a separation utilizing natural buffers and land use transition areas that mitigate or prevent land use conflicts with the development interest providing the buffers.

C.3.10.10 Yolo County General Plan

The Yolo County General Plan contains land use, agriculture, open space, and resource conservation goals, objectives, and policies that are reflective of local public needs and wishes for a better physical and natural community environment throughout the county (Yolo County 2009). The Yolo County General Plan contains the following goals, objectives, and policies that pertain to urban growth, agricultural land preservation, and conservation of open space.

Land Use Goals and Policies

- **Goal LU-2** Preserve farm land and expand opportunities for related business and infrastructure to ensure a strong local agricultural economy.
- **Goal LU-7.** Ensure inclusion, fair treatment, and equitable outcomes for the County and its residents in regional land use planning efforts.
- **Policy LU-7.3.** Coordinate with other stakeholder agencies and entities to continue local and regional planning efforts to preserve agriculture, open space and natural resources while meeting housing needs, basic infrastructure and service levels, County economic development goals and County fiscal objectives.
- **Policy LU-7.4.** Work with SACOG (Sacramento Area Council of Governments) and its other member jurisdictions to develop a mutually-acceptable plan for open space conservation, habitat protection and mitigation banking, to ensure that Yolo County is appropriately compensated when its land is used to achieve region-wide environmental benefits.

Agricultural Resources Goals, Objectives, and Policies

- **Goal AG-1:** Preserve and defend agriculture as fundamental to the identity of Yolo County.
- **Policy AG-1.6:** Continue to mitigate at a ratio of no less than 1:1 the conversion of farm land and/or the conversion of land designated or zoned for agriculture, to other uses.
- **Policy AG-1.14:** Preserve agricultural lands using a variety of programs, including the Williamson Act, Farmland Preservation Zones (implemented through the Williamson Act), conservation easements, an Agricultural Lands Conversion Ordinance and the Right-to-Farm Ordinance.

- **Policy AG-1.23:** Oppose the creation of any conservation easements within growth boundaries. Conservation easements within growth boundaries shall not be accepted for mitigation purposes.
- **Goal AG-2:** Protect the natural resources needed to ensure that agriculture remains an essential part of Yolo County's future.
- **Policy AG-2.10:** Encourage habitat protection and management that does not preclude or unreasonably restrict on-site agricultural production.

Open Space Goals, Objectives, and Policies

- **Goal CO-1:** Provide a diverse, connected and accessible network of open space, to enhance natural resources and their appropriate use.
- **Policy CO-1.6:** Coordinate open space acquisition with habitat acquisition that occurs pursuant to the Yolo Natural Heritage Program.

C.3.10.11 Yuba County General Plan

The Yuba County General Plan (Yuba County 2011) contains the following goals, objectives, and policies that pertain to land use and agricultural resources.

Land Use Goals

- **Goal CD9:** Preserve and enhance the rural character through development and conservation in Yuba County's Rural Communities and open space areas.

Open Space Goals, Objectives, and Policies

- **Goal NR1:** High-quality, accessible public recreational open space.
- **Policy NR1.11:** Recreational open space along rivers and streams should incorporate flood control objectives, habitat preservation, and habitat restoration, as appropriate.
- **Policy NR1.12:** The County will incorporate trails along canals, transmission lines, and other easements and rights-of-way, where feasible, including trail development atop levees, so long as flood protection facilities are not adversely affected.
- **Goal NR3:** Provide for long-term, vibrant local agricultural operations.
- **Policy NR3.7:** Agricultural buffers should be designed to accommodate drainage, trails, roads, other facilities or infrastructure, community gardens, native landscaping, and other uses that would be compatible with ongoing agricultural operations and provide valuable services or amenities.
- **Policy NR3.10:** Cropland and grazing land may be used for habitat conservation and mitigation purposes, consistent with the Yuba-Sutter County Natural Community Conservation Plan/Habitat Conservation Plan, once adopted.

C.3.11 Chapter 14, Recreation

C.3.11.1 Butte County General Plan

The Butte County General Plan (2010) states that the county supports a comprehensive and high-quality system of recreational open space and facilities.

C.3.11.2 Colusa County General Plan

A goal of the draft Colusa County General Plan (2011) is to preserve open space and opportunities for recreation and leisure-time activities in Colusa County. The plan promotes the expansion of recreational opportunities, including boating, rafting, fishing, and hunting, as well as preserving opportunities for rural and forest recreation.

C.3.11.3 Glenn County General Plan

The Glenn County General Plan (1993) classifies recreation under Land Use to identify areas having open space value for recreation purposes and provide for use of these areas for development of public or private recreation (3.0.17).

C.3.11.4 Placer County General Plan

The Placer County General Plan (1994) includes policies that encourage recreational development that complements the natural features of the area, including the topography, waterways, vegetation, and soil characteristics (Policy 5.A.12).

C.3.11.5 Sacramento County

American River Parkway Plan

The American River Parkway Plan aims to preserve, protect, interpret, and improve resources of the American River Parkway. The Parkway is intended to be oriented to passive, unstructured water-enhanced recreation activities. Policy 3.14 states that "portions of the parkway may be temporarily closed to certain uses in order to restore habitat values, visual quality, and recreation opportunities, upon assessment that the environmental resources, aesthetics, or recreational setting of the Parkway have become degraded" (Sacramento County 2008).

Sacramento County General Plan

The County of Sacramento General Plan (2011) lists goals, policies, and objectives for recreation as part of the plan. The general plan defines recreation areas as open space that provides for active and passive public recreational uses, including county/regional parks, community parks, neighborhood parks, and activity areas within the American River Parkway.

C.3.11.6 Solano County General Plan

One of the Delta policies in the Solano County General Plan (2008) is to promote continued recreational use of the land and waters of the Delta, including fishing and boating (Policy RS.P-26). An objective of the Park and Recreation Element of the plan is to identify, preserve, and manage significant recreation and natural areas (Objective 3).

C.3.11.7 Sutter County General Plan

The Sutter County General Plan Policy Document (2011) lists as a goal providing adequate park and open space areas for passive and active recreation, social, education, and cultural opportunities for the residents of Sutter County.

C.3.11.8 Tehama County General Plan

Two policies of the Tehama County General Plan (2009) are to protect and enhance resource lands in the county for the continued benefit of recreation (Policy OS-9.1) and to actively promote outdoor recreation opportunities such as agri-tourism, nature-tourism, and environmental learning tourism (Policy OS-9.4).

C.3.11.9 Yolo County General Plan

The Open Space and Recreation Element of the Yolo County General Plan (2009) lists as goals, policies, and objectives for recreation that open space be expanded and enhanced to support recreation (Policy CO-1.1), that a connected system of recreational trails be developed to link communities and parks (Policy CO-1.2), and emphasize the use of native grasses, shrubs and trees as the primary focus of restoration within parks and other open spaces (Policy CO-1.21).

C.3.11.10 Yuba County General Plan

A goal of the Yuba County General Plan (2011) is that the county maintain high-quality, accessible public recreational open space. In addition, Policy NR1.11 states that recreational open space along rivers and streams should incorporate flood control objectives, habitat preservation, and habitat restoration, as appropriate.

C.3.12 Chapter 15, Population and Housing

State law requires each city and county to adopt a general plan for its future growth. This plan must include a housing element that identifies housing needs for all economic segments and provides opportunities for housing development to meet those needs. At the state level, the California Housing and Community Development Department (HCD) estimates the relative share of California's projected population growth that will occur in each county as provided by the Department of Finance's Demographic Research Unit.

Each city and county must update its general plan housing element on a regular basis (every 8 years). Among other things, the housing element must incorporate policies and identify potential sites that will accommodate the city's and county's share of the regional housing need. Prior to adopting a general plan update for housing, the city or county must submit the draft to HCD for its review. HCD advises the local jurisdiction whether its housing element complies with provisions of California Housing Element Law.

C.3.12.1 Butte County General Plan

The Butte County General Plan Housing Element (Butte County 2010) includes six goals to help implement secure, affordable and energy efficient housing in Butte County. The county is responsible for the implementation of the goals.

C.3.12.2 Colusa County General Plan

The housing goal for Colusa County is to ensure the opportunity to obtain safe, adequate housing in a suitable living environment (Colusa County 2011). The draft Colusa County General Plan Update Housing Element also contains the goal of preserving existing housing and neighborhoods.

C.3.12.3 Glenn County General Plan

The Glenn County Housing Element contains five goals: assurance of housing locations within the unincorporated area; development of sufficient and safe housing; maintaining and improving the quality of existing housing stock; limiting government constraints on the provision of housing; and the provision of suitable housing for all income groups (Glenn County 2010).

C.3.12.4 Placer County General Plan

The Placer County Housing Section has goals that address affordable and safe housing supply for residents in all income categories, conservation and rehabilitation of existing units, preservation of at-risk units, special needs, the homeless, energy conservation, and equal opportunity (Placer County 2009).

C.3.12.5 Sacramento County General Plan

The Housing Element of the Sacramento County General Plan “promote[s] an adequate supply of decent, safe, and affordable housing to meet the needs of all residents of Sacramento County” (Sacramento County 2011). One of the strategies provided in the Housing Element is to promote the health and safety of all residents.

C.3.12.6 Solano County General Plan

The primary goal for the Solano County General Plan Housing Element (Solano County 2008) is to promote and ensure adequate housing in a satisfying environment for all residents of Solano County. Nine objectives are outlined in the Housing Element.

- Housing Conservation and Rehabilitation.
- Opportunities for Housing Production.
- Affordable Housing Assistance.
- Special Housing Needs and Equal Housing Opportunity.
- Governmental and Non-Governmental Constraints.
- Housing Location, Density, and Timing.
- Public Facilities and Services.
- Environmental Quality.
- Energy Conservation.

C.3.12.7 Sutter County General Plan

Sutter County adopted its current Housing Element in 2011, which sets out the following goals (among others): (1) provide for an adequate supply of new housing to meet the needs of present and future Sutter County residents incorporating a variety of housing types and densities that accommodate all income groups including extremely low income households, (2) ensure that new housing in Sutter County is safe and sanitary and receives public services adequate to support the level of development, (3) conserve and improve existing housing in Sutter County to ensure safe and sanitary conditions, and (4) promote equal housing opportunities for all residents of Sutter County (Sutter County 2011).

C.3.12.8 Tehama County General Plan

The Tehama County Housing Element includes goals and implementing policies. In the element, Tehama County pledges to provide an adequate number housing units, to ensure available housing is affordable and adequate sites are available for housing, to facilitate special needs housing, to promote fair housing/equal opportunity, to remove government constraints on housing development and improvement when possible, and to encourage energy conservation in housing development (Tehama County 2009b).

C.3.12.9 Yolo County General Plan

The Housing Element of the Yolo County General Plan identifies seven specific goals relating to housing mix, housing funding, reduced housing constraints, special-needs housing, strengthened neighborhoods, sustainable housing, and housing in the Delta (Yolo County 2009).

C.3.12.10 Yuba County General Plan

The Housing Element of the Yuba County General Plan outlines eight housing goals and policies, and implementation measures for each goal (Yuba County 2009b). These goals range from addressing the need to match future construction needs, to provision of affordable low-income housing, to the promotion of energy conservation within the housing communities throughout Yuba County. The Yuba County General Plan also provides for adequate flood protection for urban and other developing areas.

C.3.13 Chapter 16, Utilities and Public Services

City and county general plans that may be affected within the program area provide the policies and objectives governing their respective responsibilities for the provision of public utilities and services. Individual projects would need to determine the jurisdiction within which county, city, or other special planning area to determine the applicable public services and utilities-related goals and policies that are relevant at the project level.

C.3.14 Chapter 17, Aesthetics

Individual projects would need to ascertain the responsible jurisdiction within a county, city, or other special planning area to determine the applicable policies that pertain to that particular project. Counties and cities are likely to have policies related to protecting and preserving aesthetics within their general plans (including specific plans) and zoning ordinances, heritage tree ordinances, and designated scenic roadways. Other planning documents may also apply.

C.3.14.1 American River Parkway Plan

The American River Parkway Plan aims to preserve, protect, interpret and improve resources of the American River Parkway in Sacramento County. The parkway is intended to be oriented to passive, unstructured water-enhanced recreation activities. Policy 3.14 states that "portions of the parkway may be temporarily closed to certain uses in order to restore habitat values, visual quality, and recreation opportunities, upon assessment that the environmental resources, aesthetics, or recreational setting of the Parkway have become degraded" (Sacramento County 2008).

C.3.15 Chapter 18, Public Health and Environmental Hazards

C.3.15.1 Butte County General Plan

The Butte County General Plan contains findings and policies designed to identify hazards within the county and plan land uses around such hazards. A major hazard the general plan addresses is erosion areas and seeks to support the development of erosion control projects and the protection of river banks using appropriate methods (Butte County 2010).

C.3.15.2 Colusa County General Plan

The draft Colusa County General Plan addresses hazardous materials in the safety element of the General Plan. It is an objective of the General Plan to recognize and address threats to public health posed by the use, transport, storage, manufacture, and disposal of hazardous waste and hazardous materials (Colusa County 2011).

C.3.15.3 Glenn County General Plan

The Glenn County General Plan discusses public safety goals and policies. Included with this part of the general plan are risks related to fire hazards and fire protection, geologic hazards, flood hazards, solid and hazardous waste. The general plan specifically addresses the protection and reduction of loss of life and personal property due to flooding (Glenn County 1993).

C.3.15.4 Placer County General Plan

The Placer County General Plan addresses seismic and geological hazards, flood hazards, fire hazards, airport hazards, emergency management, hazardous materials, and public health. The general plan contains a goal of minimizing the risk of loss of life, injury, damage to property, and economic and social dislocations resulting from flood hazards. This goal includes the policy of promoting flood control measures that maintain natural conditions within the 100-year floodplain of rivers and streams (Placer County 1994).

C.3.15.5 Sacramento County

American River Parkway Plan

The American River Parkway Plan provides policies to ensure that access for emergency vehicles and boats is maintained. Because the parkway is primarily for pedestrians and cyclists, it is important to maintain areas designated for emergency access, including parking areas, service roads, levee crowns, trails, and fire breaks (Sacramento County 2008).

Sacramento County General Plan

According to the Sacramento County General Plan, Sacramento County does not impose more stringent standards or requirements on hazardous material handlers than are in state or federal law (Sacramento County 2011).

C.3.15.6 Solano County General Plan

The Solano County General Plan establishes a policy of working with federal, state, and local agencies to improve flood control and drainage throughout the county. Additionally, the county has a policy of working with responsible parties to ensure dams, levees, and canals throughout the county are properly maintained and/or improved (Solano County 2008).

C.3.15.7 Sutter County General Plan

The Public Health and Safety Element of the Sutter County General Plan contains several policies relating to hazardous materials. General Plan Policy PHS 3.1 states that the use and disposal of hazardous materials and waste shall comply with appropriate federal, state, and local requirements (Sutter County 2011).

C.3.15.8 Tehama County General Plan

The Safety and Open Space Elements of the Tehama County General Plan address hazardous waste. The safety section deals with compliance with federal, state, and local regulations, along with the development of a hazardous waste management plan. The open space section restricts hazardous material storage in a 100-year floodplain (Tehama County 2009a).

C.3.15.9 Yolo County General Plan

The Yolo County Health Department, Environmental Health Division regulates the use, storage, and disposal of hazardous substances by issuing permits, monitoring regulatory compliance, and performing other enforcement activities. The goals and policies for hazardous substance management, including transportation, storage, and disposal, are reflected in the Yolo County Hazardous Waste Management Plan (Yolo County 2009).

C.3.15.10 Yuba County General Plan

The Public Health and Safety Element of the Yuba County General Plan has a stated goal of protecting the community from the harmful effects of hazards and hazardous materials. Policy HS7-3 states that the county will collaborate with appropriate federal, state, and regional agencies in an effort to identify and remediate soils and groundwater contaminated with toxic materials and to identify and eliminate sources contributing to such contamination (Yuba County 2011).

C.3.16 Chapter 20, Socioeconomics and Environmental Justice

OPR is required to provide guidance to cities and counties for integrating environmental justice into their general plans (Government Code Section 65040.12(c)). The 2003 General Plan Guidelines discusses the framework for environmental justice and the relationship of environmental justice to local general plans (Governor's Office of Planning and Research 2003).

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Appendix D
Air Quality Mitigation Measures by Air District

Appendix D-1: Bay Area Air Quality Management District

Criteria Air Pollutants and Precursors
Basic Construction Mitigation Measures—These control measures are to be implemented at all construction sites for dust and exhaust construction impacts. • All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. • All haul trucks transporting soil, sand, or other loose material off-site shall be covered. • All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. • All vehicle speeds on unpaved roads shall be limited to 15 mph. • All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. • Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points. • All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator. • Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.
Additional Construction Mitigation Measures—The following measures should be implemented, if more mitigation is necessary.to reduces all construction-related criteria air pollutants and precursors to levels below the project's thresholds. • All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12 percent. Moisture content can be verified by lab samples or moisture probe. • All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph. • Wind breaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Wind breaks should have at maximum 50 percent air porosity. • Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established. • The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time. • All trucks and equipment, including their tires, shall be washed off prior to leaving the site. • Site accesses to a distance of 100 feet from the paved road shall be treated with a 6 to 12 inch compacted layer of wood chips, mulch, or gravel. • Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than one percent. • Minimizing the idling time of diesel powered construction equipment to two minutes. • The project shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) would achieve a project wide fleet-average 20 percent NO_X reduction and 45 percent PM reduction compared to the most recent ARB fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available. • Use low VOC (i.e., ROG) coatings beyond the local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings).

Appendix D-1: Continued

• Requiring that all construction equipment, diesel trucks, and generators be equipped with Best Available Control Technology for emission reductions of NO_X and PM. • Requiring all contractors use equipment that meets CARB's most recent certification standard for off-road heavy duty diesel engines.
Greenhouse Gases
Lead agencies are encouraged to incorporate best management practices to reduce GHG emissions during construction, as applicable. Best management practices may include, but are not limited to: using alternative fueled (e.g., biodiesel, electric) construction vehicles/equipment of at least 15 percent of the fleet; using local building materials of at least 10 percent; and recycling or reusing at least 50 percent of construction waste or demolition materials.
Adapted from: Bay Area Air Quality Management District 2012

Appendix D-2: Butte County Air Quality Management District

Construction Effects

There are three operational emissions threshold levels used to determine the level of mitigation required for a project. These levels also apply to construction, if construction is expected to last longer than 6 months. The three levels are as follows:

	NO_X	ROG	PM_{10}
Level A	≤ 25 lbs/day	≤ 25 lbs/day	≤ 80 lbs/day
Level B	> 25 lbs/day	> 25 lbs/day	> 80 lbs/day
Level C	> 137 lbs/day	> 137 lbs/day	> 137 lbs/day

Construction Equipment Exhaust Mitigation[a]	
Standard Mitigation Measures for Construction Equipment	• Maintain all construction equipment in proper tune according to manufacturer's specifications. • Maximize to the extent feasible, the use of diesel construction equipment meeting the CARB's 1996 or newer certification standard for off-road heavy-duty diesel engines.
Discretionary Mitigation Measures for Construction Equipment	• Electrify equipment where feasible. • Substitute gasoline-powered for diesel-powered equipment, where feasible. • Use alternatively fueled construction equipment on site where feasible, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane, or biodiesel. • Use equipment that has Caterpillar pre-chamber diesel engines.

Fugitive Dust PM_{10} Mitigation Measures[b]

- Land Clearing/Earth Moving:
  - Water shall 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.
  - Haul vehicles transporting soil into or out of the property shall be covered.
  - A water truck shall be on site at all times. Water shall be applied to disturbed areas a minimum of 2 times per day or more as necessary.
  - On-site vehicles limited to a speed which minimizes dust emissions on unpaved roads.
  - Post a publicly visible sign with the telephone number and person to contact regarding dust complaints. This person shall respond and take corrective action within 24 hours. The telephone number of the District shall also be visible to ensure compliance with District Rule 200 & 205 (*Nuisance* and *Fugitive Dust Emissions*).

- Visibly Dry Disturbed Soil Surface Areas:
  - All visibly dry disturbed soil surface areas of operation shall be watered to minimize dust emission.

Appendix D-2: Continued

Fugitive Dust PM_{10} Mitigation Measures[b]
• Paved Road Track-Out: o Existing roads and streets adjacent to the project will be cleaned at least once per day unless conditions warrant a greater frequency. • Visibly Dry Disturbed Unpaved Roads: o All visibly dry disturbed unpaved roads surface areas of operation shall be watered to minimize dust emission. o Unpaved roads may be graveled to reduce dust emissions. o A water truck shall be on site at all times. Water shall be applied to disturbed areas a minimum of 2 times per day or more as necessary. o On-site vehicles limited to a speed which minimizes dust emissions on unpaved roads. o Haul roads shall be sprayed down at the end of the work shift to form a thin crust. This application of water shall be in addition to the minimum rate of application. • Vehicles Entering/Exiting Construction Area: o Vehicles entering or exiting construction area shall travel at a speed which minimizes dust emissions. • Employee Vehicles: o Construction workers shall park in designated parking areas(s) to help reduce dust emissions. • Soil Piles: o Soil pile surfaces shall 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.
Notes: Violations of BCAQMD Regulations are enforceable under the provisions of California Health and Safety Code Section 42400, which provides for civil or criminal penalties of up to $25,000 per violation. [a] Mitigation of construction equipment exhaust should focus on strategies that reduce NO_X, ROG, and PM_{10} emissions. [b] The Fugitive PM_{10} Mitigation Measures apply to all projects with the potential to emit fugitive dust.

Appendix D-2: Continued

Operational Effects

There are three operational emissions threshold levels used to determine the level of mitigation required for a project. The three levels are as follows:

	NO_X	ROG	PM_{10}
Level A	≤ 25 lbs/day	≤ 25 lbs/day	≤ 80 lbs/day
Level B	> 25 lbs/day	> 25 lbs/day	> 80 lbs/day
Level C	> 137 lbs/day	> 137 lbs/day	> 137 lbs/day

If these thresholds are exceeded, the following mitigation measures must be applied. This text was taken directly from the BCAQMDs *CEQA Air Quality Handbook*.

> **Level A -** Recommended list of standard mitigation measures.
>
> **Level B -** Select as many Best Available Mitigation Measures (BAMMs) with point value which may include off-site mitigations, in addition to the recommended list of standard mitigation measures. Project proponents would be required to coordinate with the Planning Agencies to identify feasible mitigation measures. The emission reduction necessary is ten percent of the calculated emission increase above Level B up to Level C.
>
> **Level C** - Select as many BAMM with point value as necessary, in addition to the recommended list of standard mitigation measures. Off-site mitigation measures may also be required to reduce the overall air quality impacts of the project to a level of insignificance (below Level C). Project proponents would be required to coordinate with the Planning Agencies to identify feasible mitigation measures. The emission reduction necessary is 100 percent of the calculated emission increase above Level C.

Level A: In general, the standard mitigation measures do not apply to the project because they are geared towards projects where a building will be constructed. The following standard mitigation measure does apply to the project:

- Use fleet vehicles that run on clean-burning fuels as may be practicable.

Level B: Please refer to the Level A language above regarding the standard mitigation measures. Appendix C of the BCAQMDs *CEQA Air Quality Handbook* summarizes BAMMs for the BCAQMD. The listed BAMMs are applicable to residential, commercial, and mixed use land uses; so, they do not apply to the proposed program. But, the program proponent should consult with the BCAQMD for innovative ways to mitigate project effects, if the Level B thresholds are exceeded. In addition, offsite mitigation can also be coordinated with the BCAQMD.

Level C: Please refer to the Level B language above for BAMMs and offsite mitigation.

Source: Butte County Air Quality Management District 2008

Appendix D-3: Colusa County Air Pollution Control District

The CCAPCD uses emission reduction credits to mitigate construction and operational emissions above the thresholds indicated in its Rule 3.6 (Gomez pers. comm.).

Appendix D-4: Feather River Air Quality Management District

Criteria Air Pollutants: Standard Mitigation Measures

- Implement a Fugitive Dust Control Plan approved by the FRAQMD.
- Construction equipment exhaust emissions shall not exceed FRAQMD Regulation III, Rule 3.0, Visible Emissions limitations (40 percent opacity or Ringelmann 2.0).
- The contractor shall be responsible to ensure that all construction equipment is properly tuned and maintained prior to and for the duration of onsite operation.
- limiting idling time to 5 minutes - saves fuel and reduces emissions. (State idling rule: commercial diesel vehicles- 13 CCR Chapter 10 Section 2485 effective 02/01/2005; off road diesel vehicles- 13 CCR Chapter 9 Article 4.8 Section 2449 effective 05/01/2008)
- Utilize existing power sources (e.g., power poles) or clean fuel generators rather than temporary power generators.
- Develop a traffic plan to minimize traffic flow interference from construction activities. The plan may include advance public notice of routing, use of public transportation, and satellite parking areas with a shuttle service. Schedule operations affecting traffic for off-peak hours. Minimize obstruction of through-traffic lanes. Provide a flag person to guide traffic properly and ensure safety at construction sites.
- Portable engines and portable engine-driven equipment units used at the project work site, with the exception of on-road and off-road motor vehicles, may require California Air Resources Board (ARB) Portable Equipment Registration with the State or a local district permit. The owner/operator shall be responsible for arranging appropriate consultations with the ARB or the District to determine registration and permitting requirements prior to equipment operation at the site.

Criteria Air Pollutants: Best Available Mitigation Measures

- All grading operations on a project should be suspended when winds exceed 20 miles per hour or when winds carry dust beyond the property line despite implementation of all feasible dust control measures.
- Construction sites shall be watered as directed by the Department of Public Works or Air Quality Management District and as necessary to prevent fugitive dust violations.
- An operational water truck should be available at all times. Apply water to control dust as needed to prevent visible emissions violations and offsite dust impacts.

Appendix D-4: Continued

- Onsite dirt piles or other stockpiled particulate matter should be covered, wind breaks installed, and water and/or soil stabilizers employed to reduce windblown dust emissions. Incorporate the use of approved non-toxic soil stabilizers according to manufacturer's specifications to all inactive construction areas.

- All transfer processes involving a free fall of soil or other particulate matter shall be operated in such a manner as to minimize the free fall distance and fugitive dust emissions.

- Apply approved chemical soil stabilizers according to the manufacturers' specifications, to all-inactive construction areas (previously graded areas that remain inactive for 96 hours) including unpaved roads and employee/equipment parking areas.

- To prevent track-out, wheel washers should be installed where project vehicles and/or equipment exit onto paved streets from unpaved roads. Vehicles and/or equipment shall be washed prior to each trip. Alternatively, a gravel bed may be installed as appropriate at vehicle/equipment site exit points to effectively remove soil buildup on tires and tracks to prevent/diminish track-out.

- Paved streets shall be swept frequently (water sweeper with reclaimed water recommended; wet broom) if soil material has been carried onto adjacent paved, public thoroughfares from the project site.

- Provide temporary traffic control as needed during all phases of construction to improve traffic flow, as deemed appropriate by the Department of Public Works and/or Caltrans and to reduce vehicle dust emissions. An effective measure is to enforce vehicle traffic speeds at or below 15 mph.

- Reduce traffic speeds on all unpaved surfaces to 15 miles per hour or less and reduce unnecessary vehicle traffic by restricting access. Provide appropriate training, onsite enforcement, and signage.

- Reestablish ground cover on the construction site as soon as possible and prior to final occupancy, through seeding and watering.

- Disposal by Burning: Open burning is yet another source of fugitive gas and particulate emissions and shall be prohibited at the project site. No open burning of vegetative waste (natural plant growth wastes) or other legal or illegal burn materials (trash, demolition debris, et. al.) may be conducted at the project site. Vegetative wastes should be chipped or delivered to waste to energy facilities (permitted biomass facilities), mulched, composted, or used for firewood. It is unlawful to haul waste materials offsite for disposal by open burning.

Appendix D-4: Continued

Voluntary Offsite Mitigation Program

- Submit voluntary offsite mitigation fees to the FRAQMD to reduce construction related emissions to below FRAQMD threshold levels.

Diesel Particulate Matter

The following are mitigation measures that can be used to reduce the impact to sensitive receptors from off-road diesel equipment:

- Install diesel particulate filters or implement other ARB-verified diesel emission control strategies on all construction equipment to further reduce diesel PM emissions beyond the 45% reduction required by the District's Best Available Mitigation Measures for Construction Phase;
- Use equipment during times when receptors are not present (e.g., when school is not in session or during non-school hours; or when office buildings are unoccupied);
- Establish staging areas for the construction equipment that are as distant as possible from offsite receptors;
- Establish an electricity supply to the construction site and use electric powered equipment instead of diesel-powered equipment or generators, where feasible;
- Use haul trucks with on-road engines instead of off-road engines even for on-site hauling;
- Equip nearby buildings with High Efficiency Particle Arresting (HEPA) filter systems at all mechanical air intake points to the building to reduce the levels of diesel PM that enter the buildings; and/or
- Temporarily relocate receptors during construction activity.

Source: Feather River Air Quality Management District 2010.

Appendix D-5: Glenn County Air Pollution Control District

For construction-related projects, the GCAPCD typically requires water trucks onsite and land-leveling activities to be suspended during wind events exceeding 15 mph (Ledbetter pers. comm.).

Appendix D-6: Placer County Air Pollution Control District

The list of Best Available Mitigation Measures (BAMMs) was obtained from the PCAPCD. Only the mitigation measures that may be applicable to the proposed program were included. (Backus pers. comm.) *Rule 228 Fugitive Dust* is included after the BAMMs and is applicable to all activities that generate fugitive dust.

BEST AVAILABLE MITIGATION MEASURES

This list of mitigation strategies is provided by the District as a means for project applicants to identify measures that can be implemented to reduce the projects' short-term air quality impacts on local and region air quality. It is not expected that all measures should be implemented by any one project. However, if project's construction emissions are above the District's Significance Thresholds of 82 pounds per day, the project should be required at a minimum to implement measures 1–10 to reduce its construction emissions to the extent feasible, however, dust control measures shall be implemented for all projects.

CONSTRUCTION ACTIVITY

1. The applicant shall submit to the District and receive approval of a Construction Emission / Dust Control Plan prior to groundbreaking. This plan must address the minimum Administrative Requirements found in section 300 and 400 of District Rule 228, Fugitive Dust (www.placer.ca.gov/airpollution/airpolut.htm).

   The applicant shall have a pre-construction meeting for grading activities for 20 or more acres to discuss the construction emission/dust control plan with employees and/or contractors and the District is to be invited.

   The applicant shall suspend all grading operations when fugitive dusts exceed District Rule 228 Fugitive Dust limitations. An applicant representative, CARB-certified to perform Visible Emissions Evaluations (VEE), shall routinely evaluate compliance to Rule 228, Fugitive Dust. This requirement for a VEE is for projects grading more than 20 or more acres in size regardless in how many acres are to be disturbed daily.

   It is to be noted that fugitive dust is not to exceed 40% opacity and not go beyond property boundary at any time. If lime or other drying agents are utilized to dry out wet grading areas they shall be controlled as to not to exceed District Rule 228 Fugitive Dust limitations.

2. Construction equipment exhaust emissions shall not exceed District Rule 202 Visible Emission limitations. Operators of vehicles and equipment found to exceed opacity limits are to be immediately notified and the equipment must be repaired within 72 hours.

   An applicant representative, CARB-certified to perform Visible Emissions Evaluations (VEE), shall routinely evaluate project related off-road and heavy-duty on-road equipment emissions for compliance with this requirement for projects grading more than 20 acres in size regardless in how many acres are to be disturbed daily.

3. The prime contractor shall submit to the District a comprehensive inventory (i.e., make, model, year, emission rating) of all the heavy-duty off-road equipment (50 horsepower of greater) that will be used an

aggregate of 40 or more hours for the construction project. The project representative shall provide the District with the anticipated construction timeline including start date, and name and phone number of the project manager and on-site foreman. The project shall provide a plan for approval by the District demonstrating that the heavy-duty (> 50 horsepower) off-road vehicles to be used in the construction project, including owned, leased and subcontractor vehicles, will achieve a project wide fleet-average 20 percent NO_X reduction and 45 percent particulate reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions may include use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and/or other options as they become available. Contractors can access the Sacramento Metropolitan Air Quality Management District's web site to determine if their off-road fleet meets the requirements listed in this measure. http://www.airquality.org/ceqa/Construction_Mitigation_Calculator.xls

4. No open burning of removed vegetation during infrastructure improvements.

5. Minimize idling time to 5 minutes for all diesel-power equipment.

6. Use California Air Resources Board (CARB) diesel fuel for all diesel–power equipment.

7. Apply water to control dust as needed to prevent dust impacts offsite. Operational water truck(s), shall be onsite, as required, to control fugitive dust. Construction vehicles leaving the site shall be cleaned to prevent dust, silt, mud, and dirt from being released or tracked off-site.

8. Apply approved chemical soil stabilizers, vegetative mats, or other appropriate best management practices to manufacturer's specifications, to all-inactive construction areas (previously graded areas which remain inactive for 96 hours).

9. Spread soil binders on unpaved roads and employee/equipment parking areas and wet broom or wash streets if silt is carried over to adjacent public thoroughfares.

10. Utilize existing power sources (e.g., power poles) or clean fuel generators rather than temporary diesel power generators. If not available, low sulfur fuel is to be used for diesel power generators.

11. Install wheel washers or wash all trucks and equipment leaving the site.

12. Employ construction activity management techniques, such as: reducing the number of pieces used simultaneously; increasing the distance between emission sources; reducing or changing the hours of construction; and scheduling activity during off-peak hours.

13. Develop a traffic plan to minimize traffic flow interference from construction activities. The plan may include advance public notice of routing, use of public transportation, and satellite parking areas with a shuttle service.

Appendix D-6: Continued

14. If the project site is in an area known to contain naturally occurring asbestos (NOA), the applicant will be required to comply with the Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, And Surface Mining Operations. Submit plan to District per asbestos ATCM.

OPERATIONAL

The following is a list of mitigation measures that have been identified by the District to reduce the project's long-term operational impacts on local and regional air quality. All projects should implement those measures that are logical and feasible for their project to implement due to project specific impacts and the existing (cumulative) nonattainment designation in Placer County for ozone federal standards. Projects that cannot implement sufficient onsite measures to reduce project impacts, shall implement the off-site mitigation measure to demonstrate that the project is implementing all feasible mitigation measures. Please see the last mitigation measure on the District's offsite mitigation program.

1. Open burning of any kind shall be prohibited.

2. The project shall implement an offsite mitigation program, coordinated through the Placer County Air Pollution Control District, to offset the project's long-term ozone precursor emissions. The project offsite mitigation program must be approved by PCAPCD. The project's offsite mitigation program provides monetary incentives to sources of air pollutant emissions within the projects' air basin that are not required by law to reduce their emissions. Therefore, the emission reductions are real, quantifiable and implement provisions of the 1994 State Implementation Plan. The offsite mitigation program reduces emissions within the air basin that would not otherwise be eliminated.

   In lieu of the applicant implementing their own offsite mitigation program, the applicant can choose to participate in the Placer County Air Pollution District Offsite Mitigation Program by paying an equivalent amount of money into the District program. The actual amount of emission reductions needed through the Offsite Mitigation Program would be calculated when the project's average daily emissions have been determined.

Appendix D-7: Sacramento Metropolitan Air Quality Management District

Basic Construction Emission Control Practices

The following practices are considered feasible for controlling fugitive dust from a construction site. The most current control practices will be identified and followed at the time of construction. Control of fugitive dust is required by District Rule 403 and enforced by District staff.

- Water all exposed surfaces two times daily. Exposed surfaces include, but are not limited to soil piles, graded areas, unpaved parking areas, staging areas, and access roads.
- Cover or maintain at least two feet of free board space on haul trucks transporting soil, sand, or other loose material on the site. Any haul trucks that would be traveling along freeways or major roadways should be covered.
- Use wet power vacuum street sweepers to remove any visible trackout mud or dirt onto adjacent public roads at least once a day. Use of dry power sweeping is prohibited.
- Limit vehicle speeds on unpaved roads to 15 miles per hour (mph).
- All roadways, driveways, sidewalks, parking lots to be paved should be completed as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used.

The following practices describe exhaust emission control from diesel powered fleets working at a construction site. California regulations limit idling from both on-road and off-road diesel powered equipment. The California Air Resources Board enforces the idling limitations.

- Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes [required by California Code of Regulations, Title 13, sections 2449(d)(3) and 2485]. Provide clear signage that posts this requirement for workers at the entrances to the site.

Although not required by local or state regulation, many construction companies have equipment inspection and maintenance programs to ensure work and fuel efficiencies.

- Maintain all construction equipment in proper working condition according to manufacturer's specifications. The equipment must be checked by a certified mechanic and determine to be running in proper condition before it is operated.

Lead agencies may add these emission control practices as Conditions of Approval (COA) or include in a Mitigation Monitoring and Reporting Program (MMRP).

Enhanced Fugitive PM Dust Control Practices

Soil Disturbance Areas

- Water exposed soil with adequate frequency for continued moist soil. However, do not overwater to the extent that sediment flows off the site.
- Suspend excavation, grading, and/or demolition activity when wind speeds exceed 20 mph.
- Install wind breaks (e.g., plant trees, solid fencing) on windward side(s) of construction areas.
- Plant vegetative ground cover (fast-germinating native grass seed) in disturbed areas as soon as possible. Water appropriately until vegetation is established.

Appendix D-7: Continued

UNPAVED ROADS (ENTRAINED ROAD DUST)

- Install wheel washers for all exiting trucks, or wash off all trucks and equipment leaving the site.
- Treat site accesses to a distance of 100 feet from the paved road with a 6 to 12-inch layer of wood chips, mulch, or gravel to reduce generation of road dust and road dust carryout onto public roads.
- Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The phone number of the District shall also be visible to ensure compliance.

Enhanced Exhaust Control Practices

- The project representative shall submit to the lead agency and District a comprehensive inventory of all off-road construction equipment equal to or greater than 50 horsepower that will be used an aggregate of 40 or more hours during any portion of the construction project. The inventory shall include the horsepower rating, engine model year, and projected hours of use for each piece of equipment. The project representative shall provide the anticipated construction timeline including start date, and name and phone number of the project manager and on-site foreman. This information shall be submitted at least 4 business days prior to the use of subject heavy-duty off-road equipment. The inventory shall be updated and submitted monthly throughout the duration of the project, except that an inventory shall not be required for any 30-day period in which no construction activity occurs.~~shall provide a plan for approval by the District demonstrating that the heavy-duty (50 horsepower [hp] or more) off-road vehicles to be used in the construction project, including owned, leased, and subcontractor vehicles, will achieve a project wide fleet-average 20% NOX reduction and 45% particulate reduction compared to the most recent California Air Resources Board (ARB) fleet average. Acceptable options for reducing emissions may include use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and/or other options as they become available. The District's Construction Mitigation Calculator can be used to identify an equipment fleet that achieves this reduction.~~
- The project representative shall provide a plan for approval by the lead agency and District demonstrating that the heavy-duty off-road vehicles (50 horsepower or more) to be used in the construction project, including owned, leased, and subcontractor vehicles, will achieve a project wide fleet average 20% NO_X reduction and 45% particulate reduction compared to the most recent California Air Resources Board (ARB) fleet average. This plan shall be submitted in conjunction with the equipment inventory. Acceptable options for reducing emissions may include use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and other options as they become available.~~The project shall ensure that emissions from all off-road diesel powered equipment used on the project site do not exceed 40% opacity for more than three minutes in any one hour. Any equipment found to exceed 40 percent opacity (or Ringelmann 2.0) shall be repaired immediately. Non-compliant equipment will be documented and a summary provided to the lead agency and District monthly. A visual survey of all in-operation equipment shall be made at least weekly, and a monthly summary of the visual survey results shall be submitted throughout the duration of the project, except that the monthly summary shall not be required for any 30-day period in which no construction activity occurs. The monthly summary shall include the quantity and type of vehicles surveyed as well as the dates of each survey. The District and/or other officials may conduct periodic site inspections to determine compliance. Nothing in this section shall supercede other District or state rules or regulations.~~
- The project representative shall ensure that emissions from all off-road diesel powered equipment used on the project site do not exceed 40% opacity for more than 3 minutes in any 1 hour. Any equipment found to exceed 40% opacity (or Ringelmann 2.0) shall be repaired immediately. Non-compliant equipment will be

documented and a summary provided to the lead agency and District monthly. A visual survey of all in-operation equipment shall be made at least weekly. A monthly summary of the visual survey results shall be submitted throughout the duration of the project, except that the monthly summary shall not be required for any 30-day period in which no construction activity occurs. The monthly summary shall include the quantity and type of vehicles surveyed as well as the dates of each survey. ~~If at the time of construction, the District has adopted a regulation applicable to construction emissions, compliance with the regulation may completely or partially replace this mitigation. Consultation with the District prior to construction will be necessary to make this determination.~~

- The District and/or other officials may conduct periodic site inspections to determine compliance. Nothing in this mitigation shall supersede other District, state, or federal rules or regulations.

Mitigation Fees

If modeled construction-generated emissions of ROG, NO_X, PM10, and/or PM2.5 are not reduced to a level below the District's threshold of significance or federal *de minimis* threshold after implementation of all feasible on-site mitigation, then the project applicant must pay a mitigation fee into the District's off-site mitigation program. The District's off-site mitigation program uses these fees to purchase emission reductions in the Sacramento region. By paying the appropriate off-site mitigation fee, construction-generated emissions of ROG, NO_X, PM10, and/or PM2.5 are reduced to a less-than-significant level. The determination of the final mitigation fee shall be conducted in coordination with the District before any demolition or ground disturbance occurs for any phase of project construction. The current (2016) mitigation fee rate is $18,260 per ton of emissions. Each July the rate is adjusted. A 5% administrative fee is assessed in addition to the mitigation fee.

Guidance For Construction GHG Emissions Reductions

These measures are considered best management practices providing options for reducing greenhouse gas emissions from construction projects. Emission reductions must be quantified and documented on a case-by-case basis.

- Improve fuel efficiency from construction equipment:
  - Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to no more than 3 minutes (5 minute limit is required by the state airborne toxics control measure [Title 13, sections 2449(d)(3) and 2485 of the California Code of Regulations]). Provide clear signage that posts this requirement for workers at the entrances to the site.
  - Maintain all construction equipment in proper working condition according to manufacturer's specifications. The equipment must be checked by a certified mechanic and determined to be running in proper condition before it is operated.
  - Train equipment operators in proper use of equipment.
  - Use the proper size of equipment for the job.
  - Use equipment with new technologies (repowered engines, electric drive trains).
- Perform on-site material hauling with trucks equipped with on-road engines (if determined to be less emissive than the off-road engines).
- Use alternative fuels for generators at construction sites such as propane or solar, or use electrical power.

- Use an ARB approved low carbon fuel for construction equipment. (NOx emissions from the use of low carbon fuel must be reviewed and increases mitigated.)
- Encourage and provide carpools, shuttle vans, transit passes and/or secure bicycle parking for construction worker commutes.
- Reduce electricity use in the construction office by using compact fluorescent bulbs, powering off computers every day, and replacing heating and cooling units with more efficient ones.
- Recycle or salvage non-hazardous construction and demolition debris (goal of at least 75% by weight.)
- Use locally sourced or recycled materials for construction materials (goal of at least 20% based on costs for building materials, and based on volume for roadway, parking lot, sidewalk and curb materials). Wood products utilized should be certified through a sustainable forestry program.
- Minimize the amount of concrete for paved surfaces or utilized a low carbon concrete option.
- Produce concrete on-site if determined to be less emissive than transporting ready mix.
- Use SmartWay certified trucks for deliveries and equipment transport.
- Develop a plan to efficiently use water for adequate dust control.

References

1. California Green Building Standards Code. http://www.bsc.ca.gov.
2. U.S. EPA. Potential for Reducing Greenhouse Gas Emissions in the Construction Sector, February 2009. http://ww.epa.gov/sectors/pdf/construction-sector-report.pdf
3. U.S. EPA SmartWay Program. http://www/epa.gov.smartway/index.htm
4. U.S. Green Building Council. LEED Green Building Rating System. http://www.usgbc.org/

Source: Sacramento Metropolitan Air Quality Management District. ~~2010~~2016.~~CEQA Guide December 2009~~Guide to Air Quality Assessment in Sacramento County, Revised September ~~2010~~2016

Appendix D-8: Tehama County Air Pollution Control District

There are three emissions threshold levels used to determine the level of mitigation required for a project. The three levels that applied to both construction and operation emissions are as follows:

	NO_X	ROG	PM_{10}	Level of Significance
Level A	≤ 25 lbs/day	≤ 25 lbs/day	≤ 80 lbs/day	Potentially Significant Impacts
Level B	> 25 lbs/day	> 25 lbs/day	> 80 lbs/day	Potentially Significant Impacts
Level C	> 137 lbs/day	> 137 lbs/day	> 137 lbs/day	Significant Impacts

Construction Equipment Exhaust Mitigation	
Mitigation of construction equipment exhaust should focus on strategies that reduce NO_X, ROG, and PM10 emissions. These strategies may include restricting unnecessary vehicle idling to 5 minutes, using reformulated and emulsified fuels, incorporating catalyst and filtration technologies, and modernizing the equipment fleet with cleaner repower and newer engines, among others.	
Standard Mitigation Measures for Construction Equipment	• Maintain all construction equipment in proper tune according to manufacturer's specifications. • Maximize to the extent feasible, the use of diesel construction equipment meeting the CARB's 1996 or newer certification standard for off-road heavy-duty diesel engines. • Registration in the CARB DOORS program (www.arb.ca.gov/msprog/ordiesel/ordiesel.htm) and meeting all applicable standards for replacement and/or retrofit. • All portable equipment, rated over 50 brake horse power, in the Portable Equipment Registration Program (www.arb.ca.gov/portable/portable.htm).
Discretionary Mitigation Measures for Construction Equipment	• Electrify equipment where feasible. • Substitute gasoline-powered for diesel-powered equipment, where feasible. • Use alternatively fueled construction equipment on site where feasible, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane, or biodiesel. • Use equipment that has Caterpillar pre-chamber diesel engines.

Appendix D-8: Continued

Fugitive Dust PM_{10} Mitigation Measures
These measures apply to all projects with the potential to emit fugitive dust.

• Land Clearing/Earth Moving:
  o Water shall 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.
  o Haul vehicles transporting soil into or out of the property shall be covered.
  o Water shall be applied to disturbed areas a minimum of 2 times per day or more as necessary.
  o On-site vehicles limited to a speed which minimizes dust emissions on unpaved roads.
  o Post a publicly visible sign with the telephone number and person to contact regarding dust complaints. This person shall respond and take corrective action within 24 hours. The telephone number of the District shall also be visible to ensure compliance with District Rule 4:1 & 4:24 (Nuisance and Fugitive Dust Emissions).
 	
• Visibly Dry Disturbed Soil Surface Areas:
  o All visibly dry disturbed soil surface areas of operation shall be watered to minimize dust emission.
 	
• Paved Road Track-Out:
  o Existing roads and streets adjacent to the project will be cleaned at least once per day unless conditions warrant a greater frequency.
 	
• Visibly Dry Disturbed Unpaved Roads:
  o All visibly dry disturbed unpaved roads surface areas of operation shall be watered to minimize dust emission.
  o Unpaved roads may be graveled to reduce dust emissions.
  o Water shall be applied to disturbed areas a minimum of 2 times per day or more as necessary.
  o On-site vehicles limited to a speed which minimizes dust emissions on unpaved roads.
  o Haul roads shall be sprayed down at the end of the work shift to form a thin crust. This application of water shall be in addition to the minimum rate of application.
 	
• Vehicles Entering/Exiting Construction Area:
  o Vehicles entering or exiting construction area shall travel at a speed which minimizes dust emissions.
 	
• Employee Vehicles:
  o Construction workers shall park in designated parking areas(s) to help reduce dust emissions.
 	
• Soil Piles:
  o Soil pile surfaces shall 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.

Notes: Violations of TCAPCD Regulations are enforceable under the provisions of California Health and Safety Code Section 42400, which provides for civil or criminal penalties of up to $25,000 per violation.

Source: Tehama County Air Pollution Control District 2009

Appendix D-9: Yolo-Solano Air Quality Management District

Construction Dust Mitigation Measures

Mitigation Measure	Source Category
Water all active construction sites at least twice daily. Frequency should be based on the type of operation, soil, and wind exposure.	Fugitive emissions from active, unpaved construction areas
Haul trucks shall maintain at least 2 feet of freeboard.	Spills from haul trucks
Cover all trucks hauling dirt, sand, or loose materials.	Spills from haul trucks
Apply non-toxic binders (e.g., latex acrylic copolymer) to exposed areas after cut and fill operations and hydroseed area.	Wind erosion from inactive areas
Apply chemical soil stabilizers on inactive construction areas (disturbed lands within construction projects that are unused for at least four consecutive days).	Wind erosion from inactive areas
Plant tree windbreaks on the windward perimeter of construction projects if adjacent to open land.	Wind erosion from inactive areas
Plant vegetative ground cover in disturbed areas as soon as possible.	Wind erosion from inactive areas
Cover inactive storage piles.	Wind erosion from storage piles
Sweep streets if visible soil material is carried out from the construction site.	On-road entrained PM_{10}
Treat accesses to a distance of 100 feet from the paved road with a 6 to 12 inch layer of wood chips or mulch.	Mud/dirt carryout on-road entrained PM_{10}
Treat accesses to a distance of 100 feet from the paved road with a 6-inch layer of gravel.	Mud/dirt carryout on-road entrained PM_{10}
Adapted from: Yolo-Solano Air Quality Management District 2007	

Construction Equipment Exhaust Mitigation

Purpose	Mitigation Measure
Mitigation of construction equipment exhaust should focus on strategies that reduce NO_X, ROG, and PM_{10} emissions.	Restrict unnecessary vehicle idling to 5 Minutes.
	Use reformulated and emulsified fuels.
	Incorporate catalyst and filtration technologies.
	Modernize the equipment fleet with cleaner repower and newer engines.
Notes: Contact the YSAQMD for additional construction equipment exhaust mitigation measures. Many heavy-duty diesel mitigation measures may qualify for state and YSAQMD incentive funding programs. Adapted from: Yolo-Solano Air Quality Management District 2007	

Appendix E

Riparian Vegetation Analysis

Appendix E
Riparian Vegetation Analysis

Introduction

This appendix contains the methodology that was used to develop both broad-scale and the site-by-site riparian vegetation analyses used in the Sacramento River Bank Protection Project (SRBPP) Phase II 80,00 Linear Feet (LF) Programmatic Environmental Impact Statement/Environmental Impact Report (EIS/EIR). The broad-scale analysis of existing vegetation within the action area was conducted previously by Stillwater for the programmatic Biological Assessment (BA) covering the final 24,000 LF of the original Phase II authorization (Stillwater Sciences 2007), and their methodology is included here. This appendix also includes methodology for the site-by-site riparian vegetation analysis used in the EIS/EIR, as well as a table showing results for each site under each alternative.

Methodology for Broad-Scale Existing Vegetation Analysis

Information on the geographic distribution of existing riparian plant community types was provided by the Sacramento River Riparian Vegetation (SRRV) geographic information systems (GIS) coverage from Chico State University (Nelson et al. 2000). As part of the Sacramento River Riparian Mapping Project (Nelson et al. 2000), polygons of distinct riparian plant community types were hand digitized from mylar overlays of air photograph enlargements and from ortho-rectified 1:12,000 color infrared images. Through the Sacramento River Mapping Project, vegetation polygons in the SRBPP action area were assigned one of 12 different riparian plant community types.

For the purposes of assessing existing conditions for this programmatic EIS/EIR, the 12 plant community types identified in the SRRV database were collapsed into five vegetation cover types (described in Chapter 10, *Vegetation and Wetlands*). Agricultural areas recorded primarily as 'no label' in the SRRV coverage were reassigned to either 'Agricultural' or 'Riparian Herbaceous' based on aerial photo- interpretation of 1-meter resolution imagery from the National Agriculture Imagery Program (U.S. Department of Agriculture Farm Service Agency 2007). Those areas within the SRRV coverage that were not assigned a riparian vegetation type were also reviewed using aerial photo-imagery from the National Agriculture Imagery Program. All of those areas reviewed appeared to support sparse herbaceous cover and were assigned the general category, 'Ruderal Vegetation'.

The final vegetation layer was overlaid onto a GIS coverage of the existing levee or a 100-foot band around the water bodies, as described above. This layer was used to summarize the acreage of each riparian vegetation cover type within the four SRBPP regions.

Table E-1. Sacramento River Riparian Vegetation (SRRV) Types

SRRV Riparian Plant Community Type	Corresponding Programmatic EIS/ EIR Cover Type
Disturbed Bare Ground. This unit identifies areas that are undergoing major disturbances and are now either completely devoid of riparian vegetation or contain only small remnants of it.	Bare ground
Disturbed Riparian. This unit identifies a past disturbance, primarily dredge tailings with cottonwoods (*Populus fremontii*) as the dominant species with other riparian vegetation types having become established since the disturbance.	Riparian forest
Great Valley Cottonwood Riparian Forest. This vegetation type is defined by areas supporting over 80% cottonwood by canopy cover that includes individuals one year old or older. These forests are dominated by cottonwood and one or more tree willows (*Salix gooddigii variabilis*, *S. laevigata*, and *S. lasiandra* are most common). California Grape (*Vitis californica*) is the only conspicuous vine.	Riparian forest
Great Valley Mixed Riparian Forest. In this unit, neither willows nor cottonwoods dominate. These forests also contain a mixture of upland, later successional species that may include valley oak (*Quercus lobata*) at less than 60% canopy coverage, black walnut (*Juglans* spp.), ash (*Fraxinus latifolia*), tree of heaven (*Ailanthus altissima*), and sycamore (Plat*anus racemosa*).	Riparian forest
Valley Oak. In this unit, valley oaks (*Quercus lobata*) must be greater than approximately 60% canopy cover, and must be contiguous to other riparian vegetation or have the long axis of the polygon be parallel to the channel and of a length that is greater than the distance of the polygon from riparian other vegetation.	Riparian forest
Giant Reed. This vegetation type is defined as nearly mono-specific stands of giant reed (*Arundo donax*). Giant reed is native to Mediterranean areas of Europe and is a very invasive plant that reduces plant species diversity and replaces native species.	Emergent marsh
Gravel and Sand Bars. These appear as open, unvegetated areas in aerial photos, but ground verification reveals several annual and short-lived perennial species of sun-loving herbs, grasses and subshrubs. Vegetation coverage is <50%.	Riparian herbaceous
Herbland Cover. This is a general vegetation type that is composed of annual and perennial grasses and forbs. To qualify as a riparian vegetation type, this type has to be enclosed by riparian vegetation or the stream channel.	Riparian herbaceous
Valley Freshwater Marsh. Valley freshwater marshes are dominated by perennial emergent monocots such as cattails (*Typha* sp.) and tules (*Scirpus* sp.). Coverage may be very high, approaching 100%.	Emergent marsh
Blackberry Scrub. This vegetation type includes areas that have >80% coverage by blackberry vegetation. This can include either the native California blackberry (*Rubus ursinus*) or the invasive exotic Himalayan blackberry (*Rubus discolor*).	Riparian scrub/shrub
Great Valley Riparian Scrub. Young primary succession.	Riparian scrub/shrub
No label. Non-riparian areas surrounded by riparian types.	Reassigned to either Agricultural or Riparian Herbaceous based on aerial photo-interpretation

Table E-2. Watercourses (Reaches) Within Each Study Region Which Are Included in the Sacramento River Riparian Vegetation (SRRV) Coverage of Riparian Vegetation

Region	Watercourse	SRRV Coverage
1a	Sacramento River from Collinsville to Isleton (RM 0–20)	RM 0–17
	Three Mile Slough	No
	Georgiana Slough	No
	Steamboat Slough	No
	Yolo Bypass	No
	Miner Slough	No
	Portions of Lindsay Slough	No
	Cache Slough	No
	Ulatus Creek Bypass Unit 2	No
	Haas Slough	No
	Sutter Slough	No
	Putah Creek	All
	Willow Slough Bypass	No
	Sacramento Bypass	No
	Cache Creek from the Yolo Bypass to the upstream limit of the Project Levees	All
	Knights Landing Ridge Cut	No
1b	Sacramento River from Isleton to Feather River (RM 20–80)	All
	American River from Sacramento River to RM 13	All
	Natomas East Main Drain	No
	Natomas Cross Canal	No
	Coon Creek Group Interceptor Unit 6	No
2	Sacramento River from Feather River confluence to Colusa (RM 80–143)	All
	Colusa Basin Drain	No
	Sutter Bypass	All
	Tisdale Bypass	All
	Wadsworth Canal	No
	Colusa Bypass	All
	Cherokee Canal	No
	Butte Creek	No
	Feather River from Sacramento River upstream to RM 31	All
	Bear River from the Feather River to upstream end of levees above Hwy 65	All
	Yuba River from the Feather River upstream to RM 5	All
	Marysville Units 1,2, and 3	
	Honcut Creek	All
	Feather River from RM 31 to Honcut Creek right bank	All
	Feather River from RM 31 to Western Canal left bank	All
3	Sacramento River from Colusa to Chico (RM 143–194)	All
	Mud Creek	All
	Deer Creek	All
	Elder Creek	All

Methodology for Riparian Vegetation Site-Specific Analysis

The site-specific analysis of riparian vegetation presented in Chapter 10 of this programmatic EIS/EIR was conducted to determine approximate amounts of riparian woodland and scrub/shrub vegetation that would be removed as a result of implementing the proposed program. The analysis utilized 2008 Digital Globe aerial imagery (1-foot resolution) in addition to levee centerline and upstream/downstream site limit data for the 106 sites.

Vegetation was mapped if it was considered to be riparian woodland or riparian scrub/shrub. Distinctions were made between these two types of vegetation to the extent practicable, and mapped as distinct GIS shape files by digitizing polygons representing areas with tree canopy (either woodland or scrub/shrub).

The extent of vegetation mapped included the area within the upstream and downstream site limits and from the levee centerline waterward to the low flow channel and landward approximately 100 feet. Vegetation within these site "boundaries" was designated and calculated as "existing vegetation".

Lines representing the approximate locations of the levee toes at each site were digitized based on aerial photo interpretation. A 15-foot buffer was applied to the outward edge of each levee toe. The area between the outermost edges of the waterside and landside 15 foot buffers is considered to be the vegetation free zone (as expressed in the *Engineering Technical Letter 1110-2-571, Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams, and Appurtenant Structures* (Vegetation ETL) [U.S. Army Corps of Engineers 2009]), as applicable to each bank protection measure (BM).

For purposes of assessing effects of the proposed program, vegetation was assumed to be removed (referred to as "removed vegetation") if it was within the footprint of features to be constructed (e.g., placement of rock or soil). Vegetation within the entire vegetation free zone of each site was mapped but is not included in the "removed vegetation" calculation, as SRBPP is assumed to apply Vegetation ETL standards only within the construction footprint.

More specifically, vegetation to be removed was calculated based on the features of each measure's design. The following BM assumptions were applied:

- **BM 1, Setback Levee:** vegetation removal encompasses the areas where the new levee transitions into the existing levee at the upstream and downstream ends of the site.
- **BM 2, Rock Slope with no vegetation:** all vegetation on the waterward levee slope and extending to the low-flow river channel was removed.
- **BM 3, Adjacent Levee:** all vegetation landward of the levee centerline and extending 50 feet was removed.
- **BM 4a, 4b, 4c, Riparian Benches:** same as BM 2.
- **BM 5, Rock Slope with vegetation:** same as BM 2 except that 25% of existing vegetation is retained.

Retained vegetation was calculated by subtracting removed vegetation from existing vegetation. "Plantable area created" was calculated for each bank protection measure based on the amount of surface area that is suitable for planting riparian vegetation and outside of the vegetation free zone. For example, bank protection measures with riparian benches were assumed to provide a planting surface that is 15-feet wide and the length of the entire site. Setback levees were assumed to provide a planting area 100-feet wide and the length of the entire site except for those areas at the upstream and downstream portions of the site where the new levee transitions into the existing levee. Rock slope with vegetation was assumed to create an area 15 feet wide for the length of the site that was considered to have 25% of that area plantable. No "plantable area created" was assumed for adjacent levee or rock slope without vegetation.

The site-by-site results for each alternative are shown in Tables E-3 through E-8. The level of accuracy for all work is adequate for purposes of planning and programmatic environmental analysis only and should not be considered precise.

References

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Stillwater Sciences. 2007. *Programmatic biological assessment for the Sacramento River Bank Protection Project, Phase II*. Final. Davis, CA. Prepared for the US Army Corps of Engineers, Sacramento District.

U.S. Army Corps of Engineers. 2009. *Guidelines for Landscape Planting And Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*. (Technical Letter ETL 1110-2-571.) April 10, 2009.

U.S. Department of Agriculture Farm Service Agency. 2007. National Agriculture Imagery Program (NAIP) homepage. NAIP, Aerial Photography Field Office, USDA Farm Service Agency, Salt Lake City, Utah.

Table E-3. Site-by-Site Vegetation Analysis for Alternative 1 (Acres)

	Alternative 1						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Bear River RM 0.8 L	0.15	0.00	0.00	0.00	0.15	0.00	0.00
Cache Creek LM 3.9 L	0.06	0.00	0.00	0.00	0.06	0.00	0.00
Cache Slough RM 15.9 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cache Slough RM 22.8 R	0.00	0.09	0.00	0.00	0.00	0.09	0.00
Cache Slough RM 23.6 R	0.00	0.32	0.00	0.00	0.00	0.32	0.00
Deer Creek LM 2.4 L	0.09	0.00	0.00	0.00	0.09	0.00	0.00
Elder Creek LM 1.4 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elder Creek LM 3.0 R	0.14	0.00	0.00	0.00	0.14	0.00	0.00
Feather River RM 0.6 L	0.06	0.00	0.00	0.00	0.06	0.00	0.00
Feather River RM 5.0 L	1.44	0.00	0.00	0.00	1.44	0.00	0.00
Georgianna Slough RM 0.3 L	0.16	0.04	0.00	0.00	0.16	0.04	0.00
Georgianna Slough RM 1.7 L	0.13	0.29	0.00	0.00	0.13	0.29	0.00
Georgianna Slough RM 2.5 L	0.00	0.29	0.00	0.00	0.00	0.29	0.00
Georgianna Slough RM 3.6 L	0.22	0.77	0.00	0.00	0.22	0.77	0.00
Georgianna Slough RM 3.7a L	0.00	0.09	0.00	0.00	0.00	0.09	0.00
Georgianna Slough RM 3.7b L	0.00	0.04	0.00	0.00	0.00	0.04	0.00
Georgianna Slough RM 4.0 L	0.19	0.00	0.00	0.00	0.19	0.00	0.00
Georgianna Slough RM 4.3 L	0.27	0.00	0.00	0.00	0.27	0.00	0.00
Georgianna Slough RM 4.5 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Georgianna Slough RM 4.6 L	0.51	0.83	0.00	0.00	0.51	0.83	0.00
Georgianna Slough RM 5.3 L	1.43	0.74	0.00	0.00	1.43	0.74	0.00
Georgianna Slough RM 6.1 L	0.34	0.52	0.00	0.00	0.34	0.52	0.00
Georgianna Slough RM 6.4 L	0.04	0.03	0.00	0.00	0.04	0.03	0.00
Georgianna Slough RM 6.6 L	0.12	0.00	0.00	0.00	0.12	0.00	0.00
Georgianna Slough RM 6.8 L	0.62	0.00	0.00	0.00	0.62	0.00	0.00
Georgianna Slough RM 8.3 L	0.00	0.05	0.00	0.00	0.00	0.05	0.00
Georgianna Slough RM 9.3 L	0.46	0.00	0.00	0.00	0.46	0.00	0.00
Knights Landing Ridge Cut LM 0. 2R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 3.0 L	1.38	0.09	0.00	0.00	1.38	0.09	0.00
Knights Landing Ridge Cut LM 3.1 L	0.13	0.00	0.00	0.00	0.13	0.00	0.00
Knights Landing Ridge Cut LM 4.2 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Knights Landing Ridge Cut LM 5.3 L	1.62	0.00	0.00	0.00	1.62	0.00	0.00
Natomas Cross Canal LM 3.0 R	0.23	0.00	0.00	0.00	0.23	0.00	0.00
Sacramento River RM 101.3 R	0.17	0.00	0.00	0.00	0.17	0.00	0.00
Sacramento River RM 104.0 L	0.46	0.00	0.00	0.00	0.46	0.00	0.00
Sacramento River RM 104.5 L	0.13	0.00	0.00	0.00	0.13	0.00	0.00
Sacramento River RM 116.0 L	0.09	0.00	0.00	0.00	0.09	0.00	0.00
Sacramento River RM 116.5 L	0.30	0.00	0.00	0.00	0.30	0.00	0.00
Sacramento River RM 122.0 R	0.33	0.00	0.00	0.00	0.33	0.00	0.00
Sacramento River RM 122.3 R	0.04	0.00	0.00	0.00	0.04	0.00	0.00
Sacramento River RM 123.3 L	0.18	0.00	0.00	0.00	0.18	0.00	0.00
Sacramento River RM 123.7 R	0.01	0.00	0.00	0.00	0.01	0.00	0.00
Sacramento River RM 127.9 R	0.61	0.00	0.00	0.00	0.61	0.00	0.00
Sacramento River RM 131.8 L	0.05	0.00	0.00	0.00	0.05	0.00	0.00
Sacramento River RM 132.9 R	0.13	0.00	0.00	0.00	0.13	0.00	0.00
Sacramento River RM 133.0 L	0.00	0.68	0.00	0.00	0.00	0.68	0.00
Sacramento River RM 133.8 L	0.21	0.00	0.00	0.00	0.21	0.00	0.00
Sacramento River RM 136.6 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 138.1 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 152.8 L	0.22	0.00	0.00	0.00	0.22	0.00	0.00
Sacramento River RM 163.0 L	3.55	0.00	0.00	0.00	3.55	0.00	0.00
Sacramento River RM 168.3 L	0.72	0.00	0.00	0.00	0.72	0.00	0.00
Sacramento Rive rRM 172.0 L	0.21	0.00	0.00	0.00	0.21	0.00	0.00
Sacramento River RM 21.5 L	0.21	0.00	0.00	0.00	0.21	0.00	0.00
Sacramento River RM 22.5 L	0.49	0.00	0.00	0.00	0.49	0.00	0.00

Table E-3. Site-by-Site Vegetation Analysis for Alternative 1 (Acres)

	Alternative 1						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Sacramento River RM 22.7 L	0.20	0.00	0.00	0.00	0.20	0.00	0.00
Sacramento River RM 23.2 L	0.32	0.14	0.00	0.00	0.32	0.14	0.00
Sacramento River RM 23.3 L	0.51	0.00	0.00	0.00	0.51	0.00	0.00
Sacramento River RM 24.8 L	0.65	0.00	0.00	0.00	0.65	0.00	0.00
Sacramento River RM 25.2 L	0.34	0.00	0.00	0.00	0.34	0.00	0.00
Sacramento River RM 31.6 R	0.17	0.00	0.00	0.00	0.17	0.00	0.00
Sacramento River RM 35.3 R	0.49	0.00	0.00	0.00	0.49	0.00	0.00
Sacramento River RM 35.4 R	0.11	0.00	0.00	0.00	0.11	0.00	0.00
Sacramento River RM 38.5 R	0.04	0.00	0.00	0.00	0.04	0.00	0.00
Sacramento River RM 56.5 R	0.21	0.17	0.00	0.00	0.21	0.17	0.00
Sacramento River RM 56.6 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Sacramento River RM 56.7 R	1.06	0.00	0.00	0.00	1.06	0.00	0.00
Sacramento River RM 62.9 R	0.12	0.00	0.00	0.00	0.12	0.00	0.00
Sacramento River RM 74.4 R	2.04	0.67	0.00	0.00	2.04	0.67	0.00
Sacramento River RM 75.3 R	1.94	1.13	0.00	0.00	1.94	1.13	0.00
Sacramento River RM 77.7 R	0.23	0.00	0.00	0.00	0.23	0.00	0.00
Sacramento River RM 78.3 L	0.76	0.00	0.00	0.00	0.76	0.00	0.00
Sacramento River RM 86.3 L	2.00	0.00	0.00	0.00	2.00	0.00	0.00
Sacramento River RM 86.5 R	0.11	0.00	0.00	0.00	0.11	0.00	0.00
Sacramento River RM 86.9 R	0.70	0.00	0.00	0.00	0.70	0.00	0.00
Sacramento River RM 92.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 95.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 96.2 L	0.28	0.00	0.00	0.00	0.28	0.00	0.00
Sacramento River RM 99.0 L	1.04	0.00	0.00	0.00	1.04	0.00	0.00
Sacramneto River RM 63.0 R	0.10	0.00	0.00	0.00	0.10	0.00	0.00
Steamboat Slough RM 18.8 R	0.03	0.24	0.00	0.00	0.03	0.24	0.00
Steamboat Slough RM 23.9 R	0.62	0.00	0.00	0.00	0.62	0.00	0.00
Steamboat Slough RM 24.7 R	0.87	0.54	0.00	0.00	0.87	0.54	0.00
Steamboat Slough RM 25.0 L	0.38	0.00	0.00	0.00	0.38	0.00	0.00
Steamboat Slough RM 25.8 R	0.64	0.00	0.00	0.00	0.64	0.00	0.00
Steamboat Slough RM 26.0 L	0.48	0.00	0.00	0.00	0.48	0.00	0.00
Sutter Slough RM 24.7 R	0.00	1.01	0.00	0.00	0.00	1.01	0.00
Sutter Slough RM 26.5 L	0.30	0.00	0.00	0.00	0.30	0.00	0.00
Willow Slough Bypass LM 6.9 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 0.1 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.0 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.5 R	0.00	0.09	0.00	0.00	0.00	0.09	0.00
Yolo Bypass LM 2.6 L	1.31	0.00	0.00	0.00	1.31	0.00	0.00
Yolo Bypass LM 3.8 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yuba River LM 2.3 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Total	**36.10**	**8.89**	**0.00**	**0.00**	**36.11**	**8.89**	**0.00**

Note:
RM = river mile
LM = levee mile
L = left bank
R = right bank

Table E-4. Site-by-Site Vegetation Analysis for Alternative 2 (Acres)

Site	Alternative 2						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Bear River RM 0.8 L	0.15	0.00	0.15	0.00	0.00	0.00	0.00
Cache Creek LM 3.9 L	0.06	0.00	0.06	0.00	0.00	0.00	0.00
Cache Slough RM 15.9 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cache Slough RM 22.8 R	0.00	0.09	0.00	0.09	0.00	0.00	0.00
Cache Slough RM 23.6 R	0.00	0.32	0.00	0.32	0.00	0.00	0.00
Deer Creek LM 2.4 L	0.09	0.00	0.09	0.00	0.00	0.00	0.00
Elder Creek LM 1.4 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elder Creek LM 3.0 R	0.14	0.00	0.14	0.00	0.00	0.00	0.00
Feather River RM 0.6 L	0.06	0.00	0.06	0.00	0.00	0.00	0.00
Feather River RM 5.0 L	1.44	0.00	0.85	0.00	0.59	0.00	0.00
Georgianna Slough RM 0.3 L	0.16	0.04	0.16	0.04	0.00	0.00	0.00
Georgianna Slough RM 1.7 L	0.13	0.29	0.13	0.29	0.00	0.00	0.00
Georgianna Slough RM 2.5 L	0.00	0.29	0.00	0.28	0.00	0.00	0.00
Georgianna Slough RM 3.6 L	0.22	0.77	0.01	0.77	0.20	0.00	0.00
Georgianna Slough RM 3.7a L	0.00	0.09	0.00	0.09	0.00	0.00	0.00
Georgianna Slough RM 3.7b L	0.00	0.04	0.00	0.04	0.00	0.00	0.00
Georgianna Slough RM 4.0 L	0.19	0.00	0.19	0.00	0.00	0.00	0.00
Georgianna Slough RM 4.3 L	0.27	0.00	0.27	0.00	0.00	0.00	0.00
Georgianna Slough RM 4.5 L	0.03	0.00	0.03	0.00	0.00	0.00	0.00
Georgianna Slough RM 4.6 L	0.51	0.83	0.42	0.00	0.08	0.83	0.00
Georgianna Slough RM 5.3 L	1.43	0.74	0.95	0.72	0.48	0.02	0.00
Georgianna Slough RM 6.1 L	0.34	0.52	0.23	0.44	0.11	0.07	0.00
Georgianna Slough RM 6.4 L	0.04	0.03	0.04	0.03	0.00	0.00	0.00
Georgianna Slough RM 6.6 L	0.12	0.00	0.12	0.00	0.00	0.00	0.00
Georgianna Slough RM 6.8 L	0.62	0.00	0.45	0.00	0.16	0.00	0.00
Georgianna Slough RM 8.3 L	0.00	0.05	0.00	0.05	0.00	0.00	0.00
Georgianna Slough RM 9.3 L	0.46	0.00	0.36	0.00	0.10	0.00	0.00
Knights Landing Ridge Cut LM 0. 2R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 3.0 L	1.38	0.09	0.00	0.00	1.38	0.09	0.00
Knights Landing Ridge Cut LM 3.1 L	0.13	0.00	0.13	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 4.2 L	0.03	0.00	0.02	0.00	0.01	0.00	0.00
Knights Landing Ridge Cut LM 5.3 L	1.62	0.00	1.22	0.00	0.40	0.00	0.00
Natomas Cross Canal LM 3.0 R	0.23	0.00	0.23	0.00	0.00	0.00	0.00
Sacramento River RM 101.3 R	0.17	0.00	0.17	0.00	0.00	0.00	0.00
Sacramento River RM 104.0 L	0.46	0.00	0.01	0.00	0.46	0.00	0.00
Sacramento River RM 104.5 L	0.13	0.00	0.00	0.00	0.13	0.00	0.00
Sacramento River RM 116.0 L	0.09	0.00	0.00	0.00	0.09	0.00	0.00
Sacramento River RM 116.5 L	0.30	0.00	0.02	0.00	0.27	0.00	0.00
Sacramento River RM 122.0 R	0.33	0.00	0.32	0.00	0.01	0.00	0.00
Sacramento River RM 122.3 R	0.04	0.00	0.03	0.00	0.00	0.00	0.00
Sacramento River RM 123.3 L	0.18	0.00	0.18	0.00	0.00	0.00	0.00
Sacramento River RM 123.7 R	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Sacramento River RM 127.9 R	0.61	0.00	0.47	0.00	0.14	0.00	0.00
Sacramento River RM 131.8 L	0.05	0.00	0.04	0.00	0.01	0.00	0.00
Sacramento River RM 132.9 R	0.13	0.00	0.13	0.00	0.00	0.00	0.00
Sacramento River RM 133.0 L	0.00	0.68	0.00	0.68	0.00	0.00	0.00
Sacramento River RM 133.8 L	0.21	0.00	0.00	0.00	0.21	0.00	0.00
Sacramento River RM 136.6 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 138.1 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 152.8 L	0.22	0.00	0.22	0.00	0.00	0.00	0.00
Sacramento River RM 163.0 L	3.55	0.00	2.59	0.00	0.96	0.00	0.00
Sacramento River RM 168.3 L	0.72	0.00	0.72	0.00	0.00	0.00	0.00
Sacramento Rive rRM 172.0 L	0.21	0.00	0.18	0.00	0.03	0.00	0.00
Sacramento River RM 21.5 L	0.21	0.00	0.21	0.00	0.00	0.00	0.00
Sacramento River RM 22.5 L	0.49	0.00	0.49	0.00	0.00	0.00	0.00

Table E-4. Site-by-Site Vegetation Analysis for Alternative 2 (Acres)

	Alternative 2						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Sacramento River RM 22.7 L	0.20	0.00	0.20	0.00	0.00	0.00	0.00
Sacramento River RM 23.2 L	0.32	0.14	0.32	0.14	0.00	0.00	0.00
Sacramento River RM 23.3 L	0.51	0.00	0.50	0.00	0.00	0.00	0.00
Sacramento River RM 24.8 L	0.65	0.00	0.65	0.00	0.00	0.00	0.00
Sacramento River RM 25.2 L	0.34	0.00	0.34	0.00	0.00	0.00	0.00
Sacramento River RM 31.6 R	0.17	0.00	0.00	0.00	0.17	0.00	0.00
Sacramento River RM 35.3 R	0.49	0.00	0.00	0.00	0.49	0.00	0.00
Sacramento River RM 35.4 R	0.11	0.00	0.00	0.00	0.11	0.00	0.00
Sacramento River RM 38.5 R	0.04	0.00	0.01	0.00	0.03	0.00	0.00
Sacramento River RM 56.5 R	0.21	0.17	0.21	0.16	0.00	0.00	0.00
Sacramento River RM 56.6 L	0.03	0.00	0.03	0.00	0.00	0.00	0.00
Sacramento River RM 56.7 R	1.06	0.00	1.06	0.00	0.00	0.00	0.00
Sacramento River RM 62.9 R	0.12	0.00	0.06	0.00	0.06	0.00	0.00
Sacramento River RM 74.4 R	2.04	0.67	0.77	0.67	1.27	0.00	0.00
Sacramento River RM 75.3 R	1.94	1.13	1.55	1.13	0.39	0.00	0.00
Sacramento River RM 77.7 R	0.23	0.00	0.23	0.00	0.00	0.00	0.00
Sacramento River RM 78.3 L	0.76	0.00	0.76	0.00	0.00	0.00	0.00
Sacramento River RM 86.3 L	2.00	0.00	1.22	0.00	0.78	0.00	0.00
Sacramento River RM 86.5 R	0.11	0.00	0.11	0.00	0.00	0.00	0.00
Sacramento River RM 86.9 R	0.70	0.00	0.69	0.00	0.00	0.00	0.00
Sacramento River RM 92.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 95.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 96.2 L	0.28	0.00	0.28	0.00	0.00	0.00	0.00
Sacramento River RM 99.0 L	1.04	0.00	0.00	0.00	1.04	0.00	0.00
Sacramneto River RM 63.0 R	0.10	0.00	0.02	0.00	0.08	0.00	0.00
Steamboat Slough RM 18.8 R	0.03	0.24	0.00	0.11	0.03	0.13	0.00
Steamboat Slough RM 23.9 R	0.62	0.00	0.32	0.00	0.30	0.00	0.00
Steamboat Slough RM 24.7 R	0.87	0.54	0.22	0.54	0.65	0.00	0.00
Steamboat Slough RM 25.0 L	0.38	0.00	0.38	0.00	0.00	0.00	0.00
Steamboat Slough RM 25.8 R	0.64	0.00	0.35	0.00	0.29	0.00	0.00
Steamboat Slough RM 26.0 L	0.48	0.00	0.46	0.00	0.02	0.00	0.00
Sutter Slough RM 24.7 R	0.00	1.01	0.00	1.01	0.00	0.00	0.00
Sutter Slough RM 26.5 L	0.30	0.00	0.26	0.00	0.04	0.00	0.00
Willow Slough Bypass LM 6.9 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 0.1 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.0 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.5 R	0.00	0.09	0.00	0.09	0.00	0.00	0.00
Yolo Bypass LM 2.6 L	1.31	0.00	1.30	0.00	0.00	0.00	0.00
Yolo Bypass LM 3.8 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yuba River LM 2.3 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Total	**36.11**	**8.89**	**24.50**	**7.71**	**11.61**	**1.18**	**0.00**

Note:
RM = river mile
LM = levee mile
L = left bank
R = right bank

Table E-5. Site-by-Site Vegetation Analysis for Alternative 3 (Acres)

	Alternative 3						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Bear River RM 0.8 L	0.15	0.00	0.00	0.00	0.15	0.00	0.00
Cache Creek LM 3.9 L	0.06	0.00	0.01	0.00	0.05	0.00	0.65
Cache Slough RM 15.9 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cache Slough RM 22.8 R	0.00	0.09	0.00	0.02	0.00	0.06	0.18
Cache Slough RM 23.6 R	0.00	0.32	0.00	0.00	0.00	0.32	0.00
Deer Creek LM 2.4 L	0.09	0.00	0.00	0.00	0.09	0.00	0.00
Elder Creek LM 1.4 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elder Creek LM 3.0 R	0.14	0.00	0.00	0.00	0.14	0.00	0.00
Feather River RM 0.6 L	0.06	0.00	0.00	0.00	0.06	0.00	0.00
Feather River RM 5.0 L	1.44	0.00	0.16	0.00	1.28	0.00	0.00
Georgianna Slough RM 0.3 L	0.16	0.04	0.00	0.00	0.16	0.04	2.33
Georgianna Slough RM 1.7 L	0.13	0.29	0.00	0.01	0.13	0.28	2.82
Georgianna Slough RM 2.5 L	0.00	0.29	0.00	0.07	0.00	0.21	0.25
Georgianna Slough RM 3.6 L	0.22	0.77	0.00	0.04	0.22	0.73	2.13
Georgianna Slough RM 3.7a L	0.00	0.09	0.00	0.02	0.00	0.07	0.08
Georgianna Slough RM 3.7b L	0.00	0.04	0.00	0.00	0.00	0.04	0.00
Georgianna Slough RM 4.0 L	0.19	0.00	0.07	0.00	0.12	0.00	0.93
Georgianna Slough RM 4.3 L	0.27	0.00	0.00	0.00	0.27	0.00	0.00
Georgianna Slough RM 4.5 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Georgianna Slough RM 4.6 L	0.51	0.83	0.08	0.46	0.43	0.37	0.00
Georgianna Slough RM 5.3 L	1.43	0.74	0.42	0.02	1.01	0.72	0.00
Georgianna Slough RM 6.1 L	0.34	0.52	0.11	0.07	0.23	0.45	0.00
Georgianna Slough RM 6.4 L	0.04	0.03	0.02	0.02	0.02	0.02	0.59
Georgianna Slough RM 6.6 L	0.12	0.00	0.04	0.00	0.08	0.00	0.43
Georgianna Slough RM 6.8 L	0.62	0.00	0.16	0.00	0.45	0.00	0.00
Georgianna Slough RM 8.3 L	0.00	0.05	0.00	0.00	0.00	0.05	0.00
Georgianna Slough RM 9.3 L	0.46	0.00	0.08	0.00	0.37	0.00	0.00
Knights Landing Ridge Cut LM 0. 2R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 3.0 L	1.38	0.09	0.00	0.00	1.38	0.09	0.00
Knights Landing Ridge Cut LM 3.1 L	0.13	0.00	0.13	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 4.2 L	0.03	0.00	0.02	0.00	0.01	0.00	0.00
Knights Landing Ridge Cut LM 5.3 L	1.62	0.00	1.22	0.00	0.40	0.00	0.00
Natomas Cross Canal LM 3.0 R	0.23	0.00	0.00	0.00	0.23	0.00	0.00
Sacramento River RM 101.3 R	0.17	0.00	0.17	0.00	0.00	0.00	0.07
Sacramento River RM 104.0 L	0.46	0.00	0.40	0.00	0.06	0.00	0.00
Sacramento River RM 104.5 L	0.13	0.00	0.11	0.00	0.02	0.00	0.00
Sacramento River RM 116.0 L	0.09	0.00	0.00	0.00	0.09	0.00	1.49
Sacramento River RM 116.5 L	0.30	0.00	0.14	0.00	0.15	0.00	0.00
Sacramento River RM 122.0 R	0.33	0.00	0.00	0.00	0.33	0.00	0.00
Sacramento River RM 122.3 R	0.04	0.00	0.02	0.00	0.02	0.00	0.22
Sacramento River RM 123.3 L	0.18	0.00	0.00	0.00	0.18	0.00	0.00
Sacramento River RM 123.7 R	0.01	0.00	0.00	0.00	0.01	0.00	0.00
Sacramento River RM 127.9 R	0.61	0.00	0.12	0.00	0.49	0.00	0.20
Sacramento River RM 131.8 L	0.05	0.00	0.00	0.00	0.05	0.00	0.00
Sacramento River RM 132.9 R	0.13	0.00	0.00	0.00	0.13	0.00	1.61
Sacramento River RM 133.0 L	0.00	0.68	0.00	0.00	0.00	0.68	0.00
Sacramento River RM 133.8 L	0.21	0.00	0.21	0.00	0.00	0.00	0.00
Sacramento River RM 136.6 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 138.1 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 152.8 L	0.22	0.00	0.00	0.00	0.22	0.00	0.00
Sacramento River RM 163.0 L	3.55	0.00	0.00	0.00	3.55	0.00	0.00
Sacramento River RM 168.3 L	0.72	0.00	0.02	0.00	0.70	0.00	0.90
Sacramento Rive rRM 172.0 L	0.21	0.00	0.00	0.00	0.21	0.00	1.95
Sacramento River RM 21.5 L	0.21	0.00	0.00	0.00	0.21	0.00	0.00
Sacramento River RM 22.5 L	0.49	0.00	0.02	0.00	0.46	0.00	0.00

Table E-5. Site-by-Site Vegetation Analysis for Alternative 3 (Acres)

	Alternative 3						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Sacramento River RM 22.7 L	0.20	0.00	0.03	0.00	0.16	0.00	0.00
Sacramento River RM 23.2 L	0.32	0.14	0.01	0.01	0.32	0.13	0.00
Sacramento River RM 23.3 L	0.51	0.00	0.14	0.00	0.36	0.00	0.00
Sacramento River RM 24.8 L	0.65	0.00	0.07	0.00	0.58	0.00	0.00
Sacramento River RM 25.2 L	0.34	0.00	0.04	0.00	0.30	0.00	0.00
Sacramento River RM 31.6 R	0.17	0.00	0.04	0.00	0.13	0.00	0.00
Sacramento River RM 35.3 R	0.49	0.00	0.00	0.00	0.49	0.00	0.00
Sacramento River RM 35.4 R	0.11	0.00	0.00	0.00	0.11	0.00	0.00
Sacramento River RM 38.5 R	0.04	0.00	0.01	0.00	0.03	0.00	0.48
Sacramento River RM 56.5 R	0.21	0.17	0.00	0.00	0.21	0.17	0.00
Sacramento River RM 56.6 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Sacramento River RM 56.7 R	1.06	0.00	0.00	0.00	1.06	0.00	0.00
Sacramento River RM 62.9 R	0.12	0.00	0.00	0.00	0.12	0.00	0.00
Sacramento River RM 74.4 R	2.04	0.67	0.45	0.00	1.59	0.67	0.00
Sacramento River RM 75.3 R	1.94	1.13	0.23	0.00	1.71	1.13	0.00
Sacramento River RM 77.7 R	0.23	0.00	0.00	0.00	0.23	0.00	0.00
Sacramento River RM 78.3 L	0.76	0.00	0.00	0.00	0.76	0.00	0.00
Sacramento River RM 86.3 L	2.00	0.00	0.15	0.00	1.85	0.00	0.00
Sacramento River RM 86.5 R	0.11	0.00	0.00	0.00	0.11	0.00	0.00
Sacramento River RM 86.9 R	0.70	0.00	0.00	0.00	0.70	0.00	0.00
Sacramento River RM 92.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.34
Sacramento River RM 95.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River RM 96.2 L	0.28	0.00	0.00	0.00	0.28	0.00	0.00
Sacramento River RM 99.0 L	1.04	0.00	0.47	0.00	0.56	0.00	0.00
Sacramneto River RM 63.0 R	0.10	0.00	0.00	0.00	0.10	0.00	0.00
Steamboat Slough RM 18.8 R	0.03	0.24	0.03	0.13	0.00	0.11	0.00
Steamboat Slough RM 23.9 R	0.62	0.00	0.30	0.00	0.32	0.00	0.00
Steamboat Slough RM 24.7 R	0.87	0.54	0.63	0.00	0.24	0.54	0.00
Steamboat Slough RM 25.0 L	0.38	0.00	0.00	0.00	0.38	0.00	0.00
Steamboat Slough RM 25.8 R	0.64	0.00	0.29	0.00	0.35	0.00	0.00
Steamboat Slough RM 26.0 L	0.48	0.00	0.02	0.00	0.46	0.00	0.00
Sutter Slough RM 24.7 R	0.00	1.01	0.00	0.00	0.00	1.01	3.66
Sutter Slough RM 26.5 L	0.30	0.00	0.00	0.00	0.30	0.00	0.00
Willow Slough Bypass LM 6.9 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 0.1 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.0 R	0.00	0.00	0.00	0.00	0.00	0.00	0.27
Yolo Bypass LM 2.5 R	0.00	0.09	0.00	0.00	0.00	0.09	0.00
Yolo Bypass LM 2.6 L	1.31	0.00	0.00	0.00	1.31	0.00	0.00
Yolo Bypass LM 3.8 R	0.00	0.00	0.00	0.00	0.00	0.00	3.45
Yuba River LM 2.3 L	0.03	0.00	0.00	0.00	0.03	0.00	2.78
Total	**36.11**	**8.89**	**6.65**	**0.86**	**29.46**	**8.03**	**27.81**

Note:
RM = river mile
LM = levee mile
L = left bank
R = right bank

Table E-6. Site-by-Site Vegetation Analysis for Alternative 4 (Acres)

	Alternative 4						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Bear River RM 0.8 L	0.15	0.00	0.15	0.00	0.00	0.00	0.08
Cache Creek LM 3.9 L	0.06	0.00	0.01	0.00	0.05	0.00	0.65
Cache Slough RM 15.9 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cache Slough RM 22.8 R	0.00	0.09	0.00	0.09	0.00	0.00	0.08
Cache Slough RM 23.6 R	0.00	0.32	0.00	0.32	0.00	0.00	0.00
Deer Creek LM 2.4 L	0.09	0.00	0.09	0.00	0.00	0.00	0.03
Elder Creek LM 1.4 L	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Elder Creek LM 3.0 R	0.14	0.00	0.14	0.00	0.00	0.00	0.04
Feather River RM 0.6 L	0.06	0.00	0.06	0.00	0.00	0.00	0.05
Feather River RM 5.0 L	1.44	0.00	0.85	0.00	0.59	0.00	0.31
Georgianna Slough RM 0.3 L	0.16	0.04	0.00	0.00	0.16	0.04	2.33
Georgianna Slough RM 1.7 L	0.13	0.29	0.00	0.01	0.13	0.28	2.82
Georgianna Slough RM 2.5 L	0.00	0.29	0.00	0.07	0.00	0.21	0.25
Georgianna Slough RM 3.6 L	0.22	0.77	0.00	0.04	0.22	0.73	2.13
Georgianna Slough RM 3.7a L	0.00	0.09	0.00	0.02	0.00	0.07	0.08
Georgianna Slough RM 3.7b L	0.00	0.04	0.00	0.00	0.00	0.04	0.00
Georgianna Slough RM 4.0 L	0.19	0.00	0.07	0.00	0.12	0.00	0.93
Georgianna Slough RM 4.3 L	0.27	0.00	0.00	0.00	0.27	0.00	0.00
Georgianna Slough RM 4.5 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Georgianna Slough RM 4.6 L	0.51	0.83	0.08	0.46	0.43	0.37	0.00
Georgianna Slough RM 5.3 L	1.43	0.74	0.42	0.02	1.01	0.72	0.00
Georgianna Slough RM 6.1 L	0.34	0.52	0.11	0.07	0.23	0.45	0.00
Georgianna Slough RM 6.4 L	0.04	0.03	0.02	0.02	0.02	0.02	0.59
Georgianna Slough RM 6.6 L	0.12	0.00	0.04	0.00	0.08	0.00	0.43
Georgianna Slough RM 6.8 L	0.62	0.00	0.16	0.00	0.45	0.00	0.00
Georgianna Slough RM 8.3 L	0.00	0.05	0.00	0.00	0.00	0.05	0.00
Georgianna Slough RM 9.3 L	0.46	0.00	0.36	0.00	0.10	0.00	0.35
Knights Landing Ridge Cut LM 0. 2R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 3.0 L	1.38	0.09	0.00	0.00	1.38	0.09	0.00
Knights Landing Ridge Cut LM 3.1 L	0.13	0.00	0.13	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 4.2 L	0.03	0.00	0.02	0.00	0.01	0.00	0.00
Knights Landing Ridge Cut LM 5.3 L	1.62	0.00	1.22	0.00	0.40	0.00	0.00
Natomas Cross Canal LM 3.0 R	0.23	0.00	0.00	0.00	0.23	0.00	0.00
Sacramento River RM 101.3 R	0.17	0.00	0.17	0.00	0.00	0.00	0.06
Sacramento River RM 104.0 L	0.46	0.00	0.35	0.00	0.11	0.00	1.23
Sacramento River RM 104.5 L	0.13	0.00	0.00	0.00	0.13	0.00	0.55
Sacramento River RM 116.0 L	0.09	0.00	0.00	0.00	0.09	0.00	0.46
Sacramento River RM 116.5 L	0.30	0.00	0.02	0.00	0.27	0.00	0.84
Sacramento River RM 122.0 R	0.33	0.00	0.32	0.00	0.01	0.00	0.07
Sacramento River RM 122.3 R	0.04	0.00	0.03	0.00	0.00	0.00	0.08
Sacramento River RM 123.3 L	0.18	0.00	0.18	0.00	0.00	0.00	0.04
Sacramento River RM 123.7 R	0.01	0.00	0.01	0.00	0.00	0.00	0.04
Sacramento River RM 127.9 R	0.61	0.00	0.57	0.00	0.04	0.00	0.08
Sacramento River RM 131.8 L	0.05	0.00	0.04	0.00	0.01	0.00	0.05
Sacramento River RM 132.9 R	0.13	0.00	0.13	0.00	0.00	0.00	0.26
Sacramento River RM 133.0 L	0.00	0.68	0.00	0.68	0.00	0.00	0.38
Sacramento River RM 133.8 L	0.21	0.00	0.00	0.00	0.21	0.00	0.07
Sacramento River RM 136.6 L	0.00	0.00	0.00	0.00	0.00	0.00	0.21
Sacramento River RM 138.1 L	0.00	0.00	0.00	0.00	0.00	0.00	0.51
Sacramento River RM 152.8 L	0.22	0.00	0.22	0.00	0.00	0.00	0.09
Sacramento River RM 163.0 L	3.55	0.00	2.59	0.00	0.96	0.00	0.41
Sacramento River RM 168.3 L	0.72	0.00	0.72	0.00	0.00	0.00	0.19
Sacramento Rive rRM 172.0 L	0.21	0.00	0.18	0.00	0.03	0.00	0.34
Sacramento River RM 21.5 L	0.21	0.00	0.21	0.00	0.00	0.00	0.06
Sacramento River RM 22.5 L	0.49	0.00	0.49	0.00	0.00	0.00	0.29

Table E-6. Site-by-Site Vegetation Analysis for Alternative 4 (Acres)

	Alternative 4						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Sacramento River RM 22.7 L	0.20	0.00	0.03	0.00	0.16	0.00	0.00
Sacramento River RM 23.2 L	0.32	0.14	0.01	0.01	0.32	0.13	0.00
Sacramento River RM 23.3 L	0.51	0.00	0.50	0.00	0.00	0.00	0.09
Sacramento River RM 24.8 L	0.65	0.00	0.65	0.00	0.00	0.00	0.00
Sacramento River RM 25.2 L	0.34	0.00	0.34	0.00	0.00	0.00	0.11
Sacramento River RM 31.6 R	0.17	0.00	0.13	0.00	0.04	0.00	0.15
Sacramento River RM 35.3 R	0.49	0.00	0.00	0.00	0.49	0.00	0.07
Sacramento River RM 35.4 R	0.11	0.00	0.00	0.00	0.11	0.00	0.03
Sacramento River RM 38.5 R	0.04	0.00	0.03	0.00	0.01	0.00	0.12
Sacramento River RM 56.5 R	0.21	0.17	0.21	0.16	0.00	0.00	0.13
Sacramento River RM 56.6 L	0.03	0.00	0.03	0.00	0.00	0.00	0.03
Sacramento River RM 56.7 R	1.06	0.00	1.06	0.00	0.00	0.00	0.23
Sacramento River RM 62.9 R	0.12	0.00	0.06	0.00	0.06	0.00	0.06
Sacramento River RM 74.4 R	2.04	0.67	0.77	0.67	1.27	0.00	0.45
Sacramento River RM 75.3 R	1.94	1.13	1.84	1.13	0.10	0.00	0.95
Sacramento River RM 77.7 R	0.23	0.00	0.23	0.00	0.00	0.00	0.05
Sacramento River RM 78.3 L	0.76	0.00	0.76	0.00	0.00	0.00	0.23
Sacramento River RM 86.3 L	2.00	0.00	1.81	0.00	0.20	0.00	1.11
Sacramento River RM 86.5 R	0.11	0.00	0.11	0.00	0.00	0.00	0.04
Sacramento River RM 86.9 R	0.70	0.00	0.69	0.00	0.00	0.00	0.20
Sacramento River RM 92.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.34
Sacramento River RM 95.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.30
Sacramento River RM 96.2 L	0.28	0.00	0.28	0.00	0.00	0.00	0.42
Sacramento River RM 99.0 L	1.04	0.00	0.78	0.00	0.26	0.00	0.54
Sacramneto River RM 63.0 R	0.10	0.00	0.02	0.00	0.08	0.00	0.03
Steamboat Slough RM 18.8 R	0.03	0.24	0.03	0.13	0.00	0.11	0.00
Steamboat Slough RM 23.9 R	0.62	0.00	0.30	0.00	0.32	0.00	0.00
Steamboat Slough RM 24.7 R	0.87	0.54	0.30	0.00	0.57	0.54	0.00
Steamboat Slough RM 25.0 L	0.38	0.00	0.30	0.00	0.08	0.00	0.00
Steamboat Slough RM 25.8 R	0.64	0.00	0.29	0.00	0.35	0.00	0.00
Steamboat Slough RM 26.0 L	0.48	0.00	0.02	0.00	0.46	0.00	0.00
Sutter Slough RM 24.7 R	0.00	1.01	0.00	0.00	0.00	1.01	3.66
Sutter Slough RM 26.5 L	0.30	0.00	0.26	0.00	0.04	0.00	0.20
Willow Slough Bypass LM 6.9 R	0.00	0.00	0.00	0.00	0.00	0.00	0.23
Yolo Bypass LM 0.1 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.0 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.5 R	0.00	0.09	0.00	0.09	0.00	0.00	0.06
Yolo Bypass LM 2.6 L	1.31	0.00	1.30	0.00	0.00	0.00	0.06
Yolo Bypass LM 3.8 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yuba River LM 2.3 L	0.03	0.00	0.00	0.00	0.03	0.00	0.06
Total	**36.11**	**8.89**	**23.29**	**4.00**	**12.82**	**4.89**	**27.57**

Note:
RM = river mile
LM = levee mile
L = left bank
R = right bank

Table E-7. Site-by-Site Vegetation Analysis for Alternative 5 (Acres)

	Alternative 5						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	Woodland
Bear River RM 0.8 L	0.15	0.00	0.15	0.00	0.00	0.00	0.08
Cache Creek LM 3.9 L	0.06	0.00	0.01	0.00	0.05	0.00	0.65
Cache Slough RM 15.9 L	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Cache Slough RM 22.8 R	0.00	0.09	0.00	0.09	0.00	0.00	0.08
Cache Slough RM 23.6 R	0.00	0.32	0.00	0.01	0.00	0.30	1.48
Deer Creek LM 2.4 L	0.09	0.00	0.00	0.00	0.09	0.00	0.00
Elder Creek LM 1.4 L	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Elder Creek LM 3.0 R	0.14	0.00	0.14	0.00	0.00	0.00	0.04
Feather River RM 0.6 L	0.06	0.00	0.06	0.00	0.00	0.00	0.05
Feather River RM 5.0 L	1.44	0.00	0.85	0.00	0.59	0.00	0.31
Georgianna Slough RM 0.3 L	0.16	0.04	0.00	0.00	0.16	0.04	2.33
Georgianna Slough RM 1.7 L	0.13	0.29	0.00	0.01	0.13	0.28	2.82
Georgianna Slough RM 2.5 L	0.00	0.29	0.00	0.07	0.00	0.21	0.25
Georgianna Slough RM 3.6 L	0.22	0.77	0.00	0.04	0.22	0.73	2.13
Georgianna Slough RM 3.7a L	0.00	0.09	0.00	0.02	0.00	0.07	0.08
Georgianna Slough RM 3.7b L	0.00	0.04	0.00	0.00	0.00	0.04	0.00
Georgianna Slough RM 4.0 L	0.19	0.00	0.07	0.00	0.12	0.00	0.93
Georgianna Slough RM 4.3 L	0.27	0.00	0.00	0.00	0.27	0.00	0.00
Georgianna Slough RM 4.5 L	0.03	0.00	0.00	0.00	0.03	0.00	0.00
Georgianna Slough RM 4.6 L	0.51	0.83	0.08	0.46	0.43	0.37	0.00
Georgianna Slough RM 5.3 L	1.43	0.74	0.42	0.02	1.01	0.72	0.00
Georgianna Slough RM 6.1 L	0.34	0.52	0.11	0.07	0.23	0.45	0.00
Georgianna Slough RM 6.4 L	0.04	0.03	0.02	0.02	0.02	0.02	0.59
Georgianna Slough RM 6.6 L	0.12	0.00	0.04	0.00	0.08	0.00	0.43
Georgianna Slough RM 6.8 L	0.62	0.00	0.16	0.00	0.45	0.00	0.00
Georgianna Slough RM 8.3 L	0.00	0.05	0.00	0.00	0.00	0.05	0.00
Georgianna Slough RM 9.3 L	0.46	0.00	0.36	0.00	0.10	0.00	0.35
Knights Landing Ridge Cut LM 0. 2R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 3.0 L	1.38	0.09	0.00	0.00	1.38	0.09	0.00
Knights Landing Ridge Cut LM 3.1 L	0.13	0.00	0.13	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 4.2 L	0.03	0.00	0.02	0.00	0.01	0.00	0.00
Knights Landing Ridge Cut LM 5.3 L	1.62	0.00	1.22	0.00	0.40	0.00	0.00
Natomas Cross Canal LM 3.0 R	0.23	0.00	0.00	0.00	0.23	0.00	0.00
Sacramento River RM 101.3 R	0.17	0.00	0.17	0.00	0.00	0.00	0.06
Sacramento River RM 104.0 L	0.46	0.00	0.01	0.00	0.46	0.00	1.23
Sacramento River RM 104.5 L	0.13	0.00	0.00	0.00	0.13	0.00	0.55
Sacramento River RM 116.0 L	0.09	0.00	0.00	0.00	0.09	0.00	0.46
Sacramento River RM 116.5 L	0.30	0.00	0.00	0.00	0.30	0.00	5.30
Sacramento River RM 122.0 R	0.33	0.00	0.32	0.00	0.01	0.00	0.07
Sacramento River RM 122.3 R	0.04	0.00	0.03	0.00	0.00	0.00	0.08
Sacramento River RM 123.3 L	0.18	0.00	0.18	0.00	0.00	0.00	0.04
Sacramento River RM 123.7 R	0.01	0.00	0.01	0.00	0.00	0.00	0.04
Sacramento River RM 127.9 R	0.61	0.00	0.57	0.00	0.04	0.00	0.08
Sacramento River RM 131.8 L	0.05	0.00	0.05	0.00	0.00	0.00	0.00
Sacramento River RM 132.9 R	0.13	0.00	0.13	0.00	0.00	0.00	0.26
Sacramento River RM 133.0 L	0.00	0.68	0.00	0.68	0.00	0.00	0.38
Sacramento River RM 133.8 L	0.21	0.00	0.00	0.00	0.21	0.00	0.07
Sacramento River RM 136.6 L	0.00	0.00	0.00	0.00	0.00	0.00	0.21
Sacramento River RM 138.1 L	0.00	0.00	0.00	0.00	0.00	0.00	3.23
Sacramento River RM 152.8 L	0.22	0.00	0.22	0.00	0.00	0.00	0.09
Sacramento River RM 163.0 L	3.55	0.00	0.00	0.00	3.55	0.00	2.40
Sacramento River RM 168.3 L	0.72	0.00	0.02	0.00	0.70	0.00	0.90
Sacramento Rive rRM 172.0 L	0.21	0.00	0.00	0.00	0.21	0.00	1.95
Sacramento River RM 21.5 L	0.21	0.00	0.21	0.00	0.00	0.00	0.06
Sacramento River RM 22.5 L	0.49	0.00	0.49	0.00	0.00	0.00	0.29

Table E-7. Site-by-Site Vegetation Analysis for Alternative 5 (Acres)

	Alternative 5						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	Woodland
Sacramento River RM 22.7 L	0.20	0.00	0.03	0.00	0.16	0.00	0.00
Sacramento River RM 23.2 L	0.32	0.14	0.01	0.01	0.32	0.13	0.00
Sacramento River RM 23.3 L	0.51	0.00	0.50	0.00	0.00	0.00	0.09
Sacramento River RM 24.8 L	0.65	0.00	0.07	0.00	0.58	0.00	0.00
Sacramento River RM 25.2 L	0.34	0.00	0.34	0.00	0.00	0.00	0.11
Sacramento River RM 31.6 R	0.17	0.00	0.13	0.00	0.04	0.00	0.15
Sacramento River RM 35.3 R	0.49	0.00	0.00	0.00	0.49	0.00	0.07
Sacramento River RM 35.4 R	0.11	0.00	0.00	0.00	0.11	0.00	0.03
Sacramento River RM 38.5 R	0.04	0.00	0.03	0.00	0.01	0.00	0.12
Sacramento River RM 56.5 R	0.21	0.17	0.21	0.16	0.00	0.00	0.13
Sacramento River RM 56.6 L	0.03	0.00	0.03	0.00	0.00	0.00	0.03
Sacramento River RM 56.7 R	1.06	0.00	1.06	0.00	0.00	0.00	0.23
Sacramento River RM 62.9 R	0.12	0.00	0.06	0.00	0.06	0.00	0.06
Sacramento River RM 74.4 R	2.04	0.67	0.77	0.67	1.27	0.00	0.45
Sacramento River RM 75.3 R	1.94	1.13	0.23	0.00	1.71	1.13	0.00
Sacramento River RM 77.7 R	0.23	0.00	0.23	0.00	0.00	0.00	0.05
Sacramento River RM 78.3 L	0.76	0.00	0.76	0.00	0.00	0.00	0.23
Sacramento River RM 86.3 L	2.00	0.00	1.81	0.00	0.20	0.00	1.11
Sacramento River RM 86.5 R	0.11	0.00	0.11	0.00	0.00	0.00	0.04
Sacramento River RM 86.9 R	0.70	0.00	0.69	0.00	0.00	0.00	0.20
Sacramento River RM 92.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.34
Sacramento River RM 95.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.30
Sacramento River RM 96.2 L	0.28	0.00	0.28	0.00	0.00	0.00	0.42
Sacramento River RM 99.0 L	1.04	0.00	0.78	0.00	0.26	0.00	0.54
Sacramneto River RM 63.0 R	0.10	0.00	0.02	0.00	0.08	0.00	0.03
Steamboat Slough RM 18.8 R	0.03	0.24	0.03	0.13	0.00	0.11	0.00
Steamboat Slough RM 23.9 R	0.62	0.00	0.30	0.00	0.32	0.00	0.00
Steamboat Slough RM 24.7 R	0.87	0.54	0.30	0.00	0.57	0.54	0.00
Steamboat Slough RM 25.0 L	0.38	0.00	0.30	0.00	0.08	0.00	0.00
Steamboat Slough RM 25.8 R	0.64	0.00	0.29	0.00	0.35	0.00	0.00
Steamboat Slough RM 26.0 L	0.48	0.00	0.02	0.00	0.46	0.00	0.00
Sutter Slough RM 24.7 R	0.00	1.01	0.00	0.00	0.00	1.01	3.66
Sutter Slough RM 26.5 L	0.30	0.00	0.26	0.00	0.04	0.00	0.20
Willow Slough Bypass LM 6.9 R	0.00	0.00	0.00	0.00	0.00	0.00	0.23
Yolo Bypass LM 0.1 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.0 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.5 R	0.00	0.09	0.00	0.09	0.00	0.00	0.06
Yolo Bypass LM 2.6 L	1.31	0.00	1.30	0.00	0.01	0.00	0.28
Yolo Bypass LM 3.8 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yuba River LM 2.3 L	0.03	0.00	0.00	0.00	0.03	0.00	0.47
Total	**36.11**	**8.89**	**17.19**	**2.57**	**18.92**	**6.32**	**40.21**

Note:
RM = river mile
LM = levee mile
L = left bank
R = right bank

Table E-8. Site-by-Site Vegetation Analysis for Alternative 6 (Acres)

	Alternative 6						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	Woodland
Bear River RM 0.8 L	0.15	0.00	0.15	0.00	0.00	0.00	0.08
Cache Creek LM 3.9 L	0.06	0.00	0.01	0.00	0.05	0.00	0.65
Cache Slough RM 15.9 L	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Cache Slough RM 22.8 R	0.00	0.09	0.00	0.05	0.00	0.04	0.08
Cache Slough RM 23.6 R	0.00	0.32	0.00	0.25	0.00	0.07	0.27
Deer Creek LM 2.4 L	0.09	0.00	0.07	0.00	0.02	0.00	0.03
Elder Creek LM 1.4 L	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Elder Creek LM 3.0 R	0.14	0.00	0.08	0.00	0.06	0.00	0.04
Feather River RM 0.6 L	0.06	0.00	0.05	0.00	0.01	0.00	0.05
Feather River RM 5.0 L	1.44	0.00	0.48	0.00	0.96	0.00	0.31
Georgianna Slough RM 0.3 L	0.16	0.04	0.08	0.02	0.07	0.02	0.41
Georgianna Slough RM 1.7 L	0.13	0.29	0.10	0.20	0.03	0.09	0.47
Georgianna Slough RM 2.5 L	0.00	0.29	0.00	0.13	0.00	0.15	0.10
Georgianna Slough RM 3.6 L	0.22	0.77	0.01	0.57	0.21	0.20	0.39
Georgianna Slough RM 3.7a L	0.00	0.09	0.00	0.07	0.00	0.02	0.07
Georgianna Slough RM 3.7b L	0.00	0.04	0.00	0.03	0.00	0.01	0.02
Georgianna Slough RM 4.0 L	0.19	0.00	0.04	0.00	0.15	0.00	0.18
Georgianna Slough RM 4.3 L	0.27	0.00	0.04	0.00	0.23	0.00	0.33
Georgianna Slough RM 4.5 L	0.03	0.00	0.01	0.00	0.02	0.00	0.01
Georgianna Slough RM 4.6 L	0.51	0.83	0.17	0.00	0.34	0.83	0.39
Georgianna Slough RM 5.3 L	1.43	0.74	0.35	0.12	1.08	0.61	1.09
Georgianna Slough RM 6.1 L	0.34	0.52	0.10	0.13	0.23	0.38	0.60
Georgianna Slough RM 6.4 L	0.04	0.03	0.01	0.01	0.03	0.03	0.14
Georgianna Slough RM 6.6 L	0.12	0.00	0.02	0.00	0.10	0.00	0.12
Georgianna Slough RM 6.8 L	0.62	0.00	0.19	0.00	0.42	0.00	0.40
Georgianna Slough RM 8.3 L	0.00	0.05	0.00	0.01	0.00	0.03	0.03
Georgianna Slough RM 9.3 L	0.46	0.00	0.25	0.00	0.20	0.00	0.35
Knights Landing Ridge Cut LM 0. 2R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Knights Landing Ridge Cut LM 3.0 L	1.38	0.09	0.00	0.00	1.38	0.09	0.00
Knights Landing Ridge Cut LM 3.1 L	0.13	0.00	0.05	0.00	0.08	0.00	0.00
Knights Landing Ridge Cut LM 4.2 L	0.03	0.00	0.01	0.00	0.03	0.00	0.00
Knights Landing Ridge Cut LM 5.3 L	1.62	0.00	0.84	0.00	0.78	0.00	0.00
Natomas Cross Canal LM 3.0 R	0.23	0.00	0.22	0.00	0.01	0.00	0.07
Sacramento River RM 101.3 R	0.17	0.00	0.17	0.00	0.01	0.00	0.06
Sacramento River RM 104.0 L	0.46	0.00	0.35	0.00	0.12	0.00	1.23
Sacramento River RM 104.5 L	0.13	0.00	0.00	0.00	0.13	0.00	0.55
Sacramento River RM 116.0 L	0.09	0.00	0.00	0.00	0.09	0.00	0.46
Sacramento River RM 116.5 L	0.30	0.00	0.00	0.00	0.30	0.00	0.84
Sacramento River RM 122.0 R	0.33	0.00	0.30	0.00	0.03	0.00	0.07
Sacramento River RM 122.3 R	0.04	0.00	0.01	0.00	0.03	0.00	0.08
Sacramento River RM 123.3 L	0.18	0.00	0.06	0.00	0.12	0.00	0.04
Sacramento River RM 123.7 R	0.01	0.00	0.01	0.00	0.00	0.00	0.04
Sacramento River RM 127.9 R	0.61	0.00	0.53	0.00	0.08	0.00	0.08
Sacramento River RM 131.8 L	0.05	0.00	0.02	0.00	0.03	0.00	0.05
Sacramento River RM 132.9 R	0.13	0.00	0.12	0.00	0.01	0.00	0.26
Sacramento River RM 133.0 L	0.00	0.68	0.00	0.68	0.00	0.00	0.38
Sacramento River RM 133.8 L	0.21	0.00	0.00	0.00	0.21	0.00	0.07
Sacramento River RM 136.6 L	0.00	0.00	0.00	0.00	0.00	0.00	0.21
Sacramento River RM 138.1 L	0.00	0.00	0.00	0.00	0.00	0.00	0.51
Sacramento River RM 152.8 L	0.22	0.00	0.12	0.00	0.10	0.00	0.09
Sacramento River RM 163.0 L	3.55	0.00	2.28	0.00	1.27	0.00	0.41
Sacramento River RM 168.3 L	0.72	0.00	0.68	0.00	0.04	0.00	0.19
Sacramento Rive rRM 172.0 L	0.21	0.00	0.18	0.00	0.03	0.00	0.34
Sacramento River RM 21.5 L	0.21	0.00	0.10	0.00	0.11	0.00	0.06
Sacramento River RM 22.5 L	0.49	0.00	0.41	0.00	0.08	0.00	0.29

Table E-8. Site-by-Site Vegetation Analysis for Alternative 6 (Acres)

	Alternative 6						
	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Created
Site	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	Woodland
Sacramento River RM 22.7 L	0.20	0.00	0.10	0.00	0.10	0.00	0.11
Sacramento River RM 23.2 L	0.32	0.14	0.19	0.07	0.14	0.07	0.20
Sacramento River RM 23.3 L	0.51	0.00	0.27	0.00	0.23	0.00	0.09
Sacramento River RM 24.8 L	0.65	0.00	0.30	0.00	0.35	0.00	0.27
Sacramento River RM 25.2 L	0.34	0.00	0.13	0.00	0.21	0.00	0.11
Sacramento River RM 31.6 R	0.17	0.00	0.13	0.00	0.04	0.00	0.15
Sacramento River RM 35.3 R	0.49	0.00	0.00	0.00	0.49	0.00	0.07
Sacramento River RM 35.4 R	0.11	0.00	0.00	0.00	0.11	0.00	0.03
Sacramento River RM 38.5 R	0.04	0.00	0.02	0.00	0.02	0.00	0.12
Sacramento River RM 56.5 R	0.21	0.17	0.02	0.01	0.19	0.16	0.13
Sacramento River RM 56.6 L	0.03	0.00	0.03	0.00	0.00	0.00	0.03
Sacramento River RM 56.7 R	1.06	0.00	0.30	0.00	0.75	0.00	0.23
Sacramento River RM 62.9 R	0.12	0.00	0.06	0.00	0.06	0.00	0.06
Sacramento River RM 74.4 R	2.04	0.67	0.48	0.61	1.56	0.07	0.45
Sacramento River RM 75.3 R	1.94	1.13	1.80	1.12	0.15	0.01	0.95
Sacramento River RM 77.7 R	0.23	0.00	0.22	0.00	0.01	0.00	0.05
Sacramento River RM 78.3 L	0.76	0.00	0.71	0.00	0.05	0.00	0.23
Sacramento River RM 86.3 L	2.00	0.00	1.72	0.00	0.29	0.00	1.11
Sacramento River RM 86.5 R	0.11	0.00	0.04	0.00	0.07	0.00	0.04
Sacramento River RM 86.9 R	0.70	0.00	0.29	0.00	0.41	0.00	0.20
Sacramento River RM 92.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.34
Sacramento River RM 95.8 L	0.00	0.00	0.00	0.00	0.00	0.00	0.30
Sacramento River RM 96.2 L	0.28	0.00	0.25	0.00	0.03	0.00	0.42
Sacramento River RM 99.0 L	1.04	0.00	0.78	0.00	0.26	0.00	0.54
Sacramneto River RM 63.0 R	0.10	0.00	0.02	0.00	0.08	0.00	0.03
Steamboat Slough RM 18.8 R	0.03	0.24	0.00	0.08	0.03	0.16	0.13
Steamboat Slough RM 23.9 R	0.62	0.00	0.14	0.00	0.47	0.00	0.06
Steamboat Slough RM 24.7 R	0.87	0.54	0.16	0.31	0.72	0.23	0.30
Steamboat Slough RM 25.0 L	0.38	0.00	0.11	0.00	0.26	0.00	0.09
Steamboat Slough RM 25.8 R	0.64	0.00	0.02	0.00	0.61	0.00	0.09
Steamboat Slough RM 26.0 L	0.48	0.00	0.10	0.00	0.38	0.00	0.11
Sutter Slough RM 24.7 R	0.00	1.01	0.00	0.99	0.00	0.02	0.60
Sutter Slough RM 26.5 L	0.30	0.00	0.14	0.00	0.17	0.00	0.20
Willow Slough Bypass LM 6.9 R	0.00	0.00	0.00	0.00	0.00	0.00	0.23
Yolo Bypass LM 0.1 R	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yolo Bypass LM 2.0 R	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Yolo Bypass LM 2.5 R	0.00	0.09	0.00	0.09	0.00	0.00	0.06
Yolo Bypass LM 2.6 L	1.31	0.00	1.23	0.00	0.07	0.00	0.28
Yolo Bypass LM 3.8 R	0.00	0.00	0.00	0.00	0.00	0.00	0.57
Yuba River LM 2.3 L	0.03	0.00	0.00	0.00	0.03	0.00	0.47
Total	**36.11**	**8.89**	**18.42**	**5.57**	**17.69**	**3.32**	**22.80**

Note:
RM = river mile
LM = levee mile
L = left bank
R = right bank

Appendix F

Standard Assessment Methodology (SAM) Analysis Process

Appendix F
Fish Effects Assessment Methods Using the Standard Assessment Methodology

Introduction

This appendix describes the detailed methods of the Sacramento River Bank Protection Project (SRBPP) Phase II Supplemental Authority fish effect assessment using the Standard Assessment Methodology (SAM). SAM was applied to give a program-level analysis of potential effects by SRBPP region while recognizing that more refined SAM analyses will be undertaken to determine project-level effects at individual sites in the future.

The effects of the SRBPP Phase II Supplemental Authority for implementation of up to 80,000 linear feet (LF) of additional bank protection in the Sacramento River Flood Control Project area on fish habitat was assessed using the Standard Assessment Methodology Electronic Calculation Template (ECT) Version 3.0 beta edition (June 2009) developed for and in conjunction with the U.S. Army Corps of Engineers (Corps) and the Central Valley Flood Protection Board by Stillwater Sciences. SAM assesses changes in habitat condition for various focus fish species as a result of levee improvement or bank protection actions within the SRBPP area and has been used previously in both programmatic (U.S. Army Corps of Engineers 2007a) and project-level (e.g., Jones & Stokes 2007) bank protection effect analyses.

SAM quantifies habitat values in terms of weighted response indices (WRIs) that are calculated by combining habitat quality (fish response indices) with quantity (bank length) for each season, target year, and relevant species/life stage. SAM employs six habitat variables (described below) to characterize nearshore and floodplain habitats of listed fish species. The fish response indices are derived from hypothesized relationships between key habitat variables and the responses of individual species and life stages. The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (e.g., with or without project), SAM uses the fish response relationships to determine the response of individual species and life stages to changes in the habitat variables for each season and target year. The response indices for each variable are multiplied together to generate an overall species response index. The species response index is then multiplied by the area or linear feet of bank to which it applies to generate a species WRI, which is expressed as feet or square feet. The WRI provides a common metric that can be used to quantify habitat values over time, compare project alternatives with existing conditions, and evaluate the effectiveness of on-site and off-site mitigation actions. For example, the difference in WRIs between with- and without-project conditions in a given year and season provides a measure of the adverse effects (negative species response) or benefits (positive species response) of the project relative to baseline conditions. More detail on SAM is provided by Standard Assessment Methodology for the Sacramento River Bank Protection Project (U.S. Army Corps of Engineers 2004) and Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (U.S. Army Corps of Engineers 2007a).

Focus Species

SAM considers seven focus fish species, which are federally or state-listed as threatened or endangered under the Endangered Species Act (ESA) or California Endangered Species Act (CESA) or are subject to a Fishery Management Plan under the Magnuson-Stevens Fishery Conservation and Management Act (Table F-1). Longfin smelt, a CESA-listed species, is not included presently in SAM but may be in the future. The habitat requirements of some longfin smelt life stages in the SRBPP program area may be similar to those of delta smelt, although timing of upstream migration, spawning, juvenile recruitment, and downstream migration is earlier than delta smelt, and the species occupies waters of higher salinity well downstream of the SRBPP program area for much of the year (Moyle 2002).

Table F-1. Focus Fish Species Considered in the SAM Modeling of Effects on Fish from the SRBPP Phase II Additional Authorization

Species/ESUs	Federal Endangered Species Act Status	Magnuson-Stevens Fishery Act	California Endangered Species Act Status
Central Valley Spring-Run Chinook Salmon ESU	Threatened; Critical Habitat designated	Essential Fish Habitat defined	Threatened
Central Valley Fall- and Late Fall–Run Chinook Salmon ESU	Species of Concern	Essential Fish Habitat defined	-
Sacramento River Chinook Salmon Winter-Run ESU	Endangered; Critical Habitat designated	Essential Fish Habitat defined	Endangered
Central Valley Steelhead DPS	Threatened; Critical Habitat designated	-	-
Delta Smelt	Threatened; Critical Habitat designated	-	Endangered
Green Sturgeon Southern DPS	Threatened; Critical Habitat designated	-	-

ESU = Evolutionarily Significant Unit
DPS = Distinct Population Segment

Species Life Stages, Distribution, and Timing

The focus fish species occupy a variety of waterbodies within the SRBPP area. Different life stages are often found in different habitats at different times of the year. SAM accounts for this by dividing each species into several life stages (Stillwater Sciences 2009: 5).

- Adult upstream migration—the upstream movement of adults from higher salinity waters (e.g., the ocean or lower portions of the San Francisco Estuary) to freshwater. All focus fish species exhibit this life stage within the SRBPP area.
- Spawning and egg incubation—adults deposit eggs in streambed or nearshore bank substrates, or in nearshore aquatic vegetation. Within the SRBPP area, this life stage is mostly limited to delta smelt and green sturgeon.
- Larval, fry, and juvenile rearing—prior to migrating to the ocean, juveniles rear close to nearshore areas. All focus fish species exhibit this life stage within the SRBPP area.
- Juvenile/smolt outmigration—juvenile salmonids and sturgeon emigrate from the SRBPP area to the ocean. Salmonids physically change (i.e., smoltification) during their emigration to prepare for ocean life. Delta smelt do not migrate to the ocean nor exhibit the smolt life stage.
- Adult habitat/residence—steelhead, delta smelt, and green sturgeon reside within waterways of the SRBPP area prior to migrating downstream to the ocean or higher salinity portions of the San Francisco, or prior to migrating upstream to spawn.

All species are not necessarily distributed throughout the full SRBPP area. Distributions and life-history timings included in the SAM ECT are based on ESA Critical Habitat and Magnuson-Stevens EFH designations, a variety of scientific literature, data summaries of fish capture information for the SRBPP area, and known hydrologic connectivity to the Sacramento River (Table F-2). The default SAM distributions (grey shading in Table F-2) were adapted for region 1a of the SRBPP area to include all species within all waterbodies included in the SRBPP Phase II Supplemental Authority (diagonal shading in Table F-2), except for the Willow Slough Bypass. Examples of life-history timing for the focus species are provided for four reaches of the Sacramento River in Table F-3; the timing may differ between waterbodies but is substantially similar by SRBPP region. In calculating effects on focus species, the SAM ECT groups months into four seasons: spring (March–May), summer (June–August), fall (September–November), and winter (December–February).

Table F-2. Distribution of Focus Species in the SRBPP Area, as Applied in SAM

Region	Waterbody	Spring-run Chinook	Fall-run Chinook	Late-fall-run Chinook	Winter-run Chinook	Steelhead	Delta Smelt	Green Sturgeon
Region 1a	Cache Creek*							
	Cache Slough*	■	■	■	▨	■	■	▨
	Elk Slough	■				■	■	
	Georgiana Slough*	■	▨	▨	▨	■	■	■
	Haas Slough						■	■
	Knights Landing Ridge Cut*							
	Lindsay Slough		■			■	■	
	Mainstem Sacramento River, RM 0–20	■	■	■	■	■	■	■
	Miner Slough	■				■	■	■
	Putah Creek		■				■	■
	Sacramento Bypass							■
	Steamboat Slough*	■	▨	▨	▨	■	■	■
	Sutter Slough*	■	▨	▨	▨	■	■	■
	Threemile Slough	■				■	■	■
	Ulatis Creek Bypass		■				■	■
	Willow Slough Bypass*							■
	Yolo Bypass*	■	■	▨	▨	■	■	■
Region 1b	American River	■	■			■		
	Coon Creek		■			■		
	Mainstem Sacramento River, RM 20–80*	■	■	■	■	■	■	■
	Natomas Cross Canal		■			■		
	Natomas East Main Drain		■			■		
Region 2	Bear River*	■	■			■		■
	Butte Creek	■	■	■		■		
	Cherokee Canal*							
	Colusa Basin Drain							
	Colusa Bypass	■	■	■		■		
	Feather River*	■	■			■		■
	Honcut Creek							
	Mainstem Sacramento River, RM 80–143*	■	■	■	■	■		■
	Marysville Units 1,2,3							
	Sutter Bypass	■	■	■	■	■		■
	Tisdale Bypass	■	■	■	■	■		
	Wadsworth Canal					■		
	Yuba River*	■	■			■		■
Region 3	Deer Creek*	■	■			■		
	Elder Creek*	■	■		■	■		
	Mainstem Sacramento River, RM 143–194*	■	■	■	■	■		■
	Mud Creek	■	■		■	■		

*Waterbodies included in the SRBPP Phase II Supplemental Authorization

Default distribution assumed in SAM ECT: ■

Additional distribution assumed for SRBPP Phase II Supplemental Authorization Analysis: ▨

Source: SAM ECT version 3.0 (beta).

1 **Table F-3. Life-History Timing for Focus Species within the Sacramento River Portion of the SRBPP Area, as Applied in SAM**

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Spring-run Chinook	Region 1a (RM 0–20)	Adult migration	■	■	■	■	■	■	■				■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■				■	■	■
		Adult residence												
	Region 1b (RM 20–80)	Adult migration		■	■	■	■	■	■	■	■			
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■				■	■	■
		Adult residence												
	Region 2 (RM 80–143)	Adult migration	■	■	■	■	■	■	■				■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■							
		Adult residence												
	Region 3 (RM 143–194)	Adult migration	■	■	■	■	■	■	■				■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■							
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Fall-run Chinook	Region 1a (RM 0–20)	Adult migration					■	■	■	■	■	■	■	
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■						■
		Juvenile migration	■	■	■	■	■	■	■				■	■
		Adult residence												
	Region 1b (RM 20–80)	Adult migration							■	■	■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■					■	■
		Juvenile migration	■	■										■
		Adult residence												
	Region 2 (RM 80–143)	Adult migration					■	■	■	■	■	■	■	
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■									■	■
		Juvenile migration	■	■	■	■	■							■
		Adult residence												
	Region 3 (RM 143–194)	Adult migration					■	■	■	■	■	■	■	
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■									■	■
		Juvenile migration	■	■	■	■	■							■
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Late fall–run Chinook	Region 1a (RM 0–20)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 1b (RM 20–80)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 2 (RM 80–143)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 3 (RM 143–194)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Winter-run Chinook	Region 1a (RM 0-20)	Adult migration	■	■	■	■	■	■					■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■					■	■	■	■
		Adult residence												
	Region 1b (RM 20-80)	Adult migration	■	■	■	■	■	■	■				■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■							■	■	■
		Adult residence												
	Region 2 (RM 80-143)	Adult migration	■	■	■	■	■	■					■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■					■	■	■	■	■
		Adult residence												
	Region 3 (RM 143-194)	Adult migration	■	■	■	■	■	■					■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■						■	■	■	■
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Steelhead	Region 1a (RM 0-20)	Adult migration	■	■	■			■	■	■	■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence	■	■	■	■	■	■	■	■	■	■	■	■
	Region 1b (RM 20-80)	Adult migration	■	■	■			■	■	■	■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■					■	■	■
		Adult residence	■	■	■			■	■	■	■	■	■	■
	Region 2 (RM 80-143)	Adult migration	■	■	■				■	■	■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence	■	■	■	■	■	■	■	■	■	■	■	■
	Region 3 (RM 143-194)	Adult migration	■	■	■				■	■	■	■	■	■
		Spawning and egg incubation	■	■	■	■							■	■
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence	■	■	■	■	■	■	■	■	■	■	■	■

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Delta smelt	Region 1a (RM 0-20)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 1b (RM 20-80)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 2 (RM 80-143)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 3 (RM 143-194)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Green sturgeon	Region 1a (RM 0–20)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence		■	■	■	■	■	■	■	■	■	■	■
	Region 1b (RM 20–80)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation			■	■	■	■	■					
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration					■	■	■	■	■			
		Adult residence		■	■	■	■	■	■	■				
	Region 2 (RM 80–143)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence		■	■	■	■	■	■	■	■	■	■	■
	Region 3 (RM 143–194)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation			■	■	■	■	■	■				
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence	■	■	■	■	■	■	■	■	■	■	■	■

Source: SAM ECT version 3.0 (beta).

Habitat Data Assembly

Interfacing Potential Bank Protection Sites with the Revetment Database

The Corps revetment database (U.S. Army Corps of Engineers 2007b) is based on surveys undertaken along segments of the waterbody within the SRBPP area. Each segment includes relatively homogenous river bank and a new segment begins when the bank habitat appreciably changes. Thus, each segment has a particular type and size class of rock/rubble revetment or is a class of natural bank, the latter differentiated among predominance of deposition or erosion. The revetment database includes geographic information system (GIS) files and an associated Excel database. The GIS files contain coordinates of the endpoints of each segment. In the database, each row represents a segment, and data for each segment are given for each of 24 attributes of the segments.

Critical erosion sites identified by the Corps (e.g., Ayres Associates 2008) are also identified by GIS coordinates and delimited by polygons. The Corps selected potential bank protection sites for construction under the 80,000 linear feet supplemental authority from the 2008 inventory of critical erosion sites; this consists of 106 erosion sites described in the Sacramento Riverbank Protection Project: Final Alternatives Report—80,000 LF (Final Alternatives Report) (U.S. Army Corps of Engineers 2009). This selection serves as a sample of sites that may eventually be provided bank protection under the supplemental authority.

Using GIS, the revetment and erosion-site datasets were intersected, and the revetment database segments, or portions of particular segments, corresponding to each potential bank protection site were identified and clipped from the revetment database.

Habitat Attributes

Six habitat attributes are considered in the SAM analysis: bank slope, floodplain availability, bank substrate size, instream structure, aquatic vegetation, and overhanging shade. These attributes describe features of the nearshore aquatic environment that are important to fish for refuge (Stillwater Sciences 2009: 4).

- Bank slope—average bank slope along each average seasonal water surface elevation.
- Floodplain availability—ratio of wetted channel and floodplain area during the 2-year flood (Q2) to the wetted channel area during average winter and spring flows.
- Bank substrate size—the median particle diameter of the bank (i.e., D_{50}) along each average seasonal water surface elevation.
- Instream structure—percentage of shoreline coverage of instream woody material (IWM) along each average seasonal water surface elevation.
- Aquatic vegetation—percentage of shoreline coverage of inundated aquatic or riparian vegetation along each average seasonal water surface elevation.

- Overhanging shade (cover)—percentage of the shoreline coverage of shade along each average seasonal water surface elevation.

Calculation of Habitat Attribute Values for Existing Conditions

The habitat attribute values representing existing conditions for the SAM analysis were based largely on the SRBPP GIS revetment database developed by the Corps (U.S. Army Corps of Engineers 2007b). Values of habitat attributes for each potential bank protection site were obtained by calculating length-based weighted averages of the habitat attributes that were clipped from the revetment database using the procedure described above. Calculation of the SAM input values needed for the averaging process is described below. Sites not included in the revetment database had habitat values estimated from nearby sites and the qualitative description provided in the Final Alternatives Report (U.S. Army Corps of Engineers 2009). These sites included:

- Cache Slough RM 15.9L
- Deer Creek LM 2.4L
- Elder Creek LM 1.44L

Bank Slope

Existing bank slope was estimated from the revetment database using the average value derived from the 5FT_DEPTH and 10FT_DEPTH attributes. These refer to observation points 5 feet and 12 feet from the low-flow shoreline, respectively. (There appears to be a discrepancy in the measuring distances between earlier U.S. Fish and Wildlife Service surveys, which used a 12-foot distance from shore, and the revetment database, which indicates a 10-foot distance; a value of 12 feet was assumed in this analysis.) Note that bank slopes associated with low-flow shorelines are not necessarily the same as bank slopes at higher elevations (e.g., in winter), which may be more relevant for assessing conditions encountered by species such as juvenile salmonids. However, data for high-flow shorelines were not available. Each depth class at each of the two depths estimated at each site was converted to slope by assuming that the actual depth was the midpoint of the depth class or 15 feet for the >10 feet depth class (Table F-4). Slope (change in width divided by change in depth, dW/dH, or run/rise) was calculated as the average of the two slopes obtained from the two observation points (5 feet and 12 feet from the low-flow shoreline). For example, a segment of a waterbody with depth at 5 feet estimated to be <2.5 feet (i.e., a slope of 4, from dW/dH = 5/1.25) and depth at 12 feet of 2.5–5 feet (i.e., a slope of 3.2, from dW/dH = 12/3.75) would have an estimated slope of 3.6 ([4+3.2]/2). The lack of more refined season-specific data necessitated using the resulting averages of the two values for all four seasonal SAM model runs.

Table F-4. Assumed SAM Input Values for Slope, as Derived from the Revetment Database

Revetment Database Depth Class (Assumed Value)	Slope, dW/dH	
	For Depth at 5 Feet Observation	For Depth at 12 Feet Observation
<2.5 feet (1.25 feet)	4	9.6
2.5–5 feet (3.75 feet)	1.33	3.2
5–10 feet (7.5 feet)	0.67	1.6
>10 feet (15 feet)	0.33	0.8

dW/dH = change in width divided by change in depth

Floodplain Availability

Floodplain availability, as represented by the SAM variable of floodplain inundation ratio, was calculated based on distances from the river centerline to shore under seasonal average and 2-year flood flow (Q2) water-surface elevations (WSEL). Because the length of the site is assumed to remain the same between existing and project conditions, the ratio of the centerline-shore distance between Q2 and winter and fall can be used to represent the floodplain inundation ratio. For summer and fall, when water levels are low, a value of 1.0 was used to indicate no floodplain availability (U.S. Army Corps of Engineers 2007a). Channel half-width in the summer/fall was estimated from aerial photography in GIS. Channel half-widths in winter and spring were estimated by taking the midpoint of the estimated summer WSEL from the Final Alternatives Report and applying predictive regressions developed for the Sacramento River from WSEL in a number of recent SAM analyses:

- Winter WSEL = 1.0179*(summer WSEL) + 3.0728, $r^2 = 0.9865$
- Spring WSEL = 1.01*(summer WSEL) + 1.3107, $r^2 = 0.9987$

In essence, these regression relationships suggested that the winter and spring WSEL are approximately 3 feet and 1.3 feet higher than the summer WSEL. The winter and spring channel half-widths were calculated by adding the distance from the summer WSEL to the winter and spring WSEL using site cross sections presented in Final Alternatives Report (U.S. Army Corps of Engineers 2009).

The Q2 WSEL was derived from values presented in Appendix D (Attachment D.1) of the Sacramento and San Joaquin River Basins Comprehensive Study (U.S. Army Corps of Engineers 2002). Estimates of Q2 WSEL for a given site included in the SAM analysis were made by developing predictive regressions between Q2 WSEL and river mile, then applying the regressions to the river miles of the sites included in the SAM analysis. For example, the regression used for sites in Georgiana Slough was based on two data points, giving the regression:

- Q2 WSEL (site) = 0.2023*(site river mile) + 7.0094, $r^2 = 1$

Floodplain inundation ratios were calculated as:

- Winter floodplain inundation ratio = Q2 channel half-width/winter channel half-width
- Spring floodplain inundation ratio = Q2 channel half-width/spring channel half-width

Bank Substrate Size

The revetment database includes eight rock/rubble revetment classes and three natural bank classes. Based on the Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (U.S. Army Corps of Engineers 2007a), all natural bank classes were considered to have a substrate size (D_{50}) of 0.25 inches. Table F-5 indicates how these revetment database attribute values were converted to single values for input to SAM. Following U.S. Army Corps of Engineers 2007a, these values were applied to all four seasons. (The revetment database attribute for rock height does not distinguish among heights less than 10 feet above the fall-summer WSEL, and average winter WSEL is commonly only about 5 feet above the fall-summer WSEL, so the rock-height attribute would not allow substrate differences at different seasonal WSELs to be distinguished.)

Table F-5. Conversion of Revetment Database Bank-Type Classes to SAM Variable Value for Bank Substrate Size

Revetment Database Substrate Class		SAM Input Value
Natural bank (all types)		0.25”
Rock riprap	small	11”
	medium	16”
	large	20”
Cobble riprap	small	6”
	medium	8”
	large	11”
Rubble	small	12”
	large	24”

Instream Structure

The revetment database uses four classes of instream structure, based on ranges of percent shoreline having IWM. Table F-6 indicates how these revetment database attribute values were converted to a single value for input to SAM. Although these observations were made during summer and fall, IWM submerged at that time will also be submerged during spring and winter periods. Thus, these values appropriately served for all seasons.

Table F-6. Conversion of Revetment Database Instream Woody Material Classes to SAM Variable Value for Instream Structure

Revetment Database IWM Class	SAM Input Value
None	0%
1–10%	5%
11–50%	30%
>50%	75%

Aquatic Vegetation

Following the approach used by U.S. Army Corps of Engineers 2007a, the revetment database attribute for emergent vegetation was used for fall and summer seasonal model runs, and the ground cover attribute was used for the spring and winter model runs. Upstream of the Delta, this approach generally gave a vegetation value of zero for fall and summer WSELs, which is appropriate given the relative scarcity of aquatic vegetation. Several classes were used for each attribute; Table F-7 indicates how these revetment database attribute values were converted to a single value for input to SAM.

Table F-7. Conversion of Revetment Database Emergent Vegetation and Ground Cover Classes to SAM Variable Values for Vegetation

	Revetment Database Class	SAM Input Value
Fall and Summer:		
Emergent Vegetation Attribute	False	0%
	PEM 1–5%	3%
	PEM 6–25%	15%
	PEM 26–75%	50%
	PEM >75%	85%
Spring and Winter:		
Ground Cover Attribute	<25%	13%
	26–50%	38%
	51–75%	63%
	>75%	88%

Overhanging Shade

The revetment database uses five classes of overhanging shade (cover), based on ranges of percent shoreline cover. Table F-8 indicates how these revetment database attribute values were converted to a single value for input to SAM. These values served as fall and summer values. Following U.S. Army Corps of Engineers 2007a, the values for spring and winter were assumed to be 75% and 25% of the summer/fall values, respectively, to reflect leaf-out and die-back conditions.

Table F-8. Conversion of Revetment Database Overhead Cover Classes to SAM Variable Value for Overhanging Shade

Revetment Database Shade Class	SAM Input Value
None	0%
1–5%	3%
6–25%	16%
26–75%	50%
>75%	88%

Seasonal Differences

The revetment database reflects the average of summer and fall conditions, but SAM requires inputs for each of four seasons. Consequently, certain assumptions must be made for the relationship of winter and spring to average summer/fall conditions, and summer and fall modeling is assumed to be identical for existing conditions. Also, representative values of the SAM variable for each revetment observation class (bin) must be adopted. The following sections set forth the modeling approach and methods of identifying input values for the six SAM variables. A summary of determining existing conditions variables from the revetment database is provided in Table F-9, and was also discussed above under the details for each SAM variable. The methodology is generally consistent with U.S. Army Corps of Engineers 2007a.

Table F-9. Determination of Existing Conditions Variables from the Revetment Database

<table>
<tr><th rowspan="2"></th><th colspan="6">SAM Variable</th></tr>
<tr><th>Overhanging Shade</th><th>Aquatic Vegetation</th><th>Floodplain Availability (Floodplain Inundation Ratio)</th><th>Bank Substrate Size</th><th>Bank slope</th><th>Instream Structure</th></tr>
<tr><td>Fall and Summer</td><td>Use revetment database value for Overhead Cover attribute</td><td>Use revetment database Emergent Vegetation percent attribute</td><td rowspan="3">Not calculated using the revetment database</td><td rowspan="3">Use revetment database value for revetment database for all seasons</td><td rowspan="3">Use revetment database average value derived from Depth at 5’ and Depth at 12’ attribute for all seasons</td><td rowspan="3">Use revetment database value for Large Woody Debris attribute for all seasons</td></tr>
<tr><td>Spring</td><td>Use 75% of revetment database value</td><td rowspan="2">Use revetment database Ground Cover percent</td></tr>
<tr><td>Winter</td><td>Use 25% of revetment database value</td></tr>
</table>

Characterization of With-Project Conditions

Bank Protection Measures

Bank protection measures are site-specific design solutions that can be constructed at eroding sites in order to reduce flood damage risk from erosion-related levee breach. With-project conditions were generally derived from bank protection measures provided in the Final Alternatives Report (U.S. Army Corps of Engineers 2009) when those measures were compatible with the Corps policy for vegetation-free zones (see the discussion of the Proposed Site-Specific Bank Protection Measures section in Chapter 2 of the EIS/EIR). Site characteristics generally were based upon the main bank protection measure templates described in the Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (see Table F-10; Proposed Site-Specific Bank Protection Measures section in Chapter 2 of the EIS/EIR). Bank attributes that change based on vegetation growth over time (i.e., aquatic vegetation percentage cover and shade percentage) were assumed to have rates of change similar to those adopted in previous SAM analyses (U.S. Army Corps of Engineers 2007a), although a simplified calculation method (Table F-11) based on patterns of change from recent SAM analyses was used to estimate the values rather than a formal growth model (U.S. Army Corps of Engineers 2004).

Table F-10. Bank Protection and On-Site Enhancement Features That Are Specified In The Bank Protection Measure Templates. Individual Sites May Vary Based on Conditions

	Bank Protection Measure						
Bank Protection and Habitat Enhancement Features	1 (Setback Levee)	2 (Bank Fill Stone Protection with No On-Site Woody Vegetation)	3 (Adjacent Levee)	4a (Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline)	4b (Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline)	4c (Riparian and Wetland Benches with Revegetation)	5 (Bank Fill Stone Protection with On-Site Vegetation)
Revegetation	NA[1]	No	NA[1]	Yes	Yes	Yes	Yes
Riparian Bench	NA[1]	No	NA[1]	Yes	Yes	Yes	No
Wetland Bench	NA[1]	No	NA[1]	No	No	Yes	No
Benches							
Riparian Bench Flooded (Winter/Spring)	NA[1]	No	NA[1]	Yes	Yes	Yes	No
Wetland Bench Flooded (Year-round)	NA[1]	No	NA[1]	No	No	Yes	No
Bank Slope (Horizontal : Vertical)							
Average Across Revetment	As is	3:1	As is	3:1	3:1	3:1	3:1
Bench Areas	NA[1]	NA[2]	NA[1]	10:1	10:1	10:1	NA[2]
Substrate Median Diameter (D_{50}, inches)							
Above Bench (Winter/Spring)	NA[1]	8	NA[1]	0.25	0.25	0.25	8
Below Bench (Summer/Fall)	NA[1]	8	NA[1]	4	4	4	8
Instream Woody Material Coverage (Percentage of Shoreline)							
Above Bench (Winter/Spring)	NA[1]	0%	NA[1]	60%[3]	60%[3]	As is[4]	0%
Below Bench (Summer/Fall)	NA[1]	0%	NA[1]	0%	60%[3]	As is[4]	0%
Initial Retention of Existing Overhead Shade (%)	100%	0%	100%	25%	25%	25%	25%

Source: Adapted from USACE (2007a)

[1] Not applicable (NA) to setback or adjacent measures because these would retain the existing conditions on the waterside.

[2] Not applicable (NA) because benches are not included in the bankfill rock-slope measures.

[3] Instream woody material installed above pre-project levels upstream of RM 30 for Designs 4a and 4b may be used as off-site compensation for sites downstream of RM 30. A revision of SAM species response curves in ECT 3.0 requires at least 60% IWM coverage to provide essentially the same benefit as 100% coverage (compared with a requirement of 40% in prior SAM analyses).

[4] Instream woody material would be installed to pre-project conditions for bank protection measure 4c.

Table F-11. Assumed Change in Aquatic Vegetation and Shade (Both As Percentage of Shoreline Length) for with-Project Conditions

Construction Year[1]	Fall[2]	Winter	Spring	Summer
Aquatic Vegetation By Year (% Shoreline): Bank Protection Measures 4a, 4b, 5				
Year 0	Existing	Existing	Existing	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Aquatic Vegetation By Year (% Shoreline): Bank Protection Measure 4c				
Year 0	Existing	Existing	Existing	0
Year 1	50	50	50	50
Year 5	90	90	90	90
Year 15	100	100	100	100
Year 25	100	100	100	100
Year 50	100	100	100	100
Shade By Year (% Shoreline): All Bank Protection Measures				
Year 0	Existing	Existing	Existing	0.25 × Existing
Year 1	0.25 × Existing	(0.25 × Existing) + 1	(0.25 × Existing) + 1	0.25 × Existing
Year 5	0.25 × Existing	Year 1 × 2	Year 1 × 3	0.25 × Existing
Year 15	(0.25 × Existing) + 60	Year 5 + (0.67 × [25-Year 5])	Year 5 + (0.67 × [75-Year 5])	(0.25 × Existing) + 60
Year 25	100	25	75	100
Year 50	100	25	75	100

[1] Year = construction year (construction assumed to occur during summer).
[2] Fall indicates fall of the previous year (same water year).

There are relatively few data with which to examine the appropriateness of the bank protection measure assumptions related to changes over time (Table F-11). A recent examination of changes from 2008 to 2009 for 57 emergency repair sites constructed in 2006–2007 in the Sacramento River and a number of sites in the Brannan-Andrus Levee Maintenance District constructed in 2007 found the following (H. T. Harvey & Associates with PRBO Conservation Science 2010):

- Instream structure (IWM)
  - Low-elevation (summer-fall) shoreline: stayed approximately the same (average of 44.4% in 2008 and 42.8% in 2009)
  - High-elevation (winter-spring) shoreline: increased from 73.6% in 2008 to 81.5% in 2009
- Aquatic vegetation
  - Low-elevation (summer-fall) shoreline: increased from 34.4% in 2008 to 40.6% in 2009

    - High-elevation (winter-spring) shoreline: increased from 44.8% in 2008 to 53.7% in 2009
- Overhanging shade
    - Low-elevation (summer-fall) shoreline: increased from 1.8% in 2008 to 13.1% in 2009
    - High-elevation (winter-spring) shoreline: increased from 9.5% in 2008 to 32.8% in 2009

These data, although short-term and limited, generally suggest that the assumptions described in Table F-11 are appropriate and may be conservative in some respects (e.g., development of overhanging shade).

Site-Specific Bank Protection Measures

Bank protection measures were assumed to be applied to the representative project sites considered in this programmatic analysis, with a single measure per site (see Table 2-2 in Chapter 2 of the EIS/EIR). To determine the repair sites to be included in the SAM analysis, it was necessary to refine data from the 106 erosion sites listed in Table 2-2 of the EIS/EIR.

- Ten sites were determined in the Final Alternatives Report (U.S. Army Corps of Engineers 2009) not to require repair and so were omitted from the analyses.
- Sites within Cache Creek, Cherokee Canal, and Knights Landing Ridge Cut are assumed not to be within the SAM focal species' ranges (Stillwater Sciences 2009; Table F-2) and so were excluded from SAM analysis (seven sites totaling 13,789 LF, not including sites already excluded for the above reason). In addition, a site along the Yuba River far from the active river channel was also excluded (1,356 LF).
- Several sites had no revetment database coverage in their vicinity but their lengths were included in the calculation of repair length by region under the assumption that sites in the same region provided similar habitat features for the SAM calculation, with habitat features also being estimated from descriptions provided in the Final Alternatives Report. This is consistent with the method used in the Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (U.S. Army Corps of Engineers 2007a) and assumes that the sites included in the analysis are representative of all potential erosion sites that could be repaired using the supplemental authority for 80,000 LF.

Across the full SRBPP program area, there are 96 sites at which construction was assumed to occur, totaling nearly 77,000 LF (Table F-12). Of these 96 sites, 88 sites are in SAM waterbodies (i.e., waterbodies considered to be habitat for SAM focal fish species) and these sites constitute nearly 62,000 LF (80%) of the total length of assumed bank protection sites to be constructed in the SRBPP Phase II Supplemental Authority. The greatest length of construction sites by SRBPP programmatic region is assumed to be in Region 1a, which would have slightly more than 40,000 LF of construction (53% of total construction length). Nearly 12,000 LF (30% of the Region 1a total) would be in non-SAM waterbodies (the aforementioned sites in Cache Creek and Knights Landing Ridge Cut). Around 30% of construction was assumed to occur in Region 2 (more than 22,000 LF), of which more than 19,000 LF (86%) would occur in SAM waterbodies. Construction lengths in Regions 1b and 3 were less than in the other regions and constituted around 14,000 LF (18%) of all construction, all of which was assumed to occur in SAM waterbodies (Table F-12).

Because the total length of sites is 76,806 LF, the results of the SAM analysis are considered representative of 96% of the full 80,000 LF included under the Phase II supplemental authority.

Therefore, a small multiplier (1/0.96 = 1.04) should be included in any potential offsite compensation needs as assessed from the SAM results for focal fish species.

Table F-12. Assumed Bank Repair Lengths (Linear Feet) By SRBPP Programmatic Region, With Number of Sites in Parentheses

Program Region	Length In Non-SAM Waterbodies, (Number of Sites)	Length In SAM Waterbodies, (Number of Sites)	Total length, (Number of Sites)
1a	11,989 (6)	28,394 (33)	40,383 (39)
1b	0 (0)	10,777 (22)	10,777 (22)
2	3,156 (2)	19,113 (26)	22,269 (28)
3	0 (0)	3,377 (7)	3,377 (7)
Total	15,145 (8)	61,661 (88)	76,806 (96)

Note: Only sites in SAM waterbodies were examined in the fish effect analysis.

Construction Schedule

In order to represent a realistic construction schedule for the 80,000 LF Phase II Supplemental Authority, it was assumed that approximately 10,000 LF of erosion sites were repaired each year (Dietl personal communication). Construction was assumed to begin in 2013 and to end in 2020, with SAM analysis including the period from 2013 to 2070 in order to capture short-term and long-term effects that include up to 50 years from the end of construction. Total annual length of construction ranged from around 8,800 LF in 2017, 2019, and 2020, to more than 11,700 LF in 2014 (Table F-13). The annual number of sites that were assumed to be constructed ranged from six in 2016 to 26 in 2020.

SAM Analysis Results

Baseline conditions were assumed to be static over 2013–2070 and were calculated for each site using the conventions described above in the Calculation of Habitat Attribute Values for Existing Conditions section. A static baseline is typical for SAM analyses (Jones & Stokes 2007; U.S. Army Corps of Engineers 2007a) and fulfills the requirements of the ESA. SAM analyses were conducted separately for each of the four program regions (1a, 1b, 2, and 3). Results were output at several time periods in order to assess short-term and long-term habitat responses: 2013, 2014, 2015, 2017, 2018, 2028, 2038, 2063, and 2070. The analyses provided estimates of bank-line weighted relative responses of all seven species in each of the four seasons. Region-specific results are presented in Figures F-1 through F-24, and combined results for each program alternative are presented in Figures 11-1 through 11-6 in EIS/EIR Chapter 11.

Table F-13. Assumed Construction Schedule For SAM Analysis, With Length of Bank Protection By Year and SRBPP Program Region

Start Year	Program Region	Linear Feet In Non-SAM Waterbodies (Number of Sites)	Linear Feet In SAM Waterbodies (Number of Sites)	Total Linear Feet (Number of Sites)
2013	1a	1,647 (2)	3,529 (4)	5,176 (6)
2013	1b	0	665 (1)	665 (1)
2013	2	1,356 (1)	2,067 (3)	3,423 (4)
2013	3	0	525 (1)	525 (1)
2013	All	3,003 (3)	6,786 (9)	9,789 (12)
2014	1a	768 (1)	3,457 (5)	4,225 (6)
2014	1b	0	0	0
2014	2	1,800 (1)	3,134 (1)	4,934 (2)
2014	3	0	0	0
2014	All	2,568 (2)	6,591 (6)	9,159 (8)
2015	1a	8,564 (1)	3,171 (1)	11,735 (2)
2015	1b	0	0	0
2015	2	0	0	0
2015	3	0	0	0
2015	All	8,564 (1)	3,171 (1)	11,735 (2)
2016	1a	0	4,206 (4)	4,206 (4)
2016	1b	0	2,761 (1)	2,761 (1)
2016	2	0	3,459 (1)	3,459 (1)
2016	3	0	0	0
2016	All	0	10,426 (6)	10,426 (6)
2017	1a	1,010 (2)	3,540 (3)	4,550 (5)
2017	1b	0	1,439 (2)	1,439 (2)
2017	2	0	2,465 (1)	2,465 (1)
2017	3	0	334 (1)	334 (1)
2017	All	1,010 (2)	7,778 (7)	8,788 (9)
2018	1a	0	3,514 (4)	3,514 (4)
2018	1b	0	2,699 (5)	2,699 (5)
2018	2	0	2,429 (5)	2,429 (5)
2018	3	0	694 (2)	694 (2)
2018	All	0	9,336 (16)	9,336 (16)
2019	1a	0	4,154 (6)	4,154 (6)
2019	1b	0	1,262 (6)	1,262 (6)
2019	2	0	2,831 (4)	2,831 (4)
2019	3	0	546 (1)	546 (1)
2019	All	0	8,793 (17)	8,793 (17)
2020	1a	0	2,823 (6)	2,823 (6)
2020	1b	0	1,951 (7)	1,951 (7)
2020	2	0	2,728 (11)	2,728 (11)
2020	3	0	1,278 (2)	1,278 (2)
2020	All	0	8,780 (26)	8,780 (26)
All	Total	15,145 (8)	61,661 (88)	76,806 (96)

The results were used to assess the extent to which site designs provided sufficient compensation for alteration of habitat by bank protection over both the long term (project life of 50 years) and the short term. Short-term deficits were examined in relation to periods approximating the species' life spans (U.S. Army Corps of Engineers 2007a):

- Chinook salmon: 5 years (i.e., 2018);
- Steelhead: 4 years (i.e., 2017);
- Delta smelt: 2 years (i.e., 2015); and
- Green sturgeon: 15 years (i.e., 2028).

Although SAM results are presented in linear feet differences between baseline and project for each life stage of each species, these results are not comparable across species because habitat suitability (i.e., SAM species response indices) differs by species and life stage. In many cases the largest absolute differences (in terms of linear feet) are found for the least sensitive life stages because habitat suitability is high across a range of conditions. Therefore, the standard SAM results were categorized to indicate relative percentage change under the SRBPP from baseline[1]. The categories were:

- <5% difference in habitat suitability,
- 5–10% less habitat suitability,
- >10–25% less habitat suitability,
- >25–50% less habitat suitability,
- >50% less habitat suitability,
- 5–10% greater habitat suitability,
- >10–25% greater habitat suitability,
- >25–50% greater habitat suitability,
- >50% greater habitat suitability.

Note that the absolute linear footages reported in the SAM results represent the difference from baseline in terms of optimal habitat for a given species and life stage, i.e., the linear footage of habitat for which all six habitat variables are at optimum levels and have a response index of 1.

[1] For the Biological Assessment, SAM was only run for sites at which construction would affect the waterside of the river bank at each site; adjacent levees were not run. However, in order to properly represent the relative change from baseline under the project across a region, habitat value under existing conditions must be included for all sites. To accomplish this, existing conditions SAM values from Alternative 6 of the SRBPP Phase II Supplemental Authorization EIR/EIS were used because this alternative assumes construction at all sites and so the SAM was run for all sites.

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Region-Specific SAM Results

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	0		0	0		0		0	0		0		0	0		0		0	0	
2015	2		1	3		2		1	3		2		1	4		2		1	3	
2017	9		4	12		9		4	15		9		7	17		9		4	12	
2018	13		5	16		12		6	22		13		9	24		13		5	16	
2028	19		7	36		22		11	51		20		14	51		19		7	36	
2038	13		3	35		20		7	54		14		7	51		13		3	35	
2063	2		-2	26		14		1	45		5		-4	37		2		-2	26	
2070	0		-3	24		13		0	43		3		-5	34		0		-3	24	
Fall-run Chinook																				
2013	0			0				0	0		0		0	0		0		0	0	
2014	0			0				0	0		0		0	0		0		0	0	
2015	2			3				1	3		2		1	4		2		1	3	
2017	9			12				4	15		9		7	17		9		4	12	
2018	13			16				6	22		13		9	24		13		5	16	
2028	19			36				11	51		20		14	51		19		7	36	
2038	13			35				7	54		14		7	51		13		3	35	
2063	2			26				1	45		5		-4	37		2		-2	26	
2070	0			24				0	43		3		-5	34		0		-3	24	
Late fall–run Chinook																				
2013	0			0		0			0		0		0	0					0	
2014	0			0		0			0		0		0	0					0	
2015	2			3		2			3		2		1	4					3	
2017	9			12		9			15		9		7	17					12	
2018	13			16		12			22		13		9	24					16	
2028	19			36		22			51		20		14	51					36	
2038	13			35		20			54		14		7	51					35	
2063	2			26		14			45		5		-4	37					26	
2070	0			24		13			43		3		-5	34					24	
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		0	0		0		0	0		0		0	0		0		0		
2015	2		1	3		2		1	3		2		1	4		2		1		
2017	9		4	12		9		4	15		9		7	17		9		4		
2018	13		5	16		12		6	22		13		9	24		13		5		
2028	19		7	36		22		11	51		20		14	51		19		7		
2038	13		3	35		20		7	54		14		7	51		13		3		
2063	2		-2	26		14		1	45		5		-4	37		2		-2		
2070	0		-3	24		13		0	43		3		-5	34		0		-3		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2015	4		1	2	4	4		2	3	4	4		2	3	4	4		1	2	4
2017	20		6	10	20	19		7	12	19	19		9	12	19	20		6	10	20
2018	28		8	14	28	27		10	16	27	28		13	17	28	28		8	14	28
2028	44		13	29	44	47		18	38	47	44		20	36	44	44		13	29	44
2038	34		6	27	34	44		13	41	44	35		11	34	35	34		6	27	34
2063	15		-3	18	15	31		4	35	31	17		-4	23	17	15		-3	18	15
2070	11		-4	16	11	28		3	33	28	14		-6	21	14	11		-4	16	11
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2015	0				0	0	4	6		0	0	4	6		0	0	3	4		0
2017	0				0	0	18	28		0	0	18	28		0	0	13	20		0
2018	0				0	0	26	40		0	0	26	40		0	0	18	28		0
2028	0				0	0	52	60		0	0	52	60		0	0	36	42		0
2038	0				0	0	56	44		0	0	56	44		0	0	39	31		0
2063	0				0	0	54	23		0	0	54	23		0	0	38	16		0
2070	0				0	0	52	20		0	0	52	20		0	0	36	14		0
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2015			4	0	2	0		4	0	2	0		4	0	2	0		4	0	2
2017			17	0	7	0		17	0	7	0		17	0	7	0		17	0	7
2018			24	0	10	0		24	0	10	0		24	0	10	0		24	0	10
2028			75	0	20	0		75	0	20	0		75	0	20	0		75	0	20
2038			71	0	22	0		71	0	22	0		71	0	22	0		71	0	22
2063			23	0	21	0		23	0	21	0		23	0	21	0		23	0	21
2070			15	0	21	0		15	0	21	0		15	0	21	0		15	0	21

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Figure F-1
Alternative 1 SAM results showing bank-line weighted relative response (feet) within Region 1a

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	0		0	0		0		0	0		0		0	0		-4		0	-4	
2015	0		0	0		0		0	0		0		0	0		-8		0	-8	
2017	0		0	0		0		0	0		0		0	0		-15		0	-16	
2018	0		0	0		0		0	0		0		0	0		-18		0	-19	
2028	2		**2**	**5**		2		3	6		2		4	7		-22		2	-21	
2038	7		6	13		6		9	18		6		12	18		-16		6	-12	
2063	21		18	34		17		23	49		17		30	48		4		18	15	
2070	24		21	38		19		26	55		20		34	55		9		21	22	
Fall-run Chinook																				
2013	0		0			0		0	0				0			0		0		
2014	0		0			0		0	0				0			-4		0		
2015	0		0			0		0	0				0			-8		0		
2017	0		0			0		0	0				0			-15		0		
2018	0		0			0		0	0				0			-18		0		
2028	2		2			2		3	6				4			-22		2		
2038	7		6			6		9	18				12			-16		6		
2063	21		18			17		23	49				30			4		18		
2070	24		21			19		26	55				34			9		21		
Late fall–run Chinook																				
2013	0		0	0		0		0	0		0		0					0		
2014	0		0	0		0		0	0		0		0					0		
2015	0		0	0		0		0	0		0		0					0		
2017	0		0	0		0		0	0		0		0					0		
2018	0		0	0		0		0	0		0		0					0		
2028	2		2	5		2		3	6		2		4					2		
2038	7		6	13		6		9	18		6		12					6		
2063	21		18	34		17		23	49		17		30					18		
2070	24		21	38		19		26	55		20		34					21		
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		0	0		0		0	0		0		0	0		-4		0		
2015	0		0	0		0		0	0		0		0	0		-8		0		
2017	0		0	0		0		0	0		0		0	0		-15		0		
2018	0		0	0		0		0	0		0		0	0		-18		0		
2028	2		2	5		2		3	6		2		4	7		-22		2		
2038	7		6	13		6		9	18		6		12	18		-16		6		
2063	21		18	34		17		23	49		17		30	48		4		18		
2070	24		21	38		19		26	55		20		34	55		9		21		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
2014	0		0	0	0	0		0	0	0	0		0	0	0	-7		0		-7
2015	0		0	0	0	0		0	0	0	0		0	0	0	-14		0		-14
2017	0		0	0	0	0		0	0	0	0		0	0	0	-29		0		-29
2018	0		0	0	0	0		0	0	0	0		0	0	0	-35		0		-35
2028	5		4	3	5	5		5	3	5	5		6	3	5	-41		4		-41
2038	14		11	9	14	13		13	10	13	13		16	10	13	-30		11		-30
2063	41		29	25	41	35		34	29	35	35		41	28	35	7		29		7
2070	47		33	28	47	40		39	33	40	40		47	32	40	17		33		17
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	0	0		0	0	0	0		0	0	-9	0		0
2015	0				0	0	0	0		0	0	0	0		0	0	-18	0		0
2017	0				0	0	0	0		0	0	0	0		0	0	-35	0		0
2018	0				0	0	0	0		0	0	0	0		0	0	-42	0		0
2028	0				0	0	3	14		0	0	3	15		0	0	-54	10		0
2038	0				0	0	8	38		0	0	8	38		0	0	-49	26		0
2063	0				0	0	20	84		0	0	20	85		0	0	-26	58		0
2070	0				0	0	23	95		0	0	24	95		0	0	-20	66		0
Green Sturgeon																				
2013			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
2014			0	0		0		0		0	0	0	0	0	0	0	0	-9	0	-6
2015			0	0		0		0		0	0	0	0	0	0	0	0	-17	0	-12
2017			0	0		0		0		0	0	0	0	0	0	0	0	-34	0	-24
2018			0	0		0		0		0	0	0	0	0	0	0	0	-41	0	-29
2028			9	0		0		9		1	0	0	9	0	1	0	0	-46	0	-37
2038			22	0		0		22		3	0	0	22	0	3	0	0	-31	0	-34
2063			52	0		0		52		7	0	0	52	0	7	0	0	13	0	-20
2070			60	0		0		60		8	0	0	60	0	8	0	0	25	0	-16

Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
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5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

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Figure F-2
Alternative 1 SAM results showing bank-line weighted relative response (feet) within Region 1b

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
2014	-635	0	-11	0		-629	0	-30	-329		-633	0	-34	-343		-635	0	-11	0	
2015	-635	0	-11	0		-629	0	-30	-328		-633	0	-33	-341		-635	0	-11	0	
2017	-635	0	-11	0		-629	0	-29	-324		-633	0	-32	-338		-635	0	-10	0	
2018	-635	0	-10	0		-629	0	-29	-322		-633	0	-32	-336		-635	0	-10	0	
2028	-515	0	12	0		-530	0	-7	-123		-526	0	1	-108		-515	0	12	0	
2038	-439	0	13	0		-457	0	-14	-152		-453	0	-6	-136		-439	0	13	0	
2063	-436	0	-2	0		-435	0	-48	-434		-440	0	-49	-447		-436	0	-2	0	
2070	-442	0	-2	0		-439	0	-52	-471		-445	0	-54	-487		-442	0	-2	0	
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0				
2014	-635	0	-11			0	0	-30	-329		-633		0	-343		-635				
2015	-635	0	-11			0	0	-30	-328		-633		0	-341		-635				
2017	-635	0	-11			0	0	-29	-324		-633		0	-338		-635				
2018	-635	0	-10			0	0	-29	-322		-633		0	-336		-635				
2028	-515	0	12			0	0	-7	-123		-526		0	-108		-515				
2038	-439	0	13			0	0	-14	-152		-453		0	-136		-439				
2063	-436	0	-2			0	0	-48	-434		-440		0	-447		-436				
2070	-442	0	-2			0	0	-52	-471		-445		0	-487		-442				
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-635			-180		-629			-329		-633		-34							
2015	-635			-179		-629			-328		-633		-33							
2017	-635			-176		-629			-324		-633		-32							
2018	-635			-175		-629			-322		-633		-32							
2028	-515			-1		-530			-123		-526		1							
2038	-439			38		-457			-152		-453		-6							
2063	-436			-50		-435			-434		-440		-49							
2070	-442			-57		-439			-471		-445		-54							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-635		-11	-180		-629		-30	-329		-633		-34	-343		-635		-11	-179	
2015	-635		-11	-179		-629		-30	-328		-633		-33	-341		-635		-11	-178	
2017	-635		-11	-176		-629		-29	-324		-633		-32	-338		-635		-10	-174	
2018	-635		-10	-175		-629		-29	-322		-633		-32	-336		-635		-10	-172	
2028	-515		12	-1		-530		-7	-123		-526		1	-108		-515		12	1	
2038	-439		13	38		-457		-14	-152		-453		-6	-136		-439		13	39	
2063	-436		-2	-50		-435		-48	-434		-440		-49	-447		-436		-2	-50	
2070	-442		-2	-57		-439		-52	-471		-445		-54	-487		-442		-2	-57	
Steelhead																				
2013	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-550		-33	-284	-550	-539	0	-69	-411	-539	-547	0	-74	-422	-547	-550		-33	-284	-550
2015	-550		-33	-284	-550	-539	0	-68	-411	-539	-547	0	-74	-422	-547	-550		-32	-282	-550
2017	-550		-32	-282	-550	-539	0	-67	-408	-539	-547	0	-72	-419	-547	-550		-31	-279	-550
2018	-550		-32	-280	-550	-539	0	-66	-407	-539	-547	0	-72	-418	-547	-550		-31	-277	-550
2028	-315		9	-114	-315	-340	0	-32	-249	-340	-333	0	-22	-237	-333	-315		9	-112	-315
2038	-162		11	-70	-162	-194	0	-47	-264	-194	-185	0	-38	-252	-185	-162		11	-69	-162
2063	-158		-19	-145	-158	-156	0	-112	-484	-156	-165	0	-116	-496	-165	-158		-19	-145	-158
2070	-172		-21	-152	-172	-166	0	-119	-513	-166	-177	0	-125	-528	-177	-172		-21	-151	-172
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			-667	0	-665	0		-667	0	-665	0	0	-667	0	-665	0	0	-666	0	-673
2015			-683	0	-665	0		-683	0	-665	0	0	-683	0	-665	0	0	-680	0	-680
2017			-727	0	-665	0		-727	0	-665	0	0	-727	0	-665	0	0	-721	0	-696
2018			-747	0	-665	0		-747	0	-665	0	0	-747	0	-665	0	0	-741	0	-703
2028			-700	0	-611	0		-707	0	-558	0	0	-707	0	-558	0	0	-696	0	-640
2038			-613	0	-542	0		-622	0	-468	0	0	-622	0	-468	0	0	-610	0	-559
2063			-474	0	-506	0		-485	0	-416	0	0	-485	0	-416	0	0	-473	0	-514
2070			-441	0	-507	0		-453	0	-415	0	0	-453	0	-415	0	0	-440	0	-515

Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-3
Alternative 1 SAM results showing bank-line weighted relative response (feet) within Region 2

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0			0		0	0		0		0	0		0	0	0		
2014	-3	0	-1			-1		-1	-4		-3		-2	-11		-6	0	-2		
2015	-6	0	-2			-2		-1	-8		-5		-3	-18		-7	0	-2		
2017	-9	0	-2			-5		-2	-14		-8		-4	-27		-10	0	-3		
2018	-11	0	-3			-6		-2	-17		-9		-5	-30		-12	0	-3		
2028	-45	0	-22			-28		-39	-147		-40		-71	-186		-45	0	-22		
2038	-70	0	-39			-43		-67	-242		-63		-117	-298		-70	0	-39		
2063	-78	0	-48			-51		-80	-263		-71		-138	-327		-78	0	-49		
2070	-75	0	-49			-51		-79	-246		-68		-136	-308		-75	0	-49		
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0		0		
2014	-3	0	-1			0	0	-1	-4		-3		0	-11		-6		0		
2015	-6	0	-2			0	0	-1	-8		-5		0	-18		-7		0		
2017	-9	0	-2			0	0	-2	-14		-8		0	-27		-10		0		
2018	-11	0	-3			0	0	-2	-17		-9		0	-30		-12		0		
2028	-45	0	-22			0	0	-39	-147		-40		0	-186		-45		0		
2038	-70	0	-39			0	0	-67	-242		-63		0	-298		-70		0		
2063	-78	0	-48			0	0	-80	-263		-71		0	-327		-78		0		
2070	-75	0	-49			0	0	-79	-246		-68		0	-308		-75		0		
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-3			-10		-1			-4		-3		-2							
2015	-6			-15		-2			-8		-5		-3							
2017	-9			-21		-5			-14		-8		-4							
2018	-11			-24		-6			-17		-9		-5							
2028	-45			-78		-28			-147		-40		-71							
2038	-70			-118		-43			-242		-63		-117							
2063	-78			-135		-51			-263		-71		-138							
2070	-75			-132		-51			-246		-68		-136							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-3		-1	-10		-1		-1	-4		-3		-2	-11		-6		-2		
2015	-6		-2	-15		-2		-1	-8		-5		-3	-18		-7		-2		
2017	-9		-2	-21		-5		-2	-14		-8		-4	-27		-10		-3		
2018	-11		-3	-24		-6		-2	-17		-9		-5	-30		-12		-3		
2028	-45		-22	-78		-28		-39	-147		-40		-71	-186		-45		-22		
2038	-70		-39	-118		-43		-67	-242		-63		-117	-298		-70		-39		
2063	-78		-48	-135		-51		-80	-263		-71		-138	-327		-78		-49		
2070	-75		-49	-132		-51		-79	-246		-68		-136	-308		-75		-49		
Steelhead																				
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-7	0	-3	-8	-7	-2	0	-1	-3	-2	-6	0	-4	-9	-6	-13		-5	-15	-13
2015	-13	0	-4	-14	-13	-5	0	-2	-6	-5	-10	0	-6	-14	-10	-16		-5	-17	-16
2017	-20	0	-5	-18	-20	-11	0	-3	-10	-11	-17	0	-7	-20	-17	-22		-6	-20	-22
2018	-23	0	-5	-20	-23	-14	0	-3	-12	-14	-20	0	-8	-22	-20	-25		-6	-22	-25
2028	-89	0	-35	-71	-89	-58	0	-54	-107	-58	-81	0	-91	-138	-81	-89		-35	-71	-89
2038	-135	0	-60	-108	-135	-88	0	-92	-177	-88	-124	0	-151	-223	-124	-136		-60	-108	-136
2063	-153	0	-76	-119	-153	-104	0	-112	-191	-104	-141	0	-179	-241	-141	-154		-76	-119	-154
2070	-149	0	-76	-114	-149	-103	0	-111	-177	-103	-137	0	-176	-226	-137	-149		-77	-115	-149
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			7	0	0	0		7	0	0	0	0	7	0	0	0	0	7	0	0
2015			13	0	0	0		13	0	0	0	0	13	0	0	0	0	12	0	0
2017			19	0	-2	0		19	0	-2	0	0	19	0	-2	0	0	18	0	-2
2018			22	0	-2	0		22	0	-2	0	0	22	0	-2	0	0	20	0	-2
2028			19	0	-20	0		19	0	-20	0	0	19	0	-20	0	0	18	0	-20
2038			16	0	-33	0		16	0	-33	0	0	16	0	-33	0	0	15	0	-33
2063			3	0	-43	0		3	0	-43	0	0	3	0	-43	0	0	3	0	-43
2070			-1	0	-44	0		-1	0	-44	0	0	-1	0	-44	0	0	-1	0	-44

Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
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<5% Different
5%-10% Less
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>50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-4
Alternative 1 SAM results showing bank-line weighted relative response (feet) within Region 3

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-237		-157	-405		-184		-121	-566		-225		-187	-644		-1,010		-688	-1,975	
2015	-467		-320	-858		-362		-234	-1,107		-442		-364	-1,264		-1,432		-927	-2,695	
2017	-923		-616	-1,730		-716		-437	-2,147		-873		-687	-2,467		-1,970		-1,166	-3,492	
2018	-1,162		-738	-2,119		-901		-540	-2,696		-1,099		-851	-3,104		-2,140		-1,232	-3,724	
2028	-2,300		-1,246	-3,832		-1,783		-1,070	-5,531		-2,176		-1,661	-6,313		-2,682		-1,426	-4,427	
2038	-2,564		-1,357	-4,213		-1,986		-1,192	-6,199		-2,426		-1,845	-7,064		-2,793		-1,465	-4,570	
2063	-2,761		-1,441	-4,499		-2,139		-1,283	-6,699		-2,613		-1,984	-7,627		-2,876		-1,495	-4,677	
2070	-2,786		-1,451	-4,534		-2,158		-1,294	-6,761		-2,636		-2,001	-7,696		-2,886		-1,498	-4,690	
Fall-run Chinook																				
2013	0			0				0	0		0		0	0		0		0	0	
2014	-237			-405				-121	-566		-225		-187	-644		-1,010		-688	-1,975	
2015	-467			-858				-234	-1,107		-442		-364	-1,264		-1,432		-927	-2,695	
2017	-923			-1,730				-437	-2,147		-873		-687	-2,467		-1,970		-1,166	-3,492	
2018	-1,162			-2,119				-540	-2,696		-1,099		-851	-3,104		-2,140		-1,232	-3,724	
2028	-2,300			-3,832				-1,070	-5,531		-2,176		-1,661	-6,313		-2,682		-1,426	-4,427	
2038	-2,564			-4,213				-1,192	-6,199		-2,426		-1,845	-7,064		-2,793		-1,465	-4,570	
2063	-2,761			-4,499				-1,283	-6,699		-2,613		-1,984	-7,627		-2,876		-1,495	-4,677	
2070	-2,786			-4,534				-1,294	-6,761		-2,636		-2,001	-7,696		-2,886		-1,498	-4,690	
Late fall–run Chinook																				
2013	0			0		0			0		0		0	0					0	
2014	-237			-405		-184			-566		-225		-187	-644					-1,975	
2015	-467			-858		-362			-1,107		-442		-364	-1,264					-2,695	
2017	-923			-1,730		-716			-2,147		-873		-687	-2,467					-3,492	
2018	-1,162			-2,119		-901			-2,696		-1,099		-851	-3,104					-3,724	
2028	-2,300			-3,832		-1,783			-5,531		-2,176		-1,661	-6,313					-4,427	
2038	-2,564			-4,213		-1,986			-6,199		-2,426		-1,845	-7,064					-4,570	
2063	-2,761			-4,499		-2,139			-6,699		-2,613		-1,984	-7,627					-4,677	
2070	-2,786			-4,534		-2,158			-6,761		-2,636		-2,001	-7,696					-4,690	
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-237		-157	-405		-184		-121	-566		-225		-187	-644		-1,010		-688		
2015	-467		-320	-858		-362		-234	-1,107		-442		-364	-1,264		-1,432		-927		
2017	-923		-616	-1,730		-716		-437	-2,147		-873		-687	-2,467		-1,970		-1,166		
2018	-1,162		-738	-2,119		-901		-540	-2,696		-1,099		-851	-3,104		-2,140		-1,232		
2028	-2,300		-1,246	-3,832		-1,783		-1,070	-5,531		-2,176		-1,661	-6,313		-2,682		-1,426		
2038	-2,564		-1,357	-4,213		-1,986		-1,192	-6,199		-2,426		-1,845	-7,064		-2,793		-1,465		
2063	-2,761		-1,441	-4,499		-2,139		-1,283	-6,699		-2,613		-1,984	-7,627		-2,876		-1,495		
2070	-2,786		-1,451	-4,534		-2,158		-1,294	-6,761		-2,636		-2,001	-7,696		-2,886		-1,498		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014	-453		-226	-381	-453	-368		-185	-456	-368	-437		-266	-527	-437	-1,949		-1,012	-1,793	-1,949
2015	-895		-456	-785	-895	-725		-357	-893	-725	-862		-518	-1,036	-862	-2,763		-1,373	-2,434	-2,763
2017	-1,774		-893	-1,556	-1,774	-1,435		-680	-1,712	-1,435	-1,706		-994	-2,001	-1,706	-3,792		-1,754	-3,166	-3,792
2018	-2,234		-1,083	-1,908	-2,234	-1,805		-845	-2,143	-1,805	-2,148		-1,240	-2,510	-2,148	-4,113		-1,863	-3,382	-4,113
2028	-4,402		-1,899	-3,492	-4,402	-3,558		-1,703	-4,401	-3,558	-4,235		-2,465	-5,111	-4,235	-5,131		-2,183	-4,044	-5,131
2038	-4,903		-2,077	-3,848	-4,903	-3,963		-1,900	-4,937	-3,963	-4,717		-2,744	-5,724	-4,717	-5,340		-2,248	-4,179	-5,340
2063	-5,278		-2,211	-4,114	-5,278	-4,266		-2,048	-5,338	-4,266	-5,078		-2,954	-6,184	-5,078	-5,497		-2,297	-4,280	-5,497
2070	-5,324		-2,228	-4,147	-5,324	-4,303		-2,066	-5,387	-4,303	-5,122		-2,979	-6,240	-5,122	-5,516		-2,303	-4,293	-5,516
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	-722	-583		0	0	-722	-583		0	0	-2,442	-1,988		0
2015	0				0	0	-1,432	-1,140		0	0	-1,433	-1,141		0	0	-3,225	-2,612		0
2017	0				0	0	-2,698	-2,185		0	0	-2,702	-2,188		0	0	-4,091	-3,280		0
2018	0				0	0	-3,345	-2,710		0	0	-3,352	-2,717		0	0	-4,346	-3,473		0
2028	0				0	0	-6,877	-5,658		0	0	-6,892	-5,673		0	0	-5,146	-4,044		0
2038	0				0	0	-7,732	-6,361		0	0	-7,749	-6,377		0	0	-5,310	-4,160		0
2063	0				0	0	-8,374	-6,888		0	0	-8,392	-6,905		0	0	-5,432	-4,246		0
2070	0				0	0	-8,452	-6,952		0	0	-8,471	-6,970		0	0	-5,447	-4,257		0
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014			-207	0	-127	0		-207	0	-127	0		-207	0	-127	0		-626	0	-625
2015			-342	0	-259	0		-342	0	-259	0		-342	0	-259	0		-833	0	-927
2017			-669	0	-568	0		-669	0	-568	0		-669	0	-568	0		-1,114	0	-1,329
2018			-861	0	-743	0		-861	0	-743	0		-861	0	-743	0		-1,181	0	-1,457
2028			-1,233	0	-1,588	0		-1,233	0	-1,588	0		-1,233	0	-1,588	0		-1,268	0	-1,869
2038			-1,261	0	-1,785	0		-1,261	0	-1,785	0		-1,261	0	-1,785	0		-1,282	0	-1,954
2063			-1,281	0	-1,933	0		-1,281	0	-1,933	0		-1,281	0	-1,933	0		-1,292	0	-2,018
2070			-1,284	0	-1,952	0		-1,284	0	-1,952	0		-1,284	0	-1,952	0		-1,293	0	-2,026

Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

Graphics ... 00627.08 (6/23/14) AB

ICF INTERNATIONAL

Figure F-5
Alternative 2 SAM results showing bank-line weighted relative response (feet) within Region 1a

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-129		-23	-89		-119		-31	-147		-126		-47	-167		-282		-85	-296	
2015	-151		-34	-123		-137		-46	-206		-147		-70	-235		-389		-123	-434	
2017	-195		-46	-177		-177		-69	-326		-191		-99	-363		-592		-187	-688	
2018	-259		-63	-257		-236		-102	-502		-253		-140	-551		-670		-211	**-784**	
2028	-765		**-227**	**-886**		-655		-371	-1,860		-736		-520	-2,081		-939		-283	-1,094	
2038	-890		-264	-1,032		-757		-432	-2,189		-855		-608	-2,452		-994		-298	-1,157	
2063	-984		-292	-1,142		-834		-479	-2,435		-945		-674	-2,730		-1,036		-309	-1,204	
2070	-995		-295	-1,155		-844		-485	-2,466		-956		-683	-2,764		-1,041		-310	-1,210	
Fall-run Chinook																				
2013	0		0			0		0	0				0			0		0		
2014	-129		-23			-119		-31	-147				-47			-282		-85		
2015	-151		-34			-137		-46	-206				-70			-389		-123		
2017	-195		-46			-177		-69	-326				-99			-592		-187		
2018	-259		-63			-236		-102	-502				-140			-670		-211		
2028	-765		-227			-655		-370	-1,860				-520			-939		-283		
2038	-890		-264			-757		-433	-2,189				-608			-994		-298		
2063	-984		-292			-834		-478	-2,435				-674			-1,036		-309		
2070	-995		-296			-844		-484	-2,466				-682			-1,041		-310		
Late fall–run Chinook																				
2013	0		0	0		0		0	0		0		0					0		
2014	-129		-23	-89		-119		-31	-147		-126		-47					-85		
2015	-151		-34	-123		-137		-46	-206		-147		-70					-123		
2017	-195		-46	-177		-177		-69	-326		-191		-99					-187		
2018	-259		-63	-257		-236		-102	-502		-253		-140					-211		
2028	-765		-227	-886		-655		-371	-1,860		-736		-520					-283		
2038	-890		-264	-1,032		-757		-432	-2,189		-855		-608					-298		
2063	-984		-292	-1,142		-834		-479	-2,435		-945		-674					-309		
2070	-995		-295	-1,155		-844		-485	-2,466		-956		-683					-310		
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-129		-23	-89		-119		-31	-147		-126		-47	-167		-282		-85		
2015	-151		-34	-123		-137		-46	-206		-147		-70	-235		-389		-123		
2017	-195		-46	-177		-177		-69	-326		-191		-99	-363		-592		-187		
2018	-259		-63	-257		-236		-102	-502		-253		-140	-551		-670		-211		
2028	-765		-227	-886		-655		-371	-1,860		-736		-520	-2,081		-939		-283		
2038	-890		-264	-1,032		-757		-432	-2,189		-855		-608	-2,452		-994		-298		
2063	-984		-292	-1,142		-834		-479	-2,435		-945		-674	-2,730		-1,036		-309		
2070	-995		-295	-1,155		-844		-485	-2,466		-956		-683	-2,764		-1,041		-310		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
2014	-161		-38	-95	-161	-144		-49	-133	-144	-157		-69	-149	-157	-461		-137		-461
2015	-204		-56	-125	-204	-179		-72	-178	-179	-199		-101	-202	-199	-672		-198		-672
2017	-291		-77	-171	-291	-260		-110	-269	-260	-284		-147	-299	-284	-1,067		-305		-1,067
2018	-416		-107	-239	-416	-374		-165	-405	-374	-406		-211	-445	-406	-1,218		-344		-1,218
2028	-1,395		-377	-811	-1,395	-1,201		-588	-1,487	-1,201	-1,349		-775	-1,669	-1,349	-1,732		-467		-1,732
2038	-1,636		-438	-946	-1,636	-1,403		-686	-1,752	-1,403	-1,581		-907	-1,970	-1,581	-1,838		-492		-1,838
2063	-1,816		-484	-1,047	-1,816	-1,555		-759	-1,951	-1,555	-1,755		-1,005	-2,195	-1,755	-1,917		-511		-1,917
2070	-1,838		-489	-1,059	-1,838	-1,574		-768	-1,975	-1,574	-1,776		-1,017	-2,223	-1,776	-1,927		-513		-1,927
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	-188	-180		0	0	-189	-180		0	0	-293	-259		0
2015	0				0	0	-254	-245		0	0	-255	-246		0	0	-439	-375		0
2017	0				0	0	-406	-398		0	0	-407	-399		0	0	-718	-596		0
2018	0				0	0	-635	-616		0	0	-636	-617		0	0	-826	-676		0
2028	0				0	0	-2,514	-2,236		0	0	-2,521	-2,241		0	0	-1,191	-922		0
2038	0				0	0	-2,985	-2,627		0	0	-2,993	-2,633		0	0	-1,267	-972		0
2063	0				0	0	-3,339	-2,920		0	0	-3,348	-2,926		0	0	-1,323	-1,009		0
2070	0				0	0	-3,382	-2,956		0	0	-3,391	-2,962		0	0	-1,330	-1,013		0
Green Sturgeon																				
2013			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
2014			-133	0		0		-133		-123	0	-66	-133	0	-123	0	-4	-286	0	-245
2015			-180	0		0		-180		-140	0	-68	-180	0	-140	0	63	-355	0	-335
2017			-228	0		0		-228		-183	0	-73	-228	0	-183	0	198	-514	0	-503
2018			-296	0		0		-296		-244	0	-81	-296	0	-244	0	268	-573	0	-564
2028			-643	0		0		-643		-640	0	395	-643	0	-640	0	609	-706	0	-774
2038			-693	0		0		-693		-737	0	555	-693	0	-737	0	684	-731	0	-817
2063			-730	0		0		-730		-809	0	675	-730	0	-809	0	739	-749	0	-850
2070			-735	0		0		-735		-818	0	690	-735	0	-818	0	746	-752	0	-854

Legend
Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

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Figure F-6
Alternative 2 SAM results showing bank-line weighted relative response (feet) within Region 1b

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
2014	-655	0	-14	0		-645	0	-53	-546		-652	0	-59	-569		-708	0	-27	-22	
2015	-665	0	-16	0		-653	0	-72	-722		-662	0	-80	-750		-741	0	-37	-44	
2017	-670	0	-15	0		-656	0	-93	-919		-666	0	-101	-949		-806	0	-55	-85	
2018	-671	0	-14	0		-657	0	-101	-1,000		-667	0	-110	-1,030		-838	0	-64	-105	
2028	-888	0	-72	-136		-768	0	-264	-2,102		-874	0	-320	-2,210		-974	0	-98	-197	
2038	-951	0	-90	-180		-797	0	-309	-2,404		-934	0	-379	-2,535		-1,002	0	-105	-217	
2063	-998	0	-103	-213		-818	0	-343	-2,630		-979	0	-424	-2,779		-1,024	0	-110	-231	
2070	-1,004	0	-104	-217		-821	0	-347	-2,658		-984	0	-429	-2,809		-1,026	0	-111	-233	
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0				
2014	-655	0	-14			0	0	-53	-546		-652		0	-569		-708				
2015	-665	0	-16			0	0	-72	-722		-662		0	-750		-741				
2017	-670	0	-15			0	0	-93	-919		-666		0	-949		-806				
2018	-671	0	-14			0	0	-101	-1,000		-667		0	-1,030		-838				
2028	-888	0	-72			-69	0	-264	-2,102		-791		-82	-2,210		-974				
2038	-951	0	-90			-91	0	-309	-2,404		-824		-108	-2,535		-1,002				
2063	-998	0	-103			-108	0	-343	-2,630		-849		-127	-2,779		-1,024				
2070	-1,004	0	-104			-110	0	-347	-2,658		-852		-130	-2,809		-1,026				
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-655			-214		-645			-546		-652		-59							
2015	-665			-231		-653			-722		-662		-80							
2017	-670			-232		-656			-919		-666		-101							
2018	-671			-226		-657			-1,000		-667		-110							
2028	-800			-322		-768			-1,857		-791		-238							
2038	-834			-348		-797			-2,078		-824		-271							
2063	-860			-367		-818			-2,244		-849		-296							
2070	-863			-369		-821			-2,265		-852		-300							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-655		-14	-214		-645		-53	-546		-652		-59	-569		-695		-19	-257	
2015	-665		-16	-231		-653		-72	-722		-662		-80	-750		-715		-22	-266	
2017	-670		-15	-232		-656		-93	-919		-666		-101	-949		-753		-26	-289	
2018	-671		-14	-226		-657		-101	-1,000		-667		-110	-1,030		-773		-29	-303	
2028	-800		-33	-322		-768		-211	-1,857		-791		-238	-1,927		-847		-40	-358	
2038	-834		-38	-348		-797		-239	-2,078		-824		-271	-2,159		-863		-43	-369	
2063	-860		-42	-367		-818		-260	-2,244		-849		-296	-2,333		-874		-44	-377	
2070	-863		-43	-369		-821		-263	-2,265		-852		-300	-2,354		-875		-44	-378	
Steelhead																				
2013	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-590		-38	-319	-590	-571	0	-111	-595	-571	-585	0	-122	-613	-585	-695		-58	-356	-695
2015	-610		-40	-334	-610	-587	0	-147	-744	-587	-604	0	-160	-766	-604	-759		-72	-361	-759
2017	-620		-39	-334	-620	-595	0	-188	-909	-595	-613	0	-203	-934	-613	-886		-100	-374	-886
2018	-622		-37	-327	-622	-596	0	-205	-975	-596	-615	0	-220	-1,000	-615	-948		-114	-384	-948
2028	-1,043		-132	-521	-1,043	-951	0	-486	-1,863	-951	-1,021	0	-563	-1,952	-1,021	-1,211		-172	-427	-1,211
2038	-1,165		-160	-580	-1,165	-1,053	0	-564	-2,106	-1,053	-1,138	0	-658	-2,214	-1,138	-1,266		-184	-435	-1,266
2063	-1,257		-181	-625	-1,257	-1,129	0	-622	-2,288	-1,129	-1,226	0	-730	-2,411	-1,226	-1,307		-193	-441	-1,307
2070	-1,268		-184	-630	-1,268	-1,139	0	-629	-2,310	-1,139	-1,237	0	-739	-2,435	-1,237	-1,312		-195	-442	-1,312
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			-599	0	-682	0		-599	0	-682	0	0	-599	0	-682	0	-1	-469	0	-729
2015			-565	0	-691	0		-565	0	-691	0	0	-565	0	-691	0	-3	-406	0	-759
2017			-530	0	-697	0		-530	0	-697	0	0	-530	0	-697	0	-5	-297	0	-817
2018			-474	0	-699	0		-474	0	-699	0	0	-474	0	-699	0	-7	-264	0	-846
2028			-260	0	-827	0		-260	0	-891	0	-9	-260	0	-891	0	-13	-188	0	-966
2038			-216	0	-861	0		-216	0	-946	0	-12	-216	0	-946	0	-15	-173	0	-991
2063			-182	0	-886	0		-182	0	-987	0	-15	-182	0	-987	0	-16	-161	0	-1,009
2070			-178	0	-889	0		-178	0	-992	0	-15	-178	0	-992	0	-16	-159	0	-1,012

Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-7
Alternative 2 SAM results showing bank-line weighted relative response (feet) within Region 2

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0			0		0	0		0		0	0		0	0	0		
2014	-24	0	-1			-22		-4	-62		-24		-6	-70		-71	0	-15		
2015	-37	0	-2			-33		-7	-94		-35		-9	-105		-93	0	-26		
2017	-43	0	-2			-38		-8	-109		-41		-10	-122		-136	0	-47		
2018	-44	0	-2			-39		-9	-116		-43		-11	-130		-158	0	-57		
2028	-192	0	-65			-120		-114	-536		-183		-167	-598		-259	0	-97		
2038	-241	0	-86			-150		-150	-672		-230		-221	-752		-281	0	-106		
2063	-278	0	-103			-172		-177	-775		-265		-262	-867		-298	0	-112		
2070	-282	0	-105			-175		-180	-787		-269		-267	-882		-300	0	-113		
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0		0		
2014	-24	0	-1			0	0	-4	-62		-24		0	-70		-71		-3		
2015	-37	0	-2			0	0	-7	-94		-35		0	-105		-93		-7		
2017	-43	0	-2			0	0	-8	-109		-41		0	-122		-136		-13		
2018	-44	0	-2			0	0	-9	-116		-43		-1	-130		-158		-16		
2028	-145	0	-65			-37	0	-114	-536		-183		-43	-598		-259		-24		
2038	-183	0	-86			-45	0	-150	-672		-230		-52	-752		-281		-26		
2063	-211	0	-103			-52	0	-177	-775		-265		-60	-867		-298		-27		
2070	-215	0	-105			-53	0	-180	-787		-269		-61	-882		-300		-27		
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-24			-28		-22			-62		-24		-6							
2015	-37			-42		-33			-94		-35		-9							
2017	-43			-49		-38			-109		-41		-10							
2018	-44			-51		-39			-112		-43		-11							
2028	-145			-202		-120			-396		-138		-125							
2038	-183			-259		-150			-502		-174		-169							
2063	-211			-302		-172			-582		-201		-202							
2070	-215			-307		-175			-592		-204		-206							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-24		-1	-28		-22		-4	-62		-24		-6	-70		-63		-11		
2015	-37		-2	-42		-33		-7	-94		-35		-9	-105		-78		-19		
2017	-43		-2	-49		-38		-8	-109		-41		-10	-122		-106		-35		
2018	-44		-2	-51		-39		-9	-116		-43		-11	-130		-120		-41		
2028	-145		-47	-203		-120		-86	-425		-138		-128	-479		-197		-73		
2038	-183		-64	-260		-150		-116	-536		-174		-173	-605		-214		-80		
2063	-211		-77	-304		-172		-138	-619		-201		-207	-700		-227		-85		
2070	-215		-79	-309		-175		-141	-629		-204		-211	-712		-229		-86		
Steelhead																				
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-50	0	-2	-26	-50	-44	0	-8	-52	-44	-48	0	-11	-58	-48	-142		-23	-82	-142
2015	-74	0	-3	-40	-74	-66	0	-12	-78	-66	-72	0	-16	-87	-72	-184		-41	-111	-184
2017	-87	0	-4	-46	-87	-77	0	-14	-91	-77	-84	0	-18	-101	-84	-267		-75	-168	-267
2018	-89	0	-4	-48	-89	-80	0	-15	-98	-80	-86	0	-20	-107	-86	-308		-91	-195	-308
2028	-370	0	-107	-237	-370	-310	0	-176	-431	-310	-357	0	-241	-484	-357	-498		-159	-325	-498
2038	-463	0	-142	-300	-463	-387	0	-230	-539	-387	-447	0	-317	-608	-447	-540		-173	-354	-540
2063	-533	0	-169	-348	-533	-444	0	-271	-620	-444	-514	0	-374	-700	-514	-571		-184	-375	-571
2070	-541	0	-172	-354	-541	-451	0	-276	-630	-451	-522	0	-381	-711	-522	-575		-186	-377	-575
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			-3	0	-26	0		-3	0	-26	0	-3	-3	0	-26	0	-8	-8	0	-63
2015			-5	0	-40	0		-5	0	-40	0	-5	-5	0	-40	0	-10	-11	0	-73
2017			-5	0	-46	0		-5	0	-46	0	-5	-5	0	-46	0	-14	-20	0	-93
2018			-5	0	-48	0		-5	0	-48	0	-6	-5	0	-48	0	-15	-26	0	-103
2028			-53	0	-121	0		-53	0	-121	0	-18	-53	0	-121	0	-25	-75	0	-158
2038			-74	0	-148	0		-74	0	-148	0	-23	-74	0	-148	0	-27	-87	0	-170
2063			-89	0	-168	0		-89	0	-168	0	-26	-89	0	-168	0	-28	-96	0	-179
2070			-91	0	-171	0		-91	0	-171	0	-27	-91	0	-171	0	-28	-97	0	-180

Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

Graphics ... 00627.08 (6/23/14) AB

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Figure F-8
Alternative 2 SAM results showing bank-line weighted relative response (feet) within Region 3

Focus Fish Species and Water Year	Fall (September–November) Adult migration	Fall Spawning and egg incubation	Fall Fry and juvenile rearing	Fall Juvenile migration	Fall Adult residence	Winter (December–February) Adult migration	Winter Spawning and egg incubation	Winter Fry and juvenile rearing	Winter Juvenile migration	Winter Adult residence	Spring (March–May) Adult migration	Spring Spawning and egg incubation	Spring Fry and juvenile rearing	Spring Juvenile migration	Spring Adult residence	Summer (June–August) Adult migration	Summer Spawning and egg incubation	Summer Fry and juvenile rearing	Summer Juvenile migration	Summer Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	0		0	0		0		73	95		0		107	102		0		0	0	
2015	2		1	3		2		172	207		2		257	225		2		1	3	
2017	9		4	12		9		291	346		9		438	378		9		4	12	
2018	13		5	16		12		342	411		13		518	450		13		5	16	
2028	19		7	36		22		554	677		20		841	739		19		7	36	
2038	13		3	35		20		592	729		14		898	792		13		3	35	
2063	2		-2	26		14		617	757		5		936	819		2		-2	26	
2070	0		-3	24		13		620	759		3		941	821		0		-3	24	
Fall-run Chinook																				
2013	0			0				0	0		0		0	0		0		0	0	
2014	0			0				73	95		0		107	102		0		0	0	
2015	2			3				172	207		2		257	225		2		1	3	
2017	9			12				291	346		9		438	378		9		4	12	
2018	13			16				342	411		13		518	450		13		5	16	
2028	19			36				554	677		20		841	739		19		7	36	
2038	13			35				592	729		14		898	792		13		3	35	
2063	2			26				617	757		5		936	819		2		-2	26	
2070	0			24				620	759		3		941	821		0		-3	24	
Late fall–run Chinook																				
2013	0			0		0			0		0		0	0					0	
2014	0			0		0			95		0		107	102					0	
2015	2			3		2			207		2		257	225					3	
2017	9			12		9			346		9		438	378					12	
2018	13			16		12			411		13		518	450					16	
2028	19			36		22			677		20		841	739					36	
2038	13			35		20			729		14		898	792					35	
2063	2			26		14			757		5		936	819					26	
2070	0			24		13			759		3		941	821					24	
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		0	0		0		73	95		0		107	102		0		0		
2015	2		1	3		2		172	207		2		257	225		2		1		
2017	9		4	12		9		291	346		9		438	378		9		4		
2018	13		5	16		12		342	411		13		518	450		13		5		
2028	19		7	36		22		554	677		20		841	739		19		7		
2038	13		3	35		20		592	729		14		898	792		13		3		
2063	2		-2	26		14		617	757		5		936	819		2		-2		
2070	0		-3	24		13		620	759		3		941	821		0		-3		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014	0		0	0	0	0		96	85	0	0		127	91	0	0		0	0	0
2015	4		1	2	4	4		220	185	4	4		296	197	4	4		1	2	4
2017	20		6	10	20	19		369	306	19	19		501	329	19	20		6	10	20
2018	28		8	14	28	27		436	364	27	28		594	392	28	28		8	14	28
2028	44		13	29	44	47		711	598	47	44		969	641	44	44		13	29	44
2038	34		6	27	34	44		760	645	44	35		1,034	687	35	34		6	27	34
2063	15		-3	18	15	31		792	672	31	17		1,075	712	17	15		-3	18	15
2070	11		-4	16	11	28		796	674	28	14		1,080	714	14	11		-4	16	11
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	148	131		0	0	148	131		0	0	0	0		0
2015	0				0	0	310	281		0	0	310	281		0	0	3	4		0
2017	0				0	0	501	464		0	0	501	464		0	0	13	20		0
2018	0				0	0	587	546		0	0	587	546		0	0	18	28		0
2028	0				0	0	923	853		0	0	922	851		0	0	36	42		0
2038	0				0	0	992	897		0	0	990	895		0	0	39	31		0
2063	0				0	0	1,038	920		0	0	1,036	918		0	0	38	16		0
2070	0				0	0	1,042	923		0	0	1,040	921		0	0	36	14		0
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2015			4	0	2	0		4	0	2	0		4	0	2	0		4	0	2
2017			17	0	7	0		17	0	7	0		17	0	7	0		17	0	7
2018			24	0	10	0		24	0	10	0		24	0	10	0		24	0	10
2028			75	0	20	0		75	0	20	0		75	0	20	0		75	0	20
2038			71	0	22	0		71	0	22	0		71	0	22	0		71	0	22
2063			23	0	21	0		23	0	21	0		23	0	21	0		23	0	21
2070			15	0	21	0		15	0	21	0		15	0	21	0		15	0	21

Legend
Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

Graphics … 00627.08 (6/23/14) AB

ICF INTERNATIONAL

Figure F-9
Alternative 3 SAM results showing bank-line weighted relative response (feet) within Region 1a

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	0		0	0		0		0	0		0		0	0		-4		0	-4	
2015	0		0	0		0		0	0		0		0	0		-8		0	-8	
2017	0		0	0		0		0	0		0		0	0		-15		0	-16	
2018	0		0	0		0		0	0		0		0	0		-18		0	**-19**	
2028	2		**2**	**5**		2		5	12		2		6	13		-22		2	-21	
2038	7		6	13		6		11	25		6		14	26		-16		6	-12	
2063	21		18	34		17		26	58		17		33	57		4		18	15	
2070	24		21	38		19		29	65		20		37	64		9		21	22	
Fall-run Chinook																				
2013	0		0			0		0	0				0			0		0		
2014	0		0			0		0	0				0			-4		0		
2015	0		0			0		0	0				0			-8		0		
2017	0		0			0		0	0				0			-15		0		
2018	0		0			0		0	0				0			-18		0		
2028	2		2			2		5	12				6			-22		2		
2038	7		6			6		11	25				14			-16		6		
2063	21		18			17		26	58				33			4		18		
2070	24		21			19		29	65				37			9		21		
Late fall–run Chinook																				
2013	0		0	0		0		0	0		0		0					0		
2014	0		0	0		0		0	0		0		0					0		
2015	0		0	0		0		0	0		0		0					0		
2017	0		0	0		0		0	0		0		0					0		
2018	0		0	0		0		0	0		0		0					0		
2028	2		2	5		2		5	12		2		6					2		
2038	7		6	13		6		11	25		6		14					6		
2063	21		18	34		17		26	58		17		33					18		
2070	24		21	38		19		29	65		20		37					21		
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		0	0		0		0	0		0		0	0		-4		0		
2015	0		0	0		0		0	0		0		0	0		-8		0		
2017	0		0	0		0		0	0		0		0	0		-15		0		
2018	0		0	0		0		0	0		0		0	0		-18		0		
2028	2		2	5		2		5	12		2		6	13		-22		2		
2038	7		6	13		6		11	25		6		14	26		-16		6		
2063	21		18	34		17		26	58		17		33	57		4		18		
2070	24		21	38		19		29	65		20		37	64		9		21		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
2014	0		0	0	0	0		0	0	0	0		0	0	0	-7		0		-7
2015	0		0	0	0	0		0	0	0	0		0	0	0	-14		0		-14
2017	0		0	0	0	0		0	0	0	0		0	0	0	-29		0		-29
2018	0		0	0	0	0		0	0	0	0		0	0	0	-35		0		-35
2028	5		4	3	5	5		8	10	5	5		9	10	5	-41		4		-41
2038	14		11	9	14	13		18	19	13	13		21	19	13	-30		11		-30
2063	41		29	25	41	35		40	40	35	35		47	39	35	7		29		7
2070	47		33	28	47	40		44	44	40	40		52	43	40	17		33		17
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	0	0		0	0	0	0		0	0	-9	0		0
2015	0				0	0	0	0		0	0	0	0		0	0	-18	0		0
2017	0				0	0	0	0		0	0	0	0		0	0	-35	0		0
2018	0				0	0	0	0		0	0	0	0		0	0	-42	0		0
2028	0				0	0	16	27		0	0	16	27		0	0	-54	10		0
2038	0				0	0	24	54		0	0	24	54		0	0	-49	26		0
2063	0				0	0	39	103		0	0	39	103		0	0	-26	58		0
2070	0				0	0	42	114		0	0	43	115		0	0	-20	66		0
Green Sturgeon																				
2013			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
2014			0	0		0		0		0	0	0	0	0	0	0	0	-9	0	-6
2015			0	0		0		0		0	0	0	0	0	0	0	0	-17	0	-12
2017			0	0		0		0		0	0	0	0	0	0	0	0	-34	0	-24
2018			0	0		0		0		0	0	0	0	0	0	0	0	-41	0	-29
2028			9	0		0		9		1	0	0	9	0	1	0	0	-46	0	-37
2038			22	0		0		22		3	0	0	22	0	3	0	0	-31	0	-34
2063			52	0		0		52		7	0	0	52	0	7	0	0	13	0	-20
2070			60	0		0		60		8	0	0	60	0	8	0	0	25	0	-16

- Not Analyzed
- >50% Greater
- >25%-50% Greater
- >10%-25% Greater
- 5%-10% Greater
- <5% Different
- 5%-10% Less
- >10%-25% Less
- >25%-50% Less
- >50% Less

ICF INTERNATIONAL

Figure F-10
Alternative 3 SAM results showing bank-line weighted relative response (feet) within Region 1b

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
2014	-635	0	-11	0		-629	0	-23	-307		-633	0	-25	-320		-635	0	-11	0	
2015	-635	0	-11	0		-629	0	-19	-294		-633	0	-21	-308		-635	0	-11	0	
2017	-635	0	-11	0		-629	0	-16	-285		-633	0	-18	-299		-635	0	-10	0	
2018	-635	0	-10	0		-629	0	-16	-282		-633	0	-17	-295		-635	0	-10	0	
2028	-515	0	12	0		-530	0	33	-30		-526	0	45	-14		-515	0	12	0	
2038	-439	0	13	0		-457	0	32	-46		-453	0	44	-31		-439	0	13	0	
2063	-436	0	-2	0		-435	0	0	-322		-440	0	2	-336		-436	0	-2	0	
2070	-442	0	-2	0		-439	0	-4	-358		-445	0	-3	-375		-442	0	-2	0	
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0				
2014	-635	0	-11			0	0	-23	-307		-633		0	-320		-635				
2015	-635	0	-11			0	0	-19	-294		-633		0	-308		-635				
2017	-635	0	-11			0	0	-16	-285		-633		0	-299		-635				
2018	-635	0	-10			0	0	-16	-282		-633		0	-295		-635				
2028	-515	0	12			0	0	33	-30		-526		0	-14		-515				
2038	-439	0	13			0	0	32	-46		-453		0	-31		-439				
2063	-436	0	-2			0	0	0	-322		-440		0	-336		-436				
2070	-442	0	-2			0	0	-4	-358		-445		0	-375		-442				
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-635			-180		-629			-307		-633		-25							
2015	-635			-179		-629			-294		-633		-21							
2017	-635			-176		-629			-285		-633		-18							
2018	-635			-175		-629			-282		-633		-17							
2028	-515			-1		-530			-30		-526		45							
2038	-439			38		-457			-46		-453		44							
2063	-436			-50		-435			-322		-440		2							
2070	-442			-57		-439			-358		-445		-3							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-635		-11	-180		-629		-23	-307		-633		-25	-320		-635		-11	-179	
2015	-635		-11	-179		-629		-19	-294		-633		-21	-308		-635		-11	-178	
2017	-635		-11	-176		-629		-16	-285		-633		-18	-299		-635		-10	-174	
2018	-635		-10	-175		-629		-16	-282		-633		-17	-295		-635		-10	-172	
2028	-515		12	-1		-530		33	-30		-526		45	-14		-515		12	1	
2038	-439		13	38		-457		32	-46		-453		44	-31		-439		13	39	
2063	-436		-2	-50		-435		0	-322		-440		2	-336		-436		-2	-50	
2070	-442		-2	-57		-439		-4	-358		-445		-3	-375		-442		-2	-57	
Steelhead																				
2013	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-550		-33	-284	-550	-539	0	-55	-388	-539	-547	0	-59	-399	-547	-550		-33	-284	-550
2015	-550		-33	-284	-550	-539	0	-48	-375	-539	-547	0	-52	-386	-547	-550		-32	-282	-550
2017	-550		-32	-282	-550	-539	0	-43	-367	-539	-547	0	-47	-378	-547	-550		-31	-279	-550
2018	-550		-32	-280	-550	-539	0	-42	-364	-539	-547	0	-45	-375	-547	-550		-31	-277	-550
2028	-315		9	-114	-315	-340	0	35	-154	-340	-333	0	49	-144	-333	-315		9	-112	-315
2038	-162		11	-70	-162	-194	0	30	-157	-194	-185	0	43	-147	-185	-162		11	-69	-162
2063	-158		-19	-145	-158	-156	0	-31	-370	-156	-165	0	-32	-383	-165	-158		-19	-145	-158
2070	-172		-21	-152	-172	-166	0	-38	-398	-166	-177	0	-41	-414	-177	-172		-21	-151	-172
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			-667	0	-665	0		-667	0	-665	0	0	-667	0	-665	0	0	-666	0	-673
2015			-683	0	-665	0		-683	0	-665	0	0	-683	0	-665	0	0	-680	0	-680
2017			-727	0	-665	0		-727	0	-665	0	0	-727	0	-665	0	0	-721	0	-696
2018			-747	0	-665	0		-747	0	-665	0	0	-747	0	-665	0	0	-741	0	-703
2028			-700	0	-611	0		-707	0	-558	0	0	-707	0	-558	0	0	-696	0	-640
2038			-613	0	-542	0		-622	0	-468	0	0	-622	0	-468	0	0	-610	0	-559
2063			-474	0	-506	0		-485	0	-416	0	0	-485	0	-416	0	0	-473	0	-514
2070			-441	0	-507	0		-453	0	-415	0	0	-453	0	-415	0	0	-440	0	-515

- Not Analyzed
- >50% Greater
- >25%-50% Greater
- >10%-25% Greater
- 5%-10% Greater
- <5% Different
- 5%-10% Less
- >10%-25% Less
- >25%-50% Less
- >50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-11
Alternative 3 SAM results showing bank-line weighted relative response (feet) within Region 2

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0			0		0	0		0		0	0		0	0	0		
2014	-3	0	-1			-1		2	3		-3		0	-4		-6	0	-2		
2015	-6	0	-2			-2		2	3		-5		0	-8		-7	0	-2		
2017	-9	0	-2			-5		2	-1		-8		0	-14		-10	0	-3		
2018	-11	0	-3			-6		2	-4		-9		-1	-17		-12	0	-3		
2028	-45	0	-22			-28		-31	-126		-40		-63	-165		-45	0	-22		
2038	-70	0	-39			-43		-57	-218		-63		-107	-274		-70	0	-39		
2063	-78	0	-48			-51		-70	-238		-71		-128	-302		-78	0	-49		
2070	-75	0	-49			-51		-69	-220		-68		-126	-283		-75	0	-49		
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0		0		
2014	-3	0	-1			0	0	2	3		-3		0	-4		-6		0		
2015	-6	0	-2			0	0	2	3		-5		0	-8		-7		0		
2017	-9	0	-2			0	0	2	-1		-8		0	-14		-10		0		
2018	-11	0	-3			0	0	2	-4		-9		0	-17		-12		0		
2028	-45	0	-22			0	0	-31	-126		-40		0	-165		-45		0		
2038	-70	0	-39			0	0	-57	-218		-63		0	-274		-70		0		
2063	-78	0	-48			0	0	-70	-238		-71		0	-302		-78		0		
2070	-75	0	-49			0	0	-69	-220		-68		0	-283		-75		0		
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-3			-10		-1			3		-3		0							
2015	-6			-15		-2			3		-5		0							
2017	-9			-21		-5			-1		-8		0							
2018	-11			-24		-6			-4		-9		-1							
2028	-45			-78		-28			-126		-40		-63							
2038	-70			-118		-43			-218		-63		-107							
2063	-78			-135		-51			-238		-71		-128							
2070	-75			-132		-51			-220		-68		-126							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-3		-1	-10		-1		2	3		-3		0	-4		-6		-2		
2015	-6		-2	-15		-2		2	3		-5		0	-8		-7		-2		
2017	-9		-2	-21		-5		2	-1		-8		0	-14		-10		-3		
2018	-11		-3	-24		-6		2	-4		-9		-1	-17		-12		-3		
2028	-45		-22	-78		-28		-31	-126		-40		-63	-165		-45		-22		
2038	-70		-39	-118		-43		-57	-218		-63		-107	-274		-70		-39		
2063	-78		-48	-135		-51		-70	-238		-71		-128	-302		-78		-49		
2070	-75		-49	-132		-51		-69	-220		-68		-126	-283		-75		-49		
Steelhead																				
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-7	0	-3	-8	-7	-2	0	3	4	-2	-6	0	0	-1	-6	-13		-5	-15	-13
2015	-13	0	-4	-14	-13	-5	0	4	5	-5	-10	0	0	-3	-10	-16		-5	-17	-16
2017	-20	0	-5	-18	-20	-11	0	4	2	-11	-17	0	0	-7	-17	-22		-6	-20	-22
2018	-23	0	-5	-20	-23	-14	0	4	0	-14	-20	0	-1	-9	-20	-25		-6	-22	-25
2028	-89	0	-35	-71	-89	-58	0	-39	-84	-58	-81	0	-76	-115	-81	-89		-35	-71	-89
2038	-135	0	-60	-108	-135	-88	0	-75	-152	-88	-124	0	-133	-197	-124	-136		-60	-108	-136
2063	-153	0	-76	-119	-153	-104	0	-93	-163	-104	-141	0	-160	-213	-141	-154		-76	-119	-154
2070	-149	0	-76	-114	-149	-103	0	-92	-149	-103	-137	0	-156	-197	-137	-149		-77	-115	-149
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			7	0	0	0		7	0	0	0	0	7	0	0	0	0	7	0	0
2015			13	0	0	0		13	0	0	0	0	13	0	0	0	0	12	0	0
2017			19	0	-2	0		19	0	-2	0	0	19	0	-2	0	0	18	0	-2
2018			22	0	-2	0		22	0	-2	0	0	22	0	-2	0	0	20	0	-2
2028			19	0	-20	0		19	0	-20	0	0	19	0	-20	0	0	18	0	-20
2038			16	0	-33	0		16	0	-33	0	0	16	0	-33	0	0	15	0	-33
2063			3	0	-43	0		3	0	-43	0	0	3	0	-43	0	0	3	0	-43
2070			-1	0	-44	0		-1	0	-44	0	0	-1	0	-44	0	0	-1	0	-44

Not Analyzed
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>50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-12
Alternative 3 SAM results showing bank-line weighted relative response (feet) within Region 3

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	0		0	0		0		73	95		0		107	102		-8		-2	-15	
2015	2		1	3		2		172	207		2		257	225		-14		-3	-27	
2017	9		4	12		9		291	346		9		438	378		-23		-5	-48	
2018	13		5	16		12		342	411		13		518	450		-27		-6	-59	
2028	-32		15	117		-10		544	514		-16		840	586		-57		10	88	
2038	-27		35	204		-11		592	565		-11		919	642		-42		32	187	
2063	-11		56	275		-7		635	616		-1		981	681		-19		55	267	
2070	-10		59	283		-7		640	621		-1		989	684		-17		58	275	
Fall-run Chinook																				
2013	0			0				0	0		0		0	0		0		0	0	
2014	0			0				73	95		0		107	102		-8		-2	-15	
2015	2			3				172	207		2		257	225		-14		-3	-27	
2017	9			12				291	346		9		438	378		-23		-5	-48	
2018	13			16				342	411		13		518	450		-27		-6	-59	
2028	-32			117				544	514		-16		840	586		-57		10	88	
2038	-27			204				592	565		-11		919	642		-42		32	187	
2063	-11			275				635	616		-1		981	681		-19		55	267	
2070	-10			283				640	621		-1		989	684		-17		58	275	
Late fall–run Chinook																				
2013	0			0		0			0		0		0	0					0	
2014	0			0		0			95		0		107	102					-15	
2015	2			3		2			207		2		257	225					-27	
2017	9			12		9			346		9		438	378					-48	
2018	13			16		12			411		13		518	450					-59	
2028	-32			117		-10			514		-16		840	586					88	
2038	-27			204		-11			565		-11		919	642					187	
2063	-11			275		-7			616		-1		981	681					267	
2070	-10			283		-7			621		-1		989	684					275	
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		0	0		0		73	95		0		107	102		-8		-2		
2015	2		1	3		2		172	207		2		257	225		-14		-3		
2017	9		4	12		9		291	346		9		438	378		-23		-5		
2018	13		5	16		12		342	411		13		518	450		-27		-6		
2028	-32		15	117		-10		544	514		-16		840	586		-57		10		
2038	-27		35	204		-11		592	565		-11		919	642		-42		32		
2063	-11		56	275		-7		635	616		-1		981	681		-19		55		
2070	-10		59	283		-7		640	621		-1		989	684		-17		58		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014	0		0	0	0	0		96	85	0	0		127	91	0	-13		-4	-18	-13
2015	4		1	2	4	4		220	185	4	4		296	197	4	-23		-7	-34	-23
2017	20		6	10	20	19		369	306	19	19		501	329	19	-34		-11	-63	-34
2018	28		8	14	28	27		436	364	27	28		594	392	28	-39		-13	-77	-39
2028	-42		25	57	-42	-10		689	446	-10	-17		958	494	-17	-84		16	18	-84
2038	-38		58	121	-38	-11		753	485	-11	-13		1,053	539	-13	-62		52	98	-62
2063	-24		92	177	-24	-6		810	527	-6	-7		1,129	574	-7	-37		89	165	-37
2070	-24		96	183	-24	-6		818	532	-6	-7		1,139	578	-7	-35		94	173	-35
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	148	131		0	0	148	131		0	0	-54	-42		0
2015	0				0	0	310	281		0	0	310	281		0	0	-104	-79		0
2017	0				0	0	501	464		0	0	501	464		0	0	-199	-146		0
2018	0				0	0	587	546		0	0	587	546		0	0	-245	-178		0
2028	0				0	0	475	488		0	0	474	487		0	0	-201	-125		0
2038	0				0	0	414	426		0	0	412	425		0	0	-157	-99		0
2063	0				0	0	362	371		0	0	360	369		0	0	-127	-86		0
2070	0				0	0	355	364		0	0	353	362		0	0	-124	-85		0
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014			0	0	0	0		0	0	0	0		0	0	0	0		86	0	-6
2015			4	0	2	0		4	0	2	0		4	0	2	0		175	0	-10
2017			17	0	7	0		17	0	7	0		17	0	7	0		357	0	-17
2018			24	0	10	0		24	0	10	0		24	0	10	0		447	0	-20
2028			652	0	-21	0		540	0	-261	0		540	0	-261	0		920	0	-38
2038			847	0	-32	0		696	0	-357	0		696	0	-357	0		1,008	0	-42
2063			949	0	-42	0		768	0	-431	0		768	0	-431	0		1,029	0	-47
2070			959	0	-44	0		775	0	-440	0		775	0	-440	0		1,030	0	-48

Legend
Not Analyzed
>50% Greater
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>10%-25% Greater
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<5% Different
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>50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-13
Alternative 4 SAM results showing bank-line weighted relative response (feet) within Region 1a

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-10		-12	-20		-3		-3	-10		-8		-13	-17		-93		-49	-126	
2015	-14		-18	-31		-5		-4	-13		-11		-18	-22		-167		-72	-210	
2017	-49		-27	-72		-36		-14	-61		-42		-26	-70		-303		-113	-364	
2018	-110		-43	-147		-91		-37	-166		-99		-52	-181		-349		-126	-413	
2028	-352		-81	-237		-246		-42	-269		-250		-56	-291		-435		-107	-313	
2038	-289		-18	-85		-228		33	-94		-190		68	-111		-339		-34	-130	
2063	-193		49	61		-185		135	114		-105		200	55		-218		41	38	
2070	-180		58	78		-180		148	140		-94		216	75		-202		51	59	
Fall-run Chinook																				
2013	0		0			0		0	0				0			0		0		
2014	-10		-12			-3		-3	-10				-13			-93		-49		
2015	-14		-18			-5		-4	-13				-18			-167		-72		
2017	-49		-27			-36		-14	-61				-26			-303		-113		
2018	-110		-43			-91		-37	-166				-52			-349		-126		
2028	-352		-81			-246		-42	-269				-56			-435		-107		
2038	-289		-18			-228		33	-94				68			-339		-34		
2063	-193		49			-185		135	114				200			-218		41		
2070	-180		58			-180		148	140				216			-202		51		
Late fall–run Chinook																				
2013	0		0	0		0		0	0		0		0					0		
2014	-10		-12	-20		-3		-3	-10		-8		-13					-49		
2015	-14		-18	-31		-5		-4	-13		-11		-18					-72		
2017	-49		-27	-72		-36		-14	-61		-42		-26					-113		
2018	-110		-43	-147		-91		-37	-166		-99		-52					-126		
2028	-352		-81	-237		-246		-42	-269		-250		-56					-107		
2038	-289		-18	-85		-228		33	-94		-190		68					-34		
2063	-193		49	61		-185		135	114		-105		200					41		
2070	-180		58	78		-180		148	140		-94		216					51		
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-10		-12	-20		-3		-3	-10		-8		-13	-17		-93		-49		
2015	-14		-18	-31		-5		-4	-13		-11		-18	-22		-167		-72		
2017	-49		-27	-72		-36		-14	-61		-42		-26	-70		-303		-113		
2018	-110		-43	-147		-91		-37	-166		-99		-52	-181		-349		-126		
2028	-352		-81	-237		-246		-42	-269		-250		-56	-291		-435		-107		
2038	-289		-18	-85		-228		33	-94		-190		68	-111		-339		-34		
2063	-193		49	61		-185		135	114		-105		200	55		-218		41		
2070	-180		58	78		-180		148	140		-94		216	75		-202		51		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
2014	-17		-18	-20	-17	-7		-4	-2	-7	-14		-15	-9	-14	-177		-74		-177
2015	-25		-27	-30	-25	-10		-5	-2	-10	-20		-20	-11	-20	-321		-111		-321
2017	-94		-43	-65	-94	-72		-21	-33	-72	-82		-35	-42	-82	-583		-177		-583
2018	-213		-71	-129	-213	-180		-57	-107	-180	-194		-75	-121	-194	-669		-200		-669
2028	-686		-128	-238	-686	-479		-59	-175	-479	-494		-72	-190	-494	-843		-168		-843
2038	-608		-24	-89	-608	-446		49	-39	-446	-409		98	-28	-409	-702		-48		-702
2063	-490		87	57	-490	-370		191	128	-370	-297		277	128	-297	-537		75		-537
2070	-475		101	76	-475	-360		209	149	-360	-282		299	147	-282	-516		91		-516
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	13	13		0	0	13	13		0	0	-117	-95		0
2015	0				0	0	20	19		0	0	20	19		0	0	-219	-176		0
2017	0				0	0	-41	-42		0	0	-41	-42		0	0	-413	-325		0
2018	0				0	0	-174	-165		0	0	-174	-165		0	0	-478	-370		0
2028	0				0	0	-580	-391		0	0	-581	-391		0	0	-460	-296		0
2038	0				0	0	-642	-405		0	0	-643	-405		0	0	-436	-265		0
2063	0				0	0	-688	-415		0	0	-690	-415		0	0	-417	-241		0
2070	0				0	0	-694	-416		0	0	-696	-416		0	0	-415	-238		0
Green Sturgeon																				
2013			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
2014			-12	0		0		-48		-64	0	0	-48	0	-64	0	74	-13	0	-62
2015			-18	0		0		-72		-96	0	0	-72	0	-96	0	149	-11	0	-126
2017			-46	0		0		-109		-148	0	-4	-109	0	-148	0	299	-25	0	-242
2018			-110	0		0		-175		-211	0	-12	-175	0	-211	0	377	-12	0	-278
2028			43	0		0		-93		-753	0	515	-93	0	-753	0	747	176	0	-372
2038			141	0		0		-22		-896	0	688	-22	0	-896	0	827	221	0	-390
2063			214	0		0		30		-1,004	0	818	30	0	-1,004	0	887	255	0	-404
2070			223	0		0		37		-1,017	0	834	37	0	-1,017	0	894	259	0	-406

Not Analyzed
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Graphics … 00627.08 (6/23/14) AB

ICF INTERNATIONAL

Figure F-14
Alternative 4 SAM results showing bank-line weighted relative response (feet) within Region 1b

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
2014	-653	0	-10	0		-581	0	14	-204		-587	0	11	-220		-689	0	-18	-19	
2015	-662	0	-10	0		-557	0	37	-140		-563	0	36	-156		-707	0	-22	-38	
2017	-666	0	-8	0		-542	0	54	-91		-547	0	57	-101		-743	0	-31	-74	
2018	-667	0	-7	0		-515	0	75	-18		-520	0	81	-23		-761	0	-36	-91	
2028	-673	0	8	-118		-182	0	405	1,003		-129	0	518	1,107		-719	0	-7	-171	
2038	-446	0	108	-142		-1	0	666	1,646		176	0	965	1,862		-474	0	99	-174	
2063	-177	0	210	-155		190	0	981	2,301		493	0	1,411	2,515		-190	0	205	-172	
2070	-143	0	223	-157		214	0	1,021	2,383		533	0	1,466	2,595		-155	0	219	-171	
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0				
2014	-653	0	-10			0	0	14	-204		-587		0	-220		-689				
2015	-662	0	-10			0	0	37	-140		-563		0	-156		-707				
2017	-666	0	-8			0	0	54	-91		-547		0	-101		-743				
2018	-667	0	-7			0	0	75	-18		-520		0	-23		-761				
2028	-673	0	8			-2	0	405	1,003		-125		8	1,107		-719				
2038	-446	0	108			4	0	666	1,646		170		34	1,862		-474				
2063	-177	0	210			14	0	981	2,301		473		62	2,515		-190				
2070	-143	0	223			15	0	1,021	2,383		511		65	2,595		-155				
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-653			-181		-581			-204		-587		11							
2015	-662			-181		-557			-140		-563		36							
2017	-666			-172		-542			-91		-547		57							
2018	-667			-166		-515			-18		-520		81							
2028	-596			-13		-182			999		-125		510							
2038	-360			300		-1			1,612		170		931							
2063	-92			583		190			2,228		473		1,349							
2070	-59			618		214			2,305		511		1,401							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-653		-10	-181		-581		14	-204		-587		11	-220		-677		-11	-210	
2015	-662		-10	-181		-557		37	-140		-563		36	-156		-684		-8	-189	
2017	-666		-8	-172		-542		54	-91		-547		57	-101		-696		-6	-175	
2018	-667		-7	-166		-515		75	-18		-520		81	-23		-703		-5	-174	
2028	-596		43	-13		-182		396	999		-125		510	1,102		-608		45	-11	
2038	-360		149	300		-1		640	1,612		170		931	1,833		-367		150	301	
2063	-92		253	583		190		929	2,228		473		1,349	2,464		-96		253	584	
2070	-59		265	618		214		966	2,305		511		1,401	2,541		-62		266	619	
Steelhead																				
2013	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-586		-30	-290	-586	-445	0	0	-303	-445	-456	0	-5	-317	-456	-656		-43	-319	-656
2015	-603		-29	-292	-603	-396	0	37	-245	-396	-408	0	33	-260	-408	-691		-46	-298	-691
2017	-612		-26	-284	-612	-367	0	65	-199	-367	-376	0	66	-209	-376	-759		-60	-285	-759
2018	-614		-23	-277	-614	-314	0	97	-139	-314	-322	0	101	-146	-322	-794		-68	-284	-794
2028	-663		16	-217	-663	344	0	592	670	344	428	0	731	765	428	-751		-7	-111	-751
2038	-324		205	107	-324	710	0	957	1,163	710	961	0	1,322	1,393	961	-377		191	230	-377
2063	46		397	417	46	1,094	0	1,381	1,677	1,094	1,475	0	1,905	1,952	1,475	20		390	546	20
2070	92		421	455	92	1,142	0	1,435	1,742	1,142	1,539	0	1,977	2,021	1,539	69		415	585	69
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			-610	0	-681	0		-507	0	-746	0	0	-507	0	-746	0	0	-472	0	-712
2015			-582	0	-689	0		-428	0	-786	0	0	-428	0	-786	0	0	-390	0	-727
2017			-549	0	-695	0		-370	0	-808	0	0	-370	0	-808	0	-1	-242	0	-757
2018			-498	0	-696	0		-276	0	-837	0	0	-276	0	-837	0	-1	-188	0	-772
2028			-140	0	-730	0		600	0	-1,489	0	-1	600	0	-1,489	0	-2	-9	0	-829
2038			-50	0	-736	0		830	0	-1,672	0	-2	830	0	-1,672	0	-2	29	0	-841
2063			18	0	-740	0		1,002	0	-1,810	0	-2	1,002	0	-1,810	0	-3	57	0	-850
2070			26	0	-741	0		1,023	0	-1,826	0	-2	1,023	0	-1,826	0	-3	61	0	-851

- Not Analyzed
- >50% Greater
- >25%-50% Greater
- >10%-25% Greater
- 5%-10% Greater
- <5% Different
- 5%-10% Less
- >10%-25% Less
- >25%-50% Less
- >50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-15
Alternative 4 SAM results showing bank-line weighted relative response (feet) within Region 2

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0			0		0	0		0		0	0		0	0	0		
2014	0	0	4			2		18	22		1		17	17		-5	0	3		
2015	0	0	6			4		27	34		2		27	28		-10	0	-1		
2017	0	0	7			4		32	43		3		34	38		-20	0	-11		
2018	0	0	7			8		35	51		7		38	48		-25	0	-16		
2028	-17	0	-13			59		71	164		28		84	178		-30	0	-28		
2038	17	0	6			86		122	263		63		164	280		9	0	-3		
2063	62	0	30			117		190	373		103		247	369		58	0	26		
2070	67	0	33			120		199	387		108		257	379		64	0	29		
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0		0		
2014	0	0	4			0	0	18	22		1		0	17		-5		-2		
2015	0	0	6			0	0	27	34		2		0	28		-10		-5		
2017	0	0	7			0	0	32	43		3		0	38		-20		-10		
2018	0	0	7			0	0	35	51		7		2	48		-25		-12		
2028	21	0	-13			-32	0	71	164		28		-5	178		-30		-19		
2038	60	0	6			-38	0	122	263		63		7	280		9		-19		
2063	107	0	30			-42	0	190	373		103		19	369		58		-19		
2070	113	0	33			-42	0	199	387		108		21	379		64		-19		
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	0			1		2			22		1		17							
2015	0			2		4			34		2		27							
2017	0			2		4			43		3		34							
2018	0			2		5			45		4		36							
2028	19			9		34			164		35		89							
2038	52			44		53			250		65		157							
2063	92			81		76			342		99		228							
2070	97			85		79			354		103		236							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		4	1		2		18	22		1		17	17		2		6		
2015	0		6	2		4		27	34		2		27	28		3		4		
2017	0		7	2		4		32	43		3		34	38		5		-1		
2018	0		7	2		8		35	51		7		38	48		6		-4		
2028	21		2	9		59		91	224		62		109	236		21		-8		
2038	60		22	50		86		145	334		102		194	350		60		16		
2063	107		47	93		117		214	449		146		280	447		107		44		
2070	113		51	99		120		223	463		152		291	459		113		48		
Steelhead																				
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-1	0	8	-2	-1	4	0	26	17	4	1	0	25	13	1	-9		9	-12	-9
2015	-1	0	12	-2	-1	6	0	40	26	6	3	0	39	21	3	-18		2	-20	-18
2017	-1	0	14	-3	-1	8	0	47	31	8	5	0	48	27	5	-34		-12	-37	-34
2018	-1	0	14	-3	-1	14	0	52	38	14	12	0	54	35	12	-42		-19	-46	-42
2028	-27	0	-14	-39	-27	55	0	106	126	55	58	0	120	136	58	-46		-34	-63	-46
2038	27	0	18	-3	27	98	0	170	199	98	118	0	217	218	118	16		5	-18	16
2063	93	0	57	39	93	150	0	254	282	150	181	0	316	292	181	87		51	31	87
2070	102	0	62	44	102	157	0	265	292	157	189	0	329	301	189	96		56	37	96
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			62	0	0	0		33	0	-51	0	0	33	0	-51	0	0	154	0	6
2015			92	0	0	0		50	0	-77	0	0	50	0	-77	0	0	184	0	11
2017			108	0	0	0		58	0	-90	0	0	58	0	-90	0	0	246	0	22
2018			111	0	0	0		59	0	-93	0	0	59	0	-93	0	0	277	0	27
2028			328	0	37	0		159	0	-268	0	0	159	0	-268	0	0	426	0	51
2038			399	0	48	0		190	0	-331	0	0	190	0	-331	0	0	458	0	56
2063			452	0	56	0		213	0	-378	0	0	213	0	-378	0	0	482	0	60
2070			459	0	57	0		216	0	-384	0	0	216	0	-384	0	0	485	0	61

- Not Analyzed
- >50% Greater
- >25%-50% Greater
- >10%-25% Greater
- 5%-10% Greater
- <5% Different
- 5%-10% Less
- >10%-25% Less
- >25%-50% Less
- >50% Less

Graphics ... 00627.08 (6/23/14) AB

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Figure F-16
Alternative 4 SAM results showing bank-line weighted relative response (feet) within Region 3

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	0		0	0		0		73	95		0		107	102		-8		-1	-4	
2015	2		1	3		2		172	207		2		257	225		-14		0	-5	
2017	9		4	12		9		291	346		9		438	378		-23		1	-5	
2018	13		5	16		12		342	411		13		518	450		-27		1	-4	
2028	-32		25	187		-10		565	627		-16		861	699		-57		23	180	
2038	-27		47	290		-11		619	705		-11		945	782		-42		46	286	
2063	-11		69	373		-7		665	777		-1		1,011	842		-19		69	371	
2070	-10		72	382		-7		671	785		-1		1,019	848		-17		72	380	
Fall-run Chinook																				
2013	0			0				0	0		0		0	0		0		0	0	
2014	0			0				73	95		0		107	102		-8		-1	-4	
2015	2			3				172	207		2		257	225		-14		0	-5	
2017	9			12				291	346		9		438	378		-23		1	-5	
2018	13			16				342	411		13		518	450		-27		1	-4	
2028	-32			187				565	627		-16		861	699		-57		23	180	
2038	-27			290				619	705		-11		945	782		-42		46	286	
2063	-11			373				665	777		-1		1,011	842		-19		69	371	
2070	-10			382				671	785		-1		1,019	848		-17		72	380	
Late fall–run Chinook																				
2013	0			0		0			0		0		0	0					0	
2014	0			0		0			95		0		107	102					-4	
2015	2			3		2			207		2		257	225					-5	
2017	9			12		9			346		9		438	378					-5	
2018	13			16		12			411		13		518	450					-4	
2028	-32			187		-10			627		-16		861	699					180	
2038	-27			290		-11			705		-11		945	782					286	
2063	-11			373		-7			777		-1		1,011	842					371	
2070	-10			382		-7			785		-1		1,019	848					380	
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		0	0		0		73	95		0		107	102		-8		-1		
2015	2		1	3		2		172	207		2		257	225		-14		0		
2017	9		4	12		9		291	346		9		438	378		-23		1		
2018	13		5	16		12		342	411		13		518	450		-27		1		
2028	-32		25	187		-10		565	627		-16		861	699		-57		23		
2038	-27		47	290		-11		619	705		-11		945	782		-42		46		
2063	-11		69	373		-7		665	777		-1		1,011	842		-19		69		
2070	-10		72	382		-7		671	785		-1		1,019	848		-17		72		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014	0		0	0	0	0		96	85	0	0		127	91	0	-13		-1	-7	-13
2015	4		1	2	4	4		220	185	4	4		296	197	4	-23		0	-11	-23
2017	20		6	10	20	19		369	306	19	19		501	329	19	-34		2	-18	-34
2018	28		8	14	28	27		436	364	27	28		594	392	28	-39		3	-21	-39
2028	-42		45	128	-42	-10		733	558	-10	-17		1,001	606	-17	-84		42	111	-84
2038	-38		82	208	-38	-11		807	624	-11	-13		1,107	678	-13	-62		81	197	-62
2063	-24		120	276	-24	-6		872	686	-6	-7		1,191	734	-7	-37		119	270	-37
2070	-24		124	283	-24	-6		880	693	-6	-7		1,201	739	-7	-35		124	279	-35
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	148	131		0	0	148	131		0	0	-31	-19		0
2015	0				0	0	310	281		0	0	310	281		0	0	-58	-33		0
2017	0				0	0	501	464		0	0	501	464		0	0	-108	-54		0
2018	0				0	0	587	546		0	0	587	546		0	0	-132	-64		0
2028	0				0	0	686	699		0	0	684	697		0	0	-13	63		0
2038	0				0	0	676	689		0	0	675	687		0	0	46	103		0
2063	0				0	0	664	672		0	0	662	670		0	0	86	127		0
2070	0				0	0	661	670		0	0	659	668		0	0	90	130		0
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014			0	0	0	0		0	0	0	0		0	0	0	0		83	0	-9
2015			4	0	2	0		4	0	2	0		4	0	2	0		170	0	-17
2017			17	0	7	0		17	0	7	0		17	0	7	0		348	0	-29
2018			24	0	10	0		24	0	10	0		24	0	10	0		437	0	-35
2028			636	0	-41	0		525	0	-281	0		525	0	-281	0		895	0	-64
2038			824	0	-56	0		673	0	-381	0		673	0	-381	0		979	0	-71
2063			920	0	-70	0		740	0	-459	0		740	0	-459	0		998	0	-77
2070			930	0	-72	0		746	0	-469	0		746	0	-469	0		999	0	-79

Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
>25%-50% Less
>50% Less

Graphics ... 00627.08 (6/23/14) AB

ICF INTERNATIONAL

Figure F-17
Alternative 5 SAM results showing bank-line weighted relative response (feet) within Region 1a

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-10		-12	-20		-3		-3	-10		-8		-13	-17		-23		-24	-35	
2015	-14		-18	-31		-5		-4	-13		-11		-18	-22		-26		-24	-29	
2017	-17		-21	-36		-5		-3	-10		-10		-14	-16		-33		-25	-18	
2018	-15		-21	-35		-2		1	-1		-7		-7	-5		-38		-26	**-14**	
2028	-21		**21**	**186**		39		103	307		38		127	317		-30		22	209	
2038	49		88	356		79		187	515		104		256	526		43		89	370	
2063	137		157	510		130		288	729		182		387	709		134		157	517	
2070	148		166	529		136		301	756		192		403	732		146		166	535	
Fall-run Chinook																				
2013	0		0			0		0	0				0			0		0		
2014	-10		-12			-3		-3	-10				-13			-23		-24		
2015	-14		-18			-5		-4	-13				-18			-26		-24		
2017	-17		-21			-5		-3	-10				-14			-33		-25		
2018	-15		-21			-2		1	-1				-7			-38		-26		
2028	-21		21			39		103	307				127			-30		22		
2038	49		88			79		187	515				256			43		89		
2063	137		157			130		288	729				387			134		157		
2070	148		166			136		301	756				403			146		166		
Late fall–run Chinook																				
2013	0		0	0		0		0	0		0		0					0		
2014	-10		-12	-20		-3		-3	-10		-8		-13					-24		
2015	-14		-18	-31		-5		-4	-13		-11		-18					-24		
2017	-17		-21	-36		-5		-3	-10		-10		-14					-25		
2018	-15		-21	-35		-2		1	-1		-7		-7					-26		
2028	-21		21	186		39		103	307		38		127					22		
2038	49		88	356		79		187	515		104		256					89		
2063	137		157	510		130		288	729		182		387					157		
2070	148		166	529		136		301	756		192		403					166		
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-10		-12	-20		-3		-3	-10		-8		-13	-17		-23		-24		
2015	-14		-18	-31		-5		-4	-13		-11		-18	-22		-26		-24		
2017	-17		-21	-36		-5		-3	-10		-10		-14	-16		-33		-25		
2018	-15		-21	-35		-2		1	-1		-7		-7	-5		-38		-26		
2028	-21		21	186		39		103	307		38		127	317		-30		22		
2038	49		88	356		79		187	515		104		256	526		43		89		
2063	137		157	510		130		288	729		182		387	709		134		157		
2070	148		166	529		136		301	756		192		403	732		146		166		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
2014	-17		-18	-20	-17	-7		-4	-2	-7	-14		-15	-9	-14	-37		-33		-37
2015	-25		-27	-30	-25	-10		-5	-2	-10	-20		-20	-11	-20	-41		-31		-41
2017	-29		-31	-35	-29	-10		-3	1	-10	-19		-16	-6	-19	-49		-29		-49
2018	-25		-30	-36	-25	-4		3	8	-4	-12		-7	2	-12	-55		-29		-55
2028	-26		45	114	-26	85		163	237	85	84		189	241	84	-36		50		-36
2038	88		150	261	88	167		281	390	167	198		359	409	198	82		154		82
2063	220		258	402	220	265		418	553	265	319		530	563	319	216		260		216
2070	236		272	419	236	278		436	573	278	335		551	582	335	233		273		233
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	13	13		0	0	13	13		0	0	-21	1		0
2015	0				0	0	20	19		0	0	20	19		0	0	-27	17		0
2017	0				0	0	23	22		0	0	23	22		0	0	-39	49		0
2018	0				0	0	32	41		0	0	32	41		0	0	-46	62		0
2028	0				0	0	164	352		0	0	165	354		0	0	135	298		0
2038	0				0	0	209	446		0	0	210	448		0	0	192	362		0
2063	0				0	0	243	516		0	0	244	518		0	0	234	410		0
2070	0				0	0	247	525		0	0	248	527		0	0	240	416		0
Green Sturgeon																				
2013			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
2014			-12	0		0		-48		-64	0	0	-48	0	-64	0	82	56	0	4
2015			-18	0		0		-72		-96	0	0	-72	0	-96	0	164	135	0	7
2017			-21	0		0		-85		-113	0	0	-85	0	-113	0	328	293	0	11
2018			-13	0		0		-85		-127	0	0	-85	0	-127	0	410	368	0	12
2028			498	0		0		268		-488	0	552	268	0	-488	0	791	728	0	21
2038			669	0		0		392		-593	0	730	392	0	-593	0	874	807	0	24
2063			797	0		0		485		-673	0	864	485	0	-673	0	936	866	0	25
2070			813	0		0		497		-682	0	880	497	0	-682	0	943	873	0	25

- Not Analyzed
- >50% Greater
- >25%-50% Greater
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- >25%-50% Less
- >50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-18
Alternative 5 SAM results showing bank-line weighted relative response (feet) within Region 1b

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
2014	-635	0	-11	0		-611	0	-12	-278		-615	0	-13	-291		-596	0	-6	-19	
2015	-635	0	-11	0		-601	0	-1	-252		-605	0	-2	-265		-557	0	-1	-38	
2017	-596	0	-2	0		-555	0	33	-142		-558	0	33	-152		-491	0	8	-74	
2018	-541	0	10	0		-498	0	77	10		-501	0	78	2		-481	0	8	-91	
2028	-389	0	63	-118		-91	0	491	1,262		-51	0	593	1,346		-382	0	58	-171	
2038	-170	0	180	-142		90	0	764	1,881		232	0	1,051	2,064		-166	0	176	-174	
2063	75	0	291	-155		269	0	1,074	2,456		516	0	1,489	2,631		77	0	290	-172	
2070	106	0	305	-157		292	0	1,112	2,526		551	0	1,542	2,698		107	0	304	-171	
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0				
2014	-635	0	-11			0	0	-12	-278		-615		0	-291		-596				
2015	-635	0	-11			0	0	-1	-252		-605		0	-265		-557				
2017	-596	0	-2			0	0	33	-142		-558		0	-152		-491				
2018	-541	0	10			0	0	77	10		-501		0	2		-481				
2028	-389	0	63			-2	0	491	1,262		-47		8	1,346		-382				
2038	-170	0	180			4	0	764	1,881		226		34	2,064		-166				
2063	75	0	291			14	0	1,074	2,456		495		62	2,631		77				
2070	106	0	305			15	0	1,112	2,526		529		65	2,698		107				
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-635			-179		-611			-278		-615		-13							
2015	-635			-177		-601			-252		-605		-2							
2017	-596			-126		-555			-142		-558		33							
2018	-541			-59		-498			10		-501		78							
2028	-312			266		-91			1,257		-47		585							
2038	-84			571		90			1,847		226		1,018							
2063	159			829		269			2,383		495		1,427							
2070	189			862		292			2,448		529		1,476							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-635		-11	-179		-611		-12	-278		-615		-13	-291		-584		1	-110	
2015	-635		-11	-177		-601		-1	-252		-605		-2	-265		-533		13	-44	
2017	-596		-2	-126		-555		33	-142		-558		33	-152		-445		34	72	
2018	-541		10	-59		-498		77	10		-501		78	2		-423		39	102	
2028	-312		99	266		-91		483	1,257		-47		585	1,341		-271		110	326	
2038	-84		221	571		90		737	1,847		226		1,018	2,035		-59		227	607	
2063	159		334	829		269		1,022	2,383		495		1,427	2,579		172		337	847	
2070	189		348	862		292		1,057	2,448		529		1,476	2,644		200		351	878	
Steelhead																				
2013	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-550		-33	-283	-550	-503	0	-38	-358	-503	-511	0	-42	-369	-511	-472		-20	-223	-472
2015	-550		-32	-281	-550	-484	0	-21	-329	-484	-491	0	-24	-339	-491	-394		-7	-165	-394
2017	-473		-15	-235	-473	-392	0	32	-232	-392	-398	0	31	-241	-398	-262		15	-64	-262
2018	-365		7	-177	-365	-280	0	102	-106	-280	-285	0	101	-113	-285	-240		17	-39	-240
2028	-85		112	18	-85	527	0	724	903	527	594	0	845	977	594	-69		107	173	-69
2038	271		313	310	271	898	0	1,096	1,372	898	1,105	0	1,434	1,559	1,105	280		310	463	280
2063	633		508	574	633	1,268	0	1,498	1,809	1,268	1,581	0	1,982	2,030	1,581	638		506	719	638
2070	677		532	608	677	1,313	0	1,546	1,862	1,313	1,639	0	2,048	2,086	1,639	682		531	752	682
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			-656	0	-665	0		-628	0	-683	0	0	-628	0	-683	0	0	-455	0	-617
2015			-652	0	-666	0		-610	0	-692	0	0	-610	0	-692	0	0	-261	0	-568
2017			-524	0	-624	0		-522	0	-740	0	0	-522	0	-740	0	-1	83	0	-483
2018			-358	0	-563	0		-408	0	-843	0	0	-408	0	-843	0	-1	183	0	-466
2028			289	0	-394	0		457	0	-1,840	0	-1	457	0	-1,840	0	-2	501	0	-433
2038			458	0	-357	0		707	0	-2,095	0	-2	707	0	-2,095	0	-2	586	0	-426
2063			616	0	-330	0		925	0	-2,287	0	-2	925	0	-2,287	0	-3	679	0	-422
2070			639	0	-327	0		956	0	-2,311	0	-2	956	0	-2,311	0	-3	695	0	-421

Not Analyzed
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Graphics ... 00627.08 (6/23/14) AB

Figure F-19
Alternative 5 SAM results showing bank-line weighted relative response (feet) within Region 2

Focus Fish Species and Water Year	Fall (September–November) Adult migration	Fall Spawning and egg incubation	Fall Fry and juvenile rearing	Fall Juvenile migration	Fall Adult residence	Winter (December–February) Adult migration	Winter Spawning and egg incubation	Winter Fry and juvenile rearing	Winter Juvenile migration	Winter Adult residence	Spring (March–May) Adult migration	Spring Spawning and egg incubation	Spring Fry and juvenile rearing	Spring Juvenile migration	Spring Adult residence	Summer (June–August) Adult migration	Summer Spawning and egg incubation	Summer Fry and juvenile rearing	Summer Juvenile migration	Summer Adult residence
Spring-run Chinook																				
2013	0	0	0			0		0	0		0		0	0		0	0	0		
2014	-3	0	-1			-1		2	3		-3		0	-4		-11	0	-4		
2015	-6	0	-2			-2		2	3		-5		0	-8		-18	0	-7		
2017	-9	0	-2			-5		2	-1		-8		0	-14		-31	0	-11		
2018	-11	0	-3			-3		4	2		-6		1	-11		-38	0	-13		
2028	-74	0	-33			6		-13	-86		-39		-43	-119		-85	0	-38		
2038	-93	0	-47			1		-27	-150		-52		-69	-198		-100	0	-49		
2063	-92	0	-53			3		-23	-136		-49		-66	-196		-96	0	-54		
2070	-88	0	-53			5		-19	-113		-45		-60	-172		-91	0	-54		
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0		0		
2014	-3	0	-1			0	0	2	3		-3		0	-4		-11		-2		
2015	-6	0	-2			0	0	2	3		-5		0	-8		-18		-5		
2017	-9	0	-2			0	0	2	-1		-8		0	-14		-31		-10		
2018	-11	0	-3			0	0	4	2		-6		2	-11		-38		-12		
2028	-36	0	-33			-32	0	-13	-86		-39		-5	-119		-85		-19		
2038	-50	0	-47			-38	0	-27	-150		-52		7	-198		-100		-19		
2063	-47	0	-53			-42	0	-23	-136		-49		19	-196		-96		-19		
2070	-43	0	-53			-42	0	-19	-113		-45		21	-172		-91		-19		
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-3			-10		-1			3		-3		0							
2015	-6			-15		-2			3		-5		0							
2017	-9			-21		-5			-1		-8		0							
2018	-11			-24		-6			-4		-9		-1							
2028	-38			-68		-20			-85		-32		-39							
2038	-58			-101		-32			-163		-50		-76							
2063	-62			-112		-37			-167		-54		-86							
2070	-58			-108		-36			-147		-51		-81							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-3		-1	-10		-1		2	3		-3		0	-4		-5		-2		
2015	-6		-2	-15		-2		2	3		-5		0	-8		-5		-2		
2017	-9		-2	-21		-5		2	-1		-8		0	-14		-6		-1		
2018	-11		-3	-24		-3		4	2		-6		1	-11		-7		-1		
2028	-36		-19	-68		6		7	-25		-5		-18	-61		-34		-19		
2038	-50		-30	-95		1		-5	-79		-13		-39	-128		-49		-30		
2063	-47		-35	-100		3		2	-61		-6		-33	-117		-47		-35		
2070	-43		-35	-95		5		6	-37		-2		-27	-93		-42		-35		
Steelhead																				
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-7	0	-3	-8	-7	-2	0	3	4	-2	-6	0	0	-1	-6	-23		-8	-20	-23
2015	-13	0	-4	-14	-13	-5	0	4	5	-5	-10	0	0	-3	-10	-35		-12	-27	-35
2017	-20	0	-5	-18	-20	-11	0	4	2	-11	-17	0	0	-7	-17	-60		-19	-40	-60
2018	-23	0	-5	-21	-23	-8	0	7	5	-8	-14	0	2	-4	-14	-73		-23	-47	-73
2028	-143	0	-52	-98	-143	-55	0	-11	-44	-55	-77	0	-46	-71	-77	-163		-59	-108	-163
2038	-183	0	-72	-126	-183	-76	0	-30	-88	-76	-105	0	-78	-126	-105	-195		-76	-132	-195
2063	-191	0	-80	-128	-191	-79	0	-25	-72	-79	-106	0	-76	-116	-106	-197		-82	-131	-197
2070	-186	0	-80	-122	-186	-76	0	-20	-54	-76	-100	0	-67	-96	-100	-191		-82	-125	-191
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			7	0	0	0		7	0	0	0	0	7	0	0	0	0	12	0	1
2015			13	0	0	0		13	0	0	0	0	13	0	0	0	0	21	0	2
2017			19	0	-2	0		19	0	-2	0	0	19	0	-2	0	0	37	0	2
2018			22	0	-2	0		22	0	-2	0	0	22	0	-2	0	0	45	0	3
2028			51	0	-14	0		37	0	-38	0	0	37	0	-38	0	0	59	0	-12
2038			55	0	-25	0		38	0	-55	0	0	38	0	-55	0	0	60	0	-24
2063			48	0	-34	0		29	0	-68	0	0	29	0	-68	0	0	50	0	-33
2070			44	0	-35	0		25	0	-70	0	0	25	0	-70	0	0	47	0	-34

Not Analyzed
>50% Greater
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Graphics … 00627.08 (6/23/14) AB

Figure F-20
Alternative 5 SAM results showing bank-line weighted relative response (feet) within Region 3

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-53		-52	143		2		30	85		-39		-36	8		-216		-377	-418	
2015	-105		-117	224		6		62	188		-71		-62	35		-300		-458	-391	
2017	-172		-141	496		20		180	461		-91		31	234		-425		-472	-65	
2018	-214		-135	698		30		245	604		-101		77	328		-472		-453	168	
2028	-375		38	2,029		120		720	1,616		-33		542	1,169		-482		-80	1,837	
2038	-117		399	2,774		180		882	2,013		135		838	1,600		-181		328	2,659	
2063	189		740	3,409		252		1,030	2,377		331		1,114	1,969		157		705	3,352	
2070	228		782	3,487		262		1,049	2,422		355		1,148	2,014		200		751	3,437	
Fall-run Chinook																				
2013	0			0				0	0		0		0	0		0		0	0	
2014	-53			143				30	85		-39		-36	8		-216		-377	-418	
2015	-105			224				62	188		-71		-62	35		-300		-458	-391	
2017	-172			496				180	461		-91		31	234		-425		-472	-65	
2018	-214			698				245	604		-101		77	328		-472		-453	168	
2028	-375			2,029				720	1,616		-33		542	1,169		-482		-80	1,837	
2038	-117			2,774				882	2,013		135		838	1,600		-181		328	2,659	
2063	189			3,409				1,030	2,377		331		1,114	1,969		157		705	3,352	
2070	228			3,487				1,049	2,422		355		1,148	2,014		200		751	3,437	
Late fall–run Chinook																				
2013	0			0		0			0		0		0	0					0	
2014	-53			143		2			85		-39		-36	8					-418	
2015	-105			224		6			188		-71		-62	35					-391	
2017	-172			496		20			461		-91		31	234					-65	
2018	-214			698		30			604		-101		77	328					168	
2028	-375			2,029		120			1,616		-33		542	1,169					1,837	
2038	-117			2,774		180			2,013		135		838	1,600					2,659	
2063	189			3,409		252			2,377		331		1,114	1,969					3,352	
2070	228			3,487		262			2,422		355		1,148	2,014					3,437	
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-53		-52	143		2		30	85		-39		-36	8		-216		-377		
2015	-105		-117	224		6		62	188		-71		-62	35		-300		-458		
2017	-172		-141	496		20		180	461		-91		31	234		-425		-472		
2018	-214		-135	698		30		245	604		-101		77	328		-472		-453		
2028	-375		38	2,029		120		720	1,616		-33		542	1,169		-482		-80		
2038	-117		399	2,774		180		882	2,013		135		838	1,600		-181		328		
2063	189		740	3,409		252		1,030	2,377		331		1,114	1,969		157		705		
2070	228		782	3,487		262		1,049	2,422		355		1,148	2,014		200		751		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014	-85		-56	62	-85	4		46	80	4	-65		-36	9	-65	-351		-490	-464	-351
2015	-170		-127	89	-170	11		96	172	11	-121		-58	34	-121	-490		-595	-493	-490
2017	-280		-149	232	-280	38		256	414	38	-157		61	210	-157	-695		-615	-332	-695
2018	-351		-140	349	-351	57		345	544	57	-175		120	298	-175	-772		-587	-191	-772
2028	-628		105	1,156	-628	229		987	1,383	229	-77		729	1,019	-77	-802		-61	956	-802
2038	-244		599	1,759	-244	341		1,213	1,697	341	167		1,122	1,404	167	-349		500	1,639	-349
2063	179		1,073	2,294	179	471		1,425	1,992	471	433		1,493	1,747	433	127		1,023	2,234	127
2070	232		1,131	2,360	232	488		1,452	2,029	488	466		1,539	1,789	466	186		1,088	2,308	186
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	38	36		0	0	38	36		0	0	-706	-668		0
2015	0				0	0	76	69		0	0	76	69		0	0	-706	-685		0
2017	0				0	0	296	274		0	0	296	275		0	0	-345	-352		0
2018	0				0	0	433	399		0	0	433	400		0	0	-65	-94		0
2028	0				0	0	1,011	1,024		0	0	1,013	1,026		0	0	1,595	1,477		0
2038	0				0	0	1,138	1,167		0	0	1,140	1,170		0	0	1,997	1,853		0
2063	0				0	0	1,233	1,275		0	0	1,236	1,278		0	0	2,298	2,134		0
2070	0				0	0	1,245	1,288		0	0	1,248	1,291		0	0	2,335	2,169		0
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0		0	0	0	0		0	0	0
2014			192	0	51	0		5	0	-296	0		5	0	-296	0		1,007	0	130
2015			442	0	94	0		70	0	-597	0		70	0	-597	0		1,484	0	141
2017			906	0	131	0		166	0	-1,239	0		166	0	-1,239	0		2,104	0	137
2018			1,124	0	139	0		215	0	-1,592	0		215	0	-1,592	0		2,321	0	132
2028			2,586	0	118	0		921	0	-3,523	0		921	0	-3,523	0		3,126	0	108
2038			2,971	0	109	0		1,125	0	-3,982	0		1,125	0	-3,982	0		3,296	0	103
2063			3,260	0	102	0		1,278	0	-4,326	0		1,278	0	-4,326	0		3,422	0	99
2070			3,296	0	101	0		1,297	0	-4,369	0		1,297	0	-4,369	0		3,438	0	99

Legend
Not Analyzed
>50% Greater
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Graphics ... 00627.08 (6/23/14) AB

ICF INTERNATIONAL

Figure F-21
Alternative 6 SAM results showing bank-line weighted relative response (feet) within Region 1a

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-10		-12	-20		-3		-3	-10		-8		-13	-17		-85		-47	-115	
2015	-14		-18	-31		-5		-4	-13		-11		-18	-22		-150		-70	-189	
2017	-49		-27	-72		-36		-14	-61		-42		-26	-70		-270		-112	-326	
2018	-102		-37	-122		-83		-28	-136		-91		-43	-151		-309		-124	-358	
2028	-301		-29	11		-177		44	-18		-181		29	-54		-375		-59	-58	
2038	-211		75	245		-144		141	213		-98		189	184		-255		57	204	
2063	-85		181	458		-90		262	465		8		353	395		-108		172	437	
2070	-70		194	484		-83		278	496		21		374	421		-89		186	466	
Fall-run Chinook																				
2013	0		0			0		0	0				0			0		0		
2014	-10		-12			-3		-3	-10				-13			-85		-47		
2015	-14		-18			-5		-4	-13				-18			-150		-70		
2017	-49		-27			-36		-14	-62				-25			-270		-112		
2018	-102		-37			-83		-28	-136				-43			-309		-124		
2028	-301		-29			-176		44	-18				29			-375		-59		
2038	-210		75			-144		141	213				190			-255		56		
2063	-86		180			-89		262	464				353			-108		171		
2070	-70		194			-83		278	496				374			-89		186		
Late fall–run Chinook																				
2013	0		0	0		0		0	0		0		0					0		
2014	-10		-12	-20		-3		-3	-10		-8		-13					-47		
2015	-14		-18	-31		-5		-4	-13		-11		-18					-70		
2017	-49		-27	-72		-36		-14	-61		-42		-26					-112		
2018	-102		-37	-122		-83		-28	-136		-91		-43					-124		
2028	-301		-29	11		-177		44	-18		-181		29					-59		
2038	-211		75	245		-144		141	213		-98		189					57		
2063	-85		181	458		-90		262	465		8		353					172		
2070	-70		194	484		-83		278	496		21		374					186		
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	-10		-12	-20		-3		-3	-10		-8		-13	-17		-85		-47		
2015	-14		-18	-31		-5		-4	-13		-11		-18	-22		-150		-70		
2017	-49		-27	-72		-36		-14	-61		-42		-26	-70		-270		-112		
2018	-102		-37	-122		-83		-28	-136		-91		-43	-151		-309		-124		
2028	-301		-29	11		-177		44	-18		-181		29	-54		-375		-59		
2038	-211		75	245		-144		141	213		-98		189	184		-255		57		
2063	-85		181	458		-90		262	465		8		353	395		-108		172		
2070	-70		194	484		-83		278	496		21		374	421		-89		186		
Steelhead																				
2013	0		0	0	0	0		0	0	0	0		0	0	0	0		0		0
2014	-17		-18	-20	-17	-7		-4	-1	-7	-14		-16	-8	-14	-159		-71		-159
2015	-25		-27	-30	-25	-10		-5	-2	-10	-20		-20	-11	-20	-284		-107		-284
2017	-94		-43	-65	-94	-72		-20	-33	-72	-82		-34	-42	-82	-512		-173		-512
2018	-196		-62	-109	-196	-163		-44	-83	-163	-177		-63	-97	-177	-587		-191		-587
2028	-584		-50	-61	-584	-342		62	23	-342	-360		46	-1	-360	-721		-93		-721
2038	-459		107	148	-459	-281		200	201	-281	-235		262	209	-235	-541		82		-541
2063	-295		270	348	-295	-182		367	400	-182	-89		481	401	-89	-336		257		-336
2070	-275		290	372	-275	-169		388	426	-169	-71		509	426	-71	-311		279		-311
Delta Smelt																				
2013	0				0	0	0	0		0	0	0	0		0	0	0	0		0
2014	0				0	0	13	13		0	0	13	13		0	0	-106	-84		0
2015	0				0	0	20	19		0	0	20	19		0	0	-198	-154		0
2017	0				0	0	-41	-42		0	0	-41	-42		0	0	-371	-283		0
2018	0				0	0	-140	-131		0	0	-140	-131		0	0	-413	-304		0
2028	0				0	0	-336	-147		0	0	-337	-147		0	0	-155	8		0
2038	0				0	0	-356	-119		0	0	-357	-118		0	0	-77	94		0
2063	0				0	0	-371	-97		0	0	-371	-97		0	0	-18	158		0
2070	0				0	0	-373	-95		0	0	-373	-94		0	0	-10	166		0
Green Sturgeon																				
2013			0	0		0		0		0	0	0	0	0	0	0	0	0	0	0
2014			-12	0		0		-48		-64	0	0	-48	0	-64	0	75	7	0	-49
2015			-18	0		0		-72		-96	0	0	-72	0	-96	0	151	30	0	-101
2017			-46	0		0		-109		-148	0	-4	-109	0	-148	0	303	55	0	-192
2018			-91	0		0		-164		-218	0	-11	-164	0	-218	0	382	82	0	-217
2028			149	0		0		-106		-895	0	521	-106	0	-895	0	755	304	0	-279
2038			262	0		0		-46		-1,070	0	695	-46	0	-1,070	0	835	356	0	-291
2063			347	0		0		-1		-1,202	0	826	-1	0	-1,202	0	896	394	0	-300
2070			358	0		0		4		-1,218	0	842	4	0	-1,218	0	903	399	0	-301

- Not Analyzed
- >50% Greater
- >25%-50% Greater
- >10%-25% Greater
- 5%-10% Greater
- <5% Different
- 5%-10% Less
- >10%-25% Less
- >25%-50% Less
- >50% Less

Graphics ... 00627.08 (6/23/14) AB

ICF INTERNATIONAL

Figure F-22
Alternative 6 SAM results showing bank-line weighted relative response (feet) within Region 1b

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
2014	-653	0	-10	0		-581	0	14	-204		-587	0	11	-220		-689	0	-18	-19	
2015	-662	0	-10	0		-557	0	37	-140		-563	0	36	-156		-707	0	-22	-38	
2017	-666	0	-8	0		-542	0	54	-91		-547	0	57	-101		-743	0	-31	-74	
2018	-667	0	-7	0		-515	0	75	-18		-520	0	81	-23		-761	0	-36	-91	
2028	-673	0	8	-118		-182	0	405	1,003		-129	0	518	1,107		-719	0	-7	-171	
2038	-446	0	108	-142		-1	0	666	1,646		176	0	965	1,862		-474	0	99	-174	
2063	-177	0	210	-155		190	0	981	2,301		493	0	1,411	2,515		-190	0	205	-172	
2070	-143	0	223	-157		214	0	1,021	2,383		533	0	1,466	2,595		-155	0	219	-171	
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0				
2014	-653	0	-10			0	0	14	-204		-587		0	-220		-689				
2015	-662	0	-10			0	0	37	-140		-563		0	-156		-707				
2017	-666	0	-8			0	0	54	-91		-547		0	-101		-743				
2018	-667	0	-7			0	0	75	-18		-520		0	-23		-761				
2028	-673	0	8			-2	0	405	1,003		-125		8	1,107		-719				
2038	-446	0	108			4	0	666	1,646		170		34	1,862		-474				
2063	-177	0	210			14	0	981	2,301		473		62	2,515		-190				
2070	-143	0	223			15	0	1,021	2,383		511		65	2,595		-155				
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	-653			-181		-581			-204		-587		11							
2015	-662			-181		-557			-140		-563		36							
2017	-666			-172		-542			-91		-547		57							
2018	-667			-166		-515			-18		-520		81							
2028	-596			-13		-182			999		-125		510							
2038	-360			300		-1			1,612		170		931							
2063	-92			583		190			2,228		473		1,349							
2070	-59			618		214			2,305		511		1,401							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0	0	
2014	-653		-10	-181		-581		14	-204		-587		11	-220		-677		-11	-210	
2015	-662		-10	-181		-557		37	-140		-563		36	-156		-684		-8	-189	
2017	-666		-8	-172		-542		54	-91		-547		57	-101		-696		-6	-175	
2018	-667		-7	-166		-515		75	-18		-520		81	-23		-703		-5	-174	
2028	-596		43	-13		-182		396	999		-125		510	1,102		-608		45	-11	
2038	-360		149	300		-1		640	1,612		170		931	1,833		-367		150	301	
2063	-92		253	583		190		929	2,228		473		1,349	2,464		-96		253	584	
2070	-59		265	618		214		966	2,305		511		1,401	2,541		-62		266	619	
Steelhead																				
2013	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-586		-30	-290	-586	-445	0	0	-303	-445	-456	0	-5	-317	-456	-656		-43	-319	-656
2015	-603		-29	-292	-603	-396	0	37	-245	-396	-408	0	33	-260	-408	-691		-46	-298	-691
2017	-612		-26	-284	-612	-367	0	65	-199	-367	-376	0	66	-209	-376	-759		-60	-285	-759
2018	-614		-23	-277	-614	-314	0	97	-139	-314	-322	0	101	-146	-322	-794		-68	-284	-794
2028	-663		16	-217	-663	344	0	592	670	344	428	0	731	765	428	-751		-7	-111	-751
2038	-324		205	107	-324	710	0	957	1,163	710	961	0	1,322	1,393	961	-377		191	230	-377
2063	46		397	417	46	1,094	0	1,381	1,677	1,094	1,475	0	1,905	1,952	1,475	20		390	546	20
2070	92		421	455	92	1,142	0	1,435	1,742	1,142	1,539	0	1,977	2,021	1,539	69		415	585	69
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			-610	0	-681	0		-507	0	-746	0	0	-507	0	-746	0	0	-472	0	-712
2015			-582	0	-689	0		-428	0	-786	0	0	-428	0	-786	0	0	-390	0	-727
2017			-549	0	-695	0		-370	0	-808	0	0	-370	0	-808	0	-1	-242	0	-757
2018			-498	0	-696	0		-276	0	-837	0	0	-276	0	-837	0	-1	-188	0	-772
2028			-140	0	-730	0		600	0	-1,489	0	-1	600	0	-1,489	0	-2	-9	0	-829
2038			-50	0	-736	0		830	0	-1,672	0	-2	830	0	-1,672	0	-2	29	0	-841
2063			18	0	-740	0		1,002	0	-1,810	0	-2	1,002	0	-1,810	0	-3	57	0	-850
2070			26	0	-741	0		1,023	0	-1,826	0	-2	1,023	0	-1,826	0	-3	61	0	-851

Legend
Not Analyzed
>50% Greater
>25%-50% Greater
>10%-25% Greater
5%-10% Greater
<5% Different
5%-10% Less
>10%-25% Less
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>50% Less

Graphics ... 00627.08 (6/23/14) AB

Figure F-23
Alternative 6 SAM results showing bank-line weighted relative response (feet) within Region 2

Focus Fish Species and Water Year	Fall (September–November)					Winter (December–February)					Spring (March–May)					Summer (June–August)				
	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence	Adult migration	Spawning and egg incubation	Fry and juvenile rearing	Juvenile migration	Adult residence
Spring-run Chinook																				
2013	0	0	0			0		0	0		0		0	0		0	0	0		
2014	0	0	4			2		18	22		1		17	17		-5	0	3		
2015	0	0	6			4		27	34		2		27	28		-10	0	-1		
2017	0	0	7			4		32	43		3		34	38		-20	0	-11		
2018	0	0	7			8		35	51		7		38	48		-25	0	-16		
2028	-17	0	-13			59		71	164		28		84	178		-30	0	-28		
2038	17	0	6			86		122	263		63		164	280		9	0	-3		
2063	62	0	30			117		190	373		103		247	369		58	0	26		
2070	67	0	33			120		199	387		108		257	379		64	0	29		
Fall-run Chinook																				
2013	0	0	0			0	0	0	0		0		0	0		0		0		
2014	0	0	4			0	0	18	22		1		0	17		-5		-2		
2015	0	0	6			0	0	27	34		2		0	28		-10		-5		
2017	0	0	7			0	0	32	43		3		0	38		-20		-10		
2018	0	0	7			0	0	35	51		7		2	48		-25		-12		
2028	21	0	-13			-32	0	71	164		28		-5	178		-30		-19		
2038	60	0	6			-38	0	122	263		63		7	280		9		-19		
2063	107	0	30			-42	0	190	373		103		19	369		58		-19		
2070	113	0	33			-42	0	199	387		108		21	379		64		-19		
Late fall–run Chinook																				
2013	0			0		0			0		0		0							
2014	0			1		2			22		1		17							
2015	0			2		4			34		2		27							
2017	0			2		4			43		3		34							
2018	0			2		5			45		4		36							
2028	19			9		34			164		35		89							
2038	52			44		53			250		65		157							
2063	92			81		76			342		99		228							
2070	97			85		79			354		103		236							
Winter-run Chinook																				
2013	0		0	0		0		0	0		0		0	0		0		0		
2014	0		4	1		2		18	22		1		17	17		2		6		
2015	0		6	2		4		27	34		2		27	28		3		4		
2017	0		7	2		4		32	43		3		34	38		5		-1		
2018	0		7	2		8		35	51		7		38	48		6		-4		
2028	21		2	9		59		91	224		62		109	236		21		-8		
2038	60		22	50		86		145	334		102		194	350		60		16		
2063	107		47	93		117		214	449		146		280	447		107		44		
2070	113		51	99		120		223	463		152		291	459		113		48		
Steelhead																				
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
2014	-1	0	8	-2	-1	4	0	26	17	4	1	0	25	13	1	-9		9	-12	-9
2015	-1	0	12	-2	-1	6	0	40	26	6	3	0	39	21	3	-18		2	-20	-18
2017	-1	0	14	-3	-1	8	0	47	31	8	5	0	48	27	5	-34		-12	-37	-34
2018	-1	0	14	-3	-1	14	0	52	38	14	12	0	54	35	12	-42		-19	-46	-42
2028	-27	0	-14	-39	-27	55	0	106	126	55	58	0	120	136	58	-46		-34	-63	-46
2038	27	0	18	-3	27	98	0	170	199	98	118	0	217	218	118	16		5	-18	16
2063	93	0	57	39	93	150	0	254	282	150	181	0	316	292	181	87		51	31	87
2070	102	0	62	44	102	157	0	265	292	157	189	0	329	301	189	96		56	37	96
Delta Smelt																				
2013																				
2014																				
2015																				
2017																				
2018																				
2028																				
2038																				
2063																				
2070																				
Green Sturgeon																				
2013			0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
2014			62	0	0	0		33	0	-51	0	0	33	0	-51	0	0	154	0	6
2015			92	0	0	0		50	0	-77	0	0	50	0	-77	0	0	184	0	11
2017			108	0	0	0		58	0	-90	0	0	58	0	-90	0	0	246	0	22
2018			111	0	0	0		59	0	-93	0	0	59	0	-93	0	0	277	0	27
2028			328	0	37	0		159	0	-268	0	0	159	0	-268	0	0	426	0	51
2038			399	0	48	0		190	0	-331	0	0	190	0	-331	0	0	458	0	56
2063			452	0	56	0		213	0	-378	0	0	213	0	-378	0	0	482	0	60
2070			459	0	57	0		216	0	-384	0	0	216	0	-384	0	0	485	0	61

- Not Analyzed
- >50% Greater
- >25%-50% Greater
- >10%-25% Greater
- 5%-10% Greater
- <5% Different
- 5%-10% Less
- >10%-25% Less
- >25%-50% Less
- >50% Less

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Figure F-24
Alternative 6 SAM results showing bank-line weighted relative response (feet) within Region 3

Appendix G
Cultural Context

Appendix G
Cultural Context

Prehistoric Archaeology

As a result of continuing research and interpretation, the archaeological record of the Central Valley and Delta region has been approached in two fundamentally different ways; the first is chronological, and the second involves the elucidation of contemporaneous cultural patterns. The discussion below is a succinct description of both approaches to Central Valley prehistory, beginning with the nascent, salvage-oriented archaeology of the late nineteenth century, followed by the development of cultural historical frameworks for the Central Valley under the aegis of Sacramento Junior College and the University of California. The discussion moves from this chronologically oriented approach to the functional and systems approaches favored in California archaeology from the 1960s through the present.

In the late 1800s and early 1900s, knowledge of Delta prehistory was derived largely from local collectors. The collections of J. A. Barr and E. J. Dawson, amateur archaeologists working in the Stockton area from 1893 to the early 1930s, provided the groundwork for the later development of a three-phase chronological sequence for central California (Ragir 1972). Professional archaeological research in the lower Sacramento Valley was initiated during the 1920s and 1930s. Lillard and Purves (1936) worked at several mound sites near the Deer Creek/Cosumnes River confluence in Sacramento County. From the relative sequences in stratified occupational and burial sites, Lillard and Purves identified a three-stage chronology based on artifacts, burial orientation, and condition. Simply called the Early, Transitional (later called Middle), and Late horizons, these were defined by shifting patterns in site assemblages and mortuary morphology. Although interpretations varied, explanations for change usually were linked to the movements of people. In 1939, a synthesis of this research was published and later expanded into the Central California Taxonomic System (CCTS) (Lillard et al. 1939). Later refined by Heizer (1949) and Beardsley (1948, 1954a, 1954b), the CCTS was characterized by specific artifact types, mortuary practices, and other cultural features.

Subsequent archaeological research was aimed at refining the CCTS and incorporating the study of paleoenvironmental change, settlement patterns, population movement, subsistence strategies, and development of exchange networks. These studies led to the development of a second approach. As absolute dates became available for sites with early, middle, and late assemblages, it was discovered that sites with different assemblages actually were contemporaneous. This was particularly true with sites from the Early and Middle horizons. This discovery, along with a change in archaeological paradigms to a more economic and functional orientation in the 1960s, led to a reorganization of the CCTS. This new scheme used the same archaeological manifestations to differentiate sites as did the CCTS, but ordered sites into functional groups rather than temporal ones which led to the establishment of different cultural models for many localities of central California.

This approach was advanced by Fredrickson (1973), who used the term *pattern* to describe an "adaptive mode extending across one or more regions, characterized by particular technological skills and devices, and particular economic modes." Three patterns were introduced: Windmiller, Berkeley, and Augustine. These patterns, while generally corresponding to the Early, Middle, and

Late horizons within the Central Valley, were conceptually different and free of spatial and temporal constraints. By changing the paradigm from a cultural/historical orientation to a more processual/adaptive one and introducing the concept of pattern, Fredrickson addressed problems with the chronological and regional sequences that had been nagging archaeologists for several decades (cf. King 1974).

One problem with both approaches is that they have been based on an archaeological record derived primarily from village sites. This poses less of a problem under a chronological framework but presents a more substantial problem when an economic perspective is taken. Current understanding of the prehistoric valley settlement and subsistence systems is heavily biased toward large habitation sites adjacent to permanent water sources. These sites, by their very nature, can provide only limited information on the total economic system. Much more archaeological work is needed at ephemeral and peripheral sites located away from the larger habitation sites.

The taxonomic framework of the Sacramento Valley has been described in the following sections in terms of archaeological patterns, following Fredrickson's (1973) system. A *pattern* is a general mode of life characterized archaeologically by technology, particular artifacts, economic systems, trade, burial practices, and other aspects of culture. Fredrickson's (1973) *periods* are also employed in the discussion below: Paleoindian (12,000–8000 BP), Lower Archaic (8000–5000 BP), Middle Archaic (5000–2500 B.P.), Upper Archaic (2500–950 BP), Lower Emergent (950–450 BP), and Upper Emergent (450–150 BP) (White et al. 2002: Figure 15). In Fredrickson's use, periods served as arbitrary intervals that could be used to compare patterns over space and time. Only with the clear identification of pervasive temporal patterns would periods acquire specific archaeological meaning.

Terminal Pleistocene and Early Holocene: 13,500–7000 BP

At the end of the Pleistocene (roughly the beginning of the Paleoindian Period), circa 13,500 to 10,500 BP, parts of the Sierra Nevada adjacent to the Central Valley were covered with large glaciers (West et al. 2007:27), and the valley provided a major transportation route for animals and people. This transportation corridor, perhaps rivaled only by maritime coastal travel (Erlandson et al. 2007), was undoubtedly used heavily by early Californians. Evidence for human occupation during this period, however, is scarce, the hypothesized result of being buried by deep alluvial sediments that accumulated rapidly during the late Holocene (Westwood 2005:17).

Although rare, archaeological remains of this early period were reported in and around the Central Valley (Ann S. Peak & Associates 1981; Johnson 1967; Treganza and Heizer 1953). Johnson (1967:283–284) presents evidence for some use of the Mokelumne River area, under what is now Camanche Reservoir, during the late Pleistocene. Archaeologists working at Camanche Reservoir found a number of lithic cores and a flake that are associated with Pleistocene gravels. These archaeological remains were grouped into what is called the Farmington Complex, which is characterized by core tools and large, reworked percussion flakes (Treganza and Heizer 1953:28). Farther north, at Rancho Murrieta, lithic artifacts spanning the reduction sequence, as well as unworked raw material, were recovered from gravel deposits attributed to the late Pleistocene (Ann S. Peak & Associates 1981). Recent geoarchaeological investigations at CA-STA-69 (in the vicinity of Farmington Complex–type site CA-STA-44), however, indicate that the Farmington Complex assemblage at the site is contained completely within Holocene alluvial terrace deposits, not Pleistocene glacial outwash deposits. These findings raise the question of whether reinvestigation of other Farmington Complex assemblages will reveal a Holocene assemblage (Rosenthal and Meyer 2004:96; Rosenthal et al. 2007:151).

The economy of the Central Valley residents during the late Pleistocene is thought to have been based on the hunting of large Pleistocene mammals. Although no direct evidence of this exists in the Central Valley, the similarity of the artifact assemblages with those of other locations in western North America lends some support the notion of a large-game economic focus. Much of the Pleistocene megafauna became extinct at the Pleistocene/Holocene transition. These extinctions were caused by warming temperatures, rising sea levels, and changing precipitation patterns. As the Central Valley gradually became both warmer and dryer, pine forests were replaced with vegetation similar to that found today. The rising sea level filled San Francisco Bay and created the Delta marshes. To survive without large game, people had to change their food procurement strategies to make use of a more diverse range of smaller plants and animals.

Middle to Late Holocene: 7000–1200 BP

Using a wider range of smaller resources meant people had to have access to larger areas of land to hunt and collect the food and other resources they needed. Small groups of people probably moved through the valley, foothills, and Sierra Nevada to take advantage of seasonally available resources and resources limited to particular ecozones. This mobile foraging strategy was essential to their survival.

Reliance on a diverse number of smaller plants and animals had several consequences. First, people had to move around from one area to another to take advantage of the seasonal availability of particular resources. Second, large areas of land were needed to ensure that enough resources were available during all times of the year. Third, more specialized tools were necessary to procure and process the wider range of plants and animals that were being used. This generalized subsistence strategy worked well for the inhabitants of the Central Valley for many millennia.

During the Lower Archaic Period, beginning approximately 6000 BP, a shift to a more specialized subsistence strategy began to take place. The more specialized strategy focused on ways of increasing the amount of food that could be produced from smaller portions of land. This change can be at least partially explained by the increasing numbers of people living in the Central Valley. An increased population is indicated by a much more abundant archaeological record and by dietary stress, as indicated by dental pathologies (Morrato 1984:203–204). As the population slowly increased, it became more difficult for people to obtain seasonally available resources across large areas of land. The beginnings of this intensification can be seen in the Middle-Archaic Windmiller Pattern (4500–2800 BP) and is based on the assemblage at the Windmiller site (CA-SAC-107). The Windmiller Pattern shows evidence of a mixed economy of game procurement and use of wild plant foods. Artifacts and faunal remains at Windmiller sites include seeds, a variety of small game, and fish. The archaeological record contains numerous projectile points and a wide range of faunal remains. Hunting was not limited to terrestrial animals, as evidenced by fishing hooks and spears that have been found in association with the remains of sturgeon (*Acipenser* sp.), salmon (*Oncorhynchus* sp.), and other fish. Plants also were used, as indicated by ground-stone artifacts and clay balls that were used for boiling acorn mush. The bone tool industry appears minimal but includes awls, needles, and flakers. Other characteristic artifacts include charmstones, quartz crystals, bone awls and needles, and abalone (*Haliotis* sp.) and olive snail (*Olivella* sp.) shell beads and ornaments. Trade is reflected in the material from which utilitarian, ornamental, and ceremonial objects were produced.

Windmiller Pattern origins are believed to be linked to the arrival of Utian peoples from outside California who were adapted to riverine and wetland environments (Moratto 1984). Windmiller sites are concentrated on low rises or knolls within the floodplains of major creeks or rivers. Such locations provided protection from seasonal flooding and proximity to riverine, marsh, and valley grassland biotic communities. People with a Windmiller adaptation buried their dead in formal cemeteries, suggesting a degree of sedentism, both within and separate from their villages, in a ritual context that included the use of red ochre, often rich grave offerings, and ventral extension with a predominantly western orientation (although other burial positions, such as dorsal extension and flexed, and cremations are also known) (Moratto 1984).

Settlement strategies during the Windmiller period reflect seasonal adaptations; habitation sites in the valley were occupied during winter, but populations moved into the foothills during summer (Moratto 1984). The earliest evidence of widespread occupation of the lower Sacramento Valley/Delta region comes from several sites assigned to the Windmiller Pattern (previously, Early Horizon), dated ca. 4500–2800 BP (Ragir 1972). While the Windmiller Pattern is identified with the Delta, work at Camanche Reservoir has identified sites with Windmiller assemblages (Johnson 1967), indicating that other valley settings were also used by people exhibiting these adaptations (Beardsley 1948; Gerow 1974; Heizer 1949; Heizer and Fenenga 1939; Lillard et al. 1939; Ragir 1972; Schulz 1970).

Central Valley inhabitants responded to the Middle Archaic population increase in two ways. First, they used the marshlands of the Delta, which were much more extensive and rich in food resources than they are today. Second, they increased the use of the acorn as a food source. The acorn had been used before this time, but it became a much more predominant resource with specialized procurement and processing technologies. People following these strategies were more sedentary than they had been in the past, and village sites are found throughout the valley along rivers and near other areas with permanent sources of water. An economic shift from a foraging to a collecting strategy probably occurred during the Middle Archaic.

The result of the settlement and subsistence reorientation described in the previous paragraph was a coeval, adaptive pattern with the Windmiller Pattern labeled the Berkeley Pattern (3500–2500 B.P.) (Fredrickson 1973). Windmiller Pattern sites seem to occur with more frequency in or near the Delta, while Berkeley Pattern sites tend to be more prevalent farther north. Berkeley Pattern sites are more numerous and more widely distributed than Windmiller sites and are characterized by deep midden deposits, suggesting intensified occupation and a broadened subsistence base. The Berkeley Pattern also has a greater emphasis on the exploitation of the acorn as a staple. A reduction in the number of handstones and millingstones and an increase in the number of mortars and pestles reflect this greater dependence on acorns. Although gathered resources gained importance during this period, the continued presence of projectile points and atlatls (spear-throwers) in the archaeological record indicates that hunting was still an important activity (Fredrickson 1973). Fishing technology improved and diversified, suggesting greater reliance on riverine estuarine resources. This pattern is also noted for its especially well-developed bone industry and such technological innovations as ribbon flaking of chipped stone artifacts.

Material culture similarities to the Windmiller Pattern include mortars and millingstones, quartz crystals, charmstones, projectile points, shell beads and ornaments, and bone tools. New elements include steatite beads, tubes and ear ornaments, slate pendants, and burial of the dead in flexed positions with variable orientation or cremations accompanied by fewer grave goods. During this period, flexed burials are found alongside extended burials at CA-COL-247, contrary to the pattern elsewhere in the valley, which saw near exclusive use of flexed burials for interment of the deceased (Moratto 1984; Rosenthal et al. 2007:155; White 2003:175). The use of grave goods generally declined (Moratto 1984), and trade continued to be important (Beardsley 1948; Fredrickson 1973; Heizer and Fenenga 1939; Lillard et al. 1939; Moratto 1984).

A restricted land base, coupled with a more specialized resource base, meant that people had to develop economic relationships with other groups of people with different specialized resources living in other areas. Although resources and commodities were being exchanged throughout the region before this period, more extensive and more frequently used economic networks developed during this time. Transported resources likely included foods (trans-Sierra acorn movement is known from later periods [d'Azevedo 1986]) and commodities more visible in the archaeological record, such as shell and lithic materials (Rosenthal et al. 2007:155).

Late Horizon: 1200 BP to Historic Period

The trends toward specialization, exchange, and spatial circumscription that characterized prior periods continued in the Late Horizon. Population continued to increase, and group territories continued to become smaller and more defined. The Delta region of the Central Valley reached population density figures higher than almost any other area of North America (Chartkoff and Chartkoff 1984). Patterns in the activities, social relationships, belief systems, and material culture continued to develop during this period and took forms similar to those described by the first Europeans that entered the area.

The predominant generalized subsistence pattern during this period is called the Augustine Pattern (1200 BP) and shows a high degree of technological specialization (Fredrickson 1973). Development of the Augustine Pattern was apparently stimulated by the southward expansion of Wintuan populations into the Sacramento Valley (Moratto 1984). The Augustine Pattern reflects a change in subsistence and land use patterns to those of the ethnographically known people of the historic era. This pattern exhibits a great elaboration of ceremonial and social organization, including the development of social stratification. Exchange became well developed, and an even more intensive emphasis was placed on the use of the acorn, as evidenced by the presence of shaped mortars and pestles and numerous hopper mortars in the archaeological record.

Other notable elements of the artifact assemblage associated with the Augustine Pattern include flanged tubular smoking pipes, harpoons, clam shell disc beads, bone awls for basketry, bone whistles and stone pipes, and an especially elaborate baked clay industry, which includes figurines and pottery vessels (Cosumnes Brownware). The presence of small projectile point types, referred to as the Gunther Barbed series, suggests the use of bow and arrow. Other traits associated with the Augustine Pattern include the introduction of preinterment burning of offerings in a grave pit during a mortuary ritual, increased village sedentism, maintenance of extensive exchange networks, population growth, and an incipient monetary economy in which beads were used as a standard of exchange (Moratto 1984). Burials were flexed with variable orientation and generally lacked grave goods (Beardsley 1948; Fredrickson 1973; Moratto 1984; Ragir 1972).

Ethnographic Context

To facilitate management of California Indian cultural resources in the Undertaking APE and to identify the appropriate Indian groups with which to consult regarding Undertaking activities, this ethnographic context is organized by Undertaking region (Regions 1a, 1b, 2, and 3). Seven Native American groups live within the Undertaking Area: the Bay Miwok, Konkow Maidu, Northern Valley Yokuts, Patwin, Plains Miwok, River Nomlaki, and Valley Nisenan (Figure G-1). The boundaries and names of the Native American groups depicted in the Figure G-1 are products, in part, of non-Indian cultural biases and do not represent historic (and frequently not modern) indigenous concepts of social organization or identity. Rather, designations such as “Bay Miwok” indicate a sociolinguistic unit generally concocted by University of California ethnographers interested in linguistic relationships among California Indians and in broad trends in religious practice and cosmology. They also have their basis in government policy, which sought to marginalize Native Americans from their best lands in favor of American citizens. The end result is a series of sociolinguistic groups, amalgamated on the basis of linguistic and cultural similarities. Although the construction of such analytical units is not inherently incorrect, it is important to recognize that such California Indians formerly ascribed no meaning to these terms, that Native Americans today frequently do not, and that these terms sometimes mask cultural heterogeneity within the groups.

Region 1a

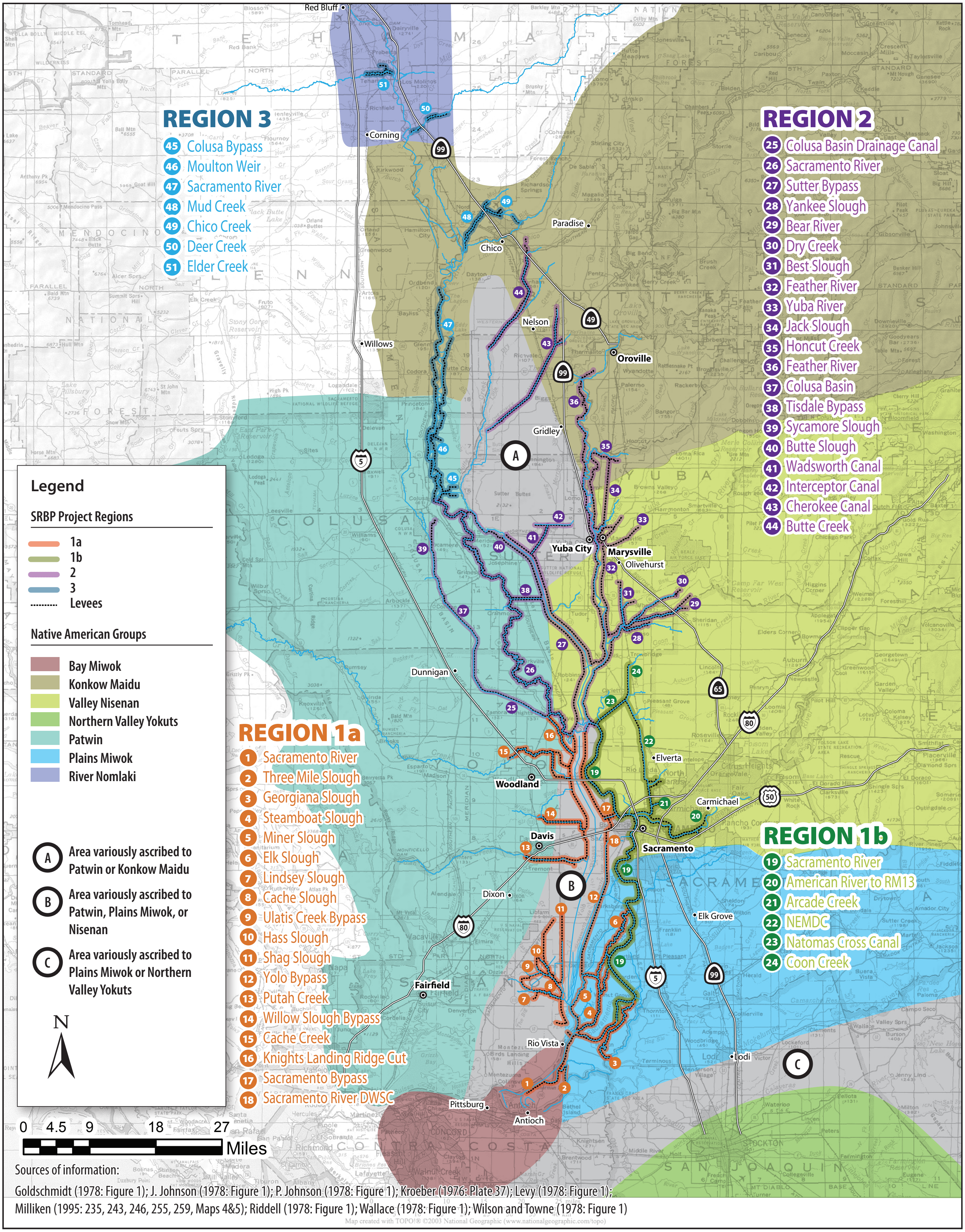
Region 1a was occupied by four Native Californian ethnolinguistic groups: the Patwin, Plains Miwok, Bay Miwok, and Northern Valley Yokuts. A summary of each group is provided below.

Patwin

The Undertaking APE is located within the historic territory of the Patwin (Johnson 1978:350; Kroeber 1976:Plate 34). *Patwin* is a collective Euroamerican referent for the speakers of one of the three languages in the Wintuan group, a part of the Penutian language family. One translation for the word is “people.” Several politically autonomous tribelets in the southwestern part of the Sacramento Valley are known to have used the word in reference to their respective individual groups (Powers 1877). The approximate maximum extent of Patwin territory in the late eighteenth and early nineteenth centuries was from Princeton in Colusa County south to Suisun Bay, and from the Sacramento River west across the eastern slope of the Coast Ranges (Johnson 1978; McCarthy 1985a:37, Map 9).

The evidence for the chronology of the initial establishment and subsequent development of Patwin territory is equivocal. Glottochronological estimates for the internal divergence of Wintuan languages suggests a California entry for Wintuan speakers ca. 2000–2500 BP (McCarthy 1985b:31), although Moratto (1984) argues from archaeological data that the Wintuan entry into California occurred approximately between 1950 and 1450 BP Glottochronological and other linguistic evidence suggests that the Patwin were in the lower Sacramento Valley by approximately 1250 BP (Bennyhoff 1977; Whistler 1977, 1988), and that they began to move onto the eastern slope of the Coast Ranges after approximately 950 BP (Moratto 1984:571).

The character of the culture that developed in the Patwin region is known from ethnographic and historic sources that date from the late eighteenth century to early twentieth century. Most of these sources date to the latter end of this range, because the intense proselytization of the Patwin by the



Sources of information:
Goldschmidt (1978: Figure 1); J. Johnson (1978: Figure 1); P. Johnson (1978: Figure 1); Kroeber (1976: Plate 37); Levy (1978: Figure 1); Milliken (1995: 235, 243, 246, 255, 259, Maps 4&5); Riddell (1978: Figure 1); Wallace (1978: Figure 1); Wilson and Towne (1978: Figure 1)

Graphics ... 06207.08 (1-11)

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Figure G-1
Native American Groups in the Program Area

Missions San Francisco de Asís, San José de Guadalupe, and San Francisco Solano in the late eighteenth and early nineteenth centuries, in combination with the malaria epidemic of 1833 and smallpox epidemic of 1837, led to an apparent rapid decline in Patwin population and the abandonment, particularly in the south, of significant portions of former Patwin territory (Johnson 1978:351–352). Most of the actual ethnographic data from native Patwin informants dates to the late nineteenth and early twentieth centuries and postdates the cultural upheaval of the earlier period. It is unclear how well the available data represents Patwin culture before European contact.

The tribelet was the broadest apparent unit of political organization among the Patwin. Kroeber (1932:258–259) developed the term to describe what appears to have been the prevailing form of Native American political organization in central California from approximately the late eighteenth century through the late nineteenth century. A tribelet is small in size, on the order of 100–300 people, with a discrete territory. The territory typically includes a permanent principal settlement or village and a number of subordinate villages that may or may not have been permanently occupied. Principal Patwin villages with dance houses appear to have been the residences of tribelet head chiefs (Kroeber 1932:259). Each village in a Patwin tribelet also had a chief (Johnson 1978:354). The position appears to have been hereditary, but, in the absence of an heir, village elders could choose a chief. The chief was the primary trustee of the village's natural resources. The chief appears to have been responsible for the reification of the village's ownership of particular resources and for decisions about resource utilization. Despite the apparent weight of a village chief's authority, the foundation for that authority was always the consensus of the households in the village.

The Patwin economy was principally based on the utilization of natural resources from the riverine corridor, wetlands, and grasslands of the lower Sacramento Valley, and from the open woodlands on the eastern foothills of the Coast Ranges (Johnson 1978; Kroeber 1932, 1976). The family was the basic subsistence unit within the tribelet engaged in the exploitation of this resource mosaic (Johnson 1978:354). Tribelets with territory primarily on the floor of the Sacramento Valley were more reliant on riverine and wetland resources. Fish, shellfish, and waterfowl were important sources of protein in the diet of these groups (Johnson 1978:355; Kroeber 1932:277–280). Salmon, sturgeon, perch, chub, sucker, pike, trout, and steelhead were variously caught with nets, weirs, lines and fishhooks, and harpoons. Mussels were taken from the gravels along the Sacramento River stream channel. Geese, ducks, and mudhens were taken with the use of decoys and various types of nets. Tribelets with territory on the western margin of the Sacramento Valley were less reliant on riverine and wetland animal resources and more reliant on terrestrial game (Kroeber 1932:294–295). Deer, tule elk, antelope, bear, mountain lion, fox, and wolf were variously driven, caught with nets, or shot.

Most of the plant resources that were important factors in the Patwin diet came from the grasslands of the lower Sacramento Valley and woodlands of the Coast Range foothills (Johnson 1978:355; Kroeber 1932:275–276, 295–296). Acorns were a staple among all the Patwin tribelets. Two types of valley oaks and a variety of hill and mountain oaks were the primary sources of this foodstuff. As in many other native California cultures, the acorns were pulverized into meal and leached with water in a sand basin. The processed meal was then used to make a gruel or bread. A number of seed plants were important secondary food sources, including sunflower, wild oat, alfilaria, clover, and bunchgrass (Johnson 1978:355). The seeds from these plants were typically parched or dried, and then ground into meal for consumption. Manzanita and juniper berries were also typically dried and ground. Blackberries, elderberries, and wild grapes could be eaten raw, dried and ground into meal, or boiled. On the western margin of the Patwin culture area, sugar pine and foothill pine nuts were roasted and eaten whole (Kroeber 1932:296).

Plains Miwok

The Plains Miwok are part of the larger Eastern Miwok group that forms one of the two major divisions of the Miwokan subgroup of the Utian speakers. The Plains Miwok lived in the Central Valley along the Sacramento, Cosumnes, and Mokelumne rivers. Like their neighbors to the north, the Plains Miwok, out of necessity, built their homes on high ground, with major villages concentrated along the major waterways. Conical homes were constructed with poles and thatching of brush, grass, or tule, and semisubterranean earth-covered homes were built as well. Major villages contained an assembly house, which was a semisubterranean structure with a diameter of 40 to 50 ft, as well as a sweathouse, which was a scaled-down version of the assembly house. (Levy 1978:408–409, Figure 1.)

The Plains Miwok gathered food resources as the seasons varied. As with most California tribes, the Plains Miwok relied heavily on the acorn for subsistence. Other gathered foods included nuts, seeds, roots, greens, berries, and mushrooms. Animal foods included tule elk, pronghorn antelope, jackrabbits, squirrels, beaver, quail, and waterfowl. Salmon was the dominant animal food resource, ranking above other river resources, such as sturgeon. Salt, nuts, basketry, and obsidian were obtained through trade with the Sierra Miwok to the east, for shells, basketry, and bows obtained in turn through trade from the west. (Levy 1978:402–405, 411–412.)

Technological items of the Plains Miwok are similar to those of the Valley Nisenan (see below). Wooden digging sticks, poles, and baskets were used for gathering vegetal resources, while stone mortars, pestles, and cooking stones were used for processing. Items used for obtaining animal resources included nets, snares, seines, bows, and arrows. Arrow points were made primarily of basalt and obsidian. (Levy 1978:405–406.)

Like the Valley Nisenan, the Plains Miwok practiced the Kuksu religion, with its ceremonies and dances, initiation rites, and ranking deity. The Plains Miwok also held ceremonies for girls' maturity, and held beliefs that explained their natural world. (Kroeber 1976:449–452.)

Bay Miwok

Bay Miwok territory encompassed the southeastern portion of the Montezuma Hills near Rio Vista and extended west to encircle what is now Walnut Creek. The southern part of Bay Miwok land included Mount Diablo and extended east as far as Plains Miwok territory in the vicinity of Sherman Island. (Levy 1978: Figure 1.)

The social organization of the Bay Miwok is similar to that of many other California Indian groups: they distributed themselves into tribelet groups that consisted of a village or groups of villages that shared linguistic and/or kinship affinities. Theodoratus et al. (1980:78) estimated the average population of Bay Miwok tribelets at 300 persons. Settlements were located on permanent watercourses and intermittent streams in drier areas and on high ground in areas near the Delta (Theodoratus et al. 1980).

To subsist adequately, the Bay Miwok followed a seasonal round to acquire necessary food and other materials. The Ompin tribelet in particular, would have visited the Montezuma Hills in spring and summer to hunt pronghorn antelope, jackrabbit, and possibly tule elk (Theodoratus et al. 1980).

Seed-bearing grasses and sedges may have been available during this period as well. Resources available in the Delta and surrounding marshlands included deer, pronghorn antelope, tule elk, rodents, waterfowl, freshwater mussels, freshwater clams, fish, and various insects.

The Bay Miwok constructed several types of structures. Conical thatch structures covered with tule mats were commonly used as residences both along the Delta and in uplands such as the Montezuma Hills. The Bay Miwok constructed semisubterranean earth-covered lodges that served as winter homes. Other structures included acorn granaries, menstrual huts, sweathouses, and assembly houses of two types: a semisubterranean earth lodge and a circular brush enclosure. The Bay Miwok made the earth lodge a ritual and social focal point. The brush enclosure provided space for ceremonies. (Levy 1978:408–409.)

Miwok technology included bone, stone, antler, wood, and textile tools. Hunting was accomplished with bow and arrow, as well as traps and snares. Basketry items included seed beaters, cradles, sifters, rackets for ball games, and baskets for storage, winnowing, parching, and carrying burdens. Other textiles included mats and cordage. Tule rafts were constructed for navigation on rivers and in the Delta. (Levy 1978:406.)

First contact between the Bay Miwok and Europeans transpired in the second half of the eighteenth century, when Spanish explorers entered the area. The first baptisms took place in 1794 and the last in 1827. A majority of the Bay and Plains Miwok converts were taken to Missions San Francisco de Asís and San José. It appears that many Bay and Plains Miwok tribelets disappeared through the combined effects of population removal to the missions and epidemics. Accounts exist of Miwok individuals who resisted missionization and fled to their villages. As a consequence, the Spanish formed military expeditions to recapture the fugitives. (Levy 1978:400; Milliken 1995:256.)

The initial Miwok defense strategy was to remain hidden in Delta lands, but eventually included counterattacks in the form of raids on missions and ranchos (Heizer 1941). With the arrival of trappers, gold miners, and settlers in California, the Miwok suffered exposure to newly introduced diseases. Although this early contact with settlers had a destructive impact on the Miwok population, specific tribal relationships with settlers varied.

Northern Valley Yokuts

Yokuts is a term applied to a large and diverse number of peoples inhabiting the San Joaquin Valley and Sierra Nevada foothills of central California. The Yokuts cultures include three primary divisions, corresponding to gross environmental zones: the Southern Valley Yokuts, Foothill Yokuts, and Northern Valley Yokuts. (Kroeber 1976:477; Silverstein 1978:446.)

There was no Yokuts tribal organization that encompassed the whole of the peoples speaking Yokutsan languages, or even a tribal organization that encompassed an entire primary division, such as the Foothill Yokuts. These are linguistic and geographic designations only. Similar to most Indian groups in California, the largest political entity among the Yokuts was the tribelet. A tribelet consisted of a large village and a few smaller surrounding villages. Larger villages and tribelets had a chief or headman, an advisory position that was passed from father to son. (Wallace 1978:466.)

The Yokuts languages, of which there are three subdivisions, belong to the Yokutsan language family of the Penutian stock (Shipley 1978). Each primary division included several dialects. The Northern Valley Yokuts lived in the northern San Joaquin Valley from around Bear Creek north of Stockton to the bend in the San Joaquin River near Mendota (Wallace 1978). The Undertaking Area was inhabited by the Northern Valley Yokuts tribelet known as the Cholbones (also Chulamni), which includes groups of Yokuts designated Nototemes, Jusmites, and Fugites or Tugites (Schenck 1926:137–138, Figure 1; Wallace 1978:469, Figure 1).

In general, the Yokuts were seasonally mobile hunter-gathers with semipermanent villages. Seasonal movements to temporary camps would occur to exploit food resources in other environmental zones. The primary difference between the various Yokuts groups rests largely on the differences in available resources in their territory. The Northern Valley Yokuts relied heavily on acorns as a food staple, which was processed into a thick soup, along with salmon and other fish, grass seeds and tule roots (which were processed into meal), and probably water fowl, tule elk, and pronghorn. (Wallace 1978:466.)

Principal settlements were located on the tops of low mounds on or near the banks of the larger watercourses. Settlements were composed of single-family dwellings, sweathouses, and ceremonial assembly chambers. Dwellings were small, lightly constructed, semisubterranean, and oval. The public structures were large and earth covered. Sedentism was fostered by the abundance of riverine resources in the area. (Wallace 1978:466.)

The Yokuts first came into contact with Europeans when Spanish explorers visited the area in the late 1700s, followed by expeditions to recover Indians who had escaped from the missions. The loss of individuals to the missions, influence of runaway neophytes, various epidemics in the 1800s, and arrival of settlers and miners inflicted major depredations on the Yokuts peoples and their culture. (Wallace 1978:468–469.)

Region 1b

Region 1b was occupied by three Native American ethnolinguistic groups: the Valley Nisenan, Plains Miwok, and Northern Valley Yokuts. The Valley Nisenan are described below; the Plains Miwok and Northern Valley Yokuts cultures are summarized under *Region 1a* above.

Valley Nisenan

The Undertaking APE is also located within the lands occupied and used by the Nisenan, or Southern Maidu. The language of the Nisenan, which includes several dialects, is classified within the Maiduan family of the Penutian linguistic stock (Kroeber 1976:392; Shipley 1978:89). The western boundary of Nisenan territory was the western bank of the Sacramento River. The eastern boundary was “the line in the Sierra Nevada mountains where the snow lay on the ground all winter” (Littlejohn 1928:13).

Nisenan settlement locations depended primarily on elevation, exposure, and proximity to water and other resources. Permanent villages were usually located on low rises along major watercourses. Villages ranged in size from three houses to 40 or 50. Houses were domed structures covered with earth and tule or grass, and measured 3.0 to 4.6 m in diameter. Brush shelters were used in summer and at temporary camps during food-gathering rounds. Larger villages often had semisubterranean dance houses that were covered in earth and tule or brush, with a central smoke hole at the top and an east-facing entrance. Another common village structure was a granary, which was used for storing acorns. (Wilson and Towne 1978:388.) A Nisenan village, Holloh, was located 2.4 kilometers (km) west of the Undertaking APE’s crossing of Bear River (Wilson and Towne 1978: Figure 1).

The Nisenan occupied permanent settlements from which specific task groups set out to harvest the seasonal bounty of flora and fauna that the rich valley environment provided. The Valley Nisenan economy involved riparian resources, in contrast to the Hill Nisenan, whose resource base consisted primarily of acorn and game procurement. The only domestic plant was native tobacco (*Nicotiana* sp.), but many wild species were closely husbanded. The acorn crop from the blue oak (*Quercus douglasii*) and black oak (*Q. kelloggii*) was so carefully managed that its management served as the equivalent of agriculture. Acorns could be stored in anticipation of winter shortfalls in resource abundance. Deer, rabbit, and salmon were the chief sources of animal protein in the aboriginal diet, but many other insect and animal species were taken when available. (Wilson and Towne 1978:389–390.)

Religion played an important role in Nisenan life. The Nisenan believed that all natural objects were endowed with supernatural powers. Two kinds of shamans existed: curing shamans and religious shamans. Curing shamans had limited contact with the spirit world and diagnosed and healed illnesses. Religious shamans gained control over the spirits through dreams and esoteric experiences. (Wilson and Towne 1978:393, 395.) The usual mode of burial was cremation (Faye 1923:37).

Region 2

Three Indian ethnolinguistic groups resided in Region 2: the Konkow Maidu, Patwin, and Valley Nisenan. The Patwin and Valley Nisenan are discussed under “Region 1a” and “Region 1b” above.

Konkow Maidu

Ethnographically, the Konkow Maidu occupied the area northwest of their Nisenan neighbors, in the foothills east of Chico and Oroville, as well as a portion of the Sacramento Valley (Riddell 1978). Konkow is one of three languages comprising the Maiduan language family of the Penutian linguistic stock. Several dialects of Konkow were spoken from the lower extent of the Feather River Canyon to the surrounding hills and in the adjacent parts of the Sacramento Valley (Shipley 1978).

The Konkow lived in village communities of three to five villages, in round semisubterranean houses covered with earth. It is estimated that a typical village consisted of about 35 people during ethnographic times. Villages were made up of smaller groups. Family units usually comprised two to five people. A major village with a large assembly structure and subterranean ceremonial lodge served as the central ceremonial and political focus for affiliated villages in the vicinity. This central village was not necessarily the most populous village, but likely served as the residence of the chief, who lived in the ceremonial lodge. The chief’s primary roles were as an advisor and spokesman. The individual villages were self sufficient, not under the control of a headman. (California Department of Water Resources 2004; Riddell 1978.)

In winter, the Konkow settled in widely dispersed patterns along river canyons, usually on ridges high above rivers and generally on small flats on the crest of the ridge, or halfway down the canyon side. A village community owned and defended a known territory, which served as a communal hunting and fishing ground. Some villages were strategically located atop isolated knolls in regard to attack and defense considerations. The Konkow followed an annual gathering cycle that made it necessary for them to leave their winter settlements on the river ridges. In summer, they traveled into the mountains to hunt. In spring, they ventured into the valley areas to collect grass seeds. (Riddell 1978.)

The Konkow economy was a mixture of hunting, fishing, and gathering. They managed their food resources skillfully, which made it possible for them to have a surplus during the nonharvest times. During harvest times, families gathered greens, tubers, roots, seeds, nuts, and berries. Although wild rye was common in their diet and pine nuts were highly valued, the most important harvested food was acorns, from black oak in particular. The Konkow managed their environment with a method of burning, which enhanced favorable ecozones. The Feather River provided a wealth of fish resources, mainly in the seasonal salmon runs. Lamprey eels were also abundant and favored by the Konkow in ethnographic times. Hunting was also an important source of food for the Konkow. Deer were the main game animal, but others included elk, rabbits, squirrels, and birds such as quail, pigeons, and ducks. (California Department of Water Resources 2004; Riddell 1978.)

Because the Konkow had no authoritarian political organization, the shaman was an important figure in their society. With his mysterious powers and spiritual communication, he provided a sense of unity among the village community. He functioned in ceremonies and festivals, and also served as a medical doctor. The office of shaman was an inherited one, falling to the shaman's sons after his death. (Riddell 1978.)

The Konkow held an annual mourning ceremony, the Keruk, for the recently deceased, which reenacted the death of the creator, Kukumat. For this ceremony, a male and female effigy were created, clothed, and burned. Other things, such as food, money, and blankets, were given to the god by burning. The Maidu participated in the Kuksu cult, also practiced by the Patwin, Pomo, northern Costanoans, and Coast and Sierra Miwok. Kuksu, "the South God," renews the world each year. The ritual was celebrated in round dance houses by dancers with elaborate costumes that included large feather headdresses. (Riddell 1978.)

Konkow life was little affected by European contact until the Gold Rush in 1849, which was particularly devastating for them. The Feather River and surrounding foothills were abundant in gold, which lured hordes of miners to the area. The miners brought diseases that were deadly to the native peoples, decimating the population. The miners also destroyed the landscape with their mining techniques and violently drove the surviving Konkow from their lands. When the mining craze was over, the miners settled in the area and turned large tracts of land into agricultural fields. Because the miners wanted their land, the Konkow were driven off their traditional lands twice. In 1853, the Konkow and other Native American groups were rounded up and sent to the Nome Lackee Reservation in Tehama County. This was not a successful reservation, and most families returned to their original lands. In 1863, the Konkow were again rounded up by the militia and driven, in what is now remembered as the "Death March," across the Coast Ranges to the Round Valley Reservation in northern Mendocino County. Many of these families remain in Round Valley today. Around the turn of the twentieth century, several small rancherias were created, finally establishing a legal land base for them and formalizing their tribal status with the federal government. Today, the Konkow are very active in cultural preservation in and around the Palermo/Feather River area. (California Department of Water Resources 2004.)

Region 3

Before Euroamerican incursions into California, Region 3 was home to three California Indian ethnolinguistic groups: the Konkow Maidu, Patwin, and River Nomlaki. The Patwin and Konkow are discussed under "Region 1a" and "Region 2" above, respectively.

River Nomlaki

At the time of Euroamerican contact, most of the western side of the Sacramento Valley north of Suisun Bay was inhabited by Wintuan-speaking people. Powers (1877) had recognized early linguistic and cultural distinctions between the southern membership of this large group (i.e., the Patwin) and the peoples occupying the northern half of the western valley. Subsequent linguistic analyses resulted in the present division of Wintuan into three stocks: southern (Patwin), central (Nomlaki), and northern (Wintu) (Shipley 1978:82). Clearly, however, the central and northern Wintuans were very closely related (Shipley 1978:82) and shared numerous cultural traits and attributes.

Two major divisions existed among the Nomlaki: the Hill and River Nomlaki (Goldschmidt 1978:Figure 1). The Hill Nomlaki occupied adjacent foothill lands to the west, extending to the summit of the North Coast Ranges in what are now Tehama and Glenn Counties. The River Nomlaki occupied the Sacramento Valley, primarily in present eastern Tehama County, and are the subject of this ethnographic summary.

Nomlaki subsistence was based on three main staples: deer, acorns, and salmon. All three were abundant within the western Sacramento Valley, particularly along the Sacramento River and its primary tributaries, although acorns and salmon were available only seasonally. These staples were supplemented with an immense array of less abundant resources, some available seasonally and some procurable year round.

Salmon was such a crucial food resource to the River Nomlaki that the availability of this food source has been used as an important variable in assessing prehistoric population levels (Baumhoff 1963) and is considered a major determinant of site distribution in portions of the Redding area (Raven et al. 1984). Other important riverine resources included trout, lamprey, whitefish, suckers, mussels, and clams. Fish poisons were used in some of the small streams and in still pools in securing various aquatic resources (Goldschmidt 1978:347).

Deer constituted a major dietary staple because they were abundant and available essentially year round. Deer were often hunted individually with bow and arrow, but also communally by being driven into snares. Many other animals were hunted with bows or slings, snared, clubbed, or shot in communal drives, including bear, rabbit, quail and other birds, rodents, and certain reptiles. (Goldschmidt, 1978:347.)

Acorns constituted the third primary staple of the Nomlaki, a food resource that was seasonally abundant and storable. Prepared during late prehistoric time periods with a hopper mortar and pestle into a meal for soup or flour for bread, acorns were available for immediate consumption or winter storage. Black and valley oak acorns were preferred for breads. Buckeye, which like acorns had to be leached, was an important vegetal resource, and other vegetal foods, including herbs, nuts, berries, fruits, seeds, and roots, were consumed in large quantities in early spring and summer. (Goldschmidt 1978:347.)

The available ethnographic information documents a complex pattern of land use, settlement, and subsistence orientation. The salmon runs, locations of seasonally available big game (especially deer), and distribution of acorn-yielding oak trees, which together supplied the primary staples for these Native Americans, required major forays from the home base because all three were concentrated in different areas. Moreover, the collection of exotic raw materials, such as obsidian and certain other utilitarian materials, often involved long, arduous trips (Goldschmidt 1978:345).

Because the locations and availability of these resources could not be modified by the Native Americans, it was necessary for the Nomlaki to arrive at a particular resource locality during its peak of production and ease of attainment. By appropriately arranging their patterns of movement, they were able not only to ensure an adequate supply of the primary staples in most years, but also to supplement these staples by hunting and collecting virtually every type of animal and plant food available within their territorial range. In addition to serving dietary needs, many of the collected animals, hundreds of varieties of plants, and inorganic minerals were sought for medicinal, technical, and magico-religious purposes. This form of resource exploitation required not only that permanent villages be established, but also that seasonal use be made of a wide variety of less-permanent villages and camps. (Jones & Stokes 1996:II-30–31.)

Although the nuclear family was the basic face-to-face interaction group of the Nomlaki, the social culture of both groups was centered on the village, or tribelet, as originally described by Kroeber (1932). Village authority was vested in a headman whose succession was inherited patrilineally, subject to approval by other male elders. Perpetuation of this role was particularly dependent on the ability of the individual to maintain social preeminence through organizational talents and accumulation of wealth. The primary duties of a chief or headman were to lead rather than to rule and included giving advice, settling disputes, and redistributing food resources, the latter being of particular significance in terms of maintaining stable and equal food supplies throughout the village over long periods. In sum, the economic cooperation effected through the chief's office served as the focal point for the social and political organization of the clusters of nuclear families, which in turn constituted a village or tribelet. (Goldschmidt 1978:343–344.)

According to Goldschmidt (1978), the external relationships of the Nomlaki were far reaching. The Nomlaki traded salt and food surpluses to the Wintu and Shasta for skins, obsidian, and yew wood for bows. Some Nomlaki individuals apparently specialized in trade, although as Goldschmidt points out, this profession was potentially very dangerous. Frequently, such specialists used the clamshell beads that had become a medium of exchange and standard of value throughout much of central California, although direct barter was also used when appropriate. (Goldschmidt 1978:344–345.)

The assimilation of Nomlaki culture into that of Euroamericans has been well documented. Their earliest contacts with Euroamericans were probably with hunters, trappers, and explorers who sporadically entered and crossed the northern Sacramento Valley during the 1820s and 1830s. A malaria epidemic in 1833 killed an estimated 75% of the Sacramento Valley Indians. Many Nomlaki villages were completely depopulated at this time (Cook 1955). The Sacramento Valley Indians never overcame the devastating effects of this epidemic and were ineffective in their efforts to resist the onslaught of miners and settlers into the region from the early 1850s through the 1880s. Following the arrival of miners and settlers, the Nomlaki suffered further catastrophic reductions in population, followed by the collapse in the economic and social bases for perpetuation of their traditional lifestyle. Eventually, the surviving members were moved to coastal and other reservations and camps. By the 1930s, there were three Nomlaki rancherias of six households each, with the men serving primarily as casual or migratory laborers (Goldschmidt 1978:342).

Historic Context

The following sections address the broad historical themes appropriate to the Undertaking Area: settlement/agriculture, flood control, and reclamation.

Settlement and Agriculture

The Sacramento River begins in the northern part of California near Mount Shasta in the Cascade Range and traverses southward for approximately 447 mi. Along the way, it meets with the Feather and American rivers just north of Sacramento. The river continues to flow southward, where it empties into the Delta (O'Neill 2006a:77–78). After the 1848 gold discovery in the Sierra Nevada, California's population increased, and settlements and towns were eventually established up and down the Sacramento River.

Region 1a

Solano County

Solano County is one of California's original 27 counties and retains its original boundaries (Munro-Fraser 1879:49–50). Euroamerican settlers began to arrive and set down roots within the boundaries of Solano County in the 1840s and 1850s (Munro-Fraser 1879:59–60). Towns such as Benicia, Vacaville, Suisun City, Fairfield, and Rio Vista were formed in the early years of Solano County's history. By 1878, an estimated 20,750 people resided within the county (Munro-Fraser 1879:80).

Throughout much of the latter part of the nineteenth century, wheat cultivation and ranching dominated the pursuits of Solano County agricultural producers. Later, parts of Solano County became major centers of fruit cultivation, a development spurred in part by local and national railroad development in the 1860s and 1870s (Delaplane 1999:5–7, 28–32; Keegan 1989:49–51, 58–60).

During the first half of the twentieth century, the local economy of Solano County was dominated by fruit production, processing, and marketing, which were hit hard by the Great Depression in the 1930s. Migrants from the Dust Bowl region arrived in the area and worked as fruit pickers and processors in the 1930s. Some of them acquired land and began farming. The local economy rebounded dramatically during World War II thanks to increased national demand for fruit products, but the county also experienced dramatic agricultural labor shortages (Delaplane 1999:6–8, 33–34; Keegan 1989:74–77). Solano County continued to grow and undergo development after World War II. By the 1980s, 8,000 personnel served at Travis Air Force Base and lived in and around the base with their 10,000 family members.

Yolo County

Yolo County is located in the northern part of the Central Valley. It is bounded on the west by Lake and Napa Counties, to the south by Solano County, to the north by Colusa County, and to the east by Sutter and Sacramento Counties. The Sacramento River spans the entire length of its eastern border. The western portion of the county features rolling hills and steep mountains, and the eastern part is composed of nearly flat alluvial plains and basins. During the early 1800s, the region was explored by hunters and trappers such as Jedediah Strong Smith, Ewing Young, and a group of Hudson's Bay Company trappers. The hunters found the banks of the rivers and streams rich with beaver, otter, and other animals whose pelts were a highly valuable commodity in the worldwide trade of the time (Hoover et al. 1990:533). Like Solano County, Yolo County was one of the original 27 counties created when California became a state in 1850. Initially, the county's territory was nearly twice as large as it is now, including a large portion of present-day Colusa County. By 1923, the boundaries were redrawn to their current configuration. At one time, the region abounded with fields of tule rushes, as well as swamplands, marshes, and sloughs (Alta California 1850:2:5; Coy 1973:296; Gudde 1969:370).

Yolo County's first town was Fremont, founded in 1849 near the confluence of the Sacramento and Feather rivers (south of present-day Knights Landing). It became the first county seat in 1849. After the damaging flood of 1851, the county seat was moved to Washington (now part of present-day West Sacramento). Between 1857 and 1861, the county seat moved from Washington to Cacheville (present day Yolo) and then back to Washington. Finally, in 1862, more flooding episodes motivated the community voters to select centrally located Woodland as the permanent county seat (Hoover et al. 1990). Today, the county is home to incorporated cities such as West Sacramento, Davis, and Winters, and several unincorporated cities such as Clarksburg, Dunnigan, and Knights Landings.

The decline of the Gold Rush resulted in disenchanted miners who realized they could make a greater fortune through farming and ranching rather than gold prospecting, and they helped transform Yolo County from an isolated farming community into a booming agricultural region. Through both the mid-nineteenth and twentieth centuries, Yolo County commerce was generally agrarian in focus; the main crops were wheat, barley, and other grains. Commercial enterprises related to agriculture and livestock also sprang up during this period, furthering the development and growth of the region (Larkey and Walters 1987).

Region 1b

Sacramento County

On the eastern banks of the Sacramento River, Sacramento County was established. The first well-documented European exploration of the general region occurred in 1808, when Spanish explorer Gabriel Moraga led an expedition from Mission San José to the northern Sacramento Valley (Hoover et al. 1966). The earliest Euroamerican settlement in the region coincided with the establishment of land grants by the Mexican government in the 1840s. John A. Sutter obtained the first such grant in 1841 at his New Helvetia Rancho, which encompassed lands on the east banks of the Feather and Sacramento rivers (Beck and Haase 1974). The Gold Rush of 1848–1849 ensued shortly thereafter.

Agriculture and ranching were the primary industries in the present-day Sacramento County during the early historic period. Regional ranching originated on the New Helvetia Rancho in the early 1840s. The Gold Rush precipitated growth in agriculture and ranching because ranchers and farmers realized handsome returns from supplying food and other goods to miners. Frequent floods plagued the residents of the region, however, and posed a significant threat to the viability of agricultural interests and further settlement.

In addition to these agricultural pursuits, Sacramento had political pursuits. California's capitol was finally established in Sacramento in 1854. The foundation for the first capitol building was laid in 1860. Floodwaters, however, washed away the foundation, forcing two terraces to be constructed in an effort to protect the building from future flooding; the building was completed in 1874. (Hoover et al. 1990:292.) The completion of the transcontinental railroad in 1869 brought further immigration to California and Sacramento (McGowan 1961:402). Advances in agricultural techniques, equipment, and water management from the 1880s to the early twentieth century brought the Sacramento Valley into the "fruit epoch." Agriculture replaced mining and cattle ranching as the valley's most profitable industry. By 1894, 75% of fruit shipped from California to the east coast was from the Sacramento Valley. (Sacramento History Online 2004.)

The development of the Sacramento and American rivers as resources for hydroelectric purposes and as forces to control increased greatly from the 1890s to the twentieth century, starting with the construction of a transmission line from Folsom Dam to Sacramento in 1895. Levees containing flood areas of both rivers were raised and expanded often in coordination with rail line improvements (Sacramento History Online 2004). Current rail line berms are built on top of levees for flood containment and date from the mid-nineteenth century, with improvements built into the mid-twentieth century.

Placer County

Gold was discovered in Auburn Ravine in Placer County in May 1848, and the area soon attracted hordes of miners. Placer County is situated north of Sacramento County and was created from sections of Sutter and Yuba Counties in 1851. The county's name is derived from placer mining, which was the county's primary source of employment, and the placers of the area were the state's grandest. (Hoover et al. 1990:257.) Throughout the 1880s, gold mining was the county's chief industry. Farming, timbering and laboring for the SPRR were attractive opportunities for new residents.

During the first years of the Gold Rush, gold deposits were extracted primarily by individuals working alone, using pick, shovel, and gold pan. Later, ground sluicing, hydraulic mining, and drift mining were the most prevalent gold recovery systems. Ground sluicing used low-pressure natural or artificial water channels to excavate gold-bearing gravels. In the 1860s, hydraulic mining techniques were developed that used powerful jets of water to expose gold-bearing earth or gravel. (California Department of Transportation 2008:48–52.)

Many canal systems in northern California originated during the Gold Rush period. Mining ditches were constructed to provide a constant supply of controlled water for processing large quantities of placer gravels. The need became critical when mining operations moved away from streambeds in the mid-1850s. After years of lawsuits and quarrels over water rights, three principal water companies in Placer County—the Rock Creek, Deer Creek, and South Yuba Canal companies—agreed to consolidate their interests in 1854. These companies merged into one, which they named the South Yuba Water Company. By the 1860s, a network of more than 390 mi of interconnecting ditches and flumes wound through the Placer County foothills (Lardner and Brock 1924). By the 1870s, many high mountain lakes had been dammed to supply year-round water. In addition to large-scale waterworks, thousands of small ditches were constructed by individual miners to control the seasonal water supply and transport water from large ditches. The Feather and American rivers connect as the source and outflow for water systems within the county. Reclamation districts were created later to better manage the county's water distribution.

Advancements in underground mining technology during the 1890s led to an increase in production for the gold mining industry. Because of both national and worldwide declines in gold values, however, this mining boom was short lived. A brief revival of mining activity took place in the 1930s, when many individuals who were feeling the effects of the Great Depression sought alternative sources of income. During World War II, mining was curtailed on a national level, and the mining industry has never again regained the success seen during the Gold Rush. (Clark 1970.)

Region 2

Sutter County

The area that now encompasses Sutter County was first explored by Gabriel Moraga in 1808 during his second expedition into the inland valley of California. Subsequent visitors include Luis Argüello, who came to the area in 1817 in search of possible mission sites, and the American frontiersman and trapper Jedediah Strong Smith, who passed through the region in 1828. Hudson's Bay Company trappers also traversed the land that forms Sutter County on their expeditions south during the 1830s and 1840s. (Gordon 1988; Hoover et al. 1990.)

The first permanent settlement in Sutter County was Hock Farm, established in 1841 by John A. Sutter. Located approximately 8 mi south of Yuba City, Hock Farm was one of Sutter's several ranchos and became the principal stock ranch for his sprawling New Helvetia settlement. Under the management of Sutter's employee, John Bidwell, Hock Farm eventually included a home, orchards, gardens, and more than 5,000 head of cattle, which grazed freely on Sutter's lands between the Sacramento and Feather rivers. The Gold Rush (1848–1852) and the resultant pillaging of his fort at Sacramento prompted Sutter to make Hock Farm his primary residence between 1850 and 1868. Sutter continued the agricultural diversification of his lands by importing cuttings and seeds from abroad, which served as the nucleus for the extensive orchards, gardens, and grain fields that support Sutter County's economy today. The agricultural opportunities generated by Sutter's land improvements soon attracted hundreds of new settlers to the region. In 1850, Sutter County was officially incorporated. (Gordon 1988; Hart 1978; Hoover et al. 1990.)

With the decline of the Gold Rush, farming and ranching became the predominant economic activities in Sutter County. By the mid-1850s, farmers were producing large quantities of wheat and other grains for local markets and for export. Land improvement projects in the Sutter Basin during the 1860s opened up new lands for the cultivation of barley, corn, rice, prunes, and the Thompson seedless grape, which was first introduced to the region in 1870. The success of fruit orchards led to the development of canning and packing operations that continue to support the economy of Sutter County today. (Gordon 1988; Hart 1978.)

The growth of commercial agriculture in Sutter County necessitated more effective means of transport to various markets in the Sacramento Valley and other parts of the state. Steam navigation between Yuba City and Sacramento via the Feather and Sacramento rivers began in the 1850s, but was continually hampered by awkward bridge transport and debris from hydraulic mining operations that filled the rivers. Rail transport effectively replaced water bound commerce with the coming of the California Northern Railroad in 1864, the California Central Railroad in 1869, the San Francisco–Marysville Railroad in 1871, and the Western Pacific Railroad in 1910. (Gordon 1988; Hart 1978.)

Sutter County experienced 15 major flood events during the twentieth century. There are more than 200 linear miles of levees countywide, 70 mi of which protect Yuba City and Live Oak alone. The last time levee breaks occurred during a flood event was in 1955 at Yuba City and Nicolaus. However, the most recent major flood event occurred on the Feather River in 1997 in Yuba City and also affected nearby municipalities in Yuba County. Twenty-four thousand residents were evacuated. (Sutter County 2010.)

Yuba County

Yuba County was founded in 1850 with Marysville as its seat. By 1850, the permanent population of Marysville reached about 500. During the winter of that year, the town's leaders formed a committee to draw up official incorporation papers to present to the new state legislature that was set to convene in January 1851. The committee also discussed a variety of names for the new city, including Yubaville, Sicardville, Scardoro, and Circumdoro, before they settled on Marysville, in honor of Mary Murphy Covillaud. In January 1851, the new California legislature approved the charter for the City of Marysville with the official incorporation occurring the following month. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.) Over the next decade, Marysville grew rapidly and the population increased steadily. Between 1851 and 1855, nearly 140 brick buildings were erected in the commercial area of town. By 1853, the city was the third largest in the state. Gold remained the center of the economy and in 1857 alone, more than $10 million in gold was shipped from Marysville's banks to the U.S. mint in San Francisco. The population reached nearly 4,000 permanent residents by the end of the decade. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

For the remainder of the nineteenth century, as gold production declined, Marysville's economic base shifted to agriculture. As was true in most regions of the state, wheat became the most profitable and therefore most popular crop during the 1860s and 1870s. The arrival of the Southern Pacific Railroad (SPRR) in the mid-1860s diverted traffic from the river and made transportation of goods to market easier and more reliable. During this time, the population of Marysville changed in character with women and children replacing single men. Although the city's population rose to nearly 5,000 in 1870, repeated flooding and the depression that followed the collapse of the international wheat market resulted in a slow decrease in population during the 1880s and 1890s. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

The construction of large-scale irrigation projects created a boom in Marysville's economy during the early part of the twentieth century. Dry-farmed wheat gave way to irrigated orchard crops as farmers subdivided their large former wheat tracts into 20 to 40 ac parcels on which to grow a variety of fruits, including peaches, plums, and grapes. Other profitable crops included beans and rice. By the 1920s, Marysville was once more the vital economic hub for the region. The Western Pacific and Sacramento Northern railroads established links to serve Marysville. Several large corporations, including Pacific Gas and Electric Company and Standard Oil, established regional headquarters in the city. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

The revitalized economy led to a 65% increase in Marysville's population between 1900 and 1930. It was also during this period of expansion that many of Marysville's most recognizable architectural landmarks were constructed. During the late 1920s, more than 20 major new buildings, valued at well over one million dollars, were erected in the city. Two of the most notable are the seven-story Hart Building and the Marysville Hotel. (Laney n.d.:46–47; Yuba County Historical Commission 1976:11–13.)

Butte County

Butte County is situated on the east side of the Sacramento Valley and is bounded by the Sacramento River to the west and the Sierra Nevada to the east. Early exploration of the county began in the 1800s, when Gabriel Moraga guided an expedition up north, along the Calaveras, Mokelumne, Cosumnes, American, and Sacramento rivers, in search of potential inland mission sites. Shortly after, hunters and trappers, such as Jedediah Strong Smith and a group of Hudson's Bay Company trappers, explored the present-day Butte County. The hunters found the banks of the rivers and streams rich with animals whose pelts were highly valuable commodities in the worldwide trade of the time. The region remained outside the mainstream of both Mexican and American settlement until the Gold Rush of 1848, which brought an influx of gold seekers to the region. Transitory encampments, such as Bidwell Bar, Long Bar, and Hamilton, were established. During the next 70 years, gold mining in some form remained the primary economic activity in Butte County. The county's present limits were established in 1923. The original county seat was Hamilton, a former mining town. In 1853, the seat moved to Bidwell Bar (another mining camp). In 1856, it moved again to its current location of Oroville. (Coy 1923; Gudde 1969; Hoover et al. 1990:35.)

During the 1850s and 1860s, much of Butte County was settled with small farms, where settlers raised wheat; vegetables; livestock; and cultivated orchards that included apples, peaches, pears, figs, citrus, and olives. Wheat became the prevalent crop during this period and dominated the agriculture of the county for much of the remainder of the century, until the state experienced an overall decline in the 1890s as a result of the wheat bust. Citrus colonies were organized in Butte County between 1886 and 1895, the most prominent of which were Thermalito, Palermo, and Rio Bonito. (Frederich 1974:13.) By the early twentieth century, Butte County served as a major fruit- and nut-producing region. During this period, land holdings increased in number but declined in overall acreage. While the number of farms increased from 1,179 to 2,603, the average farm size decreased from 574.3 ac to 238 ac. (Walker et al. 2005.)

Butte County remains basically a rural county, with Biggs, Chico, Gridley, Durham, Paradise, and Oroville representing (roughly) six of the largest communities. The lack of any real major mineral deposits, such as coal or iron, and the county's distance from major commercial centers have contributed to the overall rural development of the county.

Colusa County

Monroeville served as the original county seat of Colusa County. By 1853, the seat had moved to Colusa. In 1891, a portion of Colusa County was removed to become part of Glenn County (Coy 1923; General Land Office 1855a–c, 1856a, 1856b, 1867a, 1867b, 1879; Robinson 1948).

The Spanish explored this region of California as early as 1808. Fur trappers passed through the valley over the next few decades, and by the mid-1840s, a handful of ranchos ranging from 6,880 to 10,522 hectares (ha) had been established in the area. The ranchos were primarily used for cattle ranching. Following the Mexican War in 1846, California was ceded to the United States and became a state in 1850. Gold Rush miners who had limited success in the gold fields traveled north and settled in the area to take advantage of the temperate climate and abundant land, which was well suited for ranging and agriculture. Dry farming of wheat and barley, and cattle ranching remained the predominant activities in the region until the early part of the twentieth century (McGie 1970).

World Wars I and II were especially profitable years for the county because there was an increase in demand for grains. In the post–World War II years, agriculture continued to be the major industry in Glenn and Colusa Counties, and the region enjoyed a period of growth with the addition of several new farmsteads. Gross receipts in Colusa County in 1965 were $29,786,500 from field crops, followed by fruits and nuts at $6,123,000, and livestock at $5,431,000 (Colusa County Chamber of Commerce 1966).

Region 3

Tehama County

Tehama County was organized in 1856 from parts of Colusa, Butte, and Shasta Counties (Hoover et al. 1990:495). The county took its name from the centrally located town of Tehama, which likely was named for the Indian word for "low land" or "high water." The county seat was originally in Tehama; however, in 1857, it moved to Red Bluff, where it has remained to the present (Hoover et al. 1990:526–527).

Euroamericans entered the Tehama area beginning in the early nineteenth century. The first Euroamerican to traverse the area was likely Luis Arguello, who entered the region in 1821 and proceeded as far north as Cottonwood Creek. In 1828, Jedediah Strong Smith, who opened the Sacramento Trail (for fur trapping) in the late 1820s, passed through the region. Smith reported to the Hudson's Bay Company about the quantity and quality of furs available in California. In 1828, the company sent its first trapping expedition from the north. Other hunters and trappers entered the region along the Sacramento Trail from the south. By the mid-1800s, the Sacramento Trail had developed into a well-defined path, used by trappers such as Ewing Young, Lieutenant George Emmons and the Wiles expedition, Joseph Gale, John Bidwell (1843), Robert Hasty Thomes, and Albert G. Toomes, who were among the earliest settlers in Tehama County (Hoover et al. 1990: 526–527).

During the 1840s, Tehama County land was deeded under Mexican land grants. Five large land grants were distributed in the Tehama region: Rancho de la Barrana Colorado; Rancho de las Flores, Rancho de los Berrendos; Rancho de los Saucos, which was granted in 1844 to Robert Thomes; and Rancho del Rio de los Molinos, where settler Albert Toomes set up a ranch. Other landowners who received these grants included Dr. Stokes and his wife, and the children of Thomas O. Larkin (Jackson 2010).

Tehama County remained largely unsettled by Euroamericans during the Spanish and Mexican periods. By 1849, gold seeking settlers entered portions of the Tehama region in search of the precious metal along Feather River. Little gold was discovered in the Tehama area, and by the mid-1850s, settlers had turned to ranching and farming private operations. During the 1870s, railroads began laying down tracks throughout the state. In 1872, the Oregon and California Railroad was completed to Red Bluff, spurring fast growth in the small town and in the Tehama area at large as the railroad provided access, goods, and employment throughout the region. Beginning in the late nineteenth century, regional industry consisted of logging, agricultural, and ranching practices. These practices declined during the early twentieth century as residential development increased in the county. (Elliott & Moore 1880:14; Hoover et al. 1990:530–531.)

During the early to mid-twentieth century, transportation expansion, water distribution improvements, and other economic developments resulted in continued residential development in Tehama County. Although railroads continued to expand throughout the county during the 1910s and 1920s, automobile popularity and increased access to the county led to a decline of railroad use and development. By the late twentieth century, Tehama County had an established residential community with a population of close to 60,000 residents (U.S. Census Bureau 2010).

Glenn County

Glenn County was created in 1891 from the northern section of Colusa County and named after Dr. Hugh James Glenn. Willows is the country seat and it was named after willows growing next to the only watering hole between Stony Creek to the north and Cache Creek in Yolo County to the south. Dr. Glenn operated the largest wheat farm in California during his lifetime (Hoover et al. 1990:93).

The Feather and Sacramento rivers run through the county. Near the Feather River, John Bidwell discovered gold on what he named the Bidwell Bar. Granville Swift amassed a fortune on the lode and is reputed to have worked the claim with Stony Creek Indians as laborers.

East of the Sacramento River, in Glenn County, Butte City is an agricultural center. Also, in the eastern portion of the county north of Elk Creek, the first grindstones for milling were cut and shipped by canoe down the Sacramento River to Sutter's Fort and to San Francisco (Hoover et al. 1990:97–101).

Although the county remains mostly rural, extensive road and irrigation development greatly increased agricultural and residential development throughout the twentieth century. The extensive Mendocino National Forest extends well into eastern Glenn County.

Flood Control and Reclamation

The Sacramento River is well known for its associated large, fast-rising floodwaters that are caused by a combination of snowmelt from the Sierra Nevada, rainfall that occurs primarily during a 5-month period (Henley 2006:7; O'Neill 2006b:69), and the steep incline of the mountain range. The Sacramento River drains a watershed area of more than 58,000 square miles (Isenberg 2005:60). The land surrounding the Sacramento River was a source of an abundance of alluvial soil, which was excellent for agricultural pursuits and attracted settlers (O'Neill 2006a:77). This fertile soil, however, was often inundated by floodwaters.

Mining

The discovery of gold in 1848 brought a massive migration that propelled California into statehood in 1850. In the early stages of the Gold Rush, most men were engaged in placer mining. This changed in 1852, with the introduction of hydraulic mining, which washed away entire hillsides (Starr 2005:89–90). The mining operations along the Feather, Bear, Yuba, and American rivers were extensive, and each of these rivers flows into the Sacramento River (Isenberg 2005:70). As the debris collected in the Sacramento River, it caused the riverbed to rise and thereby affected the scale and frequency of seasonal flooding.

Mined material remained California's leading export during the early 1860s, and the mines constituted some of the top employers in the state. This same period saw improvements in hydraulic mining technology that resulted in even further hillside erosion, and silt and rock buildup in the rivers. As debris collected in the Sacramento River, it affected navigation and reduced the depth of the river. The floods of 1861–1862 were particularly devastating to places like Sacramento, where levees on the American River failed and a levee on the Sacramento River was cut to help drain the water (O'Neill 2006a:80–84). Communities along the Sacramento River felt the impacts of hydraulic mining as floods and debris ruined vast amounts of agricultural lands (Crawford and Herrick 2006:138). Farmers began concentrated efforts to halt hydraulic mining. Lawsuits were brought against the mining companies, but the lobbying efforts and political clout of the mining companies were too strong, particularly after the formation of the Hydraulic Miners Association in 1876. In 1878, the Sacramento River flooded, and only Sacramento and Marysville were not underwater (O'Neill 2006a:80–84). That same year, the Office of the State Engineer was created; for the first 2 years of the office's existence, its focus was on debris and drainage questions (Crawford and Herrick 2006:138, 140). In 1884, Judge Sawyer of the U.S. Circuit Court in San Francisco filed a permanent injunction against hydraulic mining companies that failed to properly restrain their debris. The 1884 decision basically ended hydraulic mining in California, but extensive damage to the Sacramento River had already been done, and the effects continued to be felt into the twentieth century (O'Neill 2006a:85, 92).

Flood Control

The impacts from hydraulic mining were felt by most communities and farmers along the Sacramento River. In the early years of statehood, the Sacramento Valley experienced extensive flooding. In response, private landowners constructed small levees—between 3 and 4 ft. high—near their farms. This was a pattern repeated by most landowners along the Sacramento River. These levees, however, proved ineffective and failed during the catastrophic floods from this early period (Crawford and Herrick 2006:138; McGowan 1961:287; O'Neill 2006b:74). As the floods worsened, landowners attempted to build higher levees, but these too proved ineffective (McGowan 1961:288).

California was included in the federal Swamp Land Act of 1850, which allowed for the state to reclaim its wetlands through the construction of levees. The program, however, was riddled with corruption and problems that compounded levee construction (O'Neill 2006b:48–50, 52, 73; U.S. Geological Survey 2006). In the early 1860s, as hydraulic mining increased and flooding continued to be a significant problem for farmers along the Sacramento River, a concentrated effort at levee construction began. The state legislature tried to coordinate a levee system and control levee construction by creating the Swamp Land Commission. Modeled after districts in Mississippi, the legislation gave California drainage districts the power to construct levees. It would become the responsibility of state engineers to design the levees for each district, which by the end of the first year included 28 districts. For a multitude of reasons, including more flooding, landowners refusing to pay levee fees, and others unable to pay, the system produced only minor tangible results. The legislature enhanced levee district powers in 1864, which spurred more levee construction (O'Neill 2006b:81).

However, by 1866, after complaints for local control over the districts, the state was no longer planning for a centralized levee system. The following year, the region suffered from another catastrophic flood when the American River rose so high that it flowed across the Sacramento River and breached the levees on the west side of the river, north of present-day West Sacramento in Yolo County (McGowan 1961:289). Levee construction and flood control management got a boost in 1868 with the Green Act. The act eliminated the limit on the number of swampland acres allowable under the federal swampland program and transferred to landowners the task of creating levee districts. Between 1868 and 1871, almost all remaining swampland passed into the hands of private owners (O'Neill 2006b:82). During this period, private owners constructed extensive levee systems that were much larger and, combined with the reclamation of swamplands, made flooding more serious (O'Neill 2006b:82; McGowan 1961:287).

Levee construction and flood control were compounded in the 1880s and 1890s as the fight between miners and farmers continued. There was also disagreement between USACE and the state about USACE's role and authority in the matter. This hindered federal involvement. Local reclamation districts continued to build levees piecemeal, including levees on the west bank of the Sacramento River. These raised the floodplain, protected the local lands, and blocked natural outlets. This created flood problems for residents farther down the river during the first part of the twentieth century.

In 1903 and 1904, the Sacramento River once again flooded. In 1904, a statewide lobbying organization was created for the purpose of generating more work from the state government on river improvement in cooperation with landowners and other government agencies. The governor created a Board of River Engineers composed of engineers with extensive experience with river management on the Mississippi River. The recommendation was that the stress on the levees could be relieved by constructing weirs that would temporarily allow for excess water to bypass the river channel until a proper channel depth could be achieved. The proposal was rejected by the California Board of Trade, which was pushing for the construction of more levees. This was ultimately the approach adopted by the legislature (O'Neill 2006b:94, 104, 106–107).

California continued to lobby the federal government for help. Another devastating flood in 1907 increased pressure for more federal funding, but plans for a comprehensive flood control plan stalled after it was learned that the driving force behind the plan was private landowners. It would take until 1911 for a California Debris Commission member, Thomas H. Jackson, to design a flood control plan that was more comprehensive than just constructing levees. This approach was acceptable to the federal government, and a special session of the state legislature approved California's support and participation in the new flood plan (O'Neill 2006b:111, 114–115). Lobbying efforts continued to press the federal government and finally were successful when the 1917 Flood Control Act was passed. Among other things, the act required USACE to work with state governments and local levee districts and gave $5.6 million to construct flood control facilities on the Sacramento River (O'Neill 2006b:125). The act authorized the SRFCP, which provided for the construction of more levees and the Yolo and Sutter bypasses. The Sacramento project was the first complete proposed federal project (Bailey 2007:24; California Central Valleys Flood Control Association 1960; O'Neill 2006b:125).

Changes to the act were made in 1928, 1937, and 1941. The projects on the Sacramento River were further affected by Further Flood Control Acts of 1944, 1950, 1958, and 1960. The SRFCP resulted in 980 mi of levee construction (California Central Valleys Flood Control Association 1960). In 1955, another devastating flood occurred in the Sacramento region when the Sacramento River overflowed its levees. A subsequent investigation exposed structural and functional deficiencies in the levees that could not have been foreseen or tested until a flood occurred. The levees on the Sacramento River needed maintenance, which continued to be costly. One reason for the deterioration was thought to be erosion caused by increased pleasure boating on the river that caused wave crashing (California Central Valleys Flood Control Association 1960).

Reclamation

Beginning in the 1860s, the counties of the Sacramento Valley began relying heavily on agricultural pursuits. In 1861, the state legislature created the State Board of Reclamation Commissioners and authorized the formation of reclamation districts for flood control and drainage of surplus water for agricultural purposes. Throughout the Sacramento Valley, reclamation efforts were underway. Reclamation Districts (RDs) 900 and 537 were formed to protect the American and Yolo basins and lower Sacramento County from flooding and to allow for reclamation of agricultural lands in these regions. Swampland districts were also formed, and by 1865, 42 km of levees and 32 km of drainage canals had been constructed (Bouey and Herbert 1990; Thompson 1958).

Periodic droughts and the general decline of the wheat market at the turn of the twentieth century caused farmers in the area to focus on improving crop irrigation. William S. Green, one of the early settlers of Colusa, envisioned revolutionizing agriculture in the region by constructing an irrigation canal that would divert water from the Sacramento River to farms in the valley. Although his idea had some support, diversion efforts eventually led to conflict between those who were diverting the water and those who relied on the natural flow of water to their crops and livestock. The passage of the Wright Irrigation Act in 1887 catapulted Green's idea (URS Corporation 2006:6). The state legislature passed the act in an attempt to support irrigated farming and solve conflicts over water control. It also led to the formation of irrigation districts controlled by local landowners. Although wealthy landowners with riparian rights fought for the validity of the act, irrigation districts took shape nonetheless. Within a few years of 1887, more than 90 irrigation districts had formed. However, most of the districts were plagued by water rights issues, litigation, political opposition, and poor fiscal management, which led to most not surviving. Despite this, the 1897 Wright-Bridgeford Act streamlined the process for forming irrigation districts (Corbett and Bradley 2001:J-5).

During this same period, the state legislature passed additional legislation increasing the supervision over organization and financing of the irrigation districts, including the creation of the Bond Certification Commission. The commission rendered opinions on the viability of proposed districts and approved their bonds. After 1915, the overall number of organized irrigation districts increased. By 1929, there were 15 irrigation districts in the Sacramento Valley between Sacramento and Redding, and more than half of them were formed between 1916 and 1919, during the years of the great expansion of the rice industry. By the 1930s, the state had more than 607,029 ha of irrigated land in more than 94 districts throughout the Central Valley (JRP Historical Consulting Services and California Department of Transportation 2000:43–44).

On November 22, 1887, the Central Irrigation District formed in Colusa County (Glenn County was part of Colusa County until 1891) and construction on the Central Canal began (Rogers 1970:340). Because of ongoing litigation issues, construction on the canal was hampered and eventually stopped, leaving farmers with limited means to irrigate their fields. In 1903, the Central Canal and Irrigation Company purchased the works. Although it made some progress on the canal, the company also experienced financial troubles. Within 6 years, the Central Canal and Irrigation Company changed hands, when the Sacramento Valley Irrigation Company (founded by the Kuhn banking system) purchased the Central Canal and Irrigation Company (URS Corporation 2006:7). The bank failed in 1915, which led to the Sacramento Valley West Side Canal Company being in receivership and the State Railroad Commission fixing the rates.

By 1920, the Glenn-Colusa Irrigation District (GCID) had absorbed the system. In an effort to obtain water, the GCID began construction to complete the Glenn-Colusa Canal (originally known as the Central Irrigation Canal) and secondary canals and associated ditches built by the Central Canal and Irrigation Company and later the Sacramento Valley Irrigation Company. By the time the GCID completed work on the canal, the capacity of the water feature had nearly doubled. However, unfortunate events, such as heavy rains resulting in failed crops and the stock market decline coupled with the Great Depression, wreaked havoc on Glenn and Colusa Counties. As a result, county farmers faced financial difficulties as they fell behind on payments and taxes owed to the irrigation districts and the counties, which resulted in the farmers eventually losing their land. Ultimately, the irrigation and reclamation districts (including RD 2047) became land-rich, but were unable to collect fees. In the late 1930s, Charles Lambert reorganized the district lands, offering sale of property back to the farmers. Within a few years, the onset of World War II again provided high demand for grains, making local rice a lucrative crop for a second time (JRP Historical Consulting Services and California Department of Transportation 2000:23).

The Glenn-Colusa Canal functions as the main water distribution canal for the GCID and diverts water from the Sacramento River. The canal measures approximately 105 km and terminates just south of the town of Williams. Currently the irrigation district provides irrigation water to 70,820 ha of farmland in Glenn and Colusa Counties.

In Rio Vista, located among the Cache Slough districts of the Yolo Basin reclamation districts, reclamation and flood control were affected by improvements in the Egbert Tract (RD 536) to the north; the levees constructed in RD 536 provided some flood protection for Rio Vista. Between 1870 and 1890, sufficient levee protection existed in RD 536 to permit farming. Levee improvements made along Lindsey and Cache sloughs from 1892 to 1901 were demolished in the 1902 flood; new levees were not constructed until 1909. Large levees were also built by 1912 along Lindsey and Cache sloughs, as well as along the Sacramento River (Thompson 1958:507–508). These levees form the principal flood barrier for Rio Vista.

At the turn of the twentieth century, reclamation efforts continued with the 1902 Reclamation Act, which established the U.S. Reclamation Service (presently the U.S. Bureau of Reclamation). Within 5 years of the act's passage, a total of 24 projects had been approved nationwide, including those within the Central Valley (JRP Historical Consulting Services and California Department of Transportation 2000). Between 1911 and 1918, hundreds of miles of levees were constructed to control flooding in the Sacramento Valley. As early as 1892, farmers of Yolo County had come together to construct levees along the Sacramento River from the town of Washington to roughly 9 mi downstream. In March 1911, the Sacramento Land Company (formerly the West Sacramento Land Company) assisted with the establishment of RD 900 in what is now West Sacramento. The formation of this district created a framework for using public funds through bonds, levies, and taxes to drain the land (Corbett 1993; Larkey and Walters 1987). Presently, RD 537 consists of portions of West Sacramento, including the Sacramento bypass and weir, as well as a pumping plant. Both reclamation districts operate and maintain a network of canals, ditches, lakes, and pump stations throughout the city.

Under the direction of civil engineers Haviland & Tibbetts, formation of RD 900 began. The district spanned 11,500 ac from the east–west line of the SPRR tracks, south to the vicinity of Riverview. Construction involved installing drainage canals, levees, and pump houses. The canals carried drainage to the pump houses, which in turn moved the water over the levees into the Yolo Bypass. As the land was drained of water, the fields of tules were removed, establishing acres of agricultural land. (Corbett 1993.)

Among the major projects proposed during this period was the comprehensive reclamation of the Sutter Basin, which annually received overflow from the Sacramento River. The California Debris Commission plan of 1911 advanced the bypass concept as the most effective method for reclamation and flood control in the Sacramento Valley. The bypass concept involves the diversion of high flood flows from the main river channel into an auxiliary channel or bypass, while leaving enough water in the river channel to scour its bed. The bypass directs winter flood flows to previously dry areas while allowing for the reclamation of previously swampy lands. Additionally, the bypass area itself can be farmed in years when the flood flow does not persist beyond the planting period. The California Debris Commission plan immediately attracted the attention of private investors in Sutter County who intended to use the bypass concept for the reclamation of the Sutter Basin. (California Department of Water Resources 1978; McGowan 1961.)

In 1912, a group of landowners in Sutter County formed the Sutter Basin Company and proposed the construction of a bypass through the Sutter Basin. The Sutter Basin Company additionally proposed the creation of a 60,000 ac reclamation district on land on the east and west sides of the bypass. Sutter County landowners who lived outside the proposed reclamation district immediately protested the location of the project, which they argued would be paid for by their tax dollars but would primarily benefit the Sutter Basin Company. A legal controversy over the alignment of the Sutter Bypass eventually ended with the state ruling in favor the Sutter Basin Company, whose original alignment was deemed beneficial to the entire county. (California Department of Water Resources 1978; McGowan 1961.)

Construction of the Sutter Bypass began in 1918 and initially involved the digging of 18 mi of main canal, 54 mi of lateral ditches, and 190 mi of sub-lateral ditches to drain the land toward the Feather River. Expansion of the Sutter Bypass continued through the early 1920s and included the building of the West Levee in 1924. A major component of the Sutter Bypass, the West Levee was constructed privately by several reclamation districts and is still maintained and operated by them. The East Levee was constructed in 1924 under the direction of the Reclamation Board (now CVFPB) and was enlarged to its present size in 1942 by USACE. The present Sutter Bypass is a 30 mi system of canals, levees, weirs, and pumping plants that begins near State Route 20, 4 mi west of Sutter, and terminates opposite the Fremont Weir on the Sacramento River. Serving as an overflow for flood water in winter and a source of irrigation water during summer, the Sutter Bypass is a crucial component in the agricultural economy of Sutter County and the greater Sacramento Valley. (California Department of Water Resources 1978.)

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Appendix H

Cultural Resources Section 106 Correspondence

Appendix H-1

Letter to SHPO, with Enclosures, January 15, 2010

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

JAN 15 2010

Environmental Resources Branch

Mr. Milford Wayne Donaldson
State Historic Preservation Officer
Office of Historic Preservation
P.O. Box 942896
Sacramento, California 94296-0001

Dear Mr. Donaldson:

The U.S. Army Corps of Engineers, Sacramento District (Corps), is writing pursuant to 36 CFR 800.3(c)(3) to inform you of the proposed program that would result in the construction of an additional 80,000 linear feet (LF) of bank protection in the Sacramento River Bank Protection Project (SRBPP). In accordance with 36 CFR 800.4(a)(1), we are notifying you of our determination of the area of potential effects (APE). This letter also outlines the Corps' proposed strategy for complying with Section 106 of the National Historic Preservation Act (NHPA). We are initiating our consultation with you pursuant to our discussions with Mr. William Soule of your staff at a meeting on August 18, 2009. The minutes of that meeting are enclosed (Enclosure 1.)

The SRBPP area (also referred to as the program area) is located along the Sacramento River and its tributaries and spans Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties, California (Enclosure 2). We have enclosed a general map of the APE and upon your review and response to this letter we will be providing you with a thick binder containing more detailed APE information on topographic maps. The SRBPP program area extends south-to-north along the Sacramento River from the town of Collinsville at river mile (RM) 0 upstream to Chico at RM 194 and includes reaches of lower Elder and Deer Creeks. The SRBPP program area also includes Cache Creek, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs.

Riverbank repairs are scheduled to be construction over several years beginning in 2012. The Corps is currently preparing a Programmatic EIS/EIR to address environmental impacts that may be affected by this program's activities. Please find enclosed the EIS/EIR program description as Enclosure 3. The alternatives covered by this programmatic EIS/EIR are those associated with future repair of bank erosion sites on an additional 80,000 LF within the SRBPP program area.

The Corps's Sacramento District and their non-federal sponsor, the CVFPB, conduct an annual field reconnaissance review of the Sacramento River Flood Control System. Specific criteria are used to identify erosion sites within the system as described in the Corps' Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking (Ayres Associates 2008). In most cases the criteria are based on bank and levee conditions that are threatening the function of the flood control system. An erosion site is defined as:

> A site that is at risk of erosion during floods and/or normal flow conditions; the term *critical* is used to indicate erosion sites that are an imminent threat to the integrity of the flood control system and of the highest priority for repair.

The 2008 Field Reconnaissance Report (Ayres Associates 2009) identified 154 erosion sites. Many of these sites are not classified as critical, but they do pose a substantial risk of erosion and threat to the flood control system. The Corps selected 107 sites, totaling approximately 80,000 lf, for further evaluation and identification of suitable design alternatives for bank protection in the *Final Alternatives Report – 80,000 lf* (Kleinfelder-Geomatrix 2009). Sites selected by the Corps for further evaluation and identification of suitable bank protection designs exhibited bank and levee conditions that are threatening the function of the flood control system (Kleinfelder-Geomatrix 2009).

For purposes of this EIS/EIR and undertaking, the 107 critical eroding sites along the Sacramento River and its tributaries constitute a representative sample of the sites eventually to be treated under the supplemental 80,000 lf. However, the number and extent of documented sites can change from year to year because of various factors, including, but not limited to, newly identified sites, increased or decreased rates of erosion, repaired sites, reclassification of erosion sites to maintenance sites, and removed sites. Therefore, because streambank erosion is episodic and new erosion sites can appear each year, the environmental analysis in this EIS/EIR will be programmatic in nature, analyzing the 80,000 lf in its entirety. Additional project-level environmental documentation, tiering from this programmatic analysis, will be conducted each year to address those sites that will be constructed that year.

Since these repairs will take place over several years and the specific repair sites have yet to be selected from the alternatives, the Corps proposes to meet its Section 106 responsibilities through execution of a Programmatic Agreement (PA.) This PA will stipulate that a Historic Property Management Plan (HPMP) be prepared as the guidance for consultation with your office regarding our responsibilities to consult with your office for identification of historic properties, determinations of eligibility, findings of effect and treatment of potential adverse effects. Draft outlines of our proposed PA and HPMP have been enclosed for your review and comment (Enclosures 4 and 5.) The Corps foresees that future undefined repairs will be necessary within the Sacramento River basin, and we intend to prepare these documents to be applicable to those undertakings, as well. We are seeking your concurrence with this approach.

By copy of this letter we are also asking the Advisory Council on Historic Preservation if they wish to participate as a signatory to the PA.

Pursuant to 36 CFR 800.4(a)(1), we are notifying you of this undertaking and its APE. We are also requesting that you concur that our approach to prepare a PA and HPMP is appropriate for the purposes of complying with Section 106 for this and future undertakings of this nature. Comments or questions may be sent to Mr. Daniel Bell, CESPK-PD-RC, U.S. Army Corps of Engineers, 1325 J Street, Sacramento, California 95814; email at daniel.a.bell@usace.army.mil; phone at (916) 557-6818, or fax at (916) 557-7856.

Sincerely,

Francis C. Piccola
Chief, Planning Division

Enclosures

Copy Furnished:
Mr. Don Klima, Office of Federal Agency Programs, Advisory Council on Historic Preservation, 1100 Pennsylvania Avenue NW, Suite 803, Old Post Office Building, Washington, DC 20004

cc:
SPK-PD
PD-R
CRSAS(Bell, Osborn)
SPK-PM-C (Bryant)

BELL
CESPK-PD-RC

OSBORN
CESPK-PD-RC

BRYANT
CESPK-PM-C

CLARK
CESPKPPD-R

PICCOLA
CESPK-PD

ENCLOSURE 1

Minutes of Meeting Between the Army Corps of Engineers, Jones and Stokes and William Soule (OHP), August 18, 2009

Sacramento River Bank Protection Project
Planning & Communication Strategy Meeting

August 19, 2009
9:00 - 10:30 p.m.

California Department of Parks and Recreation
Office of Historic Preservation
1416 9th Street, Room 1442
Sacramento, CA 95814

Meeting Minutes

Attendees

Name	Agency
William (Bill) Soule	California Office of Historic Preservation
Sannie Osborn	U.S. Army Corps of Engineers
Trish Fernandez	ICF Jones & Stokes
Christiaan Havelaar	ICF Jones & Stokes
Patricia Ambacher	ICF Jones & Stokes
Melissa Cascella	ICF Jones & Stokes

I. Sacramento River Bank Protection Project (SRBPP) Deliverables

ICF Jones & Stokes shared preliminary SRBPP documents with Bill. These documents are neither finalized by ICF Jones & Stokes nor approved by the Corps. Bill requested three sets of deliverables outlined below.

1. Area of Potential Effects
    a. General APE – not the specific repair locations
    b. Horizontal and vertical APE
    c. Mapped on 7.5 minute USGS topographic maps
    d. Consider barges, landside equipment, access, staging, quarrying, riverine travel corridors, utility relocations
        i. Note the difference between short term effects and long term visual effects
    e. Look at Doyle Drive APE for guidance
    f. Meet with Bill again after APE is delivered to him
2. Inventory and FOE
    a. Identification efforts
    b. Native American consultation
        i. Conduct standard consultation – at least 2 batches of letters and a follow up phone call
        ii. Send N.A.s decent package of information with example of repair.
        iii. Preburial Agreements
            1. work with NAHC to set up standard format to use as template for specific Preburial Agreements.
            2. NAHC – list of MLDs to contact initially and to update annually.
        iv. Monitoring (only under 2 circumstances)
            1. places where there is a known located site but there is no evidence now
            2. there is interest in a site with no specifics as to location
    c. Evaluation efforts
        i. Assume levee is eligible
        ii. Include a context section about Reclamation
    d. Send electronically
3. Agreement Document
    a. PA
        i. Open ended, no sunset date
        ii. Info on how additional documents and phase reports will occur
        iii. Look to Caltrans PA for guidance and standard language
            1. Bill will ask Dwight Dutschke for additional examples
            2. Sannie will ask Dan Bell for additional examples
        iv. HPTP

1. Exempted resources (ex: wood structures, pumps, and pipelines that are less than 50 years old)
2. Can be handed in separately from the PA if need be (if the project is getting delayed)

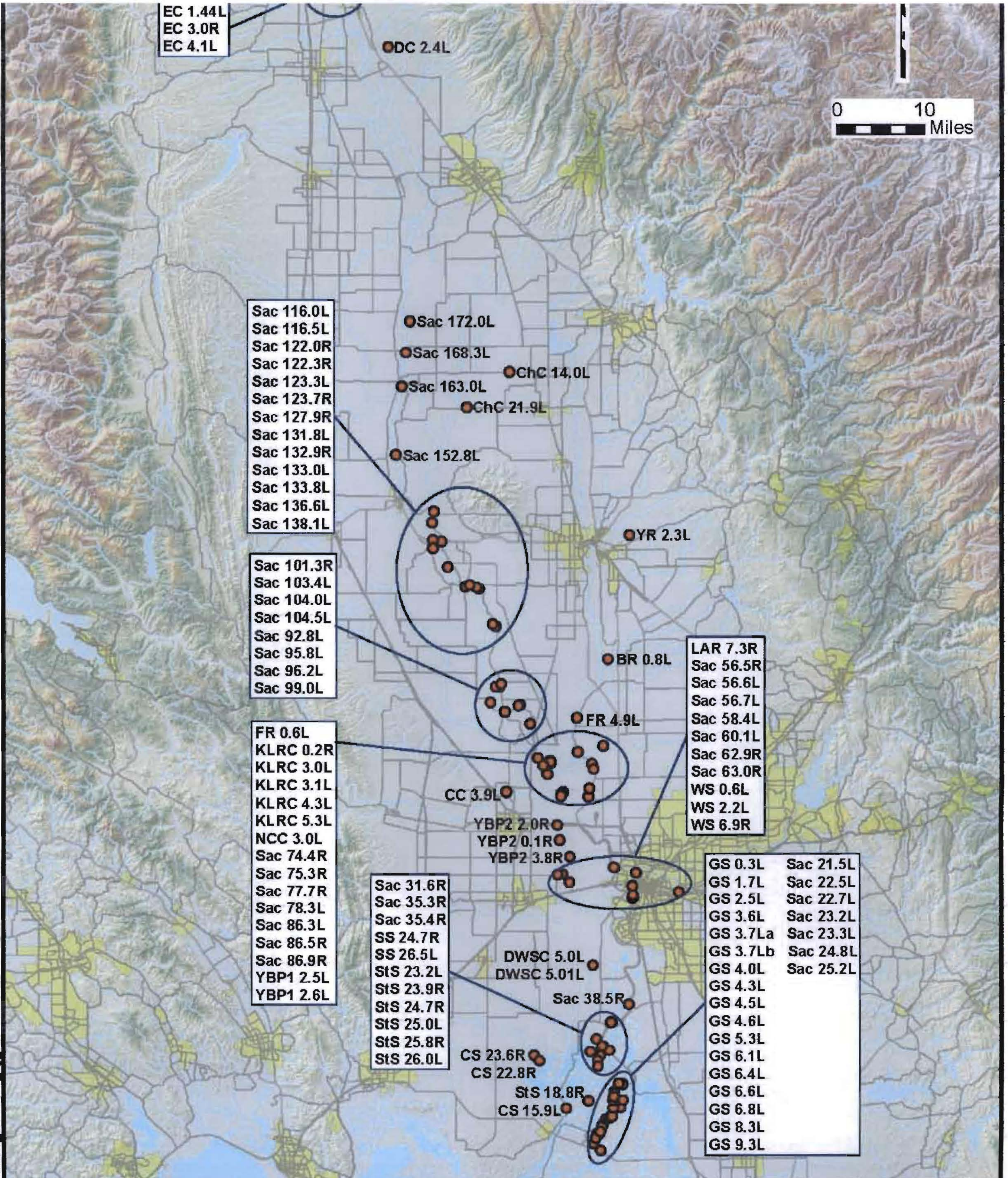
v. Give the advisory committee a heads up about this document (Chair John Eddins).

II. Future Meetings

A future meeting will occur after Bill has been sent the APE. Additional attendees to be invited: Pam Griggs and Janice Offerman.

ENCLOSURE 2

Area of Potential Effects (APE)



n: S:\13600\13691\13691_003\GIS_fig_3.0-1.mxd

KLEINFELDER • Geomatrix
A Joint-Venture Partnership

PROJECT NO.	95971	**Erosion Site Location Map**	DRAFT FIGURE
DRAWN:	11-19-08		
DRAWN BY:	DMO		
CHECKED BY:	DMO	Sacramento River Bank	3.0-1

ENCLOSURE 3

Project Description
From
Sacramento River Bank Protection Program, 80,000 Linear Feet EIS/EIR

Chapter 2
Project Description

Introduction

The U.S. Army Corps of Engineers-Sacramento District (Corps) and the Central Valley Flood Protection Board (CVFPB) propose to implement the proposed program, which would result in the construction of an additional 80,000 linear feet (LF) of bank protection in the Sacramento River Flood Control Project (SRFCP) area. This chapter describes the proposed program components, a summary of the alternatives screening process and alternatives selected for analysis, and physical and operational characteristics of the alternatives.

Project Location

The SRBPP area (also referred to as the program area) is located along the Sacramento River and its tributaries and spans Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties, California (Figure 1-1). The alternatives covered in this programmatic EIS/EIR are those associated with future repair of bank erosion sites on an additional 80,000 LF within the SRBPP program area.

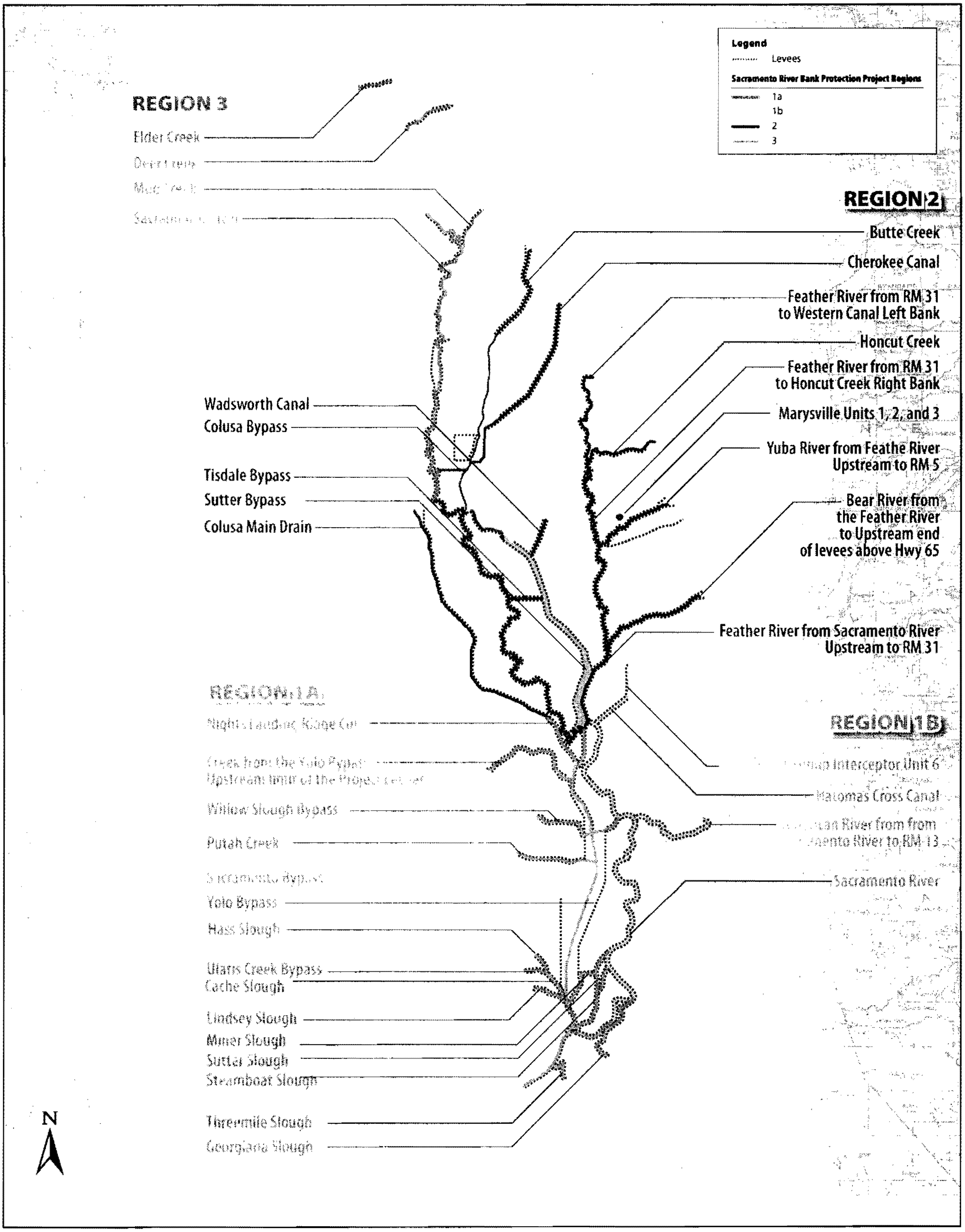
SRBPP Program Area

The SRBPP program area extends south-to-north along the Sacramento River from the town of Collinsville at river mile (RM) 0 upstream to Chico at RM 194 and includes reaches of lower Elder and Deer Creeks. The SRBPP program area also includes Cache Creek, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs.

For the purposes of this EIS/EIR, the program area has been divided into four regions, organized south to north by the location of the downstream terminus of each watercourse with the mainstem Sacramento River (Figure 2-1). Within Region 1a, the Sacramento River flows below Isleton (RM 20) into the Delta, forming a distribution network of sloughs and channels. Region 1b includes the mainstem Sacramento River from Isleton (RM 20) in the Delta, upstream past the city of Sacramento, to the Feather River confluence (RM 80) at Verona. Region 1b also includes the lower American River from the confluence with the Sacramento River upstream to RM 13, Natomas East Main Drain, Natomas Cross Canal, and Coon Creek Group Interceptor Unit 6. Within Region 2, the mainstem Sacramento River flows from Colusa (RM 143) downstream of the Colusa Bypass to the confluences with the Feather River and Sutter Bypass at Verona (RM 80). Region 3 includes the Sacramento River downstream of Chico Landing (RM 194) to Colusa (RM 143). Table 2-1 provides the watercourses by region, reach lengths in miles and feet, and counties within the program area.

Table 2-1. Watercourses, Reach Lengths, and Counties within the Program Area by Region

Region	Watercourse	Reach Length (miles)	Total Length by Region (miles)	Counties
1a	Sacramento River from Collinsville to Isleton	20.7	183.3	Contra Costa, Sacramento, Solano, Sutter, Yolo
	Threemile Slough	3.7		
	Georgiana Slough	12.4		
	Steamboat Slough	13.1		
	Yolo Bypass	37.9		
	Miner Slough	7.7		
	Portions of Lindsay Slough	7.5		
	Cache Slough	10.7		
	Ulatus Creek Bypass Unit	1.6		
	Haas Slough	2.8		
	Sutter Slough	6.8		
	Putah Creek	29.5		
	Willow Slough Bypass	7.4		
	Sacramento Bypass	1.8		
	Cache Creek from the Yolo Bypass to the upstream limit of the Project levees	13.3		
	Knights Landing Ridge Cut	6.4		
1b	Sacramento River from Isleton to Feather River (RM 20-80)	60.3	102.7	Placer, Sacramento, Solano, Sutter, Yolo
	American River from Sacramento River to RM 13	13.2		
	Natomas East Main Drain	16		
	Natomas Cross Canal	5.3		
	Coon Creek Group Interceptor Unit 6	7.9		
2	Sacramento River from Feather River confluence to Colusa (RM 80-143)	62.3		Butte, Colusa, Glenn, Placer, Sutter, Yolo, Yuba
	Colusa Basin Drain 35.8 NS NS	35.8		
	Sutter Bypass 37.2 NS NS	37.2		
	Tisdale Bypass 4.3 NS NS	4.3		
	Wadsworth Canal 4.6 NS NS	4.6		
	Colusa Bypass 2.8 NS NS	2.8		
	Cherokee Canal 18.2 NS NS	18.2		
	Butte Creek 32.5 NS NS	32.5		
	Feather River from Sacramento River upstream to RM 31	30.8		
	Bear River from Feather River to upstream end of levees above Hwy 65	12.6		



Graphics\Projects\06207.08 Sac Bank EIS/EIR (07-09) SS

ICF Jones & Stokes
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Figure 2-1
Project Location

Sacramento River Bank Protection Project

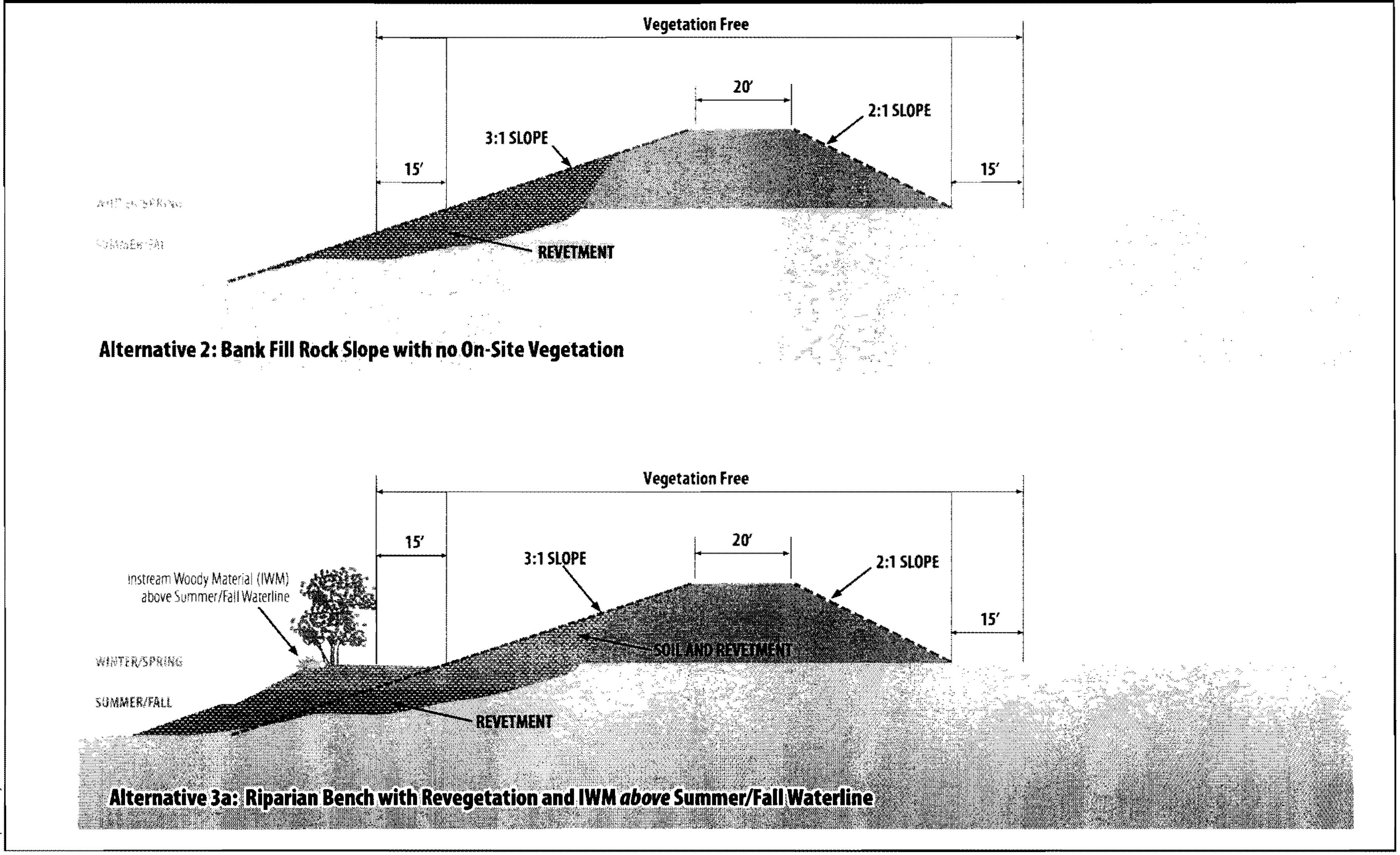

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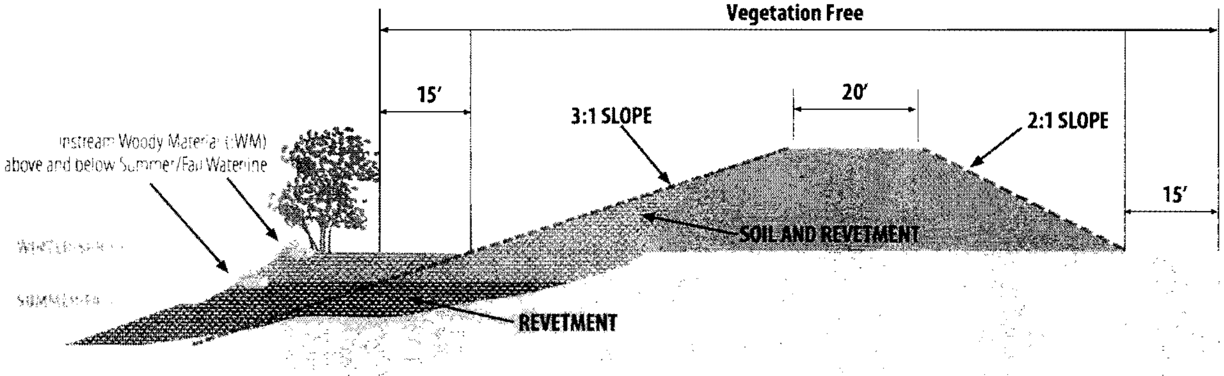
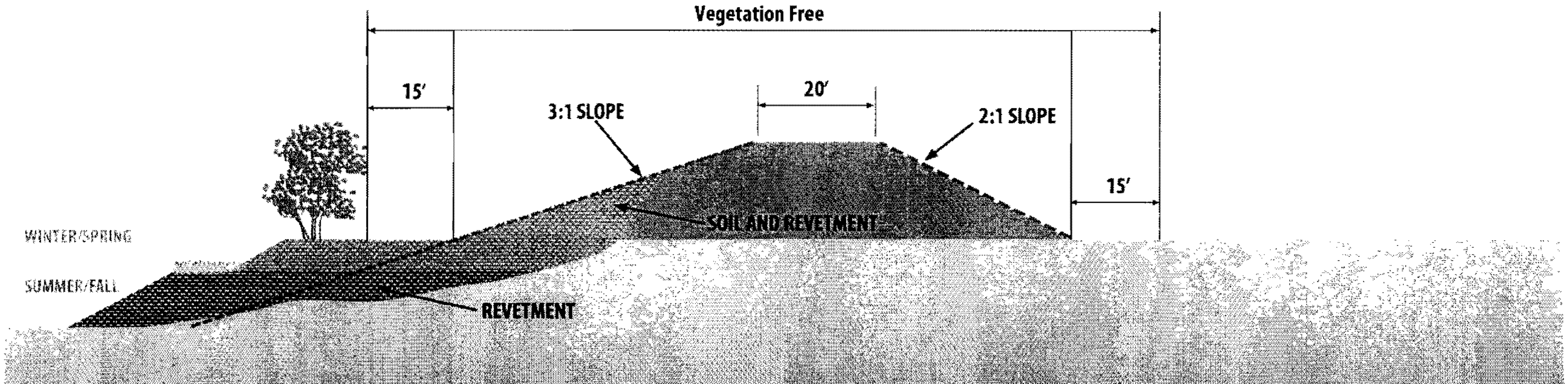
Figure 2-2
Alternatives 2 and 3a

Sacramento River Bank Protection Project



Alternative 3b: Riparian Bench with Revegetation and IWM *above and below* Summer/Fall Waterline



Alternative 3c: Riparian and Wetland Benches with Revegetation

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Sacramento District

Figure 2-3
Alternatives 3a and 3b

Sacramento River Bank Protection Project

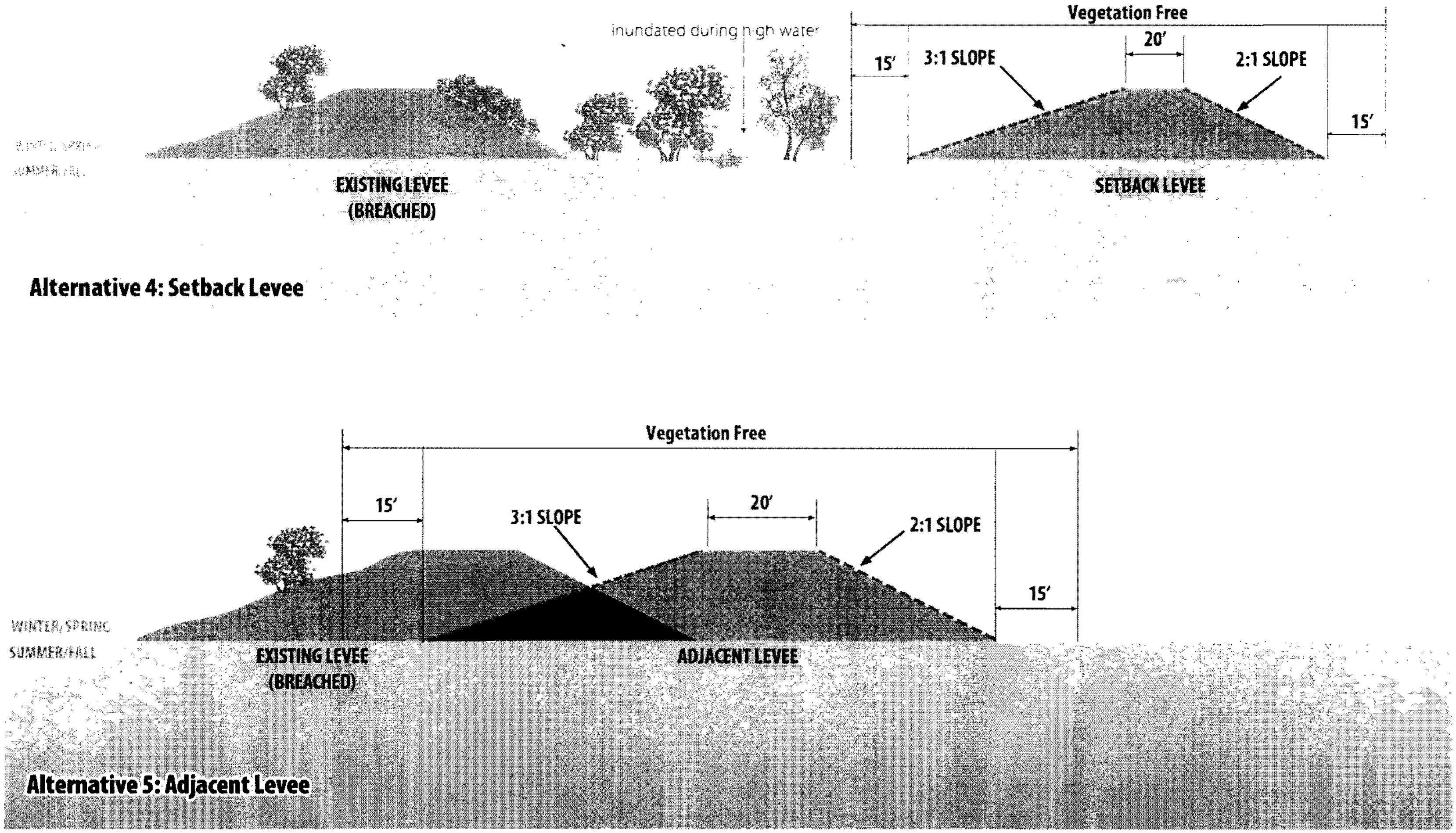

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Figure 2-4
Alternatives 4 and 5

Region	Watercourse	Reach Length (miles)	Total Length by Region (miles)	Counties
	Yuba River from Feather River upstream to RM 5	4.9		
	Marysville Units 1, 2, and 3	7.5		
	Huncut Creek	8		
	Feather River from RM 31 to Honcut Creek right bank	13.2		
	Feather River from RM 31 to Western Canal left bank	27.2		
3	Sacramento River from Colusa to Chico (RM 143-194)	50.3		Butte, Colusa, Glenn, Tehama
	Mud Creek	8		
	Dear Creek	6.7		
	Elder Creek	4		

Source: Final Programmatic Biological Assessment for the Sacramento River Bank Protection Project Phase II (Stillwater 2007)

Erosion Sites

The Corps's Sacramento District and their non-federal sponsor, the CVFPB, conduct an annual field reconnaissance review of the Sacramento River Flood Control System. Specific criteria are used to identify erosion sites within the system as described in the Corps' Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking (Ayres Associates 2008). In most cases the criteria are based on bank and levee conditions that are threatening the function of the flood control system. An erosion site is defined as:

> A site that is at risk of erosion during floods and/or normal flow conditions; the term *critical* is used to indicate erosion sites that are an imminent threat to the integrity of the flood control system and of the highest priority for repair.

The 2008 Field Reconnaissance Report (Ayres Associates 2009) identified 154 erosion sites. Many of these sites are not classified as critical, but they do pose a substantial risk of erosion and threat to the flood control system. The Corps selected 107 sites, totaling approximately 80,000 lf, for further evaluation and identification of suitable design alternatives for bank protection in the *Final Alternatives Report – 80,000 lf* (Kleinfelder-Geomatrix 2009). Sites selected by the Corps for further evaluation and identification of suitable bank protection designs exhibited bank and levee conditions that are threatening the function of the flood control system (Kleinfelder-Geomatrix 2009).

For purposes of this EIS/EIR, the 107 critical eroding sites along the Sacramento River and its tributaries constitute a representative sample of the sites eventually to be treated under the supplemental 80,000 lf. However, the number and extent of documented sites can change from year to year because of various factors, including, but not limited to, newly identified sites, increased or decreased rates of erosion, repaired sites, reclassification of erosion sites to maintenance sites, and removed sites. Therefore, because streambank erosion is episodic and new erosion sites can appear each year, the environmental analysis in this EIS/EIR will be programmatic in nature, analyzing the 80,000 lf in its entirety. Additional project-level environmental documentation, tiering from this programmatic analysis, will be conducted each year to address those sites that will be constructed that year.

{{supplement with upcoming information from Engineering Design Report}}

Alternatives Development

NEPA and CEQA generally require that an EIS and EIR (respectively) consider a range of alternatives that would attain most of the basic project purpose, need, and objectives while avoiding or substantially lessening project effects. A range of reasonable alternatives is analyzed to define the issues and provide a clear basis for choice among the options. The NEPA and CEQA analysis also must analyze a no-action or no-project alternative.

Consistent with NEPA standards, alternatives at the program level are analyzed on an equal, non-preferential basis (i.e., there is no proposed project/preferred alternative) and at an equal level of detail. As required under NEPA and CEQA, a no-action (no-project) alternative has been included to allow the lead agencies to compare the effects of approving one of the proposed alternatives to the effects of not approving one of the proposed alternatives.

The alternatives have been developed at the program level and are not site-specific. Because site conditions and specific levee deficiencies vary in the program area and more than one alternative method of bank protection may be applicable to project erosion sites, the alternatives are not bundled or packaged, but rather are evaluated independently at the program level, allowing flexible combinability at the project level.

{{Describe Alts development process.} {supplement with upcoming information from Engineering Design Report}}

In order for design alternatives to be feasible, they must comply with the Corps's Engineering Technical Letter 1110-2-571, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures (Vegetation ETL) (Corps 2009). The key aspect of the Vegetation ETL that is relevant to the development of feasible alternatives is its requirement for a vegetation-free zone (VFZ) surrounding all levees and appurtenant structures. The VFZ must be free of obstructions to ensure access by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood-fighting. A secondary purpose is to provide a distance between root systems and levees to moderate reliability risks associated with (1) piping and seepage, and (2) structural damage (e.g., wind-driven tree overturning).

Proposed Alternatives

The suite of SRBPP alternatives (proposed program) is described below with illustrations to support each alternative. Alternatives 3a, 3b, and 3c are variations of an alternative, with habitat features such as vegetation and instream woody material placed at varying locations.

Alternative 1—No Action

Under the no-action alternative, the Corps would not implement bank protection along Sacramento River levees. The result is likely to be the continued gradual or sporadic loss of remnant floodplain (berm) and the riparian vegetation it supports, and ultimately the erosion could encroach into the cross section of the levee foundation, creating critical erosion sites. It is possible that federal or state flood control agencies eventually would implement bank protection along various sites along Sacramento River levees through emergency action. In any case, the risk of levee failure and possibly catastrophic flooding would increase substantially as more erosion sites become critical and repair is limited to emergency response. Continued erosion prior to the federal or state action would result in short- and long-term losses of valuable habitat. Although some erosion is natural, the channelization of project reaches increases erosive forces.

Alternative 2—Bank Fill Rock Slope with No On-Site Vegetation

The bank fill rock slope with no on-site riparian vegetation alternative entails filling the eroded portion of the bank and installing revetment along the levee slope and streambank from the levee's toe to crest (Figure 2-2). Vegetation would be limited to grass that would be mowed. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with riprap. Alternative 2 would be most applicable in areas where there is inadequate space or substantial constraints, either landside or waterside, to implementing Alternatives 3 through 5.

Treatment of Existing Vegetation

Existing woody vegetation and trees on the waterside levee slope (waterward of the waterside levee hinge point) and on the berm within 15 feet of the waterside toe would not be in compliance with the ETL and would be removed. Although some of this vegetation may be outside the bank protection construction footprint, it is important that the project investment result in a levee that meets design and maintenance criteria. The SRBPP proposed program does not include removal of vegetation from the landside levee slope or in waterside and areas upstream or downstream of the specific erosion site.

Existing woody vegetation and native trees that are in compliance with the ETL will be preserved to the extent practical. Unless removal is required for safety reasons, all native trees greater than 4 inches in diameter at breast height (dbh) would be preserved and protected. Herbaceous and woody vegetation, other than preserved trees, would be cleared manually to the ground surface. Clearing of vegetation would be limited to the extent required to place bank protection material or provide construction access. Necessary pruning and trimming of preserved trees, as determined at the time of construction, may be conducted prior to the placement of rock slope protection. All construction activities, including pruning and trimming vegetation, would be supervised by a qualified biologist to ensure a minimal effect on natural resources. Disturbed areas, including staging areas, would be seeded and covered with mulch to prevent erosion following project buildout.

Site Preparation

Site preparation activities would include the removal or protection of facilities (e.g., pumps, piping, docks) and vegetation and the development of on-site construction access. The specific circumstances of each facility will determine whether it remains or is removed or relocated {{discussion will be expanded based on upcoming Real Estate Working Group and Operations and Maintenance Working Group products}}. Facilities that are to remain would be protected, and appropriate coordination and authorizations would be obtained before any facilities would be relocated or removed.

As previously stated, native trees greater than 4 inches dbh would be preserved and protected to the extent feasible. Trees to be preserved would be trimmed as necessary and the trunks of the trees wrapped with layers of protective fabric. Elderberry shrubs present on the site would be protected in place or removed and transplanted to an appropriate location (e.g., U.S. Fish and Wildlife (USFWS) authorized mitigation bank). Invasive pest plants, including black locust, tamarisk, and giant reed, would be removed along with all herbaceous and woody vegetation less than 4 inches dbh. All vegetation would be removed manually. No herbicides or chemicals would be used. Vegetation would be cleared to the ground surface, and large tree roots would be removed. The surface of the erosion sites would not be subject to grubbing or contouring. Materials removed from the erosion sites would be loaded onto trucks or a barge and transported to an appropriate disposal facility.

Construction access ramps and construction access areas within the erosion sites would be positioned to minimize the need for tree removal. Signs and fencing would be established at each site to delineate construction areas and protected areas. Warning buoys would be placed in the river at the up- and down-stream boundaries of each site for the safety of boaters and other water users.

Lower Slope Quarry Stone

For all sites requiring repair below the mean summer water level (MSWL), clean quarry stone would be placed from the toe of the levee slope (i.e., the bottom of the channel) to the MSWL. The quarry stone would have a minimum thickness of 2 feet. The slope of the quarry stone below the MSWL would be no steeper than 2H:1V.

Alternative 3

Alternative 3 consists of three design variations presented as Alternatives 3a, 3b, and 3c. In general, this alternative involves the placement of clean quarry stone from the toe of the levee slope to the MSWL and placing quarry stone and soil-filled quarry stone on the levee slope above the MSWL. The repairs would involve initial site preparation, installation of a fabric layer between the quarry stone and soil-filled quarry stone, and construction of benches. These alternatives vary from one another in the placement and extent of environmental features (benches, vegetation, and instream woody material [IWM]).

Alternative 3a—Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline

The low riparian bench with revegetation and IWM above the summer/fall waterline design entails installing revetment along the levee toe and upper bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM (Figure 2-2). This design provides near-bank, shallow-water habitat for fish and is typically applicable to sites above Sacramento River Mile 30. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone would be similar to the description under Alternative 2. Alternative 3a also would involve the following activities.

Geotextile Coir Fabric

A biodegradable, geotextile coir fabric layer would be placed above the quarry stone on the lower slope to prevent the migration of soil from the soil-filled quarry stone into the underlying quarry stone and to retain soil in the areas to be revegetated. The fabric would be an open weave biodegradable geotextile material with a non-shifting square mesh consisting of 100 percent coir fiber yarns in both the warp and the weft. The fabric would have a thickness of 0.30 inch, a weight of 25 ounces (plus or minus 2 ounces) per square yard, and a tensile strength of 150 x 100 pounds per inch, dry, and the open area of the fabric would be 40% maximum.

Soil-Filled Quarry Stone

After the coir fabric is installed, soil-filled quarry stone would be placed on the levee bank slope above the MSWL. Soil-filled quarry stone is a combination of quarry stone and soil fill material. The purpose of the soil component is to fill voids in the quarry stone and provide a medium for vegetation to grow. The top elevation for placement of the soil-filled quarry stone would be determined on a site-by site-basis based on water velocities and shear stresses along the levee. At most sites, the top elevation of the soil-filled quarry stone would be level with the edge of the levee's upper bench.

Riparian Bench

The riparian bench is a vegetation-supporting low bench constructed of soil-filled quarry stone that would project into the channel along the length of the erosion site. The vegetation is intended to provide overhead cover and near-shore aquatic habitat during the low-flow season. At some sites, the riparian bench also may be used as a construction platform to help avoid impacts on existing vegetation during the construction of the upper slope bank fill revetment. The riparian benches typically would be 10 to 20 feet wide with an average elevation set 2 to 3 feet above the MSWL to provide a substantial volume of moist but unsaturated soil as a growing medium.

Alternative 3b—Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

The low riparian bench with revegetation and IWM above and below the summer/fall waterline design entails installing revetment along the levee toe and upper bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM (Figure 2-3). IWM also will be placed beyond the bench below the summer/fall waterline, thereby increasing the types and extent of mitigation for shallow-water fish habitat. This design is typically applicable to sites above Sacramento River Mile 30. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone would be similar to the description under Alternative 2. Installation of geotextile coir fabric, soil-filled quarry stone, and riparian bench would be similar to the description under Alternative 3a.

Alternative 3c—Riparian and Wetland Benches with Revegetation

The low riparian and wetland bench with revegetation and IWM design entails installing revetment along the levee toe and upper bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM (Figure 2-3). The design also includes a wetland bench below the summer/fall waterline to further increase habitat quality. This design is intended for sites downstream of Sacramento River Mile 30 and targets mitigation of impacts on delta smelt habitat. Treatment of existing vegetation would be similar to Alternative 2.

Alternative 4—Setback Levee

The levee setback alternative entails constructing a new levee some distance landward of the existing levee and would avoid or minimize construction in the stream channel or riparian areas (Figure 2-4). The land between the setback and the old levee would act as a floodplain. Land use in the new floodplain would be determined on a site-by-site basis. The old levee could be breached in several locations to allow high flows to inundate the new floodplain. Vegetation on the new setback levee and 15' beyond each toe would be restricted to mown perennial grass and managed as a vegetation-free zone. Existing vegetation on an old levee with a setback levee behind it could remain.

Setback levees can be very effective, but cost, existing land use, and technical issues limit opportunities for setback levees in the programmatic plan area.

Alternative 5—Adjacent Levee

The adjacent levee alternative involves the construction of a new levee embankment adjacent to and landward of the existing levee (Figure 2-4). The adjacent levee would be constructed to Corps standards. The landward portion of the old levee would be an integral, structural part of the new levee. The waterward portion of the old levee would be an "overbuilt" structure over a "root-free zone." Vegetation and IWM would be placed on the overbuilt structure.

This alternative bank protection measure may be the only viable solution at some erosion sites. It should be retained as an alternative as long as it is considered in ETL compliance or with assurance that a variance will be granted. This is an important alternative that would be appropriate at many sites.

Treatment of Existing Vegetation

Vegetation on the original levee to the waterside of a newly constructed adjacent levee may lie within the VFZ. If this is the case, this vegetation would be removed.

Construction

Construction Activities

It is anticipated that construction would take place between April 1 and November 30, with in-water construction activities to be conducted between August 1 and November 30. No construction would be permitted during the winter months (December through March). The anticipated construction season may need to be modified to respond to high water levels in the river, the presence of special-status species, or other constraints.

For waterside construction, work would be conducted from cranes mounted on barges, with the crane (boom) systems mechanically placing the rock along the shore and beneath the water line. Waterside construction typically would result in less noise, less roadway traffic, and less disturbance of vegetation than landside construction. The contractor may choose to use excavators, loaders, and other construction equipment once the revetment has reached the MSWL.

Landside construction would take place at sites that are not accessible from the waterside. A crane located on the levee would be used to mechanically place the rock along the shore and beneath the water line. The contractor may choose to use excavators, loaders, and other construction equipment along the benches on sites that are inappropriate for a crane and/or once the revetment has reached the MSWL.

Protective fencing would be installed to prevent construction crews from getting too close to the waterside edge of the existing bank materials and sensitive resources such as elderberry shrubs.

The Corps or CVFPB would be responsible for implementing the erosion repairs at individual sites.

{{Following sections will be updated/expanded based on upcoming Engineering Documentation Report}}

Staging Areas

Staging areas would be identified for each erosion site prior to construction. Staging areas typically are located within the erosion site construction easement or immediately adjacent to the erosion site, preferably in a location that does not affect or has a minimal impact on resources. These areas would be the sole locations used for staging vehicles, materials, and other associated construction equipment. Staging areas would be subject to the same project-level environmental analysis and documentation as the project construction footprint to ensure that any potential resources will not be adversely affected and/or appropriate mitigation is provided.

Haul Routes, Borrow Areas, Traffic, and Navigation

Depending on the site location, materials would be brought to the sites either by barge (waterside construction) or via surface roads (landside construction). Haul routes to those sites requiring landside access would be via interstate and U.S. highways, state highways, county and city roads, and levee access roads. Construction materials, including quarry stone, would be hauled from a commercial or previously permitted quarry or borrow site located within 100 miles of the site. Temporary lane closures and, in some instances, full road closures may be required. Adequate detours would be provided during any road closures. Construction signs would be posted along the haul routes, and flaggers would be used, as necessary, to minimize traffic problems and ensure public safety near the construction sites.

{{insert text about navigation access}}

Monitoring and Maintenance Activities

Monitoring and maintenance would be necessary to ensure that the replacement vegetation is successfully establishing and that the IWM is functioning as intended. Within approximately 90 days from the completion of construction at an individual site, the Corps would submit a detailed maintenance and monitoring plan (MMP) for the resource agencies to review. The MMP would include: (1) success criteria to provide a standard to assess whether mitigation efforts successfully replace lost habitat value; (2) a program to monitor the development of shaded riverine aquatic (SRA) cover and riparian habitat; (3) a protocol for implementing remedial actions should any success criteria not be met; and (4) the required duration of the monitoring efforts. Monitoring reports that evaluate the progress of each constructed erosion site in meeting the success criteria would be submitted to the resource agencies by December 31 of each monitoring year.

It is estimated that limited maintenance of replacement vegetation would be required for approximately 3 years following the completion of the levee repairs. After this time, it is anticipated that the vegetation will be established and self-sustaining. Anticipated activities during the 3-year establishment period include removal of problematic invasive species, irrigation and pruning of vegetation to promote optimal growth, replacement of any dead and/or declining vegetation, and maintenance of beaver exclusion fencing.

Maintenance activities also may include monitoring the vegetation and IWM to ensure that hazards to navigation are not present, assessing the status of the rock revetment and soil fill during high-flow events, and monitoring the sites for vandalism. Yearly maintenance at each site may include the placement of up to {{X}} cubic yards of material. Should a greater volume be required, the necessary permits/authorizations would be obtained from the appropriate regulatory agencies. Any in-water maintenance work would be conducted in coordination with the applicable federal and state resource agencies to avoid adverse effects on sensitive fish species.

Alternatives Considered but Not Included in Detailed Analysis

{{Will add alternatives screening discussion; what alternatives were considered but rejected, and why. To come based on Engineering Documentation Report}}

References Cited

Ayres Associates. 2008. *2008—Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking, Sacramento River Flood Control Levee, Tributaries and Distributaries*. Contract No. WA91238-07-D-0038. Prepared for: U.S. Army Corps of Engineers, Sacramento District. December 18. Sacramento, California.

Kleinfelder-Geomatrix. 2009. *Sacramento Riverbank Protection Project. Final Alternatives Report—80,000 LF*. Contract No. W91238-08-D-0015. Prepared by: Kleinfelder-Geomatrix, A Joint Venture Partnership. Prepared for: U.S. Army Corps of Engineers, Sacramento District. April 3. Sacramento, California.

U.S. Army Corps of Engineers (Corps). 2009. Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures. April 10. ETL 1110-2-571. Washington, D.C.

ENCLOSURE 4

Proposed Programmatic Agreement Outline
For
Sacramento River Bank Protection Program, 80,000 Linear Feet

**PROGRAMMATIC AGREEMENT
AMONG THE U.S. ARMY CORPS OF ENGINEERS,
STATE LANDS COMMISSION,
CALIFORNIA DEPARTMENT OF WATER RESOURCES,
U.S. FISH AND WILDLIFE SERVICE, CALIFORNIA DEPARTMENT OF PARKS AND RECREATION,
AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER,
REGARDING THE
SACRAMENTO RIVER BANK PROTECTION PROJECT,
BUTTE, COLUSA, CONTRA COSTA, GLENN, PLACER, SACRAMENTO, SOLANO, SUTTER, TEHAMA, YOLO, AND YUBA COUNTIES, CALIFORNIA**

Annotated Outline

1. **Recitals**

   a. Introduces the responsible parties and the location of the undertaking.

      i. Consulting parties include: the U.S. Army Corps of Engineers (USACE), the California State Historic Preservation Officer (SHPO), ACHP (possibly), the Central Valley Flood Protection Board (CVFPB), the California State Lands Commission (SLC), the Bureau of Reclamation (Reclamation), Indian tribes, the California Department of Fish and Game (CDFG), the California Department of Parks and Recreation (DPR), the California Department of Water Resources (DWR), the U.S. Fish and Wildlife Service, and possibly historical societies. *Consulting parties will be established by the USACE through consultation with the SHPO and other potential consulting parties.*

      ii. Signatories include: USACE, SHPO, DWR, DPR, SLC, USFWS, and possibly the ACHP. Concurring parties include: CVFPB, Indian tribes, and Reclamation.

   b. Provides a brief description of the undertaking, with reference to Attachment 1 for details.

   c. States that consultation has transpired between the USACE and the SHPO, and that the Advisory Council on Historic Preservation (ACHP) has been notified of the preparation of this PA.

   d. Consultation with Native Americans has been completed.

   e. States the purpose of this PA: to establish appropriate consultation and coordination standards, identification efforts, effects assessments, and treatment of historic properties over the approximately 10-year life of the undertaking.

   f. Consulting, signatory, and concurring parties are identified.

   g. Standard language concerning execution of the PA.

2. **Stipulations**

    a. Applicability and Scope

    b. Definitions (Attachment 2)

    c. Allocation of Responsibilities

    d. Screened or Exempt Actions

        i. Defines process for identifying actions not subject to cultural resources inventory.

        ii. Lists any screened or exempt actions identified at the time of PA execution in Attachment 3.

3. **Standards**

    a. Professional Standards

    b. Historic Preservation Standards (48 FR 44716-44740, Standards published by SHPO

    c. Standards specific to archaeological properties (48 Federal Register [FR] 44716–44742[1]; California Department of Transportation 2008)

    d. Standards specific to the historic built environment (*The Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act*)

    e. Standards specific to cultural landscapes (Birnbaum 1994; McClelland et al. 1995; Secretary of the Interior's "Guidelines for the Treatment of Cultural Landscapes"[2])

    f. Standards specific to historic properties of importance to Native Americans

    g. Standards derived from your Levee Strategy

4. **Project Description**

    a. Project Description

    b. APE

    c. Existing Conditions

        i. Identification of Historic Properties

        ii. *Identification efforts (i.e., inventories within the PA-approved APE will not require consultation with the SHPO once the PA is executed. It is likely that additional identification efforts will be necessary after execution of the PA. The HPMP should*

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[1] *Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines*

[2] In *The Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act*

provide for procedures for notifying the SHPO of new/changes to the APE, provide ID methodology/reporting (use your report outline), and submission of results to SHPO for review. Review periods should be 15 days.

iii. Consultation with Interested Parties

5. Provisions for modification of the APE

a. *Requires consultation with PA signatories*

6. Treatment of Effects

a. Assessment of Effects

i. *Requires consultation with PA signatories.*

b. Resolution of Adverse Effects

i. Requires preparation of an HPMP.

ii. The HPMP will be an attachment to the PA (Attachment 5).

iii. The HPMP and other means of resolving adverse effects must be reviewed by all PA signatories.

7. Reporting Requirements and Related Reviews

8. Native American and Other Public Consultation and Public Notice

9. Inadvertent Discoveries and Unanticipated Effects

a. These will be discussed in the HPMP.

b. Applicable laws, regulations, and standards will include 36 CFR 800.13

10. Treatment of Human Remains

a. This will be discussed in the HPMP.

b. Applicable laws, regulations, and standards will include the Native American Graves Protection and Repatriation Act (NAGPRA), CEQA statutes, and State CEQA Guidelines, and State PRC 5097.98 and 7050.4.

11. Administrative Provisions

12. Standards (definitions, professional qualifications, documentation standards, curation and curation standards)

13. Confidentiality

14. Resolving Objections

15. **Amendments**

16. **Failure to Carry Out Terms of the Agreement**

17. **Termination**

18. **Duration of the PA**

19. **Effective Date**

20. **Signature Pages**

    a. Separate page for each signatory for efficiency in obtaining signatures.

21. **Attachments**

    a. Description of the Undertaking

    b. Definitions

    c. Screened or exempt actions

    d. APE

    e. HPMP

References Cited (not part of contents)

Birnbaum, C. A.
1994 *Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes*. Preservation Briefs 36. Technical Preservation Services, National Park Service, U.S. Department of the Interior, Washington, D.C.

California Department of Transportation
2008 *A Historical Context and Archaeological Research Design for Mining Properties in California*. Division of Environmental Analysis, California Department of Transportation, Sacramento, California.

McClelland, L. F., J. T. Keller, G .P. Keller, and R. Z. Melnick
1995 *Guidelines for Evaluating and Documenting Rural Historic Landscapes*. National Register Bulletin 30. National Park Service U.S. Department of the Interior, Washington, D.C.

ENCLOSURE 5

Historic Property Management Plan Outline
For
Sacramento River Bank Protection Program, 80,000 Linear Feet

Draft Outline—Historic Properties Management Plan
Sacramento River Bank Protection Project

Table of Contents

Acronyms

I. INTRODUCTION
   a. Purpose and Application of Historic Property Management Plan
   b. Organization of the Report

II. Regulatory Context
   a. Overview of the HPMP Program
      i. Describes how the HPMP works and implements the PA
      ii. Definition of Historic Properties
      iii. Identifying and Resolving Adverse Effects
      iv. Includes a flowchart for easy reference and better decision-making
   b. Roles and Responsibilities
      i. Consulting parties include: the U.S. Army Corps of Engineers (USACE), the California State Historic Preservation Officer (SHPO), the Central Valley Flood Protection Board (CVFPB), the California State Lands Commission (SLC), the Bureau of Reclamation (Reclamation), Indian tribes, the California Department of Fish and Game (CDFG), the California Department of Parks and Recreation (DPR), the California Department of Water Resources (DWR), the U.S. Fish and Wildlife Service, and possibly historical societies. *Consulting parties will be established by the USACE while preparing the PA.*
      ii. Signatories include: USACE, SHPO, DWR, DPR, SLC, USFWS, and possibly the ACHP. *Signatories will have the most direct responsibility for implementation of the HPMP.*
      iii. Concurring parties include: CVFPB, Indian tribes, and Reclamation. *Concurring parties will review compliance reports prepared under the HPMP, as appropriate.*

III. BACKGROUND
   a. Description and Purpose of the Undertaking
      i. Description of the Area of Potential Effects
   b. Natural Context
   c. Cultural Context
      i. Depositional Context
      ii. Prehistoric Archaeology
      iii. Ethnographic Context
      iv. Historical Context
      v. Historical Archaeology
      vi. Submerged Resource Context

IV. PREDICTED PROPERTY TYPES

This chapter will describe the historic property types that are expected in the APE. These property type descriptions will be based on information contained in Chapter 2: Background *and the records searches conducted in support of the inventories.*

   a. Prehistoric Archaeological Property Types

b. Historical Archaeological Property Types
c. Historic Built Environment Property Types
d. Cultural Landscapes
e. Native American Property Types
f. Submereged Property Types

V. IDENTIFICATION OF HISTORIC PROPERTIES

Chapter 4 will establish basic standards and provide guidelines for the identification of historic properties for the undertaking.

a. Consultation during the Evaluation Process

The role of consultation with concerned communities, organizations, and parties to the PA will be laid out. Consultation will be framed both in terms of the review of evaluations required under the PA as well as in the sense of information gathering and the involvement of concerned parties.

b. General Standards for Identification

This section will reference existing laws, regulations, and guidance concerning identificataion methods. It will also discuss basic methods for the identification of various historic property types in order to avoid needless repetition in the sections devoted to particular property types.

c. Prehistoric Archaeological Property Types
   i. Identification
   ii. Research Themes

Research themes will be couched in a manner similar to those in Caltrans' thematic study on mining properties[1]*. The research themes provided in the HPMP will be broader than the typical site-specific research design, as the unit of analysis for the purposes of the HPMP is the property type, rather than the property. The research themes will provide a solid foundation for evaluating properties for the life of the undertaking because it will streamline the preparation of property-specific historic contexts/research designs. Additionally, the thematic approach facilitates the incorporation of changing perspectives in the study of California's cultures, history, and archaeology. Evaluation criteria will establish the general character-defining features and important aspects of integrity for each property type, encouraging standardization in the application of National/California Register significance and integrity criteria*

   iii. Evaluation Criteria

d. Historical Archaeological Property Types
   i. Identification
   ii. Research Themes
   iii. Evaluation Criteria

e. Historic Built Environment Property Types
   i. Identification
   ii. Relevant Themes

---

[1] California Department of Transportation. 2008. *A Historical Context and Archaeological Research Design for Mining Properties in California.* Division of Environmental Analysis, California Department of Transportation, Sacramento, CA.

iii. Evaluation Criteria

f. Cultural Landscapes

i. Identification

ii. Relevant Themes

iii. Evaluation Criteria

g. Native American Property Types

i. Identification

ii. Relevant Themes

iii. Evaluation Criteria

h. Submerged Property Types

i. Identification

ii. Research Themes

iii. Evaluation Criteria

VI. TREATMENT OF HISTORIC PROPERTIES

Treatment measures can include, but not be limited to: Avoidance, Special Construction areas, Monitoring, Data Recovery, Review and cataloging and reporting of Existing Collections, Public Brochure, Public Interpretation signs...

a. Assessment of Effects

This chapter will reiterate and, to the extent necessary, explicate the PA's review process for assessing effects on historic properties. A comprehensive consideration of laws, regulations, and professional standards for effects assessments will be presented.

b. Prehistoric Archaeological Property Types

The treatment of historic properties affected by the undertaking will be discussed in terms of standard treatment measures and non-standard treatment measures. Standard treatment measures will include those actions that are broadly applicable to a given property type or more than one property type. Standard treatment measures will include in their definition not only the constituent actions required to treat property types, but also the identification of responsible parties and reporting standards. An example of a standard treatment measure is the environmentally sensitive area (exclusion zone), which is commonly employed by state and federal agencies[2].

c. Historical Archaeological Property Types

d. Historic Built Environment Property Types

[2] California Department of Transportation. 2003. Environmentally Sensitive Areas. Attachment 5, Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California.

California State Historic Preservation Officer, USDA Forest Service, and Advisory Council on Historic Preservation. 1996. Attachment 7, Programmatic Agreement Among the U.S.D.A. Forest Service, Pacific Southwest Region, California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarading the Identification, Evaluation and Treatment of Historic Properties Managed by the National Forests of the Sierra Nevada, California, p. 50.

e. Native American Property Types
f. Cultural Landscapes
g. Native American Property Types
h. Submerged Property Types

VII. INADVERTENT DISCOVERY PLAN

Chapter 6 contains the undertaking's inadvertent discovery plan (IADP). The IADP applies primarily to archaeological property types and human remains and associated goods.

a. Pre-Construction Coordination

Pre-Construction coordination includes training construction and non-cultural resource management agency staff in the undertaking's IADP prior to construction.

b. Inadvertent Discovery Procedures

i. Overview of IADP

ii. Procedures for Unanticipated Effects on Known Historic Properties

The IADP will discuss procedures for responding to unanticipated effects on historic properties (here dealt with at the level of property types).

iii. Inadvertent Archaeological Discoveries

In a large, essentially riparian APE such as that encompassed by the present undertaking, there is high potential for other non-archaeological property types to be affected by the undertaking in addition to archaeological properties. Non-archaeological property types might include certain traditional cultural properties of California Indians: plant-gathering areas and fishing grounds, to name a couple of examples

i. Procedures for Archaeological Discoveries without Human Remains
ii. Significance Determinations
iii. Human Remains Discoveries

a. Human Remains Discoveries on Non-Federal Land

Human remains discoveries on non-federal lands shall be treated according to California Health and Safety Code 7050.5 and Public Resources Code Section 5097.98.

b. Human Remains Discoveries on Federal Land

Human remains discoveries on federal land shall be treated according to Section 3(C) of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3002).

iv. Inadvertent Discoveries of Non-Archaeological Properties

The IADP will contain provisions for dealing with property types that may be found in an "archaeological" context (buried), but that are typically evaluated for significance under criteria other than NRHP Criterion D or CRHR Criterion 4.

VIII. RESEARCH, CONSULTATION, LABORATORY, AND FIELD METHODS

Because many research, laboratory, and field methods may be applied to identification and treatment of historic properties, these topics are detailed in this chapter to avoid repetition throughout the HPMP.

a. Research Methods
b. Laboratory Methods
c. Field Methods

IX. PERMITS AND QUALIFICATIONS OF KEY PERSONNEL
   a. Applicable Permits
      i. Survey Permits and Rights of Entry (State Lands Commission permit, etc.)
      ii. Excavation Permits (Archaeological Resources Protection Act)
   b. Professional Qualifications for Implementation of the HPMP
      Pursuant to the PA and federal regulations, personnel charged with implementation of the HPMP must meet the Secretary of the Interior's standards for professional cultural resources managers
   c. Professional Qualifications of the Preparers

X. REPORTING AND INTERPRETATION
   a. Summary Post-Fieldwork Reports
      i. Description
      ii. Timeframe for Completion
         Due to the length of time that typically transpires between completion of fieldwork and reporting, Summary Post-Fieldwork Reports are proposed to apprise agency personnel of findings and preliminary management recommendations early on.
   b. Inventory (Survey) Reports
      i. Description
      ii. Timeframe for Completion
   c. Evaluation Reports
      i. Description
      ii. Timeframe for Compmletion
   d. Archaeological Data Recovery Reports
      i. Description
      ii. Timeframe for Completion
   e. HABS/HAER /HALS Reports
      i. Description
      ii. Timeframe for Completion
         Historic American Building Survey/Historic American Engineering Record/Historic American Landscape reports
   f. Public Interpretive Reports
      i. Description
      ii. Timeframe for Completion

XI. CURATION PLAN
   Likely curational facilities will be identified and consulted regarding their capacity for receiving collections and of what kinds.
   a. Curation of Archaeological Materials on Federal Lands
      Archaeological materials recovered on federal lands will be curated according to ARPA, NAGPRA, and applicable federal regulations.
   b. Curation of Archaeological Materials on State Lands
      Archaeological materials recovered from state lands will be curated according to federal standards, to the extent permissible under state law.
   c. Curation of Archaeological Materials on Private Land
      Although archaeological discoveries on private land are probably unlikely given the context of the undertaking, some discoveries may occur where a state or federal agency has an easement on property, but not ownership. Therefore,

guidance for curation of materials recovered from private land will be developed.

XII. REFERENCES CITED

XIII. APPENDIX

a. Programmatic Agreement

Appendix H-2

SHPO Response Letter, February 1, 2010

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, *Governor*

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 942896
SACRAMENTO, CA 94296-0001
(916) 653-6624 Fax: (916) 653-9824
calshpo@ohp.parks.ca.gov
www.ohp.parks.ca.gov

February 01, 2010

In Reply Refer To: COE100119A

Francis C. Piccola
Chief, Planning Division
Department of the Army
U.S. Army Engineer District, Sacramento
1325 J Street
Sacramento, California 95814-2922

Re: Proposed Repairs at 107 Locations Involving 80,000 Linear Feet of Levees for the Sacramento River Bank Protection Project; Butte, Colusa, Contra Costa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties, California.

Dear Mr. Piccola:

Thank you for submitting to our office, your letter and supporting documentation regarding the 2009 proposed Levee Repairs at 107 Levee Erosion Sites. This project is a component of the Sacramento River Bank Protection Project (SRBPP) and is being proposed and implemented by the COE and the Central Valley Flood Protection Board (CVFPB). The COE has identified it as an undertaking pursuant to review under Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations codified at 36 CFR Part 800.

At this time you are notifying me of the project description and Area of Potential Effects (APE) and are additionally requesting my concurrence on your proposed strategy for compliance with Section 106 regarding this undertaking, which will be implemented over a period of several years beginning in 2012. In addition to your letter of January 15, 2010, you have submitted a copy of minutes from a meeting between COE staff and William Soule of my office that took place on August 19, 2009, a large scale APE map, a project description copied from a NEPA document, an outline for a draft Programmatic Agreement (PA), and an outline for a Historic Property Management Plan (HPMP).

After reviewing your letter and supporting documentation, I have the following comments:

1) I will comment on the proposed APE when the additional documentation (binder with APE topographic maps) described on page one of your letter of 1/19/10 is provided.

2) Regarding the format submitted for the Programmatic Agreement proposed by the COE: While I have no objection to this strategy and the PA format in general, which is being proposed as Section 106 phased identification/evaluation compliance as stated in 36 CFR Part 800.4(b)(2), I will offer more specific comments when an actual draft PA is submitted by the COE.

3) Regarding the format submitted for the Historic Property Management Plan: Again, while I agree that this basic design is appropriate, I will comment when the COE has a draft HPMP that is less generic and more clearly addresses the types of historic properties (landings, piers, pump stations, loading facilities, etc.) that are likely to be present in the APE; and the levels of effort that will be employed for identification, documentation, and evaluation of historic properties.

4) I agree that the Caltrans thematic studies of historic property types are good examples for a predictive study/model for the APE.

In general, I agree that the proposed approach, as discussed in the August 19, 2009 meeting, is appropriate for the subject undertaking, which will be implemented for a period of several years and is likely to be subject to changes in the APE due to additions/deletions of individual project locations. Please keep me apprised of any comments by the Advisory Council on Historic Preservation and any changes in the project description/APE and proposed implementation.

Thank you for seeking my comments and for considering historic properties in planning your project. If you require further information, please contact William Soule, Associate State Archeologist at phone 916-654-4614 or email wsoule@parks.ca.gov.

Sincerely,

Susan K Stratton for

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

Appendix H-3

ACHP Deferral Letter, August 15, 2011

Preserving America's Heritage

August 15, 2011

Mr. Francis C. Piccola
Chief, Planning Division
Sacramento District, Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

Ref: Sacramento River Bank Protection Project, 80,000 linear feet

Dear Mr. Piccola:

The Advisory Council on Historic Preservation (ACHP) received your notification and supporting documentation regarding the adverse effects of the referenced undertaking on properties listed or eligible for listing in the National Register of Historic Places. Based upon the information you provided, we have concluded that Appendix A, Criteria for Council Involvement in Reviewing Individual Section 106 Cases, of our regulations, "Protection of Historic Properties" (36 CFR Part 800), does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to resolve adverse effects is needed. However, if we receive a request for participation from the California State Historic Preservation Officer, Tribal Historic Preservation Officer, affected Indian tribe, or other consulting party, we may reconsider this decision. Additionally, should circumstances change, and you determine that our participation is needed to conclude the consultation process, please notify us.

Pursuant to 36 CFR §800.6(b)(1)(iv), you will need to file the final Programmatic Agreement (PA), developed in consultation with the California State Historic Preservation Office (SHPO) and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with your notification of adverse effect. If you have any questions or require our further assistance, please contact Dr. Tom McCulloch at 202-606-8554 or via e-mail at tmcculloch@achp.gov.

Sincerely,

Caroline D. Hall
Assistant Director
Federal Property Management Section
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION

1100 Pennsylvania Avenue NW, Suite 803 • Washington, DC 20004
Phone: 202-606-8503 • Fax: 202-606-8647 • achp@achp.gov • www.achp.gov

Appendix H-4

Request for Programmatic Agreement Signature, SHPO, March 1, 2012

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR - 1 2012

Mr. Milford Wayne Donaldson, FAIA
State Historic Preservation Officer
Office of Historic Preservation
P.O. Box 94289
Sacramento, California 94296-0001

Dear Mr. Donaldson:

I am writing to continue consultation in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization (COE100119A).

The Corps has taken into account the comments of your staff and those of other agencies and Native American Tribes to produce the enclosed Final Programmatic Agreement (PA) and Historic Property Treatment Plan (HPTP). These documents detail the Section 106 framework the Corps has proposed for the duration of project construction [Enclosures 1 (3 copies) and 2]. This document only needs your signature for final execution. The HPTP also presents initial findings of the intensive pedestrian survey of 16 current erosion sites and 60 miles of underwater survey of the Sacramento River and tributaries. We feel a PA is the most effective means of achieving compliance with Section 106, given the nature of the project and the unknown presence of, or effects to, historic properties within the extensive project area. Pursuant to CFR 800.6 both documents are being submitted for your execution.

The Corps invited the Advisory Council on Historic Preservation to participate in this agreement and they declined on August 15, 2011 (Enclosure 3). In addition, the Corps has contacted and consulted with a number of historic societies and both federally recognized and non-federally recognized Native American Tribes (see Enclosure 2: Appendixes A and C) with claims or interest within the project area. Consultation is ongoing with the Native American Tribes and individuals listed in Enclosure 2, and they were supplied with copies of the PA and HPTP for review and comment. All federally recognized tribes from this list have been invited to participate in the PA as concurring parties, and those that have expressed interest are listed under concurring parties in the PA. All federally listed tribes listed in Enclosure 2 will be mailed a copy of the executed agreement and invited to participate as a concurring party unless they have indicated that they are not interested in the project. We will provide you with a copy of all additional signatures to this agreement, if any. The Central Valley Flood Protection Board, as project sponsor, has been invited to participate as a signatory to the document. Other California state agencies participating in this consultation include the Department of Water Resources and the State Lands Commission, both of whom have been invited to participate as concurring parties, although the latter declined.

In conclusion, the Corps is asking you to execute this PA. If you have any questions or comments, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil. Response can be sent to the above address c/o Ms. Nikki Polson, CESPK-PD-RC.

Sincerely,

for William J. Leady, P.E.
Colonel, U.S. Army
District Commander

Enclosures

cc:
CESPK-PD-R
CESPK- PD-RC (Polson)
CESPK-PM-C (Cook)

POLSON
CESPK-PD-RC

PERRY
CESPK-PD-RC

COOK
CESPK-PM-C

MUNCY
CESPK-PM-C

RINCK
CESPK-PD-RC

CLARK
CESPK-PD

KIRCHNER
CESPK-PD 2-16-12

CLAY
CESPK-OC 2/27/12

FASTING
CESPK-OC

MULLINS
CESPK-DE 3/1/12

LEADY
CESPK-DE

Appendix H-5

Request for Programmatic Agreement Signature, CVFPB, March 1, 2012

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

MAR - 1 2012

Mr. Jay Punia
Executive Officer
Central Valley Flood Protection Board
3310 El Camino Ave #151
Sacramento, California 95821

Dear Mr. Punia:

I am writing to invite your participation as a signatory in a Programmatic Agreement (PA) between the Corps and the State Historic Preservation Officer (SHPO) in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization.

We have taken into account comments from the SHPO, the Department of Water Resources, the State Lands Commission, and Native American Tribes to produce the enclosed Final PA and Historic Property Treatment Plan (HPTP), which detail the Section 106 framework the Corps has proposed for the duration of the project construction [Enclosures 1 (3 copies) and 2]. We ask that you sign the PA in preparation for this upcoming effort. The Corps feels that a PA is the most effective means of achieving compliance with Section 106, given the nature of the project and the unknown presence of or effects to historic properties within the extensive project area.

If you have any questions or comments, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil. Response can be sent to the above address c/o Ms. Nikki Polson, CESPK-PD-RC.

Sincerely,

for William J. Leady, P.E.
Colonel, U.S. Army
District Commander

Enclosures

cc:
CESPK-PD-R
CESPK- PD-RC (Polson)
CESPK-PM-C (Cook)

POLSON
CESPK-PD-RC

PERRY
CESPK-PD-RC

COOK
CESPK-PM-C

MUNCY
CESPK-PM-C

RINCK
CESPK-PD-RC

CLARK
CESPK-PD

KIRCHNER 2-16-12
CESPK-PD

CLAY
CESPK-OC 2-27-12

FASTINO
CESPK-OC

MULLINS 3/1/12
CESPK-DE

LEADY
CESPK-DE

Appendix H-6

Transmittal of Signed Programmatic Agreement to CVFPB, April 19, 2012

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Jay Punia, Executive Officer
Central Valley Flood Protection Board
3310 El Camino Avenue, Room 151
Sacramento, CA 95821

Dear Mr. Punia:

I am pleased to provide you with a copy of the executed Programmatic Agreement for the Sacramento River Bank Protection Project, 80,000 Linear Feet Authorization. The document is simultaneously being sent to various State agencies and Native American Tribes identified and potential concurring parties. Should any choose to participate, we will forward you a copy of the signature page.

Thank you for your continued support of this effort. If you have any questions or concerns about this documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

Copy Furnished (w/o enclosures):
Tiffany Schmid, Cultural Resources Environmental Compliance and Evaluation Branch, Division of Environmental Services, California Department of Water Resources 3500 Industrial Blvd., West Sacramento, CA 95691

cc:
CESPK-PD
CESPK-PD-R
CESPK- PD-RC (Polson)
CESPK-PM-C (Cook)

POLSON/ak
CESPK-PD-RC

RINCK
CESPK-PD-RC

COOK
CESPK-PM-C

GARCIA
CESPK-PD-R

CLARK
CESPK-PD

KIRCHNER
CESPK-PD
4-10-12

Appendix H-7

Transmittal of Signed Programmatic Agreement to California State Lands Commission, April 19, 2012

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Pam Griggs, Senior Staff Counsel
California State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, California 95825

Dear Ms. Griggs:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. Thank you for your interest and participation in the consultation process thus far. At this time, the Corps is providing you a copy of the executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project. As you have previously indicated that your agency would not like to participate as a Concurring Party, these materials are for your information only.

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project.

If you have any comments, questions, or concerns about these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

Copy Furnished:
Jason Ramos, Environmental Scientist, California State Lands Commission, 100 Howe Avenue, Suite 100-South, Sacramento, CA 95825-8202

cc:
CESPK-PD
CESPK-PD-R
CESPK- PD-RC (Polson)
CESPK-PM-C (Cook)

POLSON
CESPK-PD-RC

RINCK
CESPK-PD-RC

COOK
CESPK-PM-C

GARCIA
CESPK-PD-R

CLARK
CESPK-PD

KIRCHNER
CESPK-PD 4-10-1

Appendix H-8
Request for Signature as a Concurring Party to the Programmatic Agreement, sent to the California Department of Water Resources, April 19, 2012

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Tiffany A. Schmid
Associate Environmental Planner-Archaeology
Environmental Compliance & Evaluation Branch
Division of Environmental Services
Department of Water Resources
3500 Industrial Blvd.
West Sacramento, CA 95691

Dear Ms. Schmid:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Department of Water Resources to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Agency does not wish to act as a Concurring Party to the PA.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

Copy Furnished:
Kip Young, Environmental Scientist, Department of Water Resources, 3310 El Camino Avenue, Sacramento, CA 95821

cc:
CESPK-PD
CESPK-PD-R
CESPK- PD-RC (Polson)
CESPK-PM-C (Cook)

POLSON/ak
CESPK-PD-RC

RINCK
CESPK-PD-R

COOK
CESPK-PM-C

~~GARCIA~~
CESPK-PD-R

CLARK
CESPK-PD

KIRCHNER AEK
CESPK-PD
4-10-1

Appendix H-9

Requests for Signatures as a Concurring Parties to the Programmatic Agreement, sent to Tribes, April 19, 2012

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Tribal Council
United Auburn Indian Community
10720 Indian Hill Road
Auburn, CA 95603

Dear Tribal Council:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the United Auburn Indian Community to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

Copy Furnished:
Marcos Gurrero, Cultural Resources Specialist, United Auburn Indian Community, 10720 Indian Hill Road, Auburn, CA, 95603

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Jesse Brown, EPA Officer
Berry Creek Rancheria of Tyme Maidu Indians
5 Tyme Way
Oroville, CA 95966

Dear Mr. Brown:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Berry Creek Rancheria of Tyme Maidu Indians to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

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If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Tribal Council
Paskenta Band of Nomlaki Indians
P.O. Box 398
Orland, CA 95963

Dear Tribal Council:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Paskenta Band of Nomlaki Indians to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Guy Taylor
Mooretown Rancheria of Maidu Indians
#1 Alverda Drive
Oroville, CA 95966

Dear Mr. Taylor:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Mooretown Rancheria of Maidu Indians to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

Mr. Oscar Serrano Sr.
Environmental Officer
Cachil DeHe Band of Wintun Indians
Colusa Indian Community
3730 Highway 45
Colusa, CA 95932

APR 19 2012

Dear Mr. Serrano:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Cachil DeHe Band of Wintun Indians of the Colusa Indian Community to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

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If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Calvine Rose
Strawberry Valley Rancheria
P.O. Box 667
Marysville, CA 95901

Dear Mr. Rose:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Strawberry Valley Rancheria to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Ren Reynolds
Cultural/EPA Officer
Enterprise Rancheria Estom Yumeka
3690 Olive Hwy
Oroville, CA 95966

Dear Mr. Reynolds:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Enterprise Rancheria Estom Yumeka to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

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If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Ms. Kelli Hayward
Wintun Tribe of Northern California
P.O. Box 995
Shasta Lake, CA 96019

Dear Ms. Hayward:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Wintun Tribe of Northern California to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

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If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Tribal Council
Redding Rancheria
2000 Rancheria Road
Redding, CA 96001

Dear Tribal Council:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Redding Rancheria to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

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If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

Copy Furnished:
James Hayward, Sir., Cultural Resources Program, Redding Rancheria, 2000 Rancheria Road, Redding, CA 96001

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. David Jones
Cortina Band of Indians
P.O. Box 1630
Williams, CA 95987

Dear Mr. Jones:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Cortina Band of Indians to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

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If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Ms. Debbie Grimes
California Valley Miwok Tribe
10601 Escondido Pl
Stockton, CA 95212

Dear Ms. Grimes:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the California Valley Miwok Tribe to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Reno Franklin
Tribal Historic Preservation Officer
Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

Dear Mr. Franklin:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Yocha Dehe Wintun Nation to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Daniel Fonseca
Tribal Historic Preservation Officer
Shingle Springs Rancheria
P.O. Box 1340
Shingle Springs, CA 95682

Dear Mr. Fonseca:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Shingle Springs Rancheria to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

Copy Furnished:
AmyAnn Taylor, Legal Counsel, Shingle Springs Rancheria, P.O. Box 1340, Shingle Springs, CA 95682

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Ms. Regina Dock
Grindstone Rancheria
P.O. Box 63
Elk Creek, CA 95939

Dear Ms. Dock:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Grindstone Rancheria to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Mike DeSpain, EPA Coordinator
Mechoopda Indian Tribe of Chico Rancheria
125 Mission Ranch Blvd.
Chico, CA 95926

Dear Mr. DeSpain:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Mechoopda Indian Tribe of Chico Rancheria to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Mr. Leland Daniels
Cultural Resources Representative
Wilton Rancheria
7531 Maple Leaf Lane
Sacramento, CA 95828

Dear Mr. Daniels:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Wilton Rancheria to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner

Alicia E. Kirchner
Chief, Planning Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

APR 19 2012

Ms. Billie Blue
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, CA 95669

Dear Ms. Blue:

I am pleased to continue the Section 106 consultation process with you in regard to the Sacramento Riverbank Protection Project-Phase II 80,000 Linear Feet Authorization. The Corps thanks you for your interest and participation in the consultation process thus far. At this time, we are providing you a copy of the Executed Programmatic Agreement (PA) and Final Historic Property Treatment Plan (HPTP) developed for the project and inviting the Ione Band of Miwok Indians to participate in the PA as a Concurring Party (Enclosures 1 and 2).

These documents represent the work of over two years and take into account comments received from California State agencies and Native American Tribes. The enclosed PA and HPTP detail the Section 106 framework the Corps, Central Valley Flood Protection Board, and the State Historic Preservation Officer have agreed will be followed for the duration of the project. As a Concurring Party you would receive project updates as prescribed in the enclosed documents, including a summary of activities performed under the PA once per year, with an opportunity to comment.

If you wish to act as a Concurring Party, please review the documentation and sign on the appropriate page. Please return the original signed page to the Corps for the primary record and a copy will be provided to all participating entities. If no response is received within 45 days, the Corps will assume that your Tribe does not wish to act as a Concurring Party to the PA. If you do not sign, the Corps will continue to consult with your Tribe, but only when specific erosion repairs are scheduled within the Tribe's area of interest as delineated by the Native American Heritage Commission.

If you would like to schedule a meeting or have any comments, questions, or concerns about the project or these documents, please contact Ms. Nikki Polson at (916) 557-6977 or by email at: Nikki.Polson@usace.army.mil.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Enclosures

cc:
CESPK-PD
CESPK-PD-R
CESPK- PD-RC (Polson)
CESPK-PM-C (Cook)

POLSON/ak
CESPK-PD-RC

RINCK for
CESPK-PD-RC

COOK
CESPK-PM-C

GARCIA
CESPK-PD-R

CLARK
CESPK-PD

KIRCHNER AEK 4-10-12
CESPK-PD

Appendix I

Final U.S. Fish and Wildlife Service Coordination Act Report, June 2018

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
81420-2009-FA-0135-4

JUN 18 2018

Alicia Kirchner
Chief, Planning Division
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814

Dear Ms. Kirchner:

Enclosed is the U.S. Fish and Wildlife Service's Fish and Wildlife Coordination Act (FWCA) report for the Corps of Engineer's Sacramento Bank Protection Project Second Phase (Phase II). Congress recently authorized an additional 80,000 linear feet within the Phase II project. This report has been prepared under the authority of, and in accordance with, the provisions of section 2(b) of the FWCA (48 stat.401, as amended; 16 U.S.C. 661 et seq.).

On October 25, 2012, this report was circulated to the agencies and offices listed below for review and comment. We did not receive any comments on the draft FWCA report.

If you have any questions or comments regarding this report please contact Jennifer Hobbs at (916) 414-6541.

Sincerely,

Doug Weinrich

Doug Weinrich
Acting Field Supervisor

Enclosure

ec:
CDFW, Region 2, Rancho Cordova, CA (Attn: Kelley Barker)
ACOE, Sacramento, CA (Attn: Patricia Goodman)
NMFS, Sacramento, CA (Attn: Tancy Moore)
DWR, Sacramento, CA (Attn: Kip Young)

FISH AND WILDLIFE COORDINATION ACT REPORT
SACRAMENTO RIVER BANK PROTECTION PROJECT PHASE II
80,000 LINEAR FEET
June 2018

INTRODUCTION

This is the U.S. Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act (FWCA) report for the Sacramento River Bank Protection Project's (SRBPP) authorization of an additional 80,000 linear feet of bank protection in the Sacramento Valley, California. This report is prepared under the authority of, and in accordance with the FWCA, as amended. Current SRBPP work is being carried out under the Second Phase (Phase II) of the existing federal authorization. The additional 80,000 linear feet of bank protection was authorized through a provision of the Water Resources Development Act of 2007 to protect the levees and associated flood risk management infrastructure that is within the SRBPP area from erosion. The Central Valley Flood Protection Board is the project's non-federal cost-share partner.

The information presented is based primarily upon project planning information made available by the Corps of Engineers (Corps) and various reports pertinent to the project area. Coordination with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and California Department of Fish and Wildlife (CDFW) is being accomplished through project coordination which has occurred to date, as well as providing a draft copy of this report for comments. The Service did not receive any comments on the draft FWCA report.

Many of the Sacramento River levees were built close together to create high river velocities that would scour away tailings from 19th century hydraulic mining. With the mine tailings now gone, the high velocities are currently scouring the levees. The closely built levees have resulted in riparian habitat being reclaimed for agricultural purposes and population growth and very little natural floodplain habitat remaining in these sections of the Sacramento River system. Therefore, much of the historic riparian habitat has been lost along the Sacramento River. The primary impact of the SRBPP is on the remaining bands of riparian and shaded riverine aquatic (SRA) habitats which persist along benches and in many cases on the levees themselves. This habitat is vitally important to many fish and wildlife species, particularly as migratory corridors.

The SRBPP was authorized in 1960 as a continuing construction project to provide erosion protection for the existing levees and flood control facilities of the Sacramento River Flood Control Project (SRFCP). The First Phase (Phase I) of the project constructed 430,953 linear-feet of bank stabilization using rounded cobble and angular rock between 1963 and 1975. Phase II of SRBPP authorized an additional 405,000 linear feet of bank protection and construction began for this phase in 1975. Programmatic biological opinions were completed by the Service and NOAA Fisheries in 2008 for the remaining 24,000 linear feet of the original Phase II authorization.

Phase I of the project did not include provisions for mitigation for project effects in the authorization. The ability to mitigate for Phase II impacts of the SRBPP was included in that authorization. The authorizing document for Phase II allotted 10 percent of the total construction cost for mitigation of environmental values. Mitigation actions occurred over a series of separate contracts and included using rock fill to preserve existing berms or to create new berms, acquiring property in easements or in fee title, and restoring riparian habitat through vegetation planting. Additionally, a large mitigation area was developed along Cache Slough (Cache Slough/Yolo Bypass

Mitigation Area) by placing a new levee on the tip of Liberty Island, breaching the old levees, and allowing the area to inundate and become habitat. Unfortunately, many of the mitigation actions implemented early in Phase II have not been tracked and while there was some monitoring of mitigation actions by the Service (USFWS 1991 and USFWS 1992), there is a current lack of knowledge of the success of most of these mitigation efforts. Beginning in the early 1990s, habitat-based analyses of impacts and mitigation needs for SRBPP sites were refined and improved. Concurrently with this, native fish species were becoming listed (delta smelt, 1993; winter-run Chinook salmon, 1994; spring-run Chinook salmon, 2005; Central Valley steelhead, 2006) under the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). On November 7, 2000, the Service issued a draft jeopardy biological opinion on Contracts 42E and 42F, of Phase II of the SRBPP. After many meetings and negotiations, a revised project description was written by the Corps and a final non-jeopardy biological opinion was signed by the Service on July 30, 2001. Similarly, NOAA Fisheries issued a non-jeopardy biological opinion for the project.

The subsequent project descriptions for Contracts 42E and 42F included the creation of a setback levee, removal of one linear foot of existing rock riprap for every one linear foot of rock riprap that is placed due to the project, formation of an Interagency Working Group (IWG), and initiation of a programmatic biological opinion for the remaining linear feet beyond that in the project description of the biological opinion. In 2003, the Sacramento River Bank Protection Project Riprap Database was developed which identified all existing rock within the SRBPP area. Through the IWG, the Standard Assessment Methodology (SAM) was developed in 2004 to analyze effects to listed fish species. With the aid of the SAM, the Corps was able to begin to design repair sites which contained features designed to off-set impacts to listed fish species. Consequently, much of the compensation/mitigation necessary for the erosion sites that has been constructed since 2005 has been constructed on-site. Fish features at the sites include planting aquatic and terrestrial vegetation, creation of benches, and placement of instream woody material (IWM) at the summer and winter mean waterlines.

The Corps conducts a yearly erosion survey. Erosion site repair priority can change from year to year based on the previous winter flows. They can remain stable for years and become considerably worse with a high water event. Therefore, the Corps cannot determine exactly which erosion sites would be constructed under this additional 80,000 linear feet authorization.

The Corps contracted with Kleinfelder-Geomatrix in 2008 to provide preliminary designs on 107 known erosion sites. This document is known as the 2009 Alternatives Report. The Service acknowledges that the sites identified within this report may not be the sites which are ultimately constructed; however, the Corps is using these sites as a basis for their programmatic analysis of the impacts of constructing an additional 80,000 linear feet of bank protection. Because this analysis is programmatic, further site specific analysis will be necessary as specific sites are selected and designs are applied to them. The Service will provide site specific FWCA Reports at that time.

Because the Corps and the Resource Agencies are looking at this programmatically, the Service has determined that a Habitat Evaluation Procedures (HEP) analysis is not required at this time. We do have rough estimates of acreages of the main terrestrial habitats which exist along the 107 sites analyzed and can use these numbers to compare various alternatives based on habitat disturbed, removed, and created. A HEP analysis will be completed as specific sites and designs are selected. In addition, many of the habitats that will be affected are used by threatened or endangered species and will undergo consultation under the Act.

Prior to 2007, the Corps and California Department of Water Resources (CDWR) had been designing and constructing sites that engineered in the ability to plant vegetation on-site. In 2007, the Corps released a white paper which restricted vegetation on levee slopes, levee crown, and 15 feet off the toe on either side of the levee. In 2009, the Corps released its Engineering Technical Letter (ETL) 1110-2-57 "Guidance for Landscape Planning and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures" and associated draft policy guidance letter "Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls – 75 Federal Register 6364-68". These documents define where vegetation is not allowed on flood control structures and the process for obtaining a variance which would allow vegetation to remain near or on the levee.

Given these changes in policy, SRBPP has changed the planting designs on their erosion protection projects. Because of the restrictions on where vegetation can be planted and the existing narrow floodplain corridor throughout much of the system, the ETL does not allow for the same amount of vegetation to be planted as had been previously. In some instances, where the erosion has gone into the levee prism, vegetation may not be planted at the repair site at all. The Corps and CDWR could continue to design repairs with on-site vegetation and apply for a variance to allow vegetation inside the typical vegetation free zone; however, there is no guarantee that a variance would be granted by the Corps.

The Service has submitted multiple comment letters on the potential effects that full implementation of the ETL would have on fish, wildlife, and their habitats. In some areas or reaches the only existing riparian vegetation is found immediately adjacent to or on the levees. The levees were built close to the banks of the river and provide the only substrate for riparian vegetation. Therefore, the loss of this vegetation and the inability to plant vegetation in this area would greatly affect fish and wildlife species through lack of habitat and removing migration corridors. The Service holds public safety in high regard and believes that vegetation can aid in public safety through providing erosion protection of the flood control structures. We believe the Corps should assist in development of and/or permit regional exceptions to strict compliance with the ETL as ongoing research determines the risks and/or benefits of vegetation.

Again, this report presents the current views of the Service on this project. Our analysis is based on engineering and other project information provided by the Corps. Our appraisal of resources is based on literature reviews; field investigations and surveys; best professional judgment of Service biologists; and a projection of future conditions using current land-use information and analyses provided by the Corps. Our analyses will not remain valid if the project, the resource base, or anticipated future conditions change significantly.

DESCRIPTION OF PROJECT AREA

The SRFCP encompasses levees, weirs, and overflow areas from River Mile (RM) 0 near Collinsville at the confluence of the Sacramento and San Joaquin Rivers to RM 176 on the east bank and RM 184.5 on the west bank of the Sacramento River near Chico Landing. Also included are portions of large tributaries of the Sacramento River including the: American River (RM 0-23), Feather River (RM 0-61), Yuba River (RM 0-11), and Bear River (RM 0-17). The lower reaches of Elder and Deer Creeks, and Sutter, Georgiana, Steamboat, and Miner Sloughs are also part of the project area.

The Sacramento River has a drainage area of more than 27,000 square miles. On the valley floor it is an alluvial stream with meandering characteristics. Several geological controls exist along the rivers in the SRBPP area; however, along the Sacramento River, the location of man-made levees has severely constrained the ability of the Sacramento River to meander.

Historically, habitat in the Central Valley consisted of a mosaic of perennial grasslands, vernal pools, freshwater marshes, and riparian forests. Riparian forest along the Sacramento River could form up to 4 to 5 miles wide growing on sediment deposited along the banks when the river overflowed (Thompson 1961). Only a small portion of this historic habitat exists today due to the construction of levees close to the river, regulated flows from upstream dams, increased residential and commercial development, and agricultural activities. Within the area of the SRBPP, the majority of the remaining habitat exists in thin bands along the Sacramento River, which at times becomes fragmented with sections containing little to no habitat.

PROJECT DESCRIPTION

A no-action alternative and 10 action alternatives are being evaluated. Because the sites for the 80,000 linear feet of bank protection cannot be selected at this time, the Corps is using sites identified in the 2009 Alternatives Report. While it is highly likely that these sites would be constructed under this project, it is also possible that other sites may develop which present a greater risk to the levee integrity. The Corps has developed bank protection measures (BPM) which are described below. These measures are then combined into various arrangements to create alternatives for the project. The alternative descriptions follow the BPM descriptions.

Bank Protection Measures

A BPM is a site-specific design solution that can be constructed at an eroding site in order to protect the flood control structure. The following criteria have been developed for bank protection design, consistent with the project purpose and need:

- Maintaining the level of flood safety existing prior to the development of a levee threat resulting from bank erosion, through the use of structurally reliable erosion-control elements;
- Maintaining fish and wildlife habitat and scenic and recreational values, and replacing losses on-site to the degree feasible through the use of habitat mitigation elements integrated with erosion-control elements;
- Fully mitigating off-site any residual fish and wildlife habitat losses to the extent justified; and
- Minimizing costs of maintaining both erosion control and habitat mitigation elements.

BPM 1 – Setback Levee

The setback levee measure entails constructing a new levee some distance landward of the existing levee and would avoid or minimize construction in the channel and minimize construction in riparian areas. The land between the setback and existing levee would become part of the floodplain. Land use in the new floodplain would be determined on a site-by-site basis and would include levee breaching in several locations to allow high flows to inundate the new floodplain. Vegetation on the new setback levee including 15 feet beyond each toe would be restricted to grass, and managed as a vegetation-free zone (VFZ) in compliance with the ETL, while vegetation could remain on the old existing levee. Because woody waterside vegetation is of high value in California for fish and wildlife, the enlargement and revegetation of the floodplain could be used as mitigation for other sites within this project.

Setback levees can be very effective, but cost and existing land use limit opportunities for setback levees in the planning area. However, potential mitigation benefits may offset some of these constraints if the site is repaired as part of a multi-objective project and long-term maintenance of the site may be less.

BPM 2 – Bank Fill Stone Protection with No On-Site Woody Vegetation

The bank stone protection with no on-site woody vegetation measure entails filling the eroded portion of the bank and installing rock/soil as determined by site-specific analysis. Six inches of soil cover would be placed on the revetment above the summer mean water surface elevation to support grasses. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with riprap. BPM 2 would be most applicable in areas where there is inadequate space or substantial constraints, either landside or waterside, which would make it difficult to implement the other measures. Existing woody vegetation would be removed within the 15-foot VFZ. Grass would be allowed in this area.

BPM 3 – Adjacent Levee

The adjacent levee measure involves the construction of a new levee embankment adjacent to and landward of the existing levee. The adjacent levee would be constructed to Corps design standards. The landward portion of the old levee would be an integral, structural part of the new levee. Vegetation and IWM could be placed on the old levee if that portion is outside of the VFZ. The levee may also be degraded to provide riparian and/or wetland benches and planted as long as the plantings comply with the Corps' vegetation policy. Woody vegetation on the landward side of the existing levee and within the footprint of the new adjacent levee would be removed as a part of construction. This BPM would be appropriate where waterside banks are narrow or non-existent.

BPM 4 – Riparian and Wetland Benches with Revegetation

BPM 4 consists of three design variations presented as measures 4a, 4b, and 4c. In general, this BPM involves the placement of clean quarry stone from the toe of the levee slope to the Mean Summer Water Level (MSWL) and placing quarry stone and soil-filled quarry stone on the levee slope above the MSWL. The repairs would involve initial site preparation, installation of a fabric or gravel bedding layer between the quarry stone and soil-filled quarry stone, and construction of levee embankment. These BPMs vary from one another with regard to the placement and extent of environmental features that are intended to increase habitat quality (bank construction, vegetation, and IWM). These variations are driven by a number of factors, but most importantly they are driven by the types of existing resources that they are replacing and the types of species most likely to use them. New IWM would only be installed downstream of Sacramento River RM 30 to replace existing IWM removed during repair of the bank. Upstream of RM 30, new IWM is usually incorporated into the design.

In general, plantings consistent with the ETL and outside of the VFZ at each site could include box elder, white alder, Oregon ash, western sycamore, Fremont cottonwood, valley oak, Goodding's willow, red willow, arroyo willow, California wild rose, and narrowleaf willow.

BPM 4a – Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline

The low riparian bench with revegetation and IWM above the summer/fall waterline measure entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. This design provides near-bank, shallow-water habitat and SRA for fish and is typically applicable to sites upstream of Sacramento River RM 30. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone would be similar to the description under BPM 2. This BPM includes a riparian bench. The bench would be treated with geotextile coir fabric or gravel layer, and soil-filled quarry stone.

In this design, the riparian bench is intended to flood at river stages corresponding to high tide (where tidally influenced) during average winter/spring flows. The riparian bench would be vegetated in a manner similar to recent SRBPP projects with riparian bench designs. Species planted would be in compliance with the ETL. Planting plans would describe species to be planted within a specific elevation zone and would detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers.

The riparian bench would be constructed at a slope of 10:1 and the revetment portion above and below the bench would be 3:1. The width of the bench would be about 10 to 30 feet, depending on site conditions. Anchored IWM would be embedded on top of the riparian bench above the summer/fall waterline. The IWM would be available as accessible habitat along the banks only during winter/spring flows when the bench is inundated. Individual pieces of IWM would be placed to fit the site's hydraulic conditions and other applicable guidance.

BPM 4b – Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

The low riparian bench with revegetation and IWM above and below the summer/fall waterline BPM entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench (as described for BPM 4a) to support riparian vegetation and provide a place to anchor IWM. In addition to the placement of IWM as described for BPM 4a, IWM also would be placed beyond the bench below the summer/fall waterline, thereby increasing the types and extent of mitigation for shallow-water fish habitat, providing year-round instream habitat for salmonids. This design is typically applicable to sites upstream of Sacramento River RM 30. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone would be similar to the description under BPM 2. Installation of geotextile coir fabric or gravel layer, soil-filled quarry stone, and riparian bench would be similar to the description under BPM 4a.

BPM 4c – Riparian and Wetland Benches with Revegetation

The low riparian and wetland bench with revegetation BPM entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. Bench slopes would be the same as those described for BPM 4a. The design also includes a wetland bench below the summer/fall waterline to further increase habitat quality. This design is intended for sites downstream of Sacramento River RM 30 and targets compensation of impacts to delta smelt habitat. Treatment of existing vegetation would be similar to BPM 2. Because IWM might increase habitat suitability of ambush predators, IWM would be installed only to replace pre-project conditions.

The riparian and wetland benches are intended to flood at river stages corresponding to winter/spring (high) flows and summer/fall (low) flows, respectively. Both benches would be revegetated in compliance with the ETL and in accordance with appropriate planting plans. The wetland bench would typically be planted with hardstem bulrush, California bulrush, and/or giant bur-reed.

BPM 5 – Bank Fill Stone Protection with On-Site Vegetation

The bank fill rock slope with on-site riparian vegetation BPM entails filling the eroded portion of the bank and installing a rock/soil combination along the waterside slope and streambank from streambed to the height the rock protection is needed as determined by site-specific analysis. The revetment would be placed at a slope of 3:1. The rock/soil combination will vary by location and will be determined during site-specific design. All IWM would be removed from the bank; following construction it would not be replaced upon the bank protection structure. About 25 percent of existing woody vegetation that is outside of the vegetation free zone on the waterside slope is assumed to be retained during construction. New vegetation would be limited to planting native grasses within the VFZ, while woody vegetation could be planted outside of the VFZ. Six inches of soil cover would be placed on the revetment to support on-site vegetation. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with riprap.

Existing vegetation would be removed within the VFZ. However, grass would be allowed in this area. The long-term goal of vegetation planting is to provide riparian and SRA habitats. Species planted would be in compliance with the ETL and would be detailed in planting plans. Planting plans would describe species to be planted within a specific elevation zone and would detail the number, area and spacing of plants to be installed, and whether the plants are cuttings or containers.

Alternatives

The Corps has developed six major alternatives including the no action alternative. Each of the five action alternatives has a secondary alternative which is based on doing work in economically feasible basins. This results in a total of 10 action alternatives. The Corps conducted an economic analysis to determine if individual regions can be justified by showing beneficial flood damage reduction greater than the cost to construct the site. The alternatives with an A after them assume that as an aggregate, the whole 80,000 linear feet would have a positive cost benefit ratio without breaking the system into individual flood basins. The alternatives with a B after them divide the SRBPP area up into flood basins and determine the cost benefit of repairing sites within each basin. Under this series of alternatives some flood basins do not meet the positive cost benefit ratio, generally agricultural areas with few structures. Seven flood basins were determined to be Economically Justified Basins (EJB) for purposes of the SRBPP. The Corps is only analyzing effects within these seven EJBs for all of the alternatives with a B and is assuming a total length of bank protection within these alternatives to be 30,000 linear feet. If future unforeseen conditions require construction of more than 30,000 linear feet of bank protection within the EJBs, the Corps and the CVFPB will determine if subsequent environmental analyses would be needed to determine the context and intensity of resulting environmental effects on the additional linear footage of bank protection. Additionally, the Corps would work with the Service under the FWCA to look at increased effects due to changes in these alternatives. Because this linear footage for the B alternatives was provided to the Service only very recently we do not have adequate information on existing habitats and effects to these habitats from the various BPMs. The Corps will continue to work with the Service to analyze effects to fish, wildlife, and their habitat during execution of the proposed project.

Alternative 1 - No Action

Under this alternative, the Corps would take no action to halt erosion and protect the SRFCP levees. As such, the banks would continue to erode, increasing the risk of levee failure and subsequent flooding. Eventually, bank protection BPMs or a setback levee would need to be implemented to protect the levee system from failing.

Alternative 2A – Low Maintenance

This alternative would apply BPM 2 to all 107 currently identified erosion sites. Bank Protection BPM 2 would be a rock fix with no on-site vegetation planting; consequently all mitigation would be off-site.

Alternative 2B – Low Maintenance

This alternative would also use only BPM 2; however, only sites that are within the economically justified basins would be considered. Of the 107 current sites there are 18 sites within the economically justified basins which would be built under this alternative.

Alternative 3A – Maximize Meander Zone

This alternative would apply a mix of BPMs 1 and 3 to all 107 currently identified erosion sites. These would result in the construction of setback or adjacent levees such that there would be little waterside construction and an increase in floodplain habitat. In areas where the landside of the levee is constrained by existing development or there are hydraulic effects on the waterside, an adjacent levee would be built as opposed to a setback levee which would provide more floodplain habitat.

Alternative 3B – Maximize Meander Zone

This alternative would also apply a mix of BPMs 1 and 3; however, only sites that are within the economically justified basins would be considered for repair. Of the 107 current sites there are 18 sites within the economically justified basins which would be built under this alternative.

Alternative 4A – Habitat Replacement

This alternative would apply a combination of BPMs 1, 2, 3, 4, and 5. A BPM was selected for use if it was identified in the 2009 Alternatives Report and was also ETL compliant. BPMs that were not ETL compliant from the 2009 Alternatives Report were then changed to make the site ETL compliant. Off-site mitigation, when necessary, would be done within the region the effects occurred (1A, 1B, 2, or 3).

Alternative 4B – Habitat Replacement

This alternative would also apply a combination of BPMs; however, only sites within the economically justified basins would be considered for repair. Of the 107 current sites there are 18 sites within the economically justified basins which would be built under this alternative.

Alternative 5A – Habitat Replacement Reaching Environmental Neutrality

This alternative would apply a combination of BPMs 1, 2, 3, 4, and 5. However, unlike Alternative 4, this alternative attempts to minimize the need to go off-site for mitigation by applying fewer BPMs that result in adverse effects to fish, wildlife, and habitat. The Corps defines environmental neutrality as full replacement or greater of estimated SAM calculations and riparian habitat loss. While the intent is to not require off-site mitigation with this alternative, should that be necessary it would be provided within the region the effects occurred.

Alternative 5B – Habitat Replacement Reaching Environmental Neutrality

This alternative would also apply a combination of BPMs; however, only sites within the economically justified basins would be considered for repair. Of the 107 current sites there are 18 sites within the economically justified basins which would be built under this alternative.

Alternative 6A – Habitat Replacement with ETL Variance

This alternative would apply a combination of BPMs 1, 4, and 5, as described in the 2009 Alternative Report without any modification. A number of these BPMs include protection of existing vegetation and placement of on-site vegetation within the vegetation free zone and therefore would require a variance to the ETL. Off-site mitigation, when necessary, would be provided within the region where the effects occurred.

Alternative 6B – Habitat Replacement with ETL Variance

This alternative would also apply a combination of BPMs as described in the 2009 Alternative Report without any modification; however, only sites within the economically justified basins would be considered for repair. Of the 107 current sites there are 18 sites within the economically justified basins which would be built under this alternative.

FISH AND WILDLIFE RESOURCES

Vegetation

The SRBPP typically affects habitat located at the interface of the water surface and land. Cover-types associated with this area include the following:

Shallow, Open Water - Shallow, open water habitat is defined as areas < 3 meters deep along the shoreline where cover and structural elements, and thus hydraulic diversity, are generally lacking. Most such areas have substrates composed of relatively small particle sizes, such as sand and silt and have relatively low water velocities, except during high-flow conditions. Also, sediment accretion is often occurring such as sandbars.

Such shallow, open water is important to a number of regionally important fish and wildlife. For example, wading birds (e.g., herons and egrets) use it for feeding. It is also part of the critical habitat designated for the federally-listed delta smelt that spawns in shallow sandy areas with little vegetation.

Shaded Riverine Aquatic (SRA) - The Service has defined SRA as the nearshore aquatic area occurring at the interface between a river and adjacent woody riparian habitat. Principal attributes of this cover-type are: (a) the adjacent bank being composed of natural, eroding substrates supporting riparian vegetation that either overhangs or protrudes into the water; and (b) the water containing variable amounts of woody debris, such as leaves, logs, branches and roots, as well as variable depths, velocities, and currents. Whole trees, which periodically become dislodged from the adjacent eroding banks, often also contribute to the instream structure of SRA. Such attributes of SRA provide high-value feeding areas, burrowing substrates, escape cover, and reproductive cover for a wide array of regionally important fish and wildlife, including several federally-listed species of fish. In particular, the SRA and related shoreline-riparian interface along the site is part of the designated critical habitat of the Sacramento River winter-run Chinook salmon.

Riparian. Riparian habitat is not static and is exhibited in many forms over its successional period. For purposes of this document riparian would be further subdivided into riparian forest and riparian scrub shrub.

Riparian scrub shrub - Early riparian habitat may be called scrub shrub. Scrub shrub generally refers to areas where the woody riparian canopy is composed of trees or shrubs ≤ 20 feet high. Species that are typically found in these habitats include young cottonwood, willow, elderberry, buttonbush, Himalaya blackberry, wild grape, and poison oak. In very dense stands there may be no understory; however, in open canopies, understory vegetation may consist of an herbaceous layer of sedges, rushes, grasses, and forbs. Provided disturbance of the area is low, the scrub shrub may acquire enough overstory cover to become riparian forest within 20 years.

Riparian forest – Riparian forest typically has a dominant overstory of cottonwood, California sycamore, or valley oak. Species found in the scrub-shrub would make up the subcanopy and could also include white alder and box elder. Layers of climbing vegetation make up part of the subcanopy, with wild grape being a major component, but wild cucumber and clematis are also found in riparian communities.

Herbaceous Ruderal. The herbaceous ruderal habitat is found on most levees along the Sacramento River. It occurs on the levees and also within gaps in the riparian habitats. Plant species include wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue. Common forbs include broadleaf filaree, redstem filaree, turkey mullein, clovers, and many others. The majority of these plants are not native to the project area.

Wildlife

The variety of habitats along the rivers of the Sacramento Valley support a wide range of wildlife species including mammals, amphibians, reptiles, and migratory birds. Overall, however, the quantity and variety of wildlife species now inhabiting the area are fewer than before flood control, agricultural, and development permanently removed much of the native and natural habitat. Many of the wildlife species are unable to adapt to other habitat types or altered habitat conditions and are, therefore, more susceptible to habitat loss and degradation. The region also supports a variety of non-native species, some of which are detrimental to survival of native species.

Existing native habitat, especially riparian corridors along the Sacramento River and associated sloughs and creeks, provides habitat for many native species. While riparian habitat is limited, it supports the greatest abundance of wildlife, including a variety of avian species such as raptors;

mammal species such as bats, coyote, and fox; frogs, toads, and other amphibians; and garter snake, western pond turtle, and other reptiles. Riparian habitat provides shade, cover, and food supply to the immediate shoreline environment of large rivers, benefiting fish and wildlife species such as salmonids, river otter, beaver, heron, egret, and belted kingfisher. Riparian habitat along the Sacramento River is also important breeding habitat for sensitive migratory bird species including black-headed grosbeak, bank swallow, blue grosbeak, Swainson's hawk, yellow-breasted chat, and yellow-billed cuckoo (RHJV 2004).

A number of species have declined due to loss of either riparian habitat or natural riverine functions. Below is a discussion of species which are particularly affected by erosion control measures due to low population numbers and/or severe lack of habitat within the Sacramento Valley.

Bank Swallow. The bank swallow is a state listed species which nests in colonies in earthen banks and bluffs along rivers, lakes, and ocean coasts. Steeply eroded banks with the right type of soils are necessary for breeding. Bank swallow nesting habitat is ephemeral such that it requires areas to undergo erosion to expose the right kinds of soils (fine sandy loam to loam). Sites without erosion tend to build up parasites leading to potential mortality of the birds. Bank swallows forage on aquatic and terrestrial insects. Bank swallow colonies tend be found near grassland habitat, likely due to the high insect productivity and therefore better foraging opportunities (Moffat et al. 2005).

While the bank swallow's distribution extends throughout North America, within California an estimated 70 percent of the population is located along the Sacramento and Feather Rivers (Schlorff 1997). As of 2007, there were an estimated 8,010 pairs of bank swallows along the Sacramento River making up 51 colonies (Garcia et al. 2008). Over the previous 20 years the number of colonies has decreased by about 29 percent (Garcia et al. 2008). Much of the loss of breeding pairs and colonies has coincided with federal, state, and local erosion repair work in the form of riprap.

Raptors. Raptors such as Swainson's hawks (a state-listed species), red tailed hawks, and red-shouldered hawks use large riparian trees for nesting. Typically, nesting is located adjacent to grasslands or row crop agricultural areas, as these areas provide raptors with suitable foraging habitat (Estep 1989). These types of raptors typically build stick nests in large trees. Swainson's hawks are summer residents in California and migrate to South America in the winter. For Swainson's hawks the majority of known nests occur within riparian habitat.

Raptors which use riparian habitat for nesting and surrounding grassland or agricultural areas for foraging have been affected by the loss of riparian habitat within the Central Valley. Past flood control projects have constrained the rivers and lessened the amount of floodplain which could support riparian and grassland habitats. In their place are housing developments and agriculture. While some of the agriculture has been a suitable substitute for the native grasslands, others such as orchards and vineyards have lessened the amount of foraging habitat available for raptors.

Yellow-billed cuckoo. The yellow-billed cuckoo is a federally threatened species and a state endangered species. Yellow-billed cuckoo is a neotropical migrant which summers in only two known locations in California, one of which is found along the Sacramento River. Along the Sacramento River yellow-billed cuckoos use large patches of willow-cottonwood riparian habitat for nesting (Greco 2008). Yellow-billed cuckoos build a loose platform nest of sticks and twigs (Ehrlich et al., 1988). Nesting habitat is optimal when there is greater than 65 percent cover (Laymon and Halterman 1989) and in patches that are greater than 200 acres and wider than 1,950 feet.

The large loss of riparian habitat within the Sacramento Valley has resulted in a loss of nesting habitat for yellow-billed cuckoo. The loss of fluvial function within the river by the creation of levees, riprapping of banks, and reservoir operations has resulted in a decrease of the creation of willow-cottonwood riparian communities.

Fisheries

The rivers in the SRBPP supports dozens of fish species, including game, non-game, and listed species. Just about any of these species may occur within the construction footprints along the shoreline at one time or another, with the exception of sturgeon, which tend to only rarely use shallow shoreline areas. In addition, although juvenile salmonids likely use the shoreline of the construction sites it is unlikely that adult salmonids migrating upstream to spawning areas and hatcheries would do so.

Endangered Species

Potentially affected federally-listed species within the project area include valley elderberry longhorn beetle, western yellow-billed cuckoo, giant garter snake, delta smelt, Central Valley steelhead, Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and green sturgeon. The valley elderberry longhorn beetle, western yellow-billed cuckoo, giant garter snake, and delta smelt fall under the purview of the Service. NOAA Fisheries is responsible for the listed salmonids and green sturgeon (see Appendix A).

The riverbank and associated nearshore aquatic area that would be affected by the proposed action constitute portions of the designated critical habitat of the delta smelt. Indirect effects of the proposed action may also extend to other portions of this critical habitat.

In addition, the bank protection action area constitutes elements of essential fish habitat (EFH). EFH is the aquatic habitat (water and substrate) necessary to fish for spawning, breeding, feeding, or growth to maturity that will allow a level of production needed to support a long-term, sustainable commercial fishery and contribute to a healthy ecosystem. Consultation with NOAA Fisheries regarding EFH is required for all commercially-harvested runs of salmon, including winter-run and spring-run Chinook salmon of the SRBPP action area.

SERVICE MITIGATION POLICY

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Service's Mitigation Policy as published in the Federal Register (81:224, November 21, 2016).

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. One or more species of conservation interest to the Service is always necessary to initiate mitigation planning. The Service will explicitly identify evaluation species for mitigation purposes. An evaluation species must occur within the affected area for at least one stage of its life history. Selection of evaluation species may include but are not limited to the following:

a) species that are addressed in conservation plans relevant to the affected area and for which habitat objectives are articulated;
b) species strongly associated with an affected habitat type;
c) species for which habitat limiting factors are well understood;
d) species that perform a key role in ecological processes (e.g., nutrient cycling, pollination, seed dispersal, predator-prey relations), which may therefore, serve as indicators of ecosystem health;
e) species that require large areas of contiguous habitat, connectivity between disjunct habitats, or a distribution of suitable habitats along migration/movement corridors, which may, therefore, serve as indicators of ecosystem function;
f) species that belong to a group of species (a guild) that uses a common environmental resource;
g) species for which senstitivity to one or more anticipated effects of the proposed action is documented;
h) species with special status (e.g., species of concern, Birds of Conservation Concern);
i) species of cultural or religious significance to tribes;
j) species that provide monetary and non-monetary benefits to people form consumptive and non-consumptive uses including, but not limited to, fishing, hunting, bird watching, and educational, aesthetic, scientific, or subsistence uses;
k) species with characteristics such as those above that are also easily monitored to evaluate the effectiveness of mitigation actions; and/or
l) species that would be subject to direct mortality as a result of an action (e.g., wind turbine). Based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate resource and associated mitigation planning goals are determined.

The Service's mitigation planning goal is to "improve (i.e., a net gain) or, at a minimum, to maintain (i.e., no net loss) the current status of affected resources." To maintain landscape capacity to support species, our mitigation policy goal applies to all affected habitats of evaluation species. The types of resources for which the Service is authorized to recommend mitigation also include those that contribute broadly to ecological functions that sustain species. The definitions of the terms "wildlife" and "wildlife resources" in the FWCA include birds, fish, mammals, and all other classes of wild animals, and all types of aquatic and land vegetation upon which wildlife is dependent.

For all habitats, the Service will apply appropriate and practicable measures to avoid and minimize impacts over time, generally in that order, before applying compensation as mitigation for remaining impacts. For habitats the Service determines to be of high-value we will seek to avoid all impacts. For habitats the Service determines to be of lower value, the Service will consider whether compensation is more effective than other components of the mitigation hierarchy to maintain the current status of evaluation species, and if so, may seek compensation for most or all such impacts.

Evaluation Species

Five fish and/or wildlife habitats were identified in the SRBPP project area which had potential for impacts from the project. These are riparian forest, riparian scrub-shrub, SRA, herbaceous ruderal, and shallow-open water.

The evaluation species selected for the riparian forest that would be impacted by the project are Swainson's hawks, and Bullock's orioles. Riparian forest vegetation provides important cover, and roosting, foraging, and nesting habitat for these species. Large diameter trees also provide nesting sites for species such as wood ducks and Swainson's hawks. Riparian woodland cover-types are of generally high value to the evaluation species, and are overall, extremely scarce (less than 2% remaining from pre-development conditions). The evaluation species selected for the riparian scrub-shrub vegetation that would be impacted by the project is yellow warbler. Riparian scrub-shrub vegetation provides important cover, and roosting, foraging, and nesting habitat for this species. Riparian cover-types are of generally high value to the evaluation species, and are overall, extremely scarce (less than 2 percent remaining from pre-development conditions). Given the proximity to the river, this habitat is very important for riparian bird species such as the yellow warbler. Historically, this habitat was continuously created and disturbed or transitioned to riparian forest as the river eroded and accreted through its floodplain. Levees and bank protection have stopped these natural processes leaving only remnant habitat behind with very little natural regeneration. Both the Central Valley Flood Protection Plan's Conservation Strategy and The Riparian Bird Conservation Plan have identified goals and objectives which would improve riparian habitat over the landscape of the Central Valley.

The evaluation species selected for SRA habitat that would be affected by the project are juvenile salmonids (salmon and steelhead). Salmonids were selected because large declines in their numbers are among the most important resource issues in the region, and because of their very high commercial and sport fishing values. As with the riparian habitat types, SRA has declined and been eliminated in sections of the river through bank protection projects. Both the Central Valley Flood Protection Plan's Conservation Strategy and NMFS Sacramento River Winter-Run Chinook Salmon, Central Valley Spring-Run Chinook Salmon, and California Central Valley Steelhead Recovery Plan have identified goals and objectives which would improve SRA habitat at a landscape level in the Central Valley.

The evaluation species selected for the ruderal herbaceous cover-type is the Swainson's hawk, which utilizes these areas for foraging. This species was selected because of the Service's responsibility for their protection and management under the Migratory Bird Treaty Act, and their overall high non-consumptive values to humans. Ruderal herbaceous areas potentially impacted by the project vary in their relative values to the evaluation species, depending on the degree of human disturbance, plant species composition, and juxtaposition to other foraging and nesting areas. The Central Valley Flood Protection Plan's Conservation Strategy identifies goals and objectives which will improve habitat for Swainson's hawk at a landscape level in the Central Valley.

The shallow, open water cover-type is important to a number of regionally important fish and wildlife. It is part of the critical habitat designated for federally listed delta smelt. Such shallow water is generally removed when typical SRBPP bank protection is done, especially when the waterside of the levee is to be extensively reshaped. Higher velocities can develop and the change of substrate from native substrate to large rock with many interstitial spaces which can affect the success of breeding by delta smelt. Compounding the problem is the large amount of riprap that has already been placed in the vicinity of the proposed action, thus effectively removing many miles of shallow, open water. Both the Central Valley Flood Protection Plan's Conservation Strategy and Delta Native Fishes Recovery Plan identify goals and objectives which will improve habitat for delta smelt within its range.

FUTURE CONDITIONS WITHOUT THE PROJECT (NO ACTION)

Vegetation

No change in land use or management is assumed under the "no action" alternative. Vegetation removal and spread of exotic species may lead to some minor changes in the existing vegetation. Continued erosion could lead to a loss of some of the existing vegetation as the bank continues to erode; however, the expectation is that other areas of the system would accrete sediment and new vegetation would develop in these areas as has historically taken place along the rivers in the SRBPP.

Wildlife

Since little change is expected to occur to the vegetation with the project area, present trends of use by most wildlife species would continue. Normal year-to-year population fluctuations of individual species would continue to occur as now.

The exception for this is found with some of the sensitive bird species. Specifically, bank swallow breeding sites have been reduced to the point that stochastic events could cause the extirpation of bank swallows along the Sacramento and Feather Rivers even without a project occurring.

Fisheries

The aquatic resources of the project area are not expected to changes significantly from existing conditions. Resident and migratory fishes would continue to use the area as they do today.

FUTURE CONDITIONS WITH THE PROJECT

Because the Alternatives with a B following them are a subset of the A Alternative, we would be analyzing the effects of the worst case sub-alternative. For comparative purposes any of the B alternatives would have a lesser effect to vegetation, wildlife, and fisheries than the A alternatives.

The Corps had their contractor develop approximate amounts of vegetation which would be affected by each alternative at the sites identified in the 2009 Alternatives Report. This was done using 2008 aerial imagery and creating GIS shape files by digitizing the approximate footprint of each of the 107 potential erosion sites onto the aerial image. Acreages were then determined for each BPM that has been proposed at that site. Sites were then grouped into the six Alternatives such that an estimate for vegetation removed and created for the entire Alternative was derived. Only riparian forest and riparian scrub shrub were analyzed with the GIS, as these two habitats are woody and would take much longer to reach a similar habitat quality as they currently possess. Grassland was considered to be replaceable on-site and SRA and shallow water habitat would be analyzed through the Endangered Species Act section 7 consultation.

Alternatives 2A and 2B

Vegetation

For Alternative 2A it is estimated that 35.72 acres of riparian forest and 8.80 acres of riparian scrub shrub exist within the footprint. Of that, 23.09 acres of riparian forest and 7.58 acres of riparian scrub shrub would be removed due to construction and ETL compliance. The remaining 12.63 acres of riparian forest and 1.22 acres of riparian scrub shrub would be retained on-site. Mitigation for the 30.67 acres of riparian forest and scrub shrub would be accomplished off-site at an unknown location.

Wildlife

The construction of this alternative along 80,000 linear feet of riverine habitat would result in permanent negative effects to wildlife species. The construction activities would cause disturbance of wildlife species currently using the sites as well as those within the surrounding area due to noise and human activity. Additionally, construction would completely remove and potentially cause direct mortality of ground-dwelling amphibians, reptiles, and mammals due to the crushing of burrows and the clearing and grubbing of the sites prior to rock placement. Animals which relocate due to construction may increase competition for resources in the surrounding habitat areas and also cause a loss of individuals.

Given that none of the removed vegetation would be replaced on-site and that the rock face of the erosion protection would be resistant to riparian vegetation colonizing it, this alternative would negatively affect habitat connectivity along the river. This could reduce wildlife populations in some areas by cutting off migration corridors between habitat nodes (large acreages of riparian habitat that are wide and diverse) thereby reducing the movement of some wildlife species (small and large mammals, and some reptiles and amphibians) and isolating some of few remaining habitat nodes, particularly in the area downstream of the City of Colusa where the levees are close to the river.

For bird species such as raptors, removal of large trees would remove nesting habitat which as stated above, has already been heavily impacted. Off-site mitigation would offset the loss of habitat; however, it would take at least 20 years for the trees to grow to the proper size to be used as nesting habitat. This creates a short-term loss of habitat for raptors such as red-shouldered and Swainson's hawks.

Another bird species which would be negatively affected with this alternative is the bank swallow. The Corps is unable to predict the exact amount of sites that would be constructed in areas that could support bank swallow nesting. Of the 107 sites identified in the 2009 Alternatives Report, 13 sites are in close proximity to existing bank swallow colonies. Given the continued decline of bank swallows within the Sacramento Valley any additional riprapping of banks and loss of available nesting areas would hasten the extirpation of bank swallows in this area. Effects could occur as quickly as the next breeding season with the loss of an existing colony site or be as long term as the loss of natural river processes such that new areas are not eroded which supports bank swallow nesting habitat over the long term.

Fisheries

Fisheries effects due to construction include short term increase in turbidity and suspended sediment at the site and immediately downstream of the construction. This may disrupt fish from feeding if they are sight feeders. Additionally, the construction could release contaminants which have moved down the watershed due to historic gold and silver mining. Gas, oil, or lubricants from the construction equipment could be released during construction. Both of these have the potential to either kill fish outright or reduce the fish's resistance to disease through low level exposure.

In the long-term, the loss of vegetation would negatively affect fish species found in the Sacramento Valley. Vegetation along the river provides a source of nutrients which is directly related to food production for fish. Vegetation also provides shade and cover for all stages of fish life, and can be particularly important for young juvenile fish as escape cover from predatory fish species and other wildlife predators. Riprapped banks result in a very smooth hydraulic condition. This does not mimic natural banks, which as described in the SRA section provide hydraulic diversity for fish species, including slow, shallow water sections which are preferred by many fish, particularly for resting and feeding.

Alternative 3A and B

Vegetation

For Alternative 3A it is estimated that 35.72 acres of riparian forest and 8.80 acres of riparian scrub shrub exist within the footprint. Of that, 6.77 acres of riparian forest and 0.83 acre of riparian scrub shrub would be removed due to construction and ETL compliance. The remaining 28.95 acres of riparian forest and 7.97 acres of riparian scrub shrub would be retained on-site. Additionally, with this alternative 26.99 acres would be created that could be planted in either riparian forest or scrub shrub. Note this analysis only looked at the vegetation that would be lost with the adjacent levee and the tie-ins for the setback levee. Because this analysis is programmatic no site has been designed to the level of detail that would include the vegetation that would be affected by the construction of the setback levee footprint. There were also assumptions made regarding the distance from the river the setback would be placed. Actual construction of setback levees may lead to an even larger net gain in area that could be planted and allowed to return to floodplain. A vegetation analysis would be done as the site is designed.

Wildlife

Effects due to construction would have short-term adverse effects to wildlife. Construction of the setback or adjacent levee would take out some existing vegetation. However, river processes would be allowed to occur which over the long-term would provide habitat diversity for wildlife species. Additionally, because so little existing vegetation would be removed existing migration corridors are not expected to be affected. Existing connectivity would be improved upon due to the widening of the various habitats in corridor.

Because vegetation removal is lessened, the effects to raptors would be lessened with this alternative. While there would still be a temporal loss of nesting trees, the creation of up to 23.56 acres of additional floodplain would provide longer term benefits to nesting raptors and other migratory bird species, with a much smaller effect to existing vegetation.

This alternative provides the greatest benefits to bank swallow. An adjacent levee would allow existing colonies to remain until the erosion stops due to a geologic control or until the erosion begins to reach the new adjacent levee and another BPM is required. However, this does give the Corps and other agencies the opportunity to implement the *Bank Swallow Conservation Strategy for the Sacramento River Watershed, California* (BSTAC 2013). The setback levees would ensure that there is erodible bank available for a significant amount of time. While this alternative benefits bank swallow, it is worthwhile to note that it does not expand existing habitat unless it also removes rock from previously rocked areas.

Fisheries

Construction related effects to fish species would be similar to Alternative 2, though smaller in scope due to the majority of the construction being done away from the water. This alternative would not require the use of any riprap, thereby maintaining the existing condition for fish species and a natural bank substrate. Additionally, this alternative would provide more fish habitat. Because some sections of river have become incised, the floodplain habitat may be at an elevation which is inundated very rarely. However, some sites would be inundated more frequently and would provide newly inundated floodplain habitat that is highly beneficial for juvenile fish for rearing and feeding. Sites that would not be inundated frequently could be lowered through grading to provide better fish habitat. Given the programmatic nature of this document it is difficult to determine how much of the 26.99 acres of newly created floodplain would be regularly inundated; however, it would provide benefits to fish by allowing natural river processes to occur and vegetation to grow along the edge of the river.

Alternative 4A and 4B

Vegetation

For Alternative 4, an estimated 35.72 acres of riparian forest and 8.80 acres of scrub shrub exist within the footprint. Of that, 21.29 acres of riparian forest and 3.93 acres of scrub shrub would be removed due to construction and ETL compliance. The remaining 14.43 acres of riparian forest and 4.87 acres of scrub shrub would be retained on-site. With this alternative 25.55 acres would be created that could be planted with riparian forest or scrub shrub. This alternative anticipates planting all the newly created area to allow on-site mitigation.

Wildlife

Construction of this alternative would have temporary effects to wildlife, both at the site and immediately adjacent to the site, as described in Alternative 2.

Because this alternative is a mix of the BPMs, effects to wildlife would vary based on the BPM applied to the site. The Corps has applied BPM 1 and 3 to 26 sites under this alternative. While there are some temporary effects of the construction of the setback and adjacent levees, long-term there would be an increase in floodplain habitat that could be vegetated with riparian forest and scrub shrub habitat, particularly with the use of setback levees. Benefits to wildlife would be similar to those discussed under Alternative 3.

Construction of BPM 2 would occur on six sites. This BPM would not allow for any planting of the erosion site. Consequently, the site would remain a rock substrate and provide very little wildlife habitat. Additionally, the loss of any future riparian vegetation along the water's edge would permanently disrupt connectivity for wildlife, making migration difficult to impossible and exposing species to increased predation because of a lack of cover.

Construction of BPM 4 would occur on 40 sites. This BPM would allow for a small amount of additional planting above what currently exists by creating a bench into the river with rock. This can provide a benefit to migratory birds as foraging and nesting habitat. However, because of the rock substrate, there is concern that this habitat would not provide the same benefits as a natural substrate floodplain. Additionally, given planting restrictions, only a subset of the sites would likely receive large trees such as cottonwood and sycamores, which would result in an overall decrease of nesting habitat for raptors such as red-shouldered and Swainson's hawk. Given the Corps' ETL, setback levees may be the only way for additional habitat and mitigation to be placed in the floodplain.

Construction of BPM 5 would occur on 17 sites. This BPM would not create any additional planting area, but would allow the rock slope to be vegetated. Given the Corps' planting plan, this habitat would consist of small trees and shrubs which would limit the types of wildlife which would use the habitat. Nesting raptors would suffer from a loss of nesting trees and cavity nesters would suffer from a loss of large snags. While the habitat would serve as nesting habitat for some migratory birds and provide narrow habitat connectivity, it would result in a monotypic habitat condition that would be vastly improved by including diversity with the inclusion of large trees and creating wider corridors.

In areas where bank swallow nesting habitat exists or has potential to exist, BPMs 2, 4, and 5 would adversely affect bank swallows through the placement of riprap. Given the declining bank swallow population within the Sacramento Valley, any additional loss of existing or potential nesting habitat would make it more likely that bank swallows could become extirpated due to stochastic events. The only form of mitigation for the loss of nesting habitat is rock removal in areas that would not compromise public safety and allow for natural river processes and provide bank swallow nesting habitat.

Fisheries

Construction related effects to fish species would be the same as described in Alternative 2. Long-term effects to fish species due to this alternative fall somewhere in between Alternatives 2 and 3. If the bank protection repairs are similar to what was analyzed in the 2009 Alternatives Report, about 53,000 linear feet of the 80,000 linear feet would be a rock slope repair (BPM 2, 4, and 5). While over half of it (36,000 linear feet) would have vegetation integrated into the rock slope, it would still change a large amount of the substrate within the action area. Given the amount of rock that has already been placed within the SRFCP, this represents a critical loss of naturally eroding substrate. The rock placement would also adversely affect the ability of natural river processes to occur, such as erosion and accretion which are critical for the natural vegetation communities. Long-term the loss of vegetation would negatively affect fish species found in the Sacramento Valley. Vegetation along the river provides a source of nutrients which is directly related to food for fish. Additionally, vegetation provides shade and cover for all stages of fish life, and can be particularly important for young juvenile fish as escape cover from predatory fish species. Riprapped banks result in a very smooth hydraulic condition. This does not mimic natural banks, which as described in the SRA section provide hydraulic diversity for fish species, including slow, shallow water sections which are preferred by many fish, particularly for resting and feeding.

Alternative 5A and 5B

Vegetation

For Alternative 5 an estimated 35.72 acres of riparian forest and 8.80 acres of scrub shrub exist within the footprint. Of that, 16.66 acres of riparian forest and 2.50 acres of scrub shrub would be removed due to construction and ETL compliance. The remaining 19.95 acres of riparian forest and 8.30 acres of crub shrub would be retained on-site. With this alternative 39.76 acres would be created that could be planted with riparian forest or scrub shrub. Mitigation would be accomplished on-site. The Service notes that this alternative provides the largest number of acres post-construction that could be planted within the floodplain. However, we also note that a large part of this planting area has been created through the construction of rock/soil berms which will not function to the same extent as natural substrate floodplain habitat and could limit future recruitment.

Wildlife

Construction of this alternative would have temporary effects to wildlife, both at the site and immediately adjacent to the site, as described in Alternative 2.

Because this alternative is a mix of the BPMs, effects to wildlife would vary based on the BPM applied to the site. The Corps has applied BPM 1 and 3 to 33 sites under this alternative. While there are some temporary effects of the construction of the setback and adjacent levees, long-term there would be an increase in floodplain habitat that could be vegetated with riparian forest and scrub shrub habitat, particularly with the use of setback levees.

Construction of BPM 2 would occur on three sites with this alternative. This BPM would not allow for any planting of the erosion site. Consequently, the site would remain as rock and provide very little wildlife habitat. Additionally, the loss of any future riparian vegetation along the water's edge would permanently disrupt connectivity for wildlife, making migration difficult to impossible and exposing species to increased predation because of a lack of cover.

Construction of BPM 4 would occur on 42 sites with this alternative. This BPM would allow for additional planting area above what currently exists by creating a bench into the river. This can provide a benefit to migratory birds as foraging and nesting habitat. However, because of the rock substrate, there is concern that this habitat would not provide the same benefits as a natural substrate floodplain. Additionally, given planting restrictions, the Service does not anticipate that large trees such as cottonwoods would be part of the planting plan, which would result in an overall decrease of nesting habitat for raptors such as red-shouldered and Swainson's hawk. Given the Corps' ETL, setback levees may be the only way for additional habitat and mitigation to be placed in the floodplain.

Construction of BPM 5 would occur on 11 sites with this alternative. This BPM would not create any additional planting area, but would allow the rock slope to be vegetated. Given the Corps' planting plan, this habitat would consist of small trees and shrubs which would limit the types of wildlife which would use the habitat. Nesting raptors would suffer from a loss of nesting trees and cavity nesters would suffer from a loss of large snags. While the habitat would serve as nesting habitat for some migratory birds and provide narrow habitat connectivity, it would result in a monotypic habitat condition that would be vastly improved by including diversity with the inclusion of large trees and creating wider corridors.

In areas where bank swallow nesting habitat exists or has potential to exist, BPMs 2, 4, and 5 would adversely affect bank swallows through the placement of riprap. Given the declining bank swallow population within the Sacramento Valley, any additional loss of existing or potential nesting habitat would make it more likely that bank swallows could become extirpated due to stochastic events. The only form of mitigation for the loss of nesting habitat is rock removal in areas that would not compromise public safety and allow for natural river processes and provide bank swallow nesting habitat.

Fisheries

Construction related effects to fish species would be the same as described in Alternative 2. Long-term effects to fish species due to this alternative are somewhat improved over Alternative 4. If the bank protection repairs are similar to what was analyzed in the 2009 Alternatives Report about 46,000 linear feet of the 80,000 linear feet would be a rock slope repair (BPM 2, 4, and 5). While the majority of it (31,000 linear feet) would have vegetation integrated into the rock slope, it would still change a large amount of the substrate within the action area. Given the amount of rock that has already been placed within the SRFCP, this represents a critical loss of naturally eroding substrate. The rock placement would also adversely affect the ability of natural river processes to occur, such as erosion and accretion which are critical for the natural vegetation communities. Long-term the loss of vegetation would negatively affect fish species found in the Sacramento Valley. Vegetation along the river provides a source of nutrients which is directly related to food for fish. Additionally, vegetation provides shade and cover for all stages of fish life, and can be particularly important for young juvenile fish as escape cover from predatory fish species. Riprapped banks result in a very smooth hydraulic condition. This does not mimic natural banks, which as described in the SRA section provide hydraulic diversity for fish species, including slow, shallow water sections which are preferred by many fish, particularly for resting and feeding.

After Alternative 3, this alternative has the second largest number of setback levees. As described above, setback levees can help restore river processes such as erosion and accretion. They also provide additional floodplain for fishes which can be used as juvenile rearing, escapement areas from predators, and a source of vegetation input which provides the basis of the fish food web.

<u>Alternative 6A and 6B</u>

Vegetation

For Alternative 6 an estimated 35.72 acres of riparian forest and 8.80 acres of scrub shrub exist within the footprint. Of that, 18.75 acres of riparian forest and 5.68 acres of scrub shrub would be removed due to construction and ETL compliance. The remaining 16.97 acres of riparian forest and 3.12 acres of scrub shrub would be retained on-site. With this alternative 19.65 acres would be created that could be planted with riparian forest or scrub shrub. With this alternative not all of the mitigation could be accomplished on-site; off-site mitigation would occur within the region where the effects occurred.

Wildlife

Construction of this alternative would have temporary effects to wildlife, both at the site and immediately adjacent to the site, as described in Alternative 2A and B.

Because this alternative is a mix of the BPMs, effects to wildlife would vary based on the BPM applied to the site. Under this alternative, BPMs 1, 2, and 3 would not be applied to any of the sites. Construction of BPM 4 would occur on 69 sites with this alternative. This BPM would allow for additional planting area above what currently exists by creating a bench into the river. This can provide a benefit to migratory birds as foraging and nesting habitat. However, because of the rock substrate, there is concern that this habitat would not provide the same benefits as a natural substrate floodplain. Additionally, given planting restrictions, the Service does not anticipate that large trees such as cottonwoods would be part of the planting plan, which would result in an overall decrease of nesting habitat for raptors such as red-shouldered and Swainson's hawk. Given the Corps' ETL, setback levees may be the only way for additional habitat and mitigation to be placed in the floodplain.

Construction of BPM 5 would occur on 20 sites. This BPM would not create any additional planting area, but would allow the rock slope to be vegetated. Given the Corps' planting plan, this habitat would consist of small trees and shrubs which would limit the types of wildlife which would use the habitat. Nesting raptors would suffer from a loss of nesting trees and cavity nesters would suffer from a loss of large snags. While the habitat would serve as nesting habitat for some migratory birds and provide narrow habitat connectivity, it would result in a monotypic habitat condition that would be vastly improved by including diversity with the inclusion of large trees and creating wider corridors.

In areas where bank swallow nesting habitat exists or has potential to exist, BPMs 4 and 5 would adversely affect bank swallows through the placement of riprap. Given the declining bank swallow population within the Sacramento Valley, any additional loss of existing or potential nesting habitat would make it more likely that bank swallows could become extirpated due to stochastic events. The only form of mitigation for the loss of nesting habitat is rock removal in areas that would not compromise public safety and allow for natural river processes and provide bank swallow nesting habitat.

Fisheries

Construction related effects to fish species would be the same as described in Alternative 2. Long-term effects to fish species due to this alternative are similar in some respects to Alternative 2. If the bank protection repairs are similar to what was analyzed in the 2009 Alternatives Report about 75,000 linear feet of the 80,000 linear feet would be a rock slope repair (BPM 4 and 5). All of the rock slopes would have vegetation incorporated into the rock. Given the amount of rock that has already been placed within the SRFCP, this represents a critical loss of naturally eroding substrate. The rock placement would also adversely affect the ability of natural river processes to occur, such as erosion and accretion which are critical for the natural vegetation communities. Long-term the loss of vegetation would negatively affect fish species found in the Sacramento Valley. Vegetation along the river provides a source of nutrients which is directly related to food for fish. Additionally, vegetation provides shade and cover for all stages of fish life, and can be particularly important for young juvenile fish as escape cover from predatory fish species. Riprapped banks result in a very smooth hydraulic condition. This does not mimic natural banks, which as described in the SRA section provide hydraulic diversity for fish species, including slow, shallow water sections which are preferred by many fish, particularly for resting and feeding.

DISCUSSION

Riparian and SRA habitats provide diversity and complexity that have been severely degraded or completely lost due to local and landscape level disturbance. Historically, the Sacramento River meandered across its floodplain creating a vast complex of riparian and marsh habitats. Because of the dynamic nature of the river system, with some sections of the river scouring and creating a new river channel and other sections accreting and providing a place for early successional vegetation to grow, the variety of fish and wildlife of the Sacramento River system depend on the diversity created within the system.

The placement of levees along the Sacramento River from Ordbend downstream confines the river and does not allow the historical meandering to occur. While levees upstream of Colusa tend to be setback from the river's edge and allow for some floodplain habitat, most of the Sacramento River levees from Colusa downstream to the confluence of the San Joaquin River do not allow for any floodplain habitat. This serves to erode the levees that are providing flood protection to urban areas (city of Sacramento, city of West Sacramento, Natomas Basin, etc.), are at risk of erosion and require continual erosion repair.

With the completion of Phase II of the SRBPP, over 841,000 linear feet, or about 160 miles, of bank protection will have been constructed. The additional authorization would add another 80,000 linear feet (over 15 miles) of bank protection for a potential total of 920,953 linear feet, or about 175 miles, of the SRBPP with hardened levees out of the 1,000 miles of levee that are within the project area. This equates to about 20 percent of the project area and does not include rock placed by the State of California or local levee maintenance agencies.

The Service has concerns about the continued use of rock for erosion protection. Even with the addition of benches, IWM, and vegetation, the longevity of these areas to provide habitat for fish and wildlife is questionable. The only way to provide for long-term sustainable aquatic and terrestrial habitat for fish and wildlife and a better level of safety to the property and public behind flood control structures is to setback levees and allow for more diverse floodplain habitat. Because much of the levees are set close to the river, the existing system will continually erode the levees, which will need continual erosion protection to the point that almost all of the lower Sacramento River would be hardened and not allowed to meander. The Service is aware that the Corps is investigating the cost effectiveness of continual erosion protection and repair versus the cost of creating large areas of setback levees. We encourage this investigation and would hope that the Corps also includes the ecological benefits of creating large setback levees for the numerous fish and wildlife species that currently occupy the SRFCP riparian corridor and whose populations would undoubtedly expand with the restoration of some of the habitat that has been lost over the last 150 years. Continued input of riprap into the Sacramento River system would only continue to degrade an already severely degraded river system.

A species which is particularly vulnerable to continued rock placement is the state listed bank swallow. Given the decline within the Sacramento and Feather River systems of available nesting substrate, additional rock placement is likely to extirpate bank swallows from these areas. The Service recommends that alternatives to rock BPMs be used, such as BPM 1 and 3. However, we also recognize that this may not be feasible in all areas. The only way to offset the effects of rock placement on bank swallows is through the removal of existing rock. Given the uncertainty that the newly eroded area would provide immediate nesting habitat for bank swallows, the Corps should mitigate as described in the multi-agency 2013 *Bank Swallow Conservation Strategy for the Sacramento River Watershed, California* describes at a ratio between 1:1 and 2:1 while also purchasing conservation easements over currently suitable nesting habitat for the bank swallow. The Corps should continue to work with the Bank Swallow Technical Advisory Committee to locate areas for bank swallow mitigation.

Currently the Corps is reviewing the project from a programmatic level, which makes providing specific recommendations on the alternatives difficult. The Alternatives were selected to provide a range of effects which could occur from the additional 80,000 linear feet of bank protection. The Service recognizes that the bank protection measures represented in each alternative are not what may be constructed at an individual site, and that these may not be the erosion sites that would be constructed. Given the changes to the form and hydrology of the rivers within the SRFCS and the large loss of floodplain and associated vegetation, the Service would prefer to see an alternative go forward which increases the available floodplain and reduces the loss of riparian vegetation. This would mean that an alternative where setback or adjacent levees are prioritized over rock placement should be pursued. We recognize that this would not be feasible in all locations, such as where urban areas have become heavily developed up to the toe of the levee. In some cases rock placement may be the only bank protection measure feasible and BPMs 4 or 5 would be necessary.

The Corps has been installing rock bank protection with vegetation integrated at each erosion site for many years. The Service has two primary concerns about moving forward with these types of repairs. First, the Corps has not developed a comprehensive monitoring plan for vegetation or wildlife at these sites. The Service has provided this recommendation in the past. While some establishment monitoring and fisheries monitoring has occurred, it does not address all of the concerns that we have with the placement of vegetation on a rock substrate. For example, does the rock substrate affect the growth rate or potential maximum growth of vegetation? Is the vegetation providing habitat for wildlife species? What wildlife species are using the sites? Secondly, the ETL will change the amount and type of vegetation that can be planted on the riprapped sites. Large trees that are vitally important to many raptor and cavity nesting bird species are not likely to be planted or growth could be restricted as a result of the rock substrate. This could result in the Corps creating more scrub shrub habitat. Depending on the location of the river this could result in a loss of nesting trees. It is also likely that not as much vegetation would be planted on-site, leading to the need to provide more off-site compensation. This could have effects to connectivity for mobile species such as deer, or create patches that are too narrow for nesting migratory birds. The Corps should provide a baseline of existing vegetation condition, particularly along the more confined areas of the system, such as downstream of Colusa. This can be used to help develop future planting plans at repair sites. For example, knowing that the area up- and downstream of a site is primarily scrub shrub habitat could show a need for large trees as nesting and roosting habitat for raptors and other migratory birds, and therefore the Corps would be sure to include those in their planting plan or select a BPM that would allow large trees to grow (BPMs 1 and 3).

Without an overall analysis of the existing riparian vegetation within the project area it is difficult to evaluate where there is a lack of connectivity within the system and what the effects could be to existing connectivity through the removal of vegetation due to BPMs. This is compounded by the fact that at this time we do not have exact locations for the 80,000 linear feet of proposed repair. Given these unknowns, the Service is providing the following recommendations to assist with future FWCA reports that will be written as specific erosion sites are proposed for repair.

RECOMMENDATIONS

General

1. The Service recommends that the Corps select Alternative 3 as their preferred alternative. The Service acknowledges that setback levees can be more costly and time intensive. However, given the lack of natural river processes, large decline in riparian and SRA habitats, and the benefits to flood protection, it would be worth the additional time and expense.

2. The Service recommends that the Corps, CVFPB, and DWR evaluate the existing system for long-term sustainability. This includes sustainability of the SRFCP System from a flood risk reduction perspective (lowering maintenance costs, preparing for climate change) and an ecosystem restoration perspective (providing more frequently inundated floodplain habitat and allowing natural river processes to continue). The current practice of site by site repair does not allow for system-wide benefits to occur.

3. The Service recommends the Corps continue the collaboration that has begun with the California Levee Vegetation Science Team to research the potential effects of woody vegetation on levee integrity by providing financial assistance and collaboration from the Corps' Engineering Research and Development Center.

4. The Corps should work with the Service through the FWCA to analyze effects to fish, wildlife, and their habitat as the project proceeds and sites are selected for erosion repair.

River Processes

5. The Corps should compensate for the loss of fluvial functioning which occurs with the armoring of banks by: building setback levees to reclaim floodplain habitat; providing areas for river meandering by purchasing lands adjacent the Sacramento River where either levees are not present or are already setback from the river; and removal of rock along sections of river where the levee is not threatened by erosion.

6. The SRBPP should evaluate the river system, not just the individual sites, to determine if there are areas where a levee setback could repair multiple erosion sites. Less placement of rock would also lessen the need for future riprap maintenance. Additionally, this could also feed into the Central Valley Flood Protection Plan's Conservation Strategy goal of improving riverine geomorphic processes.

Riparian Vegetation

7. All sites should be planted with a diverse native mix of woody and herbaceous riparian vegetation. Sites should be diverse (a mix of riparian forest and scrub shrub) and fit into the surrounding landscape. The planting plan should take into account what is missing from the surrounding vegetation and attempt to create heterogeneous habitats. The Corps should develop a baseline map of existing vegetation communities. Given the amount of rock already placed and the amount proposed for placement, this can serve to create diverse and heterogeneous habitats.

8. The Corps, CVFPB, and DWR should include within the planting contract a provision for the contractor to plant understory species after some of the woody canopy has established. Studies have shown that planting late successional understory species after woody species canopy cover has been established provides better success for establishing these understory plants. Incorporating these species within the planting mix provides more diverse habitat for wildlife species (Johnston 2009).

Monitoring and Site Protection

9. There has been very little monitoring of the success of older mitigation sites. In fact, there is a concern whether the location of all of the mitigation sites is even known. The Corps should work with the Service to create a GIS database which includes all mitigation sites for the entire SRBPP, and create a monitoring program which evaluates the success or failure of these sites.

10. The Corps should require a conservation easement on future levee repair projects. This would provide long-term protection to the sites as compensation for project effects. Additionally, an endowment should be created for sites which would fund the long-term maintenance of the on-site habitat.

11. The Corps should update the operations and maintenance manuals for all of the bank protection sites and include maintenance of planted vegetation and installed instream woody material where appropriate.

12. The Service has concerns that riparian vegetation on the erosion repair sites may not grow at the same rate as riparian vegetation in a natural substrate. The Corps should conduct a study which compares growth rates of various riparian plant species on erosion repair sites to either growth rates at natural sites or growth rates established through prior studies. This study should include the various substrates that have been used at bank protection sites including: rock-soil mixtures of various percentages; soil trenches; or other methods of incorporating soil into the rock substrate.

13. The Corps should initiate a monitoring program to determine the success of past and future erosion repair sites as habitat for wildlife. The Service is willing to work with the Corps, CVFPB, DWR, and CDFW, to develop this monitoring program. This is particularly important given the intent with many of these sites is to maintain connectivity along the rivers.

14. The Corps should review and incorporate as appropriate the Sacramento River Riparian Monitoring and Evaluation Plan (Shilling et al 2011). This document focuses on the middle Sacramento River, but would still benefit the Corps by providing standardized monitoring and indicators that are based on the best available science.

15. Section 2036(a) of the Water Resources Development Act of 2007 requires that any report submitted to Congress for authorization shall contain a specific recommendation with a specific plan to mitigate fish and wildlife losses unless the Secretary determines that the project will have negligible adverse impacts. While the Service recognizes that this project does not fall under Section 2036 (a) of the Water Development Act of 2007 since it already has an authorization from Congress, we do still recommend that the Corps comply with this

section. The mitigation plan should comply with the mitigation standards and policies of the regulatory programs.

Bank Swallow

16. Work with the multi-agency Bank Swallow Technical Advisory Committee to determine and map areas which may have potential for use by bank swallows and have not been identified as active nesting since 1986 when surveys started. This information should be used for both protection of current and future bank swallow habitat for mitigation purposes and for the analysis of effects when evaluating alternatives at bank protection sites.

17. The Corps, CVFPB, and DWR should follow the *Bank Swallow Conservation Strategy* for the Sacramento River Watershed, California when designing projects and determining mitigation for bank swallow.

18. When determining a bank protection measure for a site that is within the river reach where bank swallows could be found use the following steps:

    a. Determine if the project site has existing or potential bank swallow habitat.
    b. If the site does not have existing or potential bank swallow habitat and this determination is coordinated and agreed upon with CDFW and the Service then follow regular site selection criteria.
    c. If site has existing or potential bank swallow habitat then the BPM should be either an adjacent levee or a setback levee.
    d. If it can be demonstrated that an adjacent or setback levee is not feasible, then the Corps, CVFPB, and DWR will consult with CDFW regarding mitigation to offset any potential effects of the project on bank swallow. Mitigation would need to be completed prior to construction of the project such that temporal effects are reduced. Given that existing conditions for bank swallow are highly susceptible to stochastic extirpation of this species from the Sacramento Valley, mitigation for effects to existing or potential bank swallow habitat should be greater than just replacement of lost habitat and should use the *Bank Swallow Conservation Strategy* to determine mitigation.

Raptors and Migratory Birds

19. The Corps should incorporate the protection of and planting of large trees within their erosion repair sites. Large trees provide habitat for numerous bird and mammal species, such as the California state listed Swainson's hawk, and are a future source of IWM.

20. Follow CDFW's avoidance and minimization measures for Swainson's hawk (Appendix B).

21. For construction during any migratory bird nesting season, the Corps will perform preconstruction surveys to determine whether raptors or migratory birds are nesting or roosting at or adjacent to staging or construction areas. In the event nesting or roosting raptors or migratory birds are identified, the Corps will coordinate with the Service and CDFW to identify measures to ensure that construction or construction related activity does

not cause nest failure and that raptors are not adversely affected. These measures may include implementation of suitable buffers and phasing of construction.

Fisheries

22. In a dry-water year, floodplains are not inundated and Sacramento splittail may spawn along the river margins. The Corps should conduct a study to determine the location of dry water-year spawning areas. Erosion repair work in potential spawning areas may adversely affect spawning Sacramento splittail. Additionally, knowing where spawning occurs could also provide information on the habitat features Sacramento splittail require when spawning on river margin habitat, which the Corps can incorporate into their future erosion repair sites.

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Appendix A
Endangered Species Act Consultation

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Appendix B

Impacts to Swainson's Hawk

The Corps shall ensure the following measures are implemented to mitigate or avoid impacts to Swainson's hawks (*Buteo swainsoni*):

Conduct preconstruction surveys to determine if an active nest is within ½ mile of construction activities.

Avoid the removal of active Swainson's hawk nest trees until nestlings have fledged.

Provide a worker environmental awareness program.

Avoid any work within ½ mile of a nesting Swainson's hawk between March 1 and August 15, or until nestlings have fledged. If an active Swainson's hawk nest is found within ½ mile of the proposed work, consult CDFG for additional avoidance measures. Additional avoidance measures may include but are not limited to the following: a) a biological monitor to observe the nesting hawks for stressed/detrimental behavior that threatens nest success; b) if it is determined during construction that the birds appear stressed, the monitor will have authority to stop construction activities until it has been determined that the birds will not be harmed; c) construction will not commence until additional avoidance or mitigation measures are implemented that will ensure that the birds will not be harmed by construction activities. These measures will be coordinated and approved by CDFG and the monitor; and d) if no additional avoidance or mitigation measures can prevent harming the birds, construction will not commence until the chicks have fledged and can leave the area.

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Appendix A
Endangered Species Act Consultation

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2014-F-0708

DEC 1 9 2017

Ms. Alicia Kirchner
Chief, Planning Division
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Formal Consultation on the Sacramento River Bank Protection Project, Phase II 80,000 Linear Feet, Sacramento, Solano, Sutter, Yolo, Butte, and Colusa Counties, California

Dear Ms. Kirchner:

This letter is in response to the U.S. Army Corps of Engineers (Corps) May 5, 2014, request for initiation of formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Sacramento River Bank Protection Project Phase II 80,000 Linear Feet (SRBPP) (LF), in Sacramento, Solano, Sutter, Yolo, Butte, and Colusa Counties, California. The Corps has revised the biological assessment in coordination with the Service and National Marine Fisheries Service (NMFS) since the initial May 5, 2014, initiation package. The current biological assessment and request for formal consultation is dated January 20, 2017, and was received by the Service on January 26, 2017. The biological assessment presents an evaluation of the proposed project's effects on the federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) and its critical habitat, delta smelt (*Hypomesus transpacificus*) and its critical habitat, giant garter snake (*Thamnophis gigas*), and western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) and its proposed critical habitat. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

The federal action we are consulting on is levee bank erosion repair projects on up to 30,000 LF of levee within the Sacramento River Flood Control Project (SRFCP). The Corps is the federal action agency and the Central Valley Flood Protection Board (CVFPB) is the non-federal sponsor of the project. Pursuant to 50 CFR 402.12(j), you submitted the biological assessment for our review and requested concurrence with your findings. These findings conclude that the proposed project may affect, and is likely to adversely affect the valley elderberry longhorn beetle and its critical habitat; delta smelt and its critical habitat; giant garter snake; and western yellow-billed cuckoo and its proposed critical habitat. Because individual sites that will be proposed for repair are unknown at this time, the Corps requested and the Service is providing a programmatic biological and conference opinion (PBO). This programmatic biological and conference opinion is consistent with the Service's recent update to our implementing regulations for section 7 of the Act. This biological opinion meets the definition of a framework programmatic action which will have subsequent consultations tiered off of it.

In considering your request, we based our evaluation of the biological assessment's findings on the following: (1) the revised January 2016 biological assessment; (2) numerous meetings with the Corps, NMFS, and California Department of Fish and Wildlife (DFW); (3) e-mail correspondence between the Service and the Corps; and (4) other information available to the Service.

CONSULTATION HISTORY

February 2009: The Service, Corps, NMFS, DFW, began meeting to discuss developing a programmatic consultation for the Water Resources Development Act 2007 authorization of an additional 80,000 LF of erosion repair on the SRFCP. This group has met regularly between then and now. During these meetings the methods of evaluating effects, developing a programmatic analysis, and conservation measures were discussed.

May 5, 2014:	The Corps submitted their biological assessment to the Service,
August 18, 2014:	The Service provided comments on the project description to the Corps via e-mail.
December 4, 2014:	The Corps submitted a revised biological assessment to the Service.
March 19, 2015:	The Service provided comments on the project description and the need to include the yellow-billed cuckoo in the consultation via e-mail.
January 22, 2016:	The Corps provided a revised biological assessment and a letter requesting consultation with the Service on the SRBPP 80,000 LF project.
January 20, 2017:	The Corps provided a further revised biological assessment which revised the project description to only include economically justified basins. This had the result of reducing the linear footage which is being consulted on to 30,000 LF.
June 21, 2017:	The Corps provided an e-mail with additional conservation measures for the yellow-billed cuckoo and delta smelt to include in the biological assessment.

BIOLOGICAL AND CONFERENCE OPINION

Description of the Action

The SRBPP Phase II additional authorization will ensure the continued integrity of the SRFCP levees through erosion protection. Levees within the SRFCP provide flood control for the Sacramento Valley and help convey water flowing from the surrounding mountain ranges to the Sacramento-San Joaquin Delta (Delta). Levees stressed by high winter flows can weaken and fail. To maintain the integrity of the flood control system, locations with a high failure potential are identified and remedied.

The SRBPP project area encompasses over 1,000 miles of levees and weirs. This area extends south-to-north along the Sacramento River, from the town of Collinsville (river mile [RM] 0) upstream to Chico at RM 184. The SRBPP also includes Cache Creek, the lower reaches of Elder and Deer Creeks, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs, as well as a number of flood bypasses and distributaries (Figure 1).

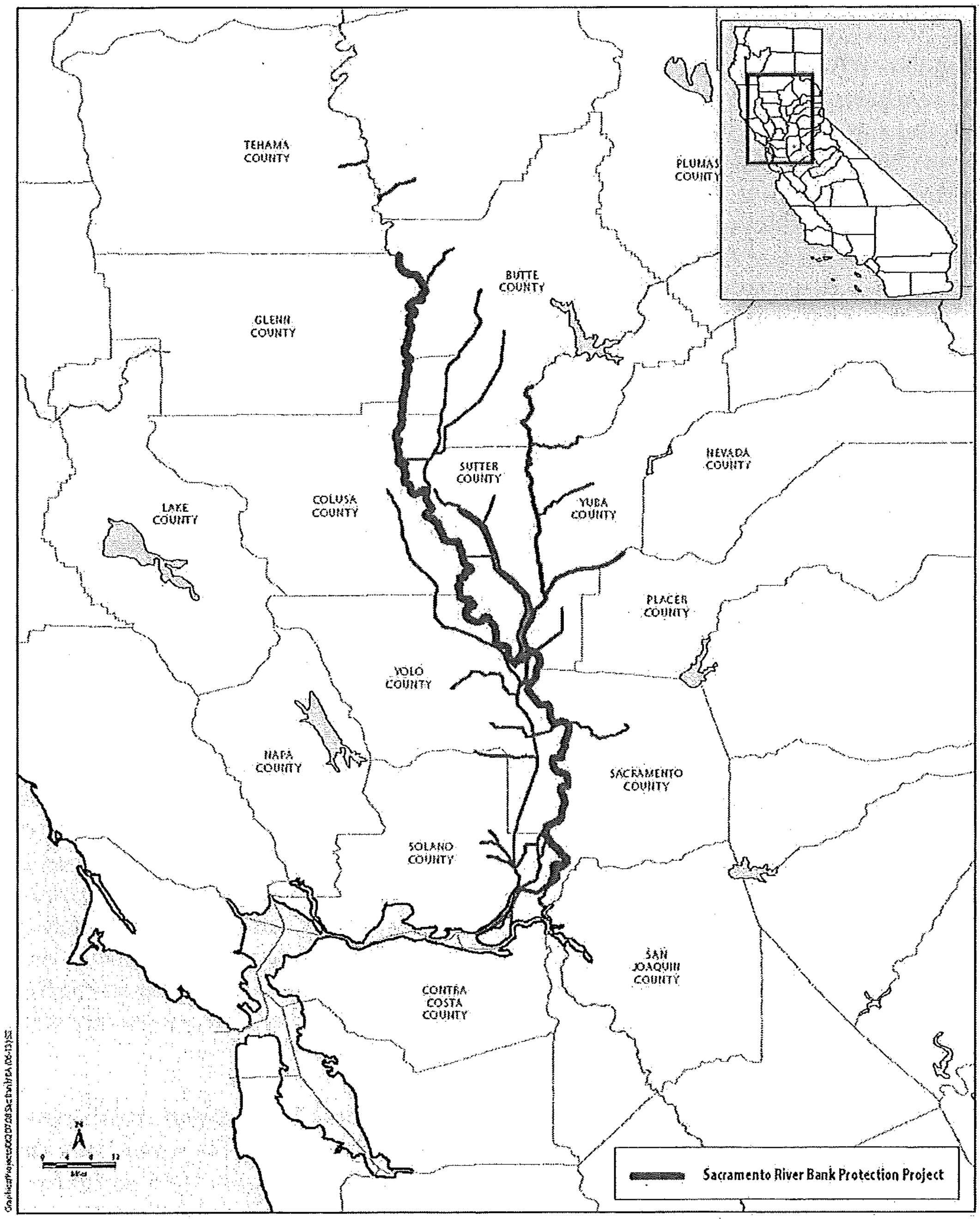

Figure 1. Program Area

For the purpose of the project description, the program area has been divided into four regions, organized south to north by the location of the downstream terminus of each watercourse with the mainstem Sacramento River. The four reaches were generally defined in a manner that captures the full range of environmental conditions within the project area while breaking them up in a manner that recognizes differences in physical structure and fish use among these four reaches (Figure 2). Region 1a includes the Yolo and Sacramento Bypasses, the Sacramento River downstream of Isleton (RM 20), and a distribution network of sloughs and channels. Region 1b includes the mainstem Sacramento River from Isleton (RM 20) in the Delta, upstream past the city of Sacramento, to the Feather River confluence at Verona (RM 80). Region 1b also includes the lower American River from the confluence with the Sacramento River upstream to RM 13, Natomas East Main Drain, Natomas Cross Canal, and Coon Creek Group Interceptor Unit 6. Within Region 2, the mainstem Sacramento River flows from Colusa (RM 143) downstream of the Colusa Bypass to the confluences with the Feather River and Sutter Bypass at Verona (RM 80). Region 3 includes the lower reaches of Elder and Deer Creeks, Mud Creek, Chico Creek, and the Sacramento River downstream of Chico Landing (RM 184) to Colusa (RM 143).

The erosion sites that need to be repaired can be found throughout the SRBPP program area. However, current implementation of the erosion repairs is influenced by a benefit-cost analysis, in accordance with Corps policy. This policy dictates that all water resources projects must be justified by showing beneficial outputs greater than project costs to determine a Federal interest. While the traditional approach has been to look at the erosion sites in the aggregate (i.e., all the authorized LF together), current policy dictates that economic flood damages within individual basins or reclamation districts, maintenance areas, or levee districts are evaluated independently, which influences the sites selected for repair. For the Post Authorization Change Report (PACR), the floodplains of the SRFCP were divided into 50 economic impact basins.

A preliminary analysis of 24 of these basins indicates that erosion repair.projects in certain less-developed regions in the program area, primarily agricultural lands with fewer damageable structures, are not likely to meet the benefit-cost criteria. During the implementation phase, it may be difficult to justify bank protection for levees in these regions. As a result, bank protection may only be considered economically justified in certain portions of the program area. In less developed areas, risk to life safety can be managed through other means, such as the Public Law 84-99 Rehabilitation and Inspection Program, which allows the Corps to undertake activities such as advance measures, emergency operations, and rehabilitation of flood control works threatened or destroyed by floods. Accordingly, this biological opinion only considers erosion control sites that are located within seven economically justified basins (EJB).

The seven basins that are most likely to satisfy the positive benefit-cost analysis criteria are shown in Figure 3. This proposed action is restricted to only repairs located within the seven EJBs identified in Table 1. Table 1 also includes the number of known erosion sites from a 2015 inventory conducted by the Corps per EJB. The number and location of sites may change as new inventories update the list. The number and extent of documented sites can change from year to year due to the episodic nature of erosion and new erosion sites can appear each year. The analysis at this point is programmatic in nature, analyzing the 30,000 LF in its entirety but not the specific sites. For the purposes of this consultation, the project description describes 30,000 LF of bank protection within the seven EJBs, while not specifically covering any individual site.

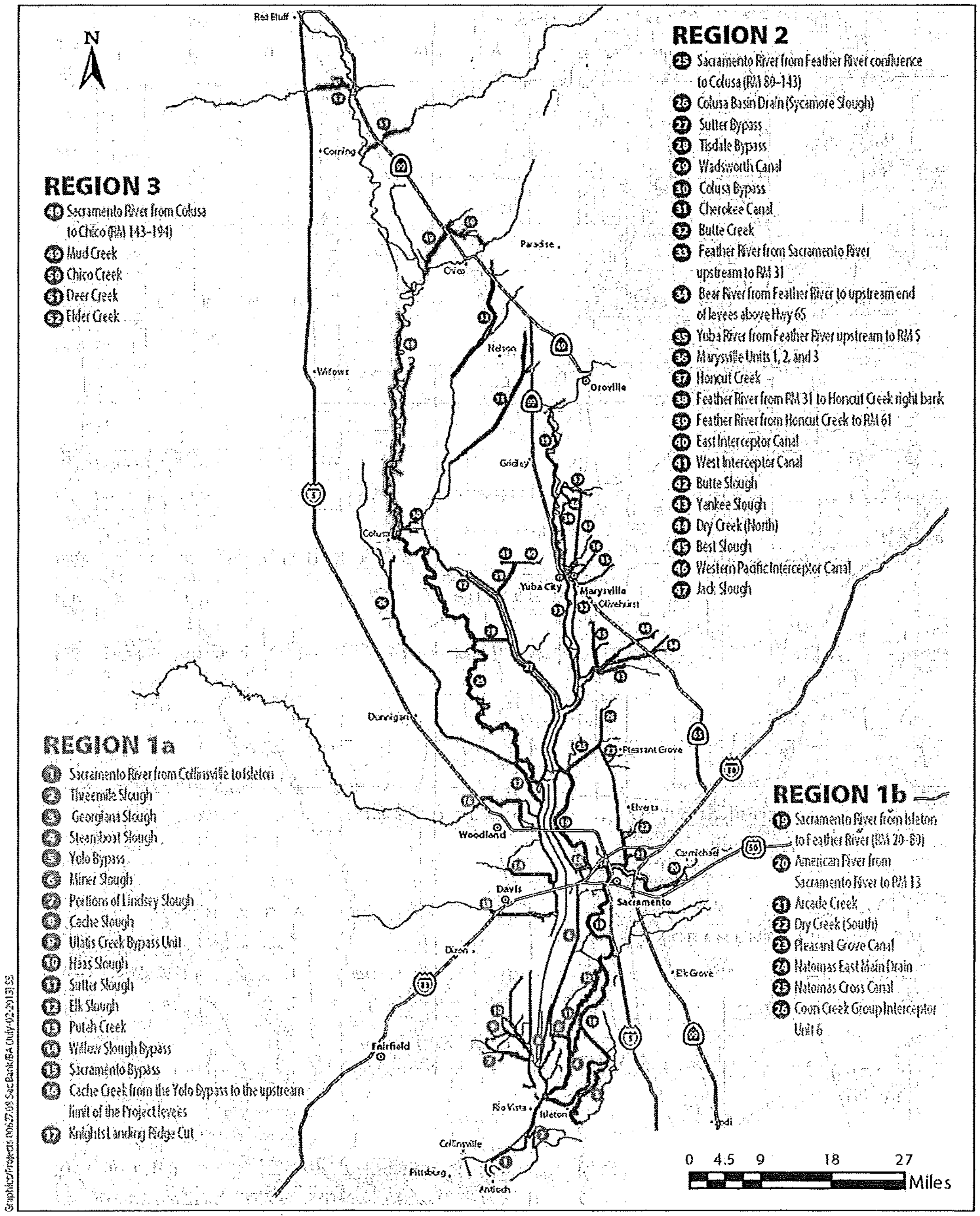

Figure 2. Program Regions

Table 1 – Justified Economic Impact Areas

Impact Area	Environmental Sub-Region	# Erosion Sites	LF Levee	Benefit/Cost Ratio	Annual Benefit ($1,000s)
Butte Basin	2, 3	4	3,549	1.9 to 1	1,028
Natomas	1B	1	654	145 to 1	17,524
Rio Oso	1B, 2	12	9,386	2.4 to 1	796
Sacramento	1B	10	2,932	332 to 1	18,577
Southport	1A, 1B	3	2,277	30 to 1	13,345
West Sacramento	1A, 1B	1	537	147 to 1	13,995
Yolo	1A	4	1,200	3.2 to 1	770
	TOTAL	35	20,535		

The economic analysis is required to be updated every 5 years and new sites in basins not previously analyzed may be evaluated. In the event new basins are identified as economically-justified, a separate consultation will be done. Therefore, this consultation is covering erosion repair to 30,000 LF constructed over a timeframe of 5 years.

The 35 selected erosion sites along the Sacramento River and its tributaries constitute a representative sample of the sites eventually proposed to be treated under the 30,000 LF.

Future site specific projects will be evaluated to determine if they meet conditions outlined in this PBO. The Service will evaluate the effects as discussed in this PBO and related to the current baseline of the species. Future bank protection projects will be tiered off of the PBO with specific conservation measures, specific effects analysis, and a specific incidental take statement for that particular site.

Proposed Bank Protection Measures
The suite of SRBPP site-specific bank protection measures are described below with figures to support each measure. A bank protection measure is a site-specific design solution to control an existing erosion site while minimizing and/or mitigating environmental impacts.

The following criteria have been developed for bank protection design, consistent with the project purpose and need:

- Restoring the flood damage risk-reduction capability of the originally-constructed levee through the use of structurally reliable erosion-control elements;

- To the extent practicable, maintaining fish and wildlife habitat and scenic and recreational values, and replacing habitat losses through the use of on-site mitigation elements overlying or integrated with erosion-control elements;

- If it is not possible to fully mitigate for fish and wildlife habitat losses on-site, full mitigation of residual habitat losses will occur off-site to the extent justified; and

- Minimizing costs of construction and maintaining both erosion-control and on-site habitat-mitigation elements.

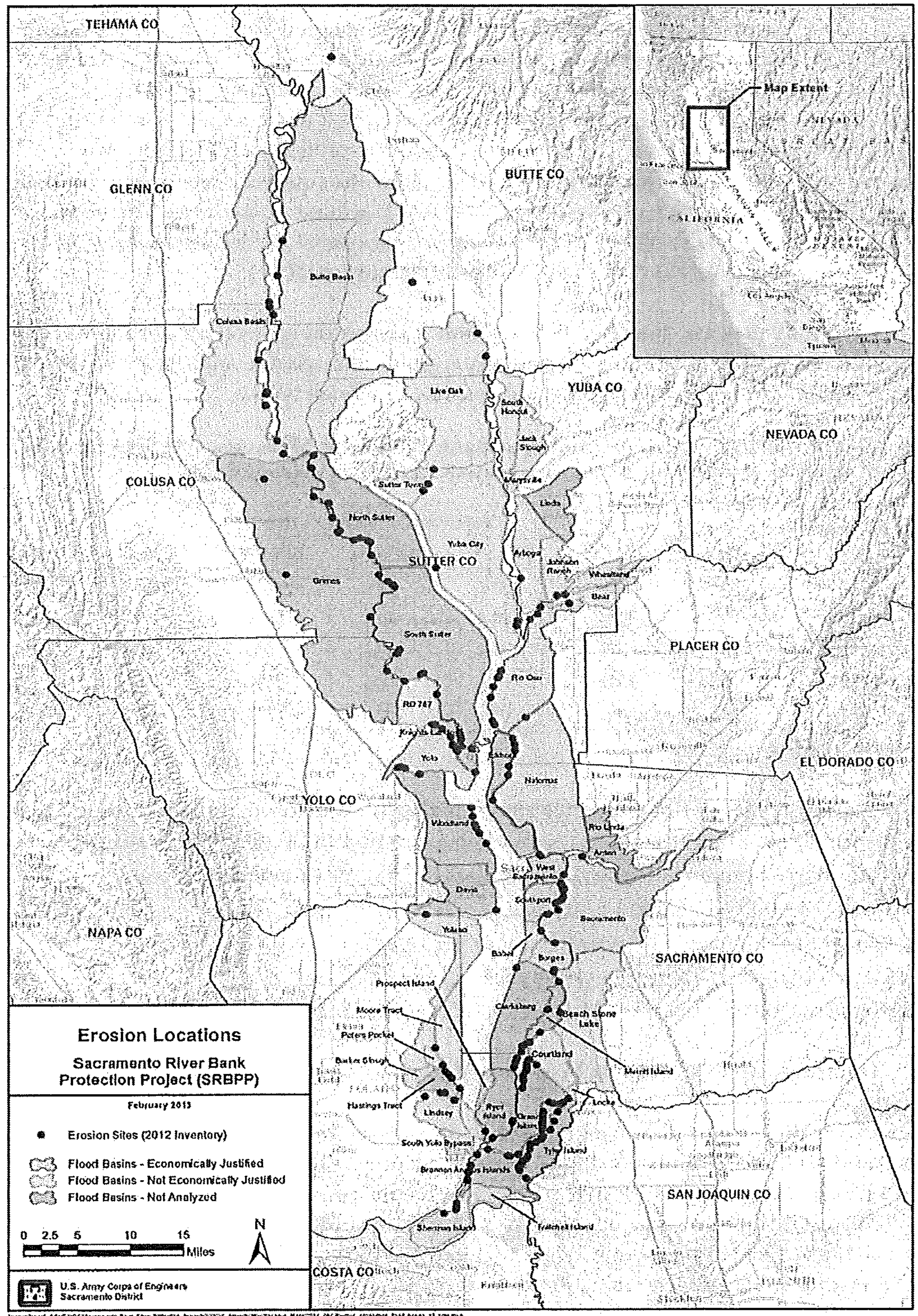

Figure 3. Economically Justified Basins

The following measures are intended to meet these criteria while also meeting the Corps' vegetation management policy as prescribed in *Engineering Technical Letter 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams, and Appurtenant Structures* (Vegetation ETL) (U.S. Army Corps of Engineers 2014). The vegetation-free zone (VFZ) is defined in the Vegetation ETL and encompasses the area 15 feet outward of each levee toe that will be restricted to native grass. These measures are conceptual and will be modified to the degree necessary to be suitable for conditions at any given erosion site. As a result, dimensions in the following figures are typical and will vary based on site-specific conditions and designs. Any variances from the Vegetation ETL that are pursued will follow the process contained in the Policy Guidance Letter (PGL)—*Process for Requesting a Variance From Vegetation Standards for Levees and Floodwalls* (77 Federal Register 9637–9650) and the *Policy for Development and Implementation of System-Wide Improvement Frameworks* (SWIFs) (U.S. Army Corps of Engineers 2011).

The bank protection measures are described below. Table 2 shows the general proportion of repair lengths attributed to each bank protection measure (by region). Site-specific application of the bank protection measures under the proposed action are discussed in detail below.

Table 2. Proportion of Repair Lengths Attributed to Bank Protection Measures – 31 Sites included in upper range SAM analysis (reasonable worst case scenario for BPM distribution)

Region	Repair Length (LF)	Proportion of Repair Types						
		BPM 1	BPM 2	BPM 3	BPM 4a	BPM 4b	BPM 4c	BPM 5
1a	1,752	0%	100%	0%	0%	0%	0%	0%
1b	9,838	0%	64%	0%	6%	18%	0%	12%
2	13,210	0%	70%	0%	20%	0%	0%	10%
3	5,182	0%	25%	0%	0%	75%	0%	0%
Total	29,982	0%	66%	0%	8%	17%	0%	9%

BPM = bank protection measure.

Using the known erosion sites as representative sites, the Corps estimates that the following are the amounts of habitat that could be affected through implementation of 30,000 LF of bank protection:

- Valley Elderberry Longhorn Beetle – 32.15 acres, 4.75 acres of habitat per year;
- Delta Smelt – 15,000 LF, 3,000 LF per year;
- Giant Garter Snake repair – 2.5 acres, 0.5 acre per year;
- Giant Garter Snake staging – 12.5 acres, 2.5 acres per year; and
- Western Yellow-Billed Cuckoo – 32.15 acres, 4.75 acres of habitat per year.

Overlap with American River Common Features, West Sacramento and Southport Projects

Some of the EJBs for this proposed project fall within the project area for other projects that have Corps approval and section 7 completed. These projects include similar types of actions to repair/improve levees. Since the SRBPP may proceed with construction actions that are coincidental with these other projects, there is some uncertainty on authority and take authorization to be applied on these future actions. The Corps acknowledges that existing biological opinions, e.g. American River Common Features General Re-evaluation Report (GRR) and West Sacramento (GRR), exist which must be considered by the SRBPP program when planning potential construction projects, and coordination must occur between the projects/programs and the resource agencies. When this occurs, it is likely that any action undertaken by SRBPP authority will be designed and constructed in alignment with these other project actions, and any take associated with the action may already have been evaluated under the respective biological opinions.

Bank Protection Measures

Bank Protection Measure 1—Setback Levee

This measure (Figure 4) entails constructing a new levee some distance landward of the existing levee and will avoid or minimize construction in waterside riparian areas. The land between the setback and existing levee will become floodplain. Land use in the new floodplain will be determined on a site-by-site basis. The old levee could be breached in several locations and/or degraded to allow high flows to inundate the new floodplain. Vegetation on the new setback levee including 15 feet beyond each toe will be restricted to grass, and managed as a vegetation-free zone, while vegetation could remain on the old levee. New vegetation planted in the setback area could serve as mitigation to offset project losses. Additionally, vegetation on the existing levee could become available to aquatic species and contribute to a net increase in floodplain vegetation.

Measure 1 will be most applicable in areas where substantial habitat values exist along the channel and land uses in the setback area are not restrictive. Setback levees can be very effective but real estate acquisition (including the need for willing sellers), existing land use, and technical issues limit opportunities for setback levees in the program area. Setback levees can restore riverine processes and may offer opportunities for mitigation of riparian, bank swallow, and fish habitat loss at other bank protection sites. Setback levees may also provide other flood control benefits such as addressing seepage issues that other bank protection measures will not address.

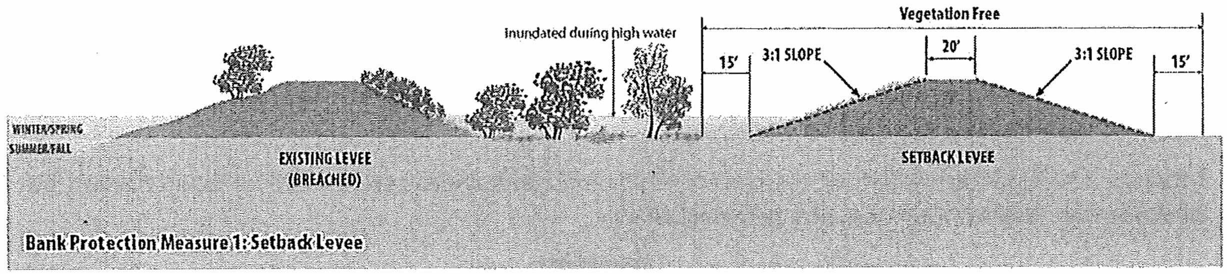

Figure 4. Bank Protection Measure 1: Setback Levee

Bank Protection Measure 2—Bank Fill Stone Protection with No On-Site Woody Vegetation

This measure (Figure 5) entails filling the eroded portion of the bank and installing soil-filled revetment along the levee slope. The rock/soil ratio will vary by location and will be determined during site-specific design. Vegetation will be limited to native grass, and existing vegetation will be removed only within the footprint of features to be constructed (e.g. placement of rock or soil). Vegetation within the VFZ but outside of the construction footprint will be left in place. If there is a natural bank, distinct from the levee that requires erosion protection, it will be treated with revetment. Measure 2 will be most applicable in areas where there is inadequate space or substantial constraints (for example, critical infrastructure, homes, roadways, pump facilities, real estate issues, etc.), either landside or waterside, where hydraulic concerns will make it difficult to implement the other measures, or where existing habitat values are very limited.

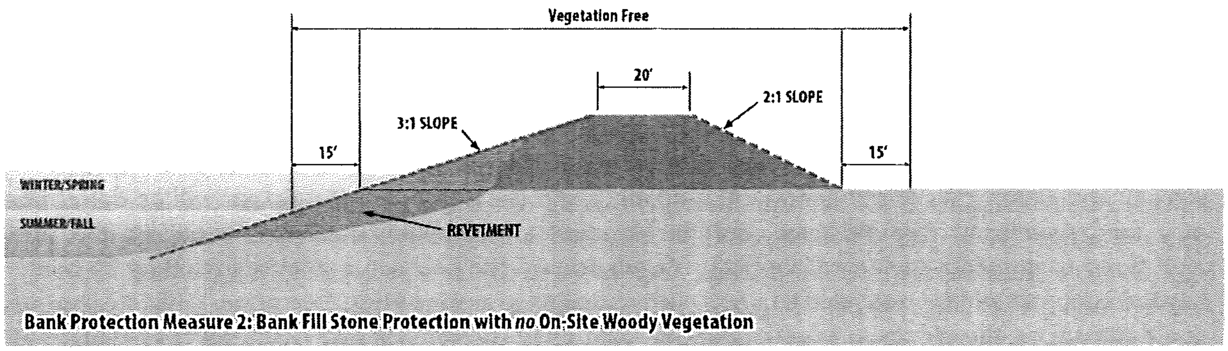

Figure 5. Bank Protection Measure 2: Bank Fill Stone Protection with *No* On-Site Vegetation

Bank Protection Measure 3—Adjacent Levee
This measure (Figure 6) involves the construction of a new levee embankment adjacent to and landward of the existing levee. The adjacent levee will be constructed to Corps design standards, which require adjacent levees to be constructed with 3:1 slopes on both the waterside and landside. The landward portion of the existing levee will be an integral, structural part of the new levee. The waterward portion of the existing levee will remain. Vegetation and instream woody material (IWM) could be placed on the old levee if that portion is outside of the vegetation free zone. However, a variance under the ETL may be required if the existing levee is considered to be a waterside planting berm based on its dimensions and proximity to the new levee. The levee may also be degraded to riparian and/or wetland benches that comply with the Corps' vegetation management policy. Vegetation on the landward side of the existing levee and within the footprint of the new adjacent levee will be removed as a part of construction.

Measure 3 will be appropriate at many sites where waterside berms are narrow or non-existent, but landside uses will limit the use of a setback levee.

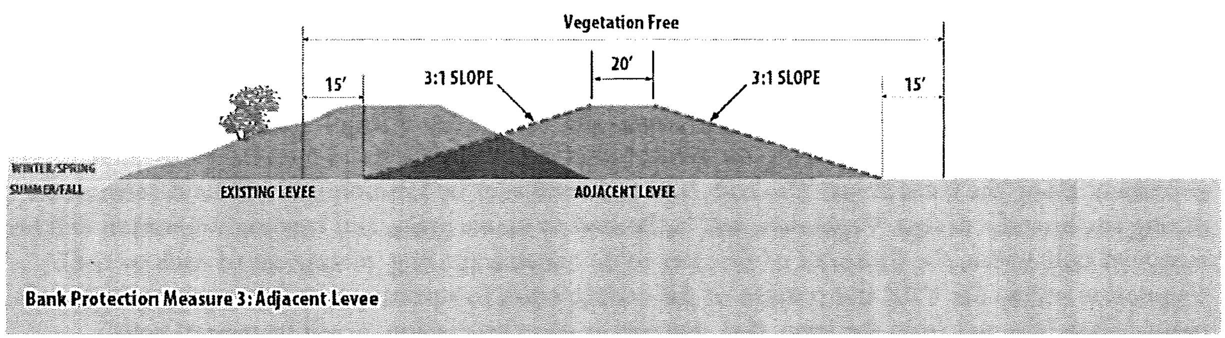

Figure 6. Bank Protection Measure 3: Adjacent Levee

Bank Protection Measure 4—Riparian and Wetland Benches with Revegetation
Measure 4 consists of three design variations presented as Measures 4a, 4b, and 4c. In general, this measure involves the placement of clean quarry stone from the toe of the bank up to the summer/fall waterline and placing quarry stone and soil-filled quarry stone on the levee slope above the summer/fall waterline. The rock/soil ratio will vary by location and will be determined during site-specific design. The repairs will involve initial site preparation and construction of levee embankment. Measures 4a, 4b, and 4c will comply with the Vegetation ETL, requiring all woody vegetation within the vegetation-free-zone to be removed.

Measures 4a, 4b, and 4c vary from one another with regard to the placement and extent of environmental features that are intended to increase habitat quality (bank construction, vegetation, and IWM). These variations are driven by a number of factors, most importantly the types of existing resources and the types of species likely to use those resources.

In general, plantings consistent with the Vegetation ETL and outside of the vegetation free zone at each site could include box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), western sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), Goodding's willow (*Salix gooddingii*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), California wild rose (*Rosa californica*), and narrowleaf willow (*Salix exigua*).

These measures are appropriate where the channel is wide enough to accommodate the installation of the stone and soil structure without substantially affecting the hydraulic capacity of the channel.

Bank Protection Measure 4a—Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline

The low riparian bench with revegetation and IWM above the summer/fall waterline measure (Figure 7) entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. This design provides near-bank, shallow-water habitat and components of shaded riverine aquatic habitat for fish. Treatment of existing vegetation, site preparation, and installation of revetment on the lower slope will be similar to the description under Measure 2. This measure includes a riparian bench. The bench will be treated with soil-filled quarry stone.

In this design, the riparian bench is intended to be inundated at river stages corresponding to high tide (where tidally influenced) during average winter/spring flows. The riparian bench will be revegetated with species that are in compliance with the standard VFZ of the ETL. Planting plans will describe species to be planted within a specific elevation zone and will detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers.

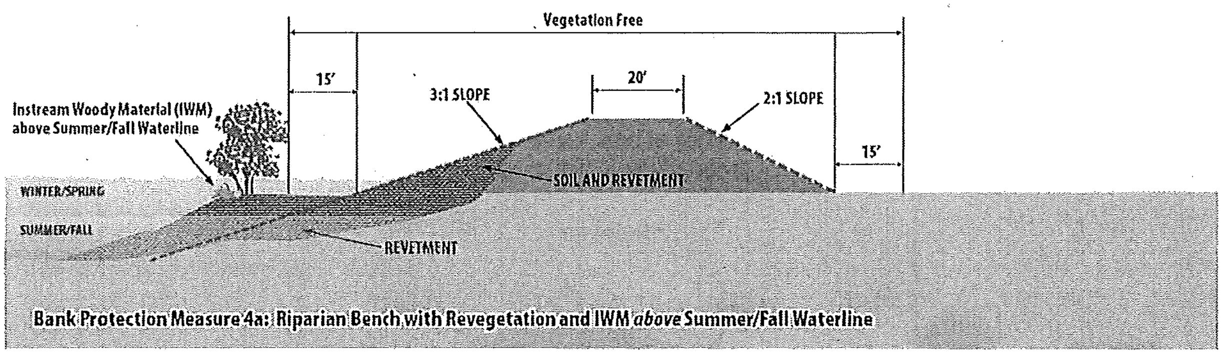

Figure 7. Bank Protection Measure 4a: Riparian Bench with Revegetation and Instream Woody Material *above* Summer/Fall Waterline

The riparian bench will be constructed at a slope of 6:1 to 10:1 and the revetment portion above and below the bench will typically be 3:1 (distance width to distance height, or dW:dH). The width of the bench will be about 10–30 feet, depending on site conditions. Anchored IWM will be embedded on top of the riparian bench above the summer/fall waterline. The IWM will be available as habitat along the banks only during winter/spring flows when the bench is inundated. Individual pieces of IWM will be placed to fit the project site's hydraulic conditions and other applicable guidance. The Corps assumes 60% IWM shoreline coverage and a high level of complexity. Exact shoreline coverage amounts and complexity components will be determined during site-specific design.

Bank Protection Measure 4b—Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

The low riparian bench with revegetation and IWM above and below the summer/fall waterline measure (Figure 8) entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench (as described for Measure 4a) to support riparian vegetation and provide a place to anchor IWM. In addition to the placement of IWM above the summer/fall waterline as described for Measure 4a, IWM also will be placed beyond the bench below the summer/fall waterline, thereby increasing the types and extent of mitigation for shallow-water fish habitat, providing year-round instream habitat for targeted fish species. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone will be similar to Measure 2. Installation of soil-filled quarry stone and riparian bench will be similar to Measure 4a.

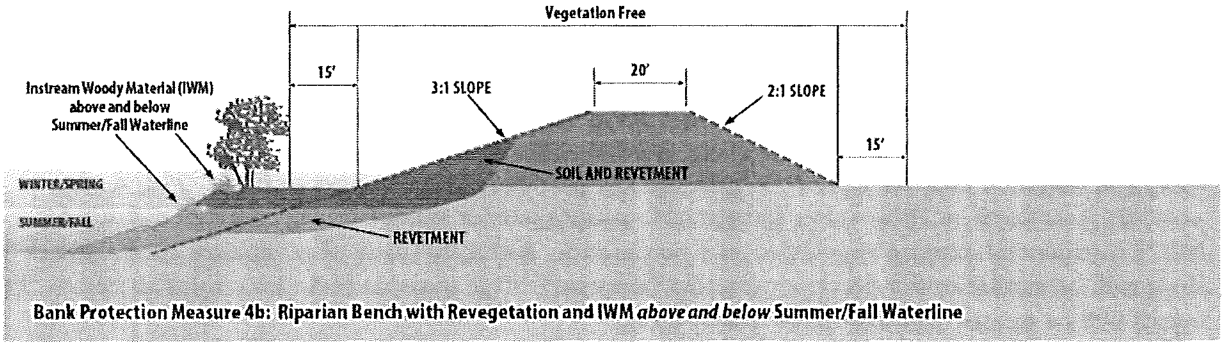

Figure 8. Bank Protection Measure 4b: Riparian Bench with Revegetation and Instream Woody Material *above and below* Summer/Fall Waterline

Bank Protection Measure 4c—Riparian and Wetland Benches with Revegetation

Measure 4c (Figure 9) entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. Bench slopes will be the same as those described for Measure 4a. The design also includes a wetland bench below the summer/fall waterline to further increase habitat quality. Existing vegetation will be removed only within the footprint of features to be constructed (e.g. placement of rock or soil). Grass will be allowed in this area. Vegetation within the VFZ, but outside of the construction footprint will be left in place. Because IWM might increase habitat suitability of ambush predators, new IWM will only be installed to replace existing IWM removed during project repair (1:1 ratio).

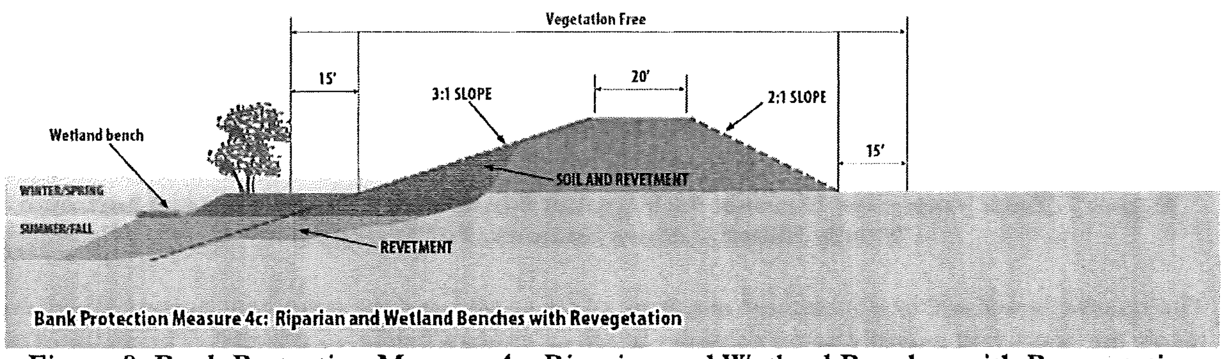

Figure 9. Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation

The riparian and wetland benches are intended to flood at river stages corresponding to winter/spring (high) flows and summer/fall (low) flows, respectively. Both benches will be revegetated in compliance with the Vegetation ETL and in accordance with appropriate planting plans. The wetland bench will typically be planted with hardstem bulrush (*Scirpus acutus*), California bulrush (*S. californicus*), and/or giant bur-reed (*Sparganium eurycarpum* ssp. *eurycarpum*).

Bank Protection Measure 5—Bank Fill Stone Protection with On-Site Vegetation
Measure 5 (Figure 10) entails filling the eroded portion of the bank and installing revetment along the waterside levee slope and streambank from streambed to a height determined by site-specific analysis. The revetment will be placed at a slope of 3:1. All IWM will be removed from the bank; following construction and will not be replaced.

Existing vegetation will be removed only within the footprint of features to be constructed (e.g. placement of rock or soil). Vegetation within the VFZ, but outside of the construction footprint will be left in place. Approximately 25% of existing vegetation that is outside of the VFZ on the waterside slope is estimated to be retained during construction. This assumption is made for analysis purposes and is based on past construction experience; however, the actual amount of retained vegetation could vary substantially from site to site during implementation. New vegetation will be limited to native grasses within the VFZ, while woody vegetation could be replaced by planting outside of the VFZ, as allowed by site-specific conditions. The long-term goal of vegetation planting is to provide riparian and shaded riverine aquatic (SRA) cover habitat. Planting plans will describe species to be planted within a specific elevation zone and will detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers. Six inches of soil cover will be placed on the revetment to support on-site vegetation. If there is a natural bank distinct from the levee that requires erosion protection, it will be treated with revetment.

Similar to Measure 2, Measure 5 will be most applicable in areas where there is inadequate space or substantial constraints that will limit the applicability of the other measures. However, some amount of space to allow for the planting of vegetation is necessary.

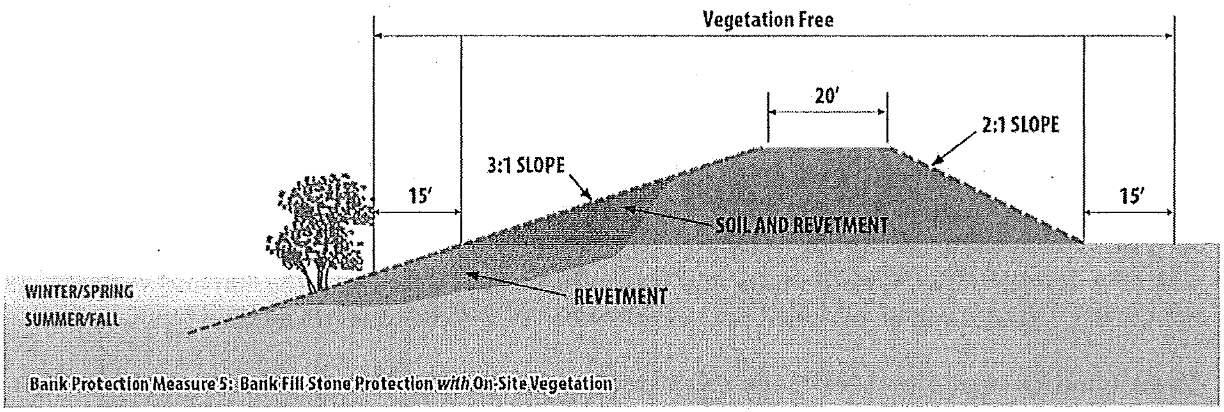

Figure 10. Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Design Selection Process

As described above, the Corps has identified seven bank protection measures based on the project delivery team's best professional judgment for the 30,000 LF in this PBO. Also noted above, additional measures and alternative materials may also be appropriate. The following process will be followed prior to selecting final bank protection measures for specific erosion sites.

Reconnaissance/Erosion Inventory. During the reconnaissance trip, a team reviews the existing erosion sites, identifies new sites, and checks the previously repaired sites.

Critical Site Decision. Determine if the erosion site is critical. This decision step of the site selection procedure allows for a fast-track path for critical sites.

Engineering Ranking and Report. The third step of the site selection process involves development of a report and an engineering site ranking based on the information collected during the erosion reconnaissance inventory. This information is provided to the Service and NMFS to inform them of the potential sites that may need to move forward for repair.

Identify Opportunities and Constraints. During this step of the process, all the potential issues and opportunities associated with each site are identified. This step addresses real estate, environmental, constructability, cultural resources, and grouping of sites. Opportunities and constraints are presented and discussed with the Inter-Agency Working Group. This step identifies sites where a variance will be applicable and is when the first steps of the variance request process will be initiated. This step provides the Service and NMFS with the opportunity to provide science and agency perspectives, identify specific issues, and help identify opportunities to minimize adverse effects and potential mitigation alternatives.

Conceptual Level Alternatives. Under this step, the project development team (PDT) develops conceptual-level designs and costs.

Site Lock-in Procedure. During step 6, sites are selected for inclusion on the "lock-in" list for site repairs. The sites on the "lock-in" list are generally anticipated to be repaired over the 3- year period that makes up each construction cycle.

Site Selection Lock-in List and Report. For step 7, the top sites chosen in step 6 and the fast-tracked critical sites are considered the locked-in sites selected for repair in each construction cycle. A report is written to document how and why the "locked-in" sites were selected for repair.

Data Collection. For this step, the PDT collects the data needed to develop the repair designs. The exact information and the level of detail collected at each site vary from site to site.

Preliminary Designs and Draft National Environmental Policy Act/California Environmental Quality Act (NEPA/CEQA) Document. Step 9 begins the design process, section 7 consultation, and the draft NEPA/CEQA document. The design alternatives are selected and 30% designs (plans, specifications, and Design Document Report (DDR) and cost estimates are completed. Designs can be provided to the Service and NMFS for their review and input.

Draft Final Design, Final NEPA/CEQA Document, and Pre-Construction Activities. After an internal review of the plans, the 90% Plans and Specifications are developed, and the final NEPA/CEQA document is completed. The Corps will provide the Service and NMFS an additional review during this step.

Review and Final Design. The official Agency Technical Review (ATR) and Independent External Peer Review (Type II IEPR, Safety Assurance Review) is performed throughout the development of the Plans and Specifications and the DDR. Revisions to the designs and contract documents are made based on these reviews, resulting in the 100% DDR and Plans and Specifications for Contract advertisement.

Contracting Procedure. The Corps compiles the final plans and specifications, provides the signed Biddability, Constructability, Operability and Environmental (BCOE) Review, and processes the funding element for construction.

Construction. The contractor constructs the bank repair following the Notice to Proceed.

Mitigation Monitoring. On-site mitigation requires monitoring to ensure the establishment criteria is met for vegetation growth and survival. The monitoring period must be sufficient to demonstrate that the compensatory mitigation has met performance standards, at least 5 years post establishment. Monitoring reports are required on a yearly basis and will be provided to the Service and NMFS.

Site Turn-over. Once the construction and mitigation monitoring is complete, the Corps turns the site over to the CVFPB, which then turns the site over to the local maintaining agency. Mitigation and monitoring will be incorporated into the operations and maintenance manual.

The Corps will review all repair sites to determine if the recommended repair is consistent with the repairs described in this project description. Additionally, the Corps will determine if the effects of the individual site repair were analyzed in this PBO and include any site specific effects that were not considered at the programmatic scale. The Corps will submit a biological assessment to the Service and request that the site be appended to the PBO.

The proposed action applies a combination of the selected site-specific bank protection measures to the erosion sites. A major aspect of selecting bank protection measures for each site is avoiding, minimizing, and mitigating negative impacts to fish and wildlife habitat. The process also includes preliminary Standard Assessment Methodology (SAM) evaluations to determine likely losses and necessary gains to habitat for salmonid species. For example, a setback levee measure may off-set losses of riparian vegetation at a rock slope bank protection site. This will depend on timing of the various measures to ensure that habitat losses are mitigated for at the time of the impact.

Off-site mitigation may be acceptable to the Corps, CVFPB, and resource agencies on a site-specific basis provided that it compensates for the values being lost, and will be provided within the region of impact (e.g., 1a, 1b, 2 or 3). The proposed action utilizes the approach taken over the last decade, which primarily focused on recreating streambank habitats through the use of constructed benches with riparian vegetation, but makes adjustments to account for implementation of the Vegetation ETL.

The extent to which actual measures are implemented in each region may vary from what is shown in Tables 1 and 2. It is intended to serve as an example of how the work could reasonably be accomplished and it provides a basis for evaluating potential effects to listed species. Thus, it is an approximation and not a formal commitment by the Corps. This approach allows the magnitude of the habitat compensation needs to be determined for the entire program while not prescribing the exact designs for site-specific actions. A radical change in the types of measures employed by the Corps could necessitate the re-initiation of consultation due to a change in effects.

Operations and Maintenance

Once repairs are complete, a project site may require limited maintenance. During the initial establishment period, maintenance activities are anticipated to be required for 3 to 5 years, and include: removing invasive vegetation detrimental to project success; pruning and watering planted vegetation to promote optimal growth; replacing plantings, monitoring navigational hazards; and placing fill and rock revetment if the site is damaged during high flow events or by vandalism. Once established, the riparian vegetation should be self-maintaining. Annual maintenance at each site will be limited to placement of no more than 600 cubic yards of material, which corresponds to a disturbance length of less than 300 feet; should more material be required in any year, the operating and maintaining agency (i.e., Central Valley Flood Protection Board) will obtain the necessary permits from the regulatory agencies. The Corps will be responsible for ensuring that conservation measures and environmental standards are stipulated in permits and all required documentation is maintained. Similarly, if outside alterations of a project site are proposed by other agencies or private entities, the Corps will work with the Service and NMFS to ensure that environmental features at the project sites are maintained, or that off-site compensation is implemented to make up for any deficits.

Conservation and Mitigation Measures

Off-Site Compensation for Chinook Salmon, Steelhead, Delta Smelt, and Green Sturgeon

Bank repair actions that are not fully self-mitigating will implement off-site compensation measures in advance of the proposed action through the use of advanced conservation measures or conservation banks. If necessary, and only in consultation with resource agencies, off-site compensation measures may be implemented concurrently or following the completion of project construction, but the amount of area to be compensated with will be adjusted to account for temporal losses. Whether constructed as part of a suite of bank protection sites or established under an agreement between the federal agencies, off-site compensation will focus on replacing and enhancing habitat values for listed species. SAM, which was specifically created to assist with quantifying effects and compensation amounts for salmonids, will be utilized to the extent practicable. The quantification methodology does not adequately reflect how delta smelt and its habitat are being affected by bank protection projects. Therefore, it will be necessary for the Service and Corps to review the sites within the range of the delta smelt and determine qualitatively and quantitatively how best to offset the effects to delta smelt. This is further described below in the delta smelt section. Proposed off-site conservation measures include the use of one or more of the following elements:

1. Setback levees to reestablish natural bank conditions along the channel provide a seasonally inundated floodplain with a mosaic of habitat types including riparian forest and shallow open water areas (Figure 4). Under these conditions, active channel migration could re-initiate and will be subject to the natural cycles of habitat disturbance and renewal.
2. Construction of in-channel and off-channel wetland benches or less steeply sloping banks to provide juvenile salmonid rearing habitat.
3. Planting riparian trees for bank shading and long-term production of instream wood for salmonid aquatic habitat.
4. Installation of instream wood for the creation of instream cover and feeding areas for salmonids.
5. Removal of rock revetment, which will allow the river to reclaim its natural geomorphic processes and move freely throughout the floodplain.

Similar compensation values may also be obtained through purchase of third party mitigation bank credits.

Off-Site Compensation Process

Sections 7(a)(1) and 7(a)(2) of the Act, 16 U.S.C. Sections 1636(a)(1) and (2), require all federal agencies to support and implement programs for the conservation of listed species, and to insure that federal actions do not jeopardize the continued existence of any endangered species or threatened species or result in destruction or adverse modification of critical habitat. Impacts to listed species are minimized by including conservation measures in the federal agency's project description. These conservation measures may include off-site enhancement of listed species habitat as part of an individual project or as part of a conservation banking agreement. The general off-site compensation process is outlined below:

1. Off-site compensation requirements for one or more individual project sites will be determined in coordination with the Service and the Corps. A combination of pre-construction survey data, shallow water habitat delineation, or post-construction survey data will be used to verify assumptions used.

2. Existing conditions will be surveyed at proposed compensation sites. Recommended compensation measures will be submitted for approval of the Service. If significant setback levee action (or other significant restorative action) is designed and developed with the intent of off-setting future SRBPP bank protection impacts, the action, shall be subject to the appropriate advance mitigation guidance, including the Service's December 27, 2016, *Compensatory Mitigation Policy.*

3. The functional value of the project sites and compensation sites will be determined by using the SAM or other assessment tool available to evaluate site locations (e.g., compensation sites located where they can be colonized by the affected life stages of the focus fish species), site attributes (e.g., potential exchanges between one or more attributes such as IWM, substrate, shade, etc.), relative sizes of the sites, and compensation timing. Functional values will be used to determine the appropriate functional equivalent of losses at the project site(s) compared to the compensation site(s).

4. Timing of project site construction, compensation site construction, and habitat evolution will be evaluated; the goal will be to achieve net positive results for the project and compensation sites at all times. This will require a balance between compensation sites and construction sites at any given time.

5. Compensation requirements shall be completed prior to impacts occurring.

Location of Compensation Sites

There is a history of policy positions favoring local or on-site mitigation over more distant compensation. Prior policy positions of NMFS have stated that the use of distant sites (>50 miles) is unacceptable because it does not ensure "in-kind" compensation, or that local populations which have been affected by the project benefit from the habitat enhancement (National Marine Fisheries Service 2001). 33 CFR Section 332 *et seq.* establishes compensatory mitigation standards and criteria for projects permitted by the Corps pursuant to Section 404 of the Clean Water Act, 33 U.S.C. Section 1344. In general, 33 CFR Section 332.3(b)(1) states that compensation sites should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions and services, taking into account such watershed scale features as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, trends in land use, ecological benefits, and compatibility with adjacent land uses.

For the purposes of the proposed action, compensation requirements will generally be determined within each of the four regions (Figure 2) with the intent of completing the proposed conservation measures at sites selected as close as practicable to bank protection project sites. Whether two potential project and compensation sites are ecologically interchangeable can primarily be assessed by determining whether fish species or specific life stages could inhabit the two sites at the same time of year. In select situations, compensation sites may be acceptable if fish species utilize the two sites at various times or during different life stages.

The Corps has proposed two potential compensation sites: rock removal at Kopta Slough in Region 3 and the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project in Region 1a. Neither site has been approved by the Service or NMFS at this time and will be evaluated in the future against current mitigation policies. Additional compensation sites within these regions and in Regions 1b and 2 will address the needs of the proposed action. Final compensation site locations may be constrained by: (1) limited potential for habitat benefits to listed species from planned acquisition or enhancement; (2) location of property relative to site(s) requiring off-site compensation; (3) compatibility of nearby land uses with proposed land use at the compensation site; (4) available funding; and (5) the willingness of landowners to sell their properties. Due to the unique qualities of some mitigation opportunities or sites (e.g. rock removal at Kopta Slough), it may be appropriate to mitigate for impacts to certain species outside of the region where the effects occurred.

Guidelines for Off-Site Compensation

Protection of listed species habitat through the use of advance mitigation sites constructed by the Corps or the CVFPB may be considered as one means to satisfy off-site compensation requirements when on-site mitigation alternatives are not feasible or will provide better conservation outcomes at a different location as described in the Service's Mitigation Policy (Service 2016a). For compensation sites constructed in advance of proposed bank repair sites, medium- to long-term habitat benefits will potentially accumulate for use in offsetting future bank repair sites. Conceptually, advance mitigation is a compensation strategy in which habitat resources are restored, created, or enhanced expressly for the purpose of providing compensatory mitigation in advance of authorized impacts. Within the SRBPP context, the goal of advance mitigation will be to offset adverse impacts to the federally listed and fish species addressed in this PBO. Purchase of mitigation credits from third-party mitigation banks may also be considered as a strategy for off-site habitat compensation.

Advance mitigation agreements will be consistent with established criteria and guidelines of the involved agencies. The Service has recently finalized the *Endangered Species Act Compensatory Mitigation Policy* (Service 2016b). This policy outlines standards and criteria for developing mitigation sites. The policy clarifies guidance given in the Service's *Guidance for the Establishment, Use, and Operation of Conservation Banks* (Service 2003).

Although relevant federal and state guidance documents for conservation and mitigation banking provide the fundamental precepts under which advance mitigation for the SRBPP shall be undertaken, SRBPP advance mitigation actions and proposals will be unique and variable. Therefore, some of the more important additional guidelines that shall also apply to advance mitigation relative to the SRBPP are as follows:

- The Interagency Working Group (IWG) shall support an independent re-analysis of the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project in Solano County, California, to determine how conservation credits may be applied to future SRBPP compensation needs. Application and use of such credits will be subject to appropriate conservation and advance mitigation agreements;
- On-site compensation efforts that create significantly more compensation than necessary to fully offset on-site impacts, may have the excess compensation credited, accounted for, and used through appropriate consultation processes, or under appropriate conservation and advance mitigation agreements;
- The project service area for each advance mitigation site may vary and shall be defined at the time each site is established;
- Advance mitigation credits may either be withdrawn directly by the Corps and CVFPB, or conservation bank credits may be purchased from an intermediate, private seller/bank operator. Regardless of the origin, the Corps will base all accounting of compensatory credits for salmonids, on the SAM (U.S. Army Corps of Engineers 2004) or other methodology approved by the resource agencies;
- Each agency shall be given an opportunity to participate in development and to

become a party to any advance mitigation or conservation banking agreements which are developed;

- The Corps and CVFPB declare their intent to routinely subrogate, to private entities capable of providing such services and that are agreeable to IWG agencies, their responsibilities for: (1) preparing advance mitigation and/or conservation banking agreements, and (2) conducting operations, maintenance, monitoring, and accounting for advance mitigation sites and/or conservation banks; and
- Protections and management of advance mitigation sites shall be established in perpetuity. Management measures shall be implemented to ensure adequate control of undesirable activities (e.g., trash dumping, tree-cutting, off-road vehicle use, and invasions by exotic vegetation). Management elements that maintain the habitat for the various listed species shall also be included, as necessary. However, for management and maintenance of all advance mitigation sites, the guiding principle shall be to achieve to the extent feasible, a largely unmanaged operation based on natural river functions and processes.

The Cache Slough advanced mitigation site was built in 1992. The site is comprised of 176 acres with 12,000 LF of exterior bank line and 138 wetted acres. It is located within designated delta smelt critical habitat on Cache Slough in the northern Sacramento-San Joaquin Delta, west of the Sacramento River, about 8 miles north of Rio Vista. The site is owned and maintained by the California Department of Water Resources (DWR) with the purpose of supplying advanced mitigation credits to address off-site mitigation requirements for SRBPP actions where compensation for habitat loss cannot be completed on-site. However, the Corps, CVFPB, DWR, and Service must reach agreement on ways in which the agencies can meet the criteria set out in the Service's *Endangered Species Compensatory Mitigation Policy*. This will include protecting the land in perpetuity through a conservation easement, a long-term monitoring and maintenance plan for the site, and a means of providing in-perpetuity funding of the plan such as an endowment. It is unclear as to how the Corps and CVFPB can provide the above protections and is unlikely to be resolved in the foreseeable future. Until this is resolved the Corps and CVFPB are unable to use any credits from this site.

Delta Smelt Conservation Measures

- All work within waters where there is potential for delta smelt to occur, as defined by the most recent data, will be confined to a seasonal work window of August 1 through November 30 when delta smelt are least likely to be present along the Sacramento River.
- Work windows may be adjusted with approval by the Service based on information from the various Delta monitoring programs.
- Permanent loss of habitat will be compensated for by purchasing credits at a Service-approved conservation bank at a 3:1 ratio. Habitat effects resulting in a change of substrate will be compensated by purchasing credits a Service-approved conservation bank at a 1:1 ratio.

Valley Elderberry Longhorn Beetle Conservation Measures

The following measures will be implemented to minimize any potential effects on valley elderberry longhorn beetles or their habitat:

- The Corps will avoid elderberry shrubs by creating and maintaining a buffer of at least 20 feet around elderberry plants.

- When encroachment upon the 20-foot buffer will occur, the Corps will provide a biological monitor to be on-site to ensure that the beetle's habitat is not damaged.
- During construction activities, all areas to be avoided will be fenced and flagged.
- Contractors will receive worker awareness training which will include the status of the valley elderberry beetle, the habitat it uses, the need to avoid damaging elderberry plants, and the possible penalties for not complying with these requirements.
- Construction work will be avoided within 165 feet of elderberry shrubs during the beetle's flight season (March – July).

Restoration and maintenance

- Areas disturbed during the construction will be restored to pre-project conditions.
- Herbicides will not be used within the drip-line of the shrub. Insecticides will not be used within 100 feet of an elderberry shrub. All chemicals will be applied using a backpack sprayer or similar direct application method.
- Mowing will be limited to the months of July – February and will avoid damaging elderberry stems.
- The Corps will update the Operations and Maintenance Manuals with these conservation measures upon completion of construction.

Elderberry plants that cannot be avoided

- Elderberry shrubs that cannot be protected in place will first be analyzed for trimming so they can remain on-site. Trimming will occur between November and February and will minimize the removal of branches or stems that exceed 1 inch in diameter. Prior to trimming the stems will be examined for exit holes. Any exit holes found will have the GPS location and number of holes provided the California Natural Diversity Database (CNDDB).
- Elderberry shrubs that must be transplanted to allow for work to occur will be transplanted to an appropriate riparian area at least 100 feet from construction activities or to a Service-approved conservation bank. Appropriate riparian areas will have some level of protection such as a conservation easement.
- Elderberry shrubs will be transplanted during their dormant season (November, after they have lost their leaves, through the first 2 weeks in February). In cases where transplantation cannot occur during the dormant season the Corps will provide additional mitigation. Elderberry shrubs will not be transplanted during the beetle's flight season (March – July).
- A qualified biologist will be on-site to monitor for the duration of the transplanting of the elderberry plants to ensure the correct shrubs are transplanted and other habitat is not disturbed. The monitor will have the authority to stop work if necessary.

Transplanting Procedure

- Exit-hole surveys will be completed immediately prior to transplanting. The number of exit holes found, global positioning system (GPS) location of the plant to be relocated, and the GPS location of where the plant is transplanted will be reported to the Service and to the CNDDB.
- Any plant requiring transplantation will be cut back the least amount in order to safely remove and move the shrub.
- The plant will be excavated taking as much of the root ball as possible and replanted immediately.

Mitigation

- For every elderberry shrub trimmed the Corps will create the same area of valley elderberry longhorn beetle habitat or purchase mitigation credits at a valley elderberry longhorn beetle conservation bank. When the Corps creates habitat for the beetle they will coordinate with the Service to ensure appropriate site selection, planting plan, long-term protection, and long-term funding for maintenance and monitoring.
- For every elderberry shrub that is transplanted the Corps will mitigate at a 3:1 ratio for the loss of habitat. The Corps will coordinate with the Service to ensure appropriate site selection, planting plan, long-term protection, and long-term funding for maintenance and monitoring are created for the site. Conversely, the Corps could purchase credits at a valley elderberry longhorn beetle conservation bank.

Giant Garter Snake Conservation Measures

The following measures will be implemented to minimize effects on giant garter snake habitat that occurs within construction activity:

- Unless approved otherwise by the Service, construction in or near giant garter snake habitat will be initiated only during the giant garter snake's active period (May 1–October 1, when they are better able to move away from disturbance).
- Construction personnel will participate in a Service-approved worker environmental awareness program describing the status of the snake identifying giant garter snake habitat avoidance areas. This should also include a discussion of the possible penalties for not complying with avoidance and minimization measures.
- Within 24 hours prior to commencement of construction activities, the site will be inspected by a qualified biologist approved by the Service. The biologist will provide the Service with a field report documenting the monitoring effort that occurred within 24 hours of commencement of construction activities. During construction, the biologist will be available; if a snake is encountered, the biologist will immediately report any incidental take to the Service.
- Giant garter snakes encountered during construction activities will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat.
- Giant garter snake habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel.
- Equipment should be checked daily to ensure that giant garter snakes are not on any part of the equipment.

Compensation for Habitat Disturbance

- Habitat (including aquatic and upland) temporarily impacted for one season (May 1–October 1) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants.
- Habitat affected for two seasons will be replaced on-site and compensated off-site at a 1:1 ratio. Habitat affected for more than two seasons will be replaced on-site and compensated off-site at a 2:1 ratio. Permanently affected habitat will be compensated at a ratio of 3:1 off-

site.

- Replacement habitats will typically include both upland and aquatic habitat components.
- One year of monitoring will be conducted for all restored areas. Five years of monitoring will be conducted for newly created on-site or off-site habitat features. A monitoring report with photo documentation will be due to the Service each year following implementation of restoration or habitat creation activities.
- The Corps will work to develop appropriate mitigation prior to any disturbance of giant garter snake habitat.

Western Yellow-Billed Cuckoo Conservation Measures

The following measures will be implemented to minimize effects on western yellow-billed cuckoos and their habitat within the construction area:

- In areas where suitable habitat exists in the project footprint or within 500 feet of the project area, work will occur between October 1 and June 1 to avoid affecting nesting and migrating cuckoos.
- Where work must occur between May 1 and September 1 in suitable habitat, surveys will be conducted by a biologist with a federal recovery permit to determine if cuckoos are in or near the project area.
- If cuckoo activity is detected in the survey area, no-disturbance buffers will be established around the cuckoo habitat to avoid disturbance or destruction of the habitat until the end of the breeding season (about September 1) or until a qualified wildlife biologist determines that the bird has moved out of the project area. The extent of the buffers will be determined by the biologists in coordination with the Service and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers.
- The permanent loss of nesting habitat for the yellow-billed cuckoo will be either creating habitat for the cuckoo or purchasing credits at a Service-approved conservation bank at a 3:1 ratio. Potential mitigation actions include:

    - Prioritizing the construction of setback levees or adjacent levees to the extent possible to minimize effects to adjacent riparian habitat and provide increased space for lateral migration of the river channel and allow for dynamic riverine processes to occur.
    - Protecting existing vegetation in place and plant vegetation on-site.
    - Purchase of inter-levee farmland and conversion to riparian woodland forest where channel migration is occurring to increase availability of suitable habitat for the cuckoo.
    - Exploring available options to remove existing revetment on banks or levees located within cuckoo proposed critical habitat areas to the extent possible consistent with the Corps policies and regulations. This will allow channel migration to occur and restore riverine processes important for the cuckoo.
    - Conduct off-site mitigation by purchasing credits from a mitigation bank or by participating in an in-lieu fee compensatory mitigation program.

Monitoring Plan

The Corps shall submit a detailed monitoring plan for on- and off-site habitat mitigation for each individual site as part of the request to tier off of the PBO. The monitoring plan will include, at a minimum: (1) monitoring methods, performance standards for SAM variables, and success criteria for riparian vegetation and SRA cover; and (2) a protocol for implementing remedial actions should any success criteria not be met. The monitoring plan will follow the protocol presented in the *Vegetation and Habitat Monitoring Methodology Protocol for Sacramento River Bank Protection Project* (SRBPP) Sites, which was developed through collaborative discussion with the Corps, Gulf South Research Corporation, CVFPB, the Service, and the Sacramento Area Flood Control Agency. The monitoring plan will be reviewed to ensure it is adequately measuring performance standards for all listed species including valley elderberry longhorn beetle, giant garter snake, and western yellow-billed cuckoo.

An annual monitoring report that evaluates how the site meets the mitigation success criteria will be submitted to the resource agencies by December of each year. Monitoring will be conducted until the projected benefits of mitigation actions are either substantially confirmed or discounted.

To ensure that on-site and off-site habitat features that were designed to specifically benefit federally protected fish species are functioning as intended, fishery monitoring efforts will be reported separately from the monitoring efforts described above. Fisheries monitoring efforts have been conducted since 2005 and efforts are still ongoing in coordination with the resource agencies. These efforts will provide key information about habitat utilization by key fish species within the project area and will continue to help determine the effects of SRBPP bank protection actions. Yearly adjustments and expansion of the fisheries monitoring plan to include new repair sites or control reaches will be made through the IWG; the Corps will submit a draft monitoring plan to the Service and NMFS by November 30 of each year and draft monitoring report will be submitted to the Services by December 30 of each year for the duration of the agreed-upon monitoring term for each site.

Once the site establishment monitoring requirements have been monitoring term is over, the site will be turned over to the local maintaining agency for long-term operations and maintenance as specified in supplements to the appropriate operations and maintenance manuals.

Additional Minimization and Conservation Measures

The Corps will avoid and minimize construction effects on listed species and their critical habitat to the extent feasible. A number of measures will be applied to the entire project or specific actions, and other measures may be appropriate at specific locations within the action area. Avoidance and minimization activities to be implemented during final design and construction may include, but are not limited to, the following:

- Where feasible, preventative measures to treat failure mechanisms that minimize project size.
- Identifying all habitats containing, or with a substantial possibility of containing, listed terrestrial, wetland, and plant species in the potentially affected project areas.
- Minimizing effects by modifying engineering design to avoid potential direct and indirect effects, limiting vegetation removal to the extent feasible, limiting site access to the smallest area possible, and limiting to the extent possible, grubbing and contouring activities.
- Incorporating sensitive habitat information into project bid specifications.
- Incorporating requirements for contractors to avoid identified sensitive habitats into project bid specifications.
- Whenever possible, placing fill materials with no excavation or movement of existing materials on site.
- Stockpiling of construction materials such as portable equipment, vehicles, and supplies, including chemicals, at designated construction staging areas and barges, exclusive of any riparian and wetlands areas.

- Erosion control measures (best management practices [BMPs]) that minimize soil or sediment from entering the river. BMPs shall be installed, monitored for effectiveness, and maintained throughout construction operations.
- Daily removal of all litter, debris, unused materials, equipment, and supplies from the project area. Such materials or waste will be deposited at an appropriate disposal or storage site.
- Immediate (within 24 hours) cleanup and reporting of any spills of hazardous materials to the resource agencies. Any such spills, and the success of the efforts to clean them up, shall also be reported in post-construction compliance reports.
- Ensuring all construction activities, including clearing, pruning, and trimming of vegetation, is supervised by a qualified biologist to ensure these activities have a minimal effect on natural resources.
- Designating a Corps-appointed biological representative as the point-of-contact for any contractor who might incidentally take a living, or find a dead, injured, or entrapped threatened or endangered species. This representative shall be identified to the employees and contractors during an all-employee education program conducted by the Corps.
- An on-site inspection tour, led by the Corps' biologist/environmental manager or contractor, if requested by the Service or NMFS personnel or other resource agencies, during or upon completion of construction activities.
- Screening any water pump intakes as specified by NMFS and Service screening specifications. Water pumps will maintain an approach velocity of 0.2 feet per second or less when working in areas that may support delta smelt.
- A Corps representative assigned to work closely with the contractor(s) through all construction stages, to ensure that any living riparian vegetation or IWM within vegetation clearing zones is avoided and left undisturbed to the extent feasible.
- If a cofferdam is needed during construction, constructing it by placing the sheet piles sequentially from the upstream to the downstream limits of the construction area. If substrate, cover, and water depths allow, seining will be conducted within the cofferdam with a small-mesh seine to remove as many fish as possible before the cofferdam is closed; upon completion of seining, exclusionary nets will be placed in the river to prevent fish from re-entering the dammed area. Once the cofferdam is closed the area will be partially dewatered, and a final seining and dip netting effort will be conducted to capture any remaining fish. Only low-flow pumps with screened intakes will be used during dewatering operations. Any captured fish will be released downstream of the construction area.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." For the proposed project, the action area encompasses the seven economically-justified basins specifically identified in Table 1 as well as areas used for staging, borrow, and haul routes. The lateral extent of the action area as it relates to wildlife species varies by bank protection measure, but is generally assumed to include the entire width of each bank protection measure to the extent that habitat for protected species is present. For aquatic species, the lateral action area is assumed to be the near-shore aquatic environment up to the ordinary high water mark, and including adjacent terrestrial habitat of value to protected aquatic species (e.g., overhanging shade).

Analytical Framework for the Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed federal action, and any cumulative effects, on the rangewide survival and recovery of the listed species. It relies on four components: (1) the *Status of the Species,* which describes the rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline,* which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the *Effects of the Action,* which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the species; and (4) the *Cumulative Effects,* which evaluates the effects of future, non-federal activities in the action area on the species.

Analytical Framework Adverse Modification

Section 7(a)(2) of the ESA requires that federal agencies insure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification" (DAM) was published on February 11, 2016 (81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states:

1. "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The DAM analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat,* which describes the range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, primary constituent elements, or physical and biological features) that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the *Environmental Baseline,* which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the *Effects of the Action,* which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and (4) *Cumulative Effects,* which evaluate the effects of future non-federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

For purposes of making the DAM determination, the Service evaluates if the effects of the proposed federal action, taken together with cumulative effects, are likely to impair or preclude the capacity of critical habitat in the action area to serve its intended conservation function to an extent that appreciably diminishes the rangewide value of critical habitat for the conservation of the listed species. The key to making that finding is understanding the value (i.e., the role) of the critical habitat in the action area for the conservation/recovery of the listed species based on the *Environmental Baseline* analysis.

Status of the Species

Valley Elderberry Longhorn Beetle

For the most recent comprehensive assessment of the species' range-wide status, please refer to the *Withdrawl of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened Wildlife* (Service 2014a). Ongoing threats to the valley elderberry longhorn beetle include habitat loss due to flood control projects, development projects, and invasive species. While these threats continue to affect the valley elderberry longhorn beetle within the Sacramento Valley, to date no project has proposed a level of effects for which the Service has issued a biological opinion of jeopardy for the valley elderberry longhorn beetle.

Delta Smelt

For the most recent comprehensive assessment of the species' range-wide status, please refer to page 6 of the 2010 delta smelt 5 year review (Service 2016b) and page 87264 of the 2016 Candidate Notice of Review of the status of the species (Service 2016c). Electronic copies of these documents are available at Http://ecos.fws.gov/docs/five_year_review/doc3570.pdf and https://www.gpo.gov/fdsys/pkg/FR-2016-12-02/pdf/2016-28817pdf.

Currently, the spawning stock of delta smelt appears to be at its second lowest abundance on record, the lowest having been recorded during Water Year 2016 (Table 6). The 2016 Fall Midwater Trawl (FMWT) Index was 8, the second lowest value on record. The CDFW Spring Kodiak Trawl (SKT) monitors the adult spawning stock of delta smelt and serves as an indication for the relative number and distribution of spawners in the system. The Service has calculated an absolute abundance estimate for adult spawners in water year 2017 using January and February SKT data. This absolute abundance estimate is also the second lowest on record (Table 6). The population size of adult delta smelt January-February (2017) was estimated to be between 22,000 and 92,000 fish with a point estimate of 47,786. The January-February (2016) point estimates were the lowest values since 2002 and suggested delta smelt experienced increased mortality during extreme drought conditions occurring during 2013-2015. While 2017 estimates likely represent an increase in recruitment and survival from the prior year, the continued low parental stock of delta smelt relative to historical numbers suggest the population will continue to be vulnerable to stochastic events and operational changes that may occur in response until successive years of increased population growth result in a substantial increase of abundance.

Table 6 shows various indices for waters years from 2002 to 2017. Column 2 is the CDFW FMWT by water year (i.e., the indices for calendar years 2001-2016). Column 3 is the CDFW SKT Index. Column 4 is an estimate of adult delta smelt abundance during January and February that the Service calculates from the SKT Survey.

Delta Smelt Critical Habitat
The Service designated critical habitat for the delta smelt on December 19, 1994 (Service 1994). The geographic area encompassed by the designation includes all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the legal Delta (as defined in section 12220 of the California Water Code).

In designating critical habitat for the delta smelt, the Service identified the following primary constituent elements (PCEs) essential to the conservation of the species:

Primary Constituent Element 1: "Physical habitat" is defined as the structural components of habitat. Because delta smelt is a pelagic fish, spawning substrate is the only known important structural component of habitat. It is possible that depth variation is an important structural characteristic of pelagic habitat that helps fish maintain position within the estuary's low-salinity zone (LSZ) (Bennett *et al.* 2002, Hobbs *et al.* 2006).

Primary Constituent Element 2: "Water" is defined as water of suitable quality to support various delta smelt life stages with the abiotic elements that allow for survival and reproduction. Delta smelt inhabit open waters of the Delta and Suisun Bay. Certain conditions of temperature, turbidity, and food availability characterize suitable pelagic habitat for delta smelt. Factors such as high entrainment risk and contaminant exposure can degrade this PCE even when the basic water quality is consistent with suitable habitat.

Primary Constituent Element 3: "River flow" is defined as transport flow to facilitate spawning migrations and transport of offspring to LSZ rearing habitats. River flow includes both inflow to and outflow from the Delta, both of which influence the movement of migrating adult, larval, and juvenile delta smelt. Inflow, outflow, and Old and Middle Rivers flow influence the vulnerability of delta smelt larvae, juveniles, and adults to entrainment at Banks and Jones Pumping Plants. River flow interacts with the fourth primary constituent element, salinity, by influencing the extent and location of the highly productive LSZ where delta smelt rear.

Table 6. Three indicators of adult delta smelt status for water years 2002-2017.

Water Year	FMWT Index (unitless)	SKT Index (unitless)	January and February SKT Abundance Estimate (number of delta smelt) [Lower; Upper Confidence Interval]
2002	603	N/A	739,877 [506,889; 1,043,891]
2003	139	N/A	634,000 [340,811; 1,081,388]
2004	210	99.7	654,492 [370,200; 1,074,662]
2005	74	52.9	477,775 [308,015; 708,388]
2006	26	18.2	186,797 [133,663; 254,133]
2007	41	32.5	291,964 [155,148; 502,239]
2008	28	24.1	325,333 [147,533; 626,188]
2009	23	43.8	365,946 [151,439; 748,841]
2010	17	27.4	169,417 [106,837; 255,665]
2011	29	18.8	290,792 [99,502; 670,574]
2012	343	130.2	772,311 [420,904; 1,303,955]
2013	42	20.4	212,504 [95,804; 410,659]
2014	18	30.1	207,595 [110,373; 356,969]
2015	9	13.8	139,310 [66,314; 259,301]
2016	7	1.8	16,159 [7,403; 30,886]

2017	8	3.8	47,786 [21,709; 91,864]

Primary Constituent Element 4: "Salinity" is defined as the LSZ nursery habitat. The LSZ is where freshwater transitions into brackish water; the LSZ is defined as 0.5-6.0 psu (parts per thousand salinity) (Kimmerer 2004). The 2 psu isohaline is a specific point within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby *et al.* 1995). By local convention the location of the LSZ is described in terms of the distance from the 2 psu isohaline to the Golden Gate Bridge (X2); X2 is an indicator of habitat suitability for many San Francisco Estuary organisms and is associated with variance in abundance of diverse components of the ecosystem (Jassby *et al.* 1995, Kimmerer 2002). The LSZ expands and moves downstream when river flows into the estuary are high. Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from San Pablo Bay (45 kilometers) to as far upstream as Rio Vista on the Sacramento River (95 kilometers). At all times of year, the location of X2 influences both the area and quality of habitat available for delta smelt to successfully complete their life cycle. In general, delta smelt habitat quality and surface area are greater when X2 is located in Suisun Bay. Both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence.

Giant Garter Snake

For the most recent assessment of the species' range-wide status please refer to the *Giant Garter Snake (Thamnophis gigas) 5-year Review: Summary and Evaluation* (Service 2012) for the current status of the species. Ongoing threats to giant garter snake include habitat loss from water transfers, rice fallowing due to drought conditions, habitat disturbance and loss from irrigation and drainage ditch maintenance, climate change, and invasive species. While these threats continue to effect the giant garter snake throughout its range, to date no project has proposed a level of effects for which the Service has issued a biological opinion of jeopardy for the giant garter snake.

Recent studies by USGS (Halstead *et al.* 2015) have bearing on the effects of the proposed project. It has been common knowledge that giant garter snakes spend half the year, roughly November to April, brumating in uplands. Review and analysis of previous giant garter snakes across the Sacramento Valley has shown that giant garter snakes spend more than half of the time during the summer in terrestrial environments. While in terrestrial habitat in the summer the snake is often underground, particularly during high temperatures. Animal burrows, brush piles, and riprap can be used as upland refugia in order to escape predation, thermoregulate, shed, and give birth. In his paper, Halstead found that the average giant garter snake is within 10 meters of aquatic habitat during the summer.

Western Yellow-Billed Cuckoo

For the most recent comprehensive assessment of the species' range-wide status, please refer to the October 3, 2014, *Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus occidentalis)* (79 FR 59991) (Service 2014b). Ongoing threats to the yellow-billed cuckoo include habitat loss from flood control projects and maintenance, alterations to hydrology, climate change, and invasive species. While these threats continue to affect the yellow-billed cuckoo throughout its range, no project, to date, has proposed a level of effects for which the Service has issued a biological opinion of jeopardy for the yellow-billed cuckoo.

Western Yellow-Billed Cuckoo Proposed Critical Habitat

The Service proposed critical habitat for the yellow-billed cuckoo on August 15, 2014 (79 FR 48548)(Service 2014c). Critical habitat was proposed in California, Nevada, Arizona, New Mexico, Texas, Idaho, Wyoming, Utah, and Colorado. Critical habitat is defined in section 3 of the Act as: (1) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species. In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b)). The Service is required to list the known PCEs together with the critical habitat description. Such physical and biological features include, but are not limited to, the following:

1. Space for individual and population growth, and for normal behavior;
2. Food, water, air, light, minerals, or other nutritional or physiological requirements;
3. Cover or shelter;
4. Sites for breeding, reproduction, rearing of offspring, or dispersal; and
5. Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The PCEs proposed for the yellow-billed cuckoo were derived from its biological needs. In designating critical habitat for the yellow-billed cuckoo, the Service identified the following primary constituent elements essential to the conservation of the species: riparian woodlands, adequate prey base, and dynamic riverine processes:

1. Riparian woodlands are defined as mixed willow-cottonwood vegetation, mesquite-thorn-forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are greater than 325 feet in width and 200 acres or more in extent. These habitat patches contain one or more nesting groves, which are generally willow-dominated, have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats.

2. Adequate prey base is defined as the presence of a prey base consisting of large insect fauna (for example cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas.

3. Dynamic riverine process is defined as hydrological processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). This allows habitat to regenerate at regular intervals, leading to riparian vegetation with variously aged patches from young to old.

Environmental Baseline

Valley Elderberry Longhorn Beetle

Elderberry shrubs, the host plant of the valley elderberry longhorn beetle occur in riparian habitat along the waterways within the SRBPP action area. Riparian habitat that includes elderberry shrubs exists in greater amounts along the Sacramento River north of the City of Colusa where the levees are setback but they are found sporadically along the remainder of the Sacramento River down to RM 0. Riparian habitat exists in fragmented patches along the Feather, Yuba, Bear, and American Rivers. There has not been a survey of riparian habitat specifically for areas that support elderberry shrubs. Habitat loss and fragmentation are the leading threats for the valley elderberry longhorn beetle within the action area. Lang *et al.* (1989) observed fewer numbers of elderberry shrubs in the lower reach (i.e., between Sacramento and Colusa) of the Sacramento River than the northern reach (i.e., Chico to Red Bluff). They attributed this difference to the loss of elderberry shrubs and riparian habitat in the southern reach as a result of extensive flood control activities such as the construction and maintenance of levees. The Central Valley Historic Mapping Project (CSUC 2003) observed similar decreases in the amount of riparian habitat. Loss of riparian habitat between 1900 and 1990 in the Central Valley was about 80% in the Sacramento Valley (Sacramento and Solano Counties to Shasta County) (96,000 acres remaining).

Channelization, levee construction, dam construction, and flood control maintenance has resulted in loss and degradation of riparian habitat within the Sacramento Valley. The remaining riparian areas tend to be narrow, fragmented, and lack natural river processes which sustain successional processes. Fragmentation has resulted in patchy distribution of valley elderberry longhorn beetles across their range. Fragmentation of habitat makes it difficult for the poorly dispersing valley elderberry longhorn beetle to colonize restored riparian habitat planted with elderberry shrubs. Past and current maintenance of the flood control system results in the removal of woody plants on levees, in the floodplain to allow for adequate capacity, and suppresses the recruitment of new habitat in the flood system because in many areas of the flood system newly recruited vegetation is prevented from establishing on the floodplain. Additionally, while at least 6,000 acres of riparian habitat have been restored along the Sacramento River (Golet *et al.* 2013), creating natural floodplain and riverine processes along dammed rivers has not been achieved. Previous phases of the SRBPP have resulted in the rocking of 837,500 LF of bank within the SRFCP. Placement of rock for erosion control has limited the ability of natural river processes to occur. Natural river processes serve to disturb senescent riparian habitat and create early successional riparian habitat. An additional factor responsible for the degradation of valley elderberry longhorn beetle habitat in the action area is pesticide use. Pesticide use on adjacent agricultural areas and flood control levees can kill or harm the elderberry plants nearby and may adversely affect the beetle itself if insecticides are applied.

The Recovery Plan for the Valley Elderberry Longhorn Beetle was written in 1984 (Service 1984). At the time of the writing of the recovery plan there was insufficient information on the life history, distribution, and habitat requirements of the valley elderberry longhorn beetle to determine actions necessary to achieve recovery. Only interim actions that will secure known populations are discussed in the recovery plan and the 1984 recovery plan did not include delisting criteria. To date the recovery plan has not been revised or updated.

Numerous valley elderberry longhorn beetle localities are documented in the California Natural Diversity Database (CNDDB 2017). Because of the programmatic nature of this biological opinion and the lack of site specificity for future erosion repairs, the Service at this point cannot delineate the extent of valley elderberry longhorn beetle habitat on sites that will be repaired under this PBO.

Given the number of documented occurrences within the SRBPP area it is likely that valley elderberry longhorn beetle habitat will occur on some of the erosion sites.

Delta Smelt and Critical Habitat

The proposed project occurs along the Sacramento River and its tributaries. Some of the action area falls within the range of the delta smelt. EJBs that are within delta smelt habitat include Natomas, Sacramento, West Sacramento, and Southport. These areas are on the upper end of the northern range for delta smelt. Beach seine data done along the banks of the Sacramento River between Isleton and the city of Sacramento suggests that delta smelt use the this portion of the river as a migratory corridor and spawning habitat. Because of the swift currents of the Sacramento River in the action area, larval and juvenile delta smelt are transported quickly downstream to outside of the action area. It is therefore unlikely that juvenile delta smelt rear in the action area. Delta smelt are typically absent from this area between August and November. Habitat conditions in the project area have been altered due to flood control, water operations, and drought. EJBs in delta smelt habitat are highly channelized with little to no floodplain. What little floodplain is present is typically a narrow band of vegetation on benches adjacent to the levees. Drought conditions and some drought management actions have decreased suitable and available aquatic habitat in the Delta for delta smelt breeding and survival, thereby reducing the overall population. Fish surveys indicate that the relative abundance of delta smelt is very low. In the last 5 years, the fall midwater trawl (FMWT), tow net survey (TNS), and 20 mm survey results have produced some of the lowest adult and larval delta smelt abundance indexes on record. The 2016 FMWT abundance index which determines the relative population status for the delta smelt was set at 8. The 2017 SKT index is 3.8, a modest increase from the record low of 1.8 in 2016. The SKT monitors the adult spawning stock of delta smelt. The Service has recently begun the Enhanced Delta Smelt Monitoring Program to estimate abundance of delta smelt.

The Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes was written in 1996 (Service 1996). The Service is in the process of revising the Recovery Plan for delta smelt. The Service has used the most up-to-date, best available information to outline the recovery needs of delta smelt. Based on information the Service has reviewed, the Service proposes that, in order to recover, delta smelt need a substantially more abundant population, an increase in the quantity and quality of habitat, and other needs such as increasing resilience to climate change, reducing aquatic invasive macrophytes, reducing cyanobacteria blooms, and reducing disease.

Giant Garter Snake

The action area for the project encompasses snake population within the Sacramento Valley. The areas within the action area that are covered in this biological opinion consist of waterways in the form of sloughs, drainage canals, and bypass canals which provide foraging opportunities, breeding, thermoregulation, cover, and movement corridors. Adjacent to these areas are the uplands which provide basking, cover, thermoregulation, and overwintering habitat. Giant garter snake populations within the action area are believed to be relatively stable compared to the San Joaquin Valley (Service 2012). However the populations with the action area are still affected by the following threats. Urbanization in the Sacramento area, Yuba City/Marysville area, and Chico area has reduced the amount of habitat available for the giant garter snake. Rice fields in the Sacramento Valley have provided an alternate habitat for lost wetland habitat. Urbanization has resulted in the loss of rice agriculture near the above urbanizing areas. As the Sacramento Valley's population continues to grow, land use changes in the form of rice conversion are expected to continue. Previous flood control projects and the maintenance of these features can result in mortality to giant garter snakes (Hansen 1988, Brode and Hansen 1992, Hansen and Brode 1993). Maintenance activities can fragment and isolate giant garter snake habitat, prevent dispersal, and reduce availability of cover and overwintering sites. Clearing, scraping and/or re-contouring canals, ditches, and levees, destroys burrows and crevices that are used as over-wintering habitat and during the summer for thermoregulation, shedding, and giving birth. These activities are being conducted by local maintaining agencies throughout the action area. The Small Erosion Repair Program is an existing maintenance program in which DWR repairs small levee erosion projects. This project can repair up to 15,000 LF of levee per year for a 5-year period. This program incorporates on-site plantings to minimize long term effects to giant garter snake habitat.

Agricultural practices and waterways, while providing alternative habitat when farmed in rice, can also negatively affect giant garter snakes through waterway maintenance, weed abatement, discharge of contaminants into waterways, water transfers, and crop rotations. Loss of rice has been shown to reduce or exclude giant garter snakes compared to areas which are actively irrigated in rice (Wylie *et al.* 2002a, b, 2004). One of the other effects of rice fallowing is the dewatering of adjacent and nearby ditches that snakes may use as foraging habitat and movement corridors. Other factors which effect the giant garter snake population in the action area include vehicular mortality particularly where canals or aquatic habitat are bordered by roads such as the crown of the levees.

The *Recovery Plan for the Giant Garter Snake* (Service 2017) subdivided the range of the species into nine recovery units that also define nine genetically unique populations. The action area for the proposed project is located within the Colusa Basin, Sutter Basin, Butte Basin, American Basin, and Delta Basin recovery units. Recovery criteria for the giant garter snake involves creating and protecting a minimum number of habitat block pairs that are all connected hydrologically within each recovery unit and between recovery units. Features in the action area can support recovery by providing movement corridors between the populations. These waterways include: Yolo Bypass, Willow Slough Bypass, Sacramento Bypass, Knights Landing Ridge Cut, Natomas East Main Drain, Natomas Cross Canal, Coon Creek Interceptor Unit 6, Colusa Basin Drain, Sutter Bypass, Tisdale Bypass, Wadsworth Canal, Colusa Bypass, Cherokee Canal, and Butte Creek. These waterways in the action area provide important aquatic and upland habitat for snakes in areas with otherwise limited habitat and can serve as movement corridors for the snake.

Previous SRBPP have affected giant garter snake habitat. Erosion protection along the Colusa Basin Drain included monitoring by USGS (Wylie and Amarello 2008) to look at effects of three different bank stabilization treatment sections on giant garter snakes. Monitoring in 2006 found more snakes along the control section of levee than along any of the treatment sites. Of the treatment sites more snakes were found along the section with soil covered rock planted in native grasses. Snakes did use the solely rock/riprap, though at lesser numbers.

Western Yellow-Billed Cuckoo

Yellow-billed cuckoo detections have occurred most frequently in the upper Sacramento River where levees are setback from the river or do not exist and riparian habitat is present in large contiguous areas. The large historic loss of riparian habitat in the Central Valley has contributed to the decline of yellow-billed cuckoos in the Central Valley. Cuckoos have been extirpated from the San Joaquin Valley and current surveys have detected the lowest numbers ever in the Sacramento Valley (Dettling *et al.* 2015). While there has been some level of restoration done along the Sacramento River, a little over 6,000 acres as of 2012 (Golet *et al.* 2013), it is possible that the long-term loss of riparian habitat within the Central Valley and the resultant decline in population numbers cannot be offset with the amount of riparian restoration done to date. Additional threats to the cuckoo in the action area include the change in river processes due to the construction of large dams on the mainstem rivers in the Sacramento Valley and construction of levees adjacent to the bank of the river channel which does not allow for natural river processes of accretion and erosion. Control of water releases from the dams have lowered sediment supply to downstream reaches of rivers through holding sediment behind dams, changed when water is released causing the loss of spring pulses which are important for establishing native riparian habitat particularly cottonwood forests, releasing water in the summer months for irrigation purposes where historically flows were reduced, which allowed floodplains plant species to reestablish and grow, and diverting water for agricultural and municipal purposes which reduces streamflow and disallows for activation of floodplains. Erosion protection projects such as the previous phases of the SRBPP have been active since the 1960s. Flood control levees were placed close to the river banks to facilitate the transport of hydraulic mining debris. This has resulted in long-term erosion issues for the levees. Typical erosion protection involves the placement of rock rip on the bank and levee to prevent the channel from moving. Channel meander is important in the development of new riparian habitat. As older stands of riparian forest erode away through channel migration, younger stages of habitat begin to develop on accreted point bars within the river. When these natural river processes do not occur due to flood control structures, habitat does not regenerate and the riparian habitat reaches senescence with no opportunity for renewal. Long-term this will cause a decline in the habitat that yellow-billed cuckoo use for breeding.

An additional threat to yellow-billed cuckoo in the action area includes the habitat loss and degradation due to agricultural activities. In the Sacramento Valley large areas of historic floodplain have been converted to agriculture. Conversion of habitat within the last 20 to 30 years to agriculture has slowed considerably, however the operation of existing agriculture continues to affect yellow-billed cuckoos. Overspray of pesticides onto foraging habitat or pesticide drift onto surrounding riparian areas may affect prey populations. Yellow-billed cuckoos may forgo breeding in years of inadequate food supplies (Veit and Petersen 1993) which effects reproductive success.

A recovery plan has not yet been developed for the recently listed yellow-billed cuckoo. Over the last 20 years a large amount of riparian restoration has occurred in the upper Sacramento River. Habitat in the action area various from narrow and linear strips of riparian to larger tracts of floodplain riparian habitat. Above Colusa on the Sacramento and along some of the Feather River the levee is setback from the river channel allowing for the larger patches of riparian habitat that cuckoos use for breeding. Less restoration has occurred on the very constrained lower portion of the Sacramento River. There are some patches large enough to support nesting yellow-billed cuckoos, though cuckoos have not been observed nesting along the American River.

Yellow-Billed Cuckoo Proposed Critical Habitat

The action area for the proposed project is located within the yellow-billed cuckoo's proposed critical habitat Unit 2: CA-2, Sacramento River. The Sacramento River unit is about 35,418 acres and is located along the Sacramento River through Colusa, Glenn, Butte, and Tehama Counties. This unit has served as a major nesting area in the recent past along a predominately active reach of the river (PCE-1 and 3). Given the previous nest success within this unit it must also provide an adequate prey base (PCE-2). The unit is an important area to maintain for occupancy during species recovery.

Areas within critical habitat that will be affected by the project include riparian habitat that occurs at along the waterside toe of the levee or on the levee itself along the Unit 2's section of the Sacramento River. This riparian habitat could contain one or all of the three PCEs. Threats to the critical habitat in these units include bank stabilization, levee maintenance, and pesticide drift from adjacent agricultural activities.

Effects of the Proposed Action

Valley Elderberry Longhorn Beetle

Valley elderberry longhorn beetle may be affected by the bank protection projects when elderberry shrubs are present on the repair site with any of the bank protection measures. Valley elderberry longhorn beetles inhabiting elderberry shrubs that are present on project sites will be affected during construction. If present in the erosion repair footprint elderberry shrubs will either be transplanted, protected in place, or, if deemed unsafe for transplantation, destroyed on-site. Transplanting or destroying elderberry shrubs will cause mortality of the beetle because the beetle spends the majority of its life cycle in the shrub. Over the long-term even shrubs that are left in place may suffer from reduced viability due to the placement of bank protection materials near their roots. While conservation measures include restoring and creating additional riparian habitat both on-site and off-site, elderberry seedlings require 5 or more years to become large enough to provide habitat for the beetle.

Removal of elderberry shrubs from the repair sites could also lead to further degradation and of habitat and fragmentation of beetle populations. Since floodplain along the Sacramento River near the Cities of Sacramento and West Sacramento is very narrow and confined by levees very little riparian vegetation remains in that area. This is also the case along other parts of the Sacramento River and on some of the tributaries in the SRBPP. Additionally, levee maintenance over the preceding decades has removed and suppressed much of the riparian habitat, including elderberry shrubs, creating areas with no riparian habitat. Because valley elderberry longhorn beetles do not disperse far (they are relatively poor fliers) removal of individual elderberry shrubs can isolate elderberry populations through habitat fragmentation and eventually cause site extirpation of valley elderberry longhorn beetles.

The Corps has proposed a number of conservation measures to minimize effects to the valley elderberry longhorn beetle and its habitat. Reducing footprints and leaving shrubs in place through on-site protection and use of trimming will reduce habitat fragmentation. In cases where elderberry shrubs cannot remain in place the Corps is proposing to transplant elderberry shrubs to a valley elderberry longhorn beetle conservation bank. The Corps has also proposed to purchase additional acres at a valley elderberry longhorn beetle conservation bank for the transplanting and trimming of elderberry shrubs. The purchase of credits will have the effect of protecting and managing lands for valley elderberry longhorn beetle in perpetuity. The compensatory lands will provide suitable habitat for breeding, feeding, and sheltering commensurate with or better than habitat lost as a result of the proposed project. Providing this compensatory habitat as part of a relatively large, contiguous block of conserved land may contribute to other recovery efforts for the species. The Corps proposes to minimize effects to elderberry habitat connectivity by limiting the number of elderberry shrubs that are removed on a bank protection site.

Valley Elderberry Longhorn Beetle Critical Habitat

Critical habitat for the valley elderberry longhorn beetle was designated at two locations along the lower American River. One location does not have any SRFCP levees nearby and therefore will not be affected by any erosion protection projects, and the other site is on the landside of the levee which also will not be subject to bank protection. Therefore, the SRBPP will not affect valley elderberry longhorn beetle critical habitat.

Delta Smelt

Effects to delta smelt at an individual site depend on the type of bank protection measure used at the erosion site. The various bank protection measures which involve the placement of riprap will have similar effects to delta smelt. Construction of the repair site will be short-term in nature and since the Corps proposes to work when delta smelt are located further downstream and unlikely to be in construction footprint and therefore effected by construction. Placement of riprap can temporarily increase suspended sediment levels in the Sacramento River. BMPs implemented by the Corps and its contractor will minimize soil and sediment from entering the water through monitoring of water quality. Additionally, the Corps is proposing BMPs to minimize any hazardous material spill as described in their conservation measures. BMPs which will minimize any contaminant release will be fully described for each site when that site is requested to be appended to the PBO.

Riprap placement changes the substrate from natural soil or sand to rock. Delta smelt use shallow open water (0 to 3 meters) areas for rearing and breeding. Changing the substrate can reduce spawning success of delta smelt when sandy beaches previously existed at the site. Eggs laid over riprap are more likely to fall into interstitial spaces precluding the egg from rolling along the substrate to hatch. While there will be a permanent change to the substrate by the placement of rock delta smelt will still be able to use the shallow water habitat for foraging. However, the placement of riprap has been known to attract predatory fish that can prey on delta smelt. Filling erosion sites with riprap creates a homogenous velocity that is typically higher since there isn't anything to break up the water velocities. As discussed in the environmental baseline for delta smelt above, adult delta smelt that migrate up the Sacramento River are likely using it as a migratory corridor and for spawning habitat. They typically use the edges of the channel where the velocities are slower. Once they have spawned, adults and larvae are likely transported downstream in the faster currents but do not use the Sacramento River between RM 45.5 and RM 80 as juvenile rearing habitat. With all of the placement of riprap in the last 40 years and the plans to place additional riprap along the Sacramento River from the Corps' West Sacramento Flood Control Project and American River Common Features Project spawning habitat for delta smelt in the action area is very sparse. Additionally, it changes from year to year depending on the flows and the amount of sediment in the water. While delta smelt do migrate within the action area, the Service believes that low numbers of delta smelt migrate this far upstream, therefore the SRBPP is expected to affect a small proportion of the population. The Corps is proposing to mitigate the effects of riprap placement through purchase of credits at a Service-approved delta smelt conservation bank. It is our expectation that compensatory mitigation will off-set the habitat effects.

Bank protection measures that involve constructing setback or adjacent levees will have a much lesser effect on delta smelt. Adjacent levees do not involve any in-water work and would therefore avoid any adverse effects to delta smelt. Setback levee construction may not involve in-water work. Some minor in-water work may occur when the old levee is either removed or breached to open the newly established floodplain to the river. Typically, in-water work is avoided as much as possible and work is conducted when river levels are low. The Corps will incorporate BMPs to minimize any sediment entering the rivers. Long-term there is a benefit to delta smelt when constructing setback levees. Opening up more land to the river will create habitat heterogeneity. New floodplain will become revegetated either naturally or through planting native species which will increase the productivity of the river. With the loss of so much floodplain and floodplain vegetation in the action area, any additional habitat will benefit delta smelt as well as other fish species by providing increased food in the system.

Delta Smelt Critical Habitat

The SRBPP will only affect PCE #1. The placement of rock or construction of setback or adjacent levees will not affect water (PCE#2), river flows (PCE #3), or salinity (PCE #4). PCE #1 is physical habitat and that is being changed either through a substrate change from natural bank and bed materials to riprap or through the creation of additional habitat with the construction of a setback levee. Because adjacent levees will not involve any waterside work, there will be no affect to delta smelt critical habitat with this bank protection measure.

Construction of a setback levee will benefit delta smelt critical habitat by providing more available habitat for delta smelt. This new area would be new critical habitat that is only inundated during high flows in the winter. Some water years the floodplain will not be activated. However, when it is activated it will provide additional primary productivity which will benefit delta smelt by increasing their prey base. It is not expected that delta smelt will use the new floodplain for spawning, though it is possible if large sandy beaches develop on part of the floodplain that they could spawn there during wet years. Given that fewer delta smelt disperse to the action area then other areas of the estuary it is not likely that it will have a large benefit to delta smelt spawning.

Placement of rock will change the substrate of the physical habitat which will result in a loss of up to 15,000 LF (2.8 miles) of shallow water habitat. It is impossible to determine how much of the 2.8 miles of shallow water habitat has substrate that is suitable for spawning for delta smelt, especially as the substrate can change from year to year as the various water years move sediment around the river channel. The Corps is proposing to mitigate for all shallow water habitat affected from placement of riprap at a Service-approved delta smelt conservation bank. Current conservation banks are located in vicinity of Liberty Island in an area of high delta smelt concentrations and will minimize the loss of critical habitat from the riprap placement.

Giant Garter Snake
Portions of Rio Oso, Butte Basin, Yolo, West Sacramento, and Southport economically justified basins have habitat which can support the giant garter snake. Snakes have been identified in Yolo, and Sacramento Bypasses, Cherokee Canal, Knights Landing Ridge Cut, Natomas East Main Drain, Natomas Cross Canal, Yankee Slough, Pleasant Grove Canal, Coon Creek Intercept, Butte Slough, and Butte Creek. Snakes are generally not found on major rivers such as the Sacramento River due to the presence of riparian vegetation and predatory fish, which means it is possible that some project repair sites will not affect giant garter snakes or their habitat. Sites will be assessed in the planning phase for giant garter snake habitat. Either upland or aquatic habitat could be affected due to construction at the repair site, use of haul routes, and staging areas.

Bank protection repairs that involve the placement of rock that have aquatic and upland giant garter snake habitat will be affected due to conversion of natural substrate to a rock substrate. This will limit the ability of some aquatic vegetation to establish. Aquatic habitat can provide cover not just for the giant garter snake but also for their prey base, small fish and tadpoles. Snakes have been observed using riprap in upland habitat as overwintering habitat though the inability for herbaceous cover to establish, exposes the snake to increased predation. Therefore the change in substrate is still usable by the snake but at a diminished capacity. The earthmoving work that occurs when applying rock to an erosion site can crush burrows in uplands that snakes use both in winter and summer. Filling and/or crushing of burrows can both kill snakes that are in underground but also temporarily remove overwintering and refugia habitat for the snake. This is especially damaging to snakes within 10 meters of aquatic habitat as that is where snakes can predominantly be found when using upland refugia.

Use of haul roads and staging areas can also adversely affect giant garter snakes. Fuel or oil spills during construction can lead to loss of prey. Snakes may be crushed or entombed due to construction equipment movement. Increased traffic on roads can crush snakes that may be basking. Construction and staging areas can cause snakes to change movement patterns as portions of their habitat are not available for their use. This can expose them to increased risk of predation.

Upon completion of construction the upland habitat on site will be restored. Rock will be covered with soil above the ordinary high water mark and then seeded with grasses and forbs which will provide cover for the snake when moving through the upland. Over time it is likely that cracks and burrows will form on the levee surface and will provide refugia habitat for the snake.

Bank Protection Measures 1 and 3 involve building either a setback levee or an adjacent levee. While it is unclear how many of these will be built, these measures can adversely affect giant garter snake through the conversion of habitat. Typically a setback levee would convert the most giant garter snake habitat. If aquatic habitat is present on the landside of the levee in the form of emergent wetlands, rice, or canals these would be converted to either levee or floodplain. Snakes evolved with flooding, however current flood control systems have created areas that can flood quickly and deeply. Historically flooding was spread out over the valley. Therefore, converting upland or aquatic giant garter snake habitat is likely to adversely affect snakes as flooding occurs during brumation when snakes are less mobile. Snakes do not use habitat that is flooded frequently. The earthmoving activities, haul roads, and staging areas necessary for these two alternatives will have the same effects as described for the riprap bank protection measures.

The SRBPP will affect relatively small amounts of habitat over a large area within the range of the giant garter snake. This has the potential to affect connectivity that the snake relies on to disperse and move between populations. The draft recovery plan relies on some of the same waterways that are covered in this PBO for movement corridors, such as: Butte Creek; Cherokee Canal; and Knight's Landing Ridge Cut. Implementation of the bank protection measures will not remove habitat along any of the above movement corridors. Bank protection measures on these creeks and canals will likely involve measures which involve riprap. While riprap could lessen the value of the upland because snakes are more susceptible to predators, it can still function as brumation habitat and provide thermoregulation for the snake which means the waterways will still be utilized by the snake for dispersal and migration. Lands affected due to setback or adjacent levees, or as staging areas or haul routes will either be mitigated for at a Service-approved conservation bank or only temporarily affected and returned to pre-project conditions.

Conservation measures proposed by the Corps will minimize effects to the giant garter snake. Working between May 1 and October 1, when the snake is more active, will allow some snakes to move out of the construction area. Permanent habitat effects will be mitigated for as described in the conservation measures. Compensatory lands will provide suitable habitat for breeding, feeding, and sheltering commensurate with or better than habitat lost as a result of the proposed project. Providing this compensatory habitat as part of a relatively large, contiguous block of conserved land may contribute to other recovery efforts for the giant garter snake.

Western Yellow-Billed Cuckoo

Bank protection measures involving riprap placement will adversely affect yellow-billed cuckoo. Riprap placement limits or halts meandering which is a method to renew and replace riparian habitat which the yellow-billed cuckoo relies upon for breeding. This has led to much of the upper Sacramento River riparian habitat being older with less early successional habitat along the river. Adding additional rock along the river particularly between Butte Slough and Sacramento River RM

175 will further constrain the Sacramento River limiting habitat for the yellow-billed cuckoo. Under SRBPP placement of riprap typically removes a narrow bank of vegetation along the edge of the river. The Corps is proposing to construct outside of the nesting season for yellow-billed cuckoo (June through August) and should therefore avoid directly affecting yellow-billed cuckoos or their nests. Because the cuckoo nests in large habitat patches, removing a narrow band of habitat could have a relatively small effect to the overall habitat patch. The Corps will include an analysis of the effects to patch size when they consult on a site. If the vegetation removal reduces the habitat quality for nesting yellow-billed cuckoos through removal of either the area or width the mitigation proposed by the Corps will offset the larger habitat loss. The Corps has proposed a number of measures to mitigate for loss of yellow-billed cuckoo habitat. Given that it can take 10 to 20 years for riparian forest to mature to a state that the yellow-billed cuckoo can use it for nesting there will be a temporal loss of habitat for yellow-billed cuckoo. The Corps has proposed to provide a ratio of 3:1 mitigated acres to affected acres to offset the temporal effects. While it is uncertain where the future mitigation will occur the Corps has proposed to locate it in areas where active channel meandering is occurring to provide long-term riparian habitat renewal and allow for optimum prey production. Additionally, mitigation areas will follow current Service policy on mitigation including providing a conservation easement, long-term monitoring, maintenance, and funding of the site. Mitigation sites should be selected where they are either large enough to serve as nesting habitat or are contiguous with other riparian habitat to create a habitat patch that will support nesting yellow-billed cuckoos.

Riparian habitat along the Sacramento River downstream of Butte Slough, and along the American River still has potential to be used as migratory stopover habitat. This habitat is used for feeding, resting, and sheltering. It is unknown at this time how much riparian habitat will be removed due to riprap placement, but the Corps intends to protect vegetation in place on the sites and mitigate the loss of any woody riparian off-site, which over the long-term will replace loss yellow-billed cuckoo habitat.

Construction of setback and adjacent levees could have short-term negative effects to yellow-billed cuckoos. Adjacent levee construction can result in the removal of riparian vegetation that could be used for migratory stopover habitat or if could be part of a larger riparian patch that is used for breeding. As with riprap placement the Corps is proposing to mitigate the loss of riparian habitat either on-site or off-site. Mitigation sites will be selected which increase riparian habitat connectivity and/or patch sizes to benefit yellow-billed cuckoo. Because setback levees create additional floodplain habitat they are a long-term benefit for yellow-billed cuckoos particularly when the setback is large enough to allow for the river to meander and the floodplain is inundated fairly frequently in order to distribute fine sediments which aid in regeneration of riparian vegetation. However there can be short-term adverse effects to yellow-billed cuckoo habitat. If riparian vegetation exists in the footprint of the setback levee, this will be removed to allow for construction. This will be off-set through the planting of the floodplain area in riparian habitat that the cuckoo can use for foraging, sheltering, and breeding. Having riparian vegetation in the floodplain is likely to be beneficial for the cuckoo as the prey they rely reach high densities in moist sites as opposed to arid or dry sites.

Proposed Yellow-Billed Cuckoo Critical Habitat

Areas with the action area that fall within proposed critical habitat for the cuckoo include the east bank of the Sacramento River north of Colusa (about RM 145) to the end of the levee system (RM 176). This reach of levee is located in Unit 2 of the proposed yellow-billed cuckoo critical habitat. As noted above there are three PCEs specific to western yellow-billed cuckoos. The SRBPP will affect PCEs 1 and 3. Construction of the repairs will remove riparian woodland vegetation. However, because of the nature of the SRBPP erosion repairs are made where the river has meandered close to or within the levee prism. In general this means that only a narrow band of vegetation is affected when any of the BPMs are employed. For all BPMs except BPM 2 the erosion repair or setback levee will plant vegetation once construction of the site is completed. And in areas where riparian vegetation is not replaced it will be mitigated off-site on areas that do not currently support riparian habitat. Therefore, the SRBPP will not adversely modify this PCE.

BMPs such as the adjacent and setback levee will not affect PCE #3, dynamic river processes. All of the BMPs that include rock placement will negatively affect dynamic river processes as the placement of riprap does not allow the river to move across the landscape moving sediment, and promoting plant growth. The setback and adjacent levee BMPs will allow dynamic river processes to continue as they currently exist. Placement of riprap will stop erosional forces that are allowing the river to migrate across the floodplain. River migration allows for the renewal of riparian vegetation through the erosion of older vegetation and allows for accretion of sediment which over time becomes vegetated and becomes early succession riparian habitat. In an unconstrained river this will occur at regular intervals and constantly be regenerating riparian habitat that the cuckoos use for breeding. To mitigate the loss of dynamic river process the Corps is proposing mitigation measures including: removal riprap on other portions of the river and restoring riparian habitat in areas that it does not currently exist. The Corps is estimating that 5,000 LF of levee would be repaired with riprap BMPs as part of this programmatic opinion. This is out of 168,960 LF of levee within proposed yellow-billed cuckoo critical habitat on the east side of the Sacramento River and a total of 1,013,760 LF of river bank within all of Unit 2 on the Sacramento River. The 5,000 LF represents a very small amount of bank protection and will not adversely modify critical habitat.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Valley Elderberry Longhorn Beetle

State, local, and private actions which occur within the action area and effect valley elderberry longhorn beetle include agricultural activities, flood maintenance activities, and recreation. Elderberry shrubs adjacent to agricultural fields are exposed to pesticide drift. If insecticides are applied during the beetle's flight season it can cause the death of the beetle or disruption of its reproduction cycle. Levee and channel maintenance requires vegetation removal which can both remove elderberry shrubs and suppress their regeneration, limiting the areas that shrubs can grow. Additionally, many levee maintainers spray herbicides along the levee to kill vegetation in order to inspect levees. In urban areas recreational activities can affect valley elderberry longhorn beetle habitat. Fisherman have cut down shrubs to gain access to the rivers and fires started by people out on the river have spread and burned acres of habitat along the lower American River. All of these activities are expected to continue in the future.

Delta Smelt

In the action area the following actions affect delta smelt: agricultural practices; urbanization and industrialism; and greenhouse gas emissions. Agricultural practices introduce nitrogen, ammonium, and other nutrients into the watershed. Additionally, numerous pesticides and herbicides applied to the fields enter irrigation discharges and may negatively affect delta smelt reproductive success.

Urbanization in the cities of West Sacramento and Sacramento will result in an increase of contaminants such as pesticides, oil and gasoline, pharmaceuticals, and ammonia entering the Sacramento River. These contaminants may adversely affect delta smelt reproductive success, survival rates, and food supply.

It is extremely likely that human activities increasing greenhouse gases have caused global warming (Huber and Knutti 2012). A variety of climate models have been used to estimate warming projections and all project increasing global warming through the end of this century. Climate change will likely adversely affect delta smelt through sea level changes and overall wet and dry cycles which may result in changes to availability and distribution of habitat and prey, and/or increase numbers of predators, parasites, diseases, and non-native competitors.

Giant Garter Snake

Non-federal activities that affect the giant garter snake in the action area include agricultural practices and levee and canal maintenance. Agricultural practices such as pesticide application particularly in rice fields can affect snakes in the fields or the drainage canals which carry away the water. Additionally, rice markets change from year to year resulting with a changing amount of habitat available to the snake. Levee and canal maintenance can adversely affect giant garter snakes through direct contact such as removing sediment from canals. Many local landowners and reclamation districts then place the spoils on the adjacent uplands which is where the majority of snakes use upland habitat (within 10 meters of aquatic habitat) and become entombed in burrows. Additional levee maintenance such as mowing and burning can adversely affect giant garter snakes. Any earth moving activities along the levees within 200 feet of aquatic habitat could hurt or injure a giant garter snake. Traffic both from agricultural activities and levee maintenance has the potential to kill basking giant garter snakes. Filling of ground squirrel holes in levees by pumping grout into the hole will entomb giant garter snakes in the burrows.

Western Yellow-Billed Cuckoo

Activities that could affect yellow-billed cuckoos in the action area include creation of recreation trails, conversion of riparian to agriculture, and flood maintenance activities. Recreational trails can disturb or harass yellow-billed cuckoos when trails are located adjacent or within cuckoo breeding habitat. Construction equipment that is used for creation of the trail has the potential to disrupt nesting yellow-billed cuckoos. While a lot of the conversion of riparian to agriculture occurred early in the 20th century, there are still instances of landowners converting riparian habitat to agriculture particularly when certain crops such as nuts become more profitable. Agriculture adjacent to riparian habitat that could be used by the yellow-billed cuckoo also has the potential to affect the cuckoo and its habitat through the use of pesticides and drift of pesticides damaging both the riparian vegetation as well as the prey base of the cuckoo. Flood maintenance activities which primarily affect cuckoo include vegetation removal and suppression. DWR is responsible for keeping the floodways clear and open to maintain capacity and will remove vegetation or suppress vegetation in areas of limited capacity. This has resulted in discontinuous riparian habitat throughout the system.

Conclusion

Listed Species/Critical Habitat

After reviewing the current status of valley elderberry longhorn beetle, delta smelt, giant garter snake, and western yellow-billed cuckoo, the environmental baseline for the action area, the effects of the proposed Sacramento River Bank Protection Phase II 80,000 LF, and the cumulative effects, it is the Service's biological opinion that projects which meet the qualifications for this PBO are not likely to jeopardize the continued existence of the valley elderberry longhorn beetle, delta smelt, giant garter snake, and western yellow-billed cuckoo. The Service reached this conclusion because the project-related effects to the species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the species based on the minimization measures, the work windows proposed for construction, and the purchase of mitigation credits at conservation banks.

After reviewing the current status of designated critical habitat for the valley elderberry longhorn beetle and delta smelt, the environmental baseline for the action area, the effects of the proposed Sacramento River Bank Protection Phase II 80,000 LF, and the cumulative effects, it is the Service's biological opinion that the Sacramento River Bank Protection Phase II 80,000 LF, as proposed, is not likely to destroy or adversely modify designated critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of the valley elderberry longhorn beetle and delta smelt critical habitat to serve its intended conservation role for the species based on the following. The effects to critical habitat are small and discrete, relative to the entire area designated as critical habitat, and are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of the valley elderberry longhorn beetle and delta smelt.

Proposed Critical Habitat
After reviewing the current status of proposed critical habitat for the western yellow-billed cuckoo, the environmental baseline for the action area, the effects of the proposed Sacramento River Bank Protection Phase II 80,000 LF, and the cumulative effects, it is the Service's conference opinion that the Sacramento River Bank Protection Phase II 80,000 LF, as proposed, is not likely to destroy or adversely modify proposed critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of the western yellow-billed cuckoo critical habitat to serve its intended conservation role for the species based on the following. The effects to critical habitat are small and discrete, relative to the entire area designated as critical habitat, and are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of the western yellow-billed cuckoo.

INCIDENTAL TAKE STATEMENT

The proposed action addressed in this biological opinion conforms to a "framework programmatic action" as that term is defined at 50 CFR 402.02 of the implementing regulations for section 7. On that basis, no take is anticipated to be caused by the proposed action. Pursuant to the authority under 50 CFR 402.14(i)(6), an incidental take statement is not required at the programmatic level for such an action. Incidental take resulting from any action subsequently authorized, funded, or carried out under such a program will be addressed in subsequent section 7 consultation, as appropriate, on that action(s). For these reasons, no take exemption is provided herein for the proposed action.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. The Service recommends the Corps develop and implement restoration measures in areas designated in the Delta Fishes Recovery Plan (Service 1996). These include: develop additional habitat and vegetation zones within the Delta (particularly the Cache Slough Complex); restore marshland within the Delta; manage bypasses for fish; and develop and implement alternative levee maintenance practices such as the incorporation of natural river berms setback from current levee alignments.

2. The Corps, under the authority of section 7(a)(1) of the Act, should implement project which benefit the valley elderberry longhorn beetle, delta smelt, giant garter snake, and yellow-billed cuckoo. The Corps could make use of ecosystem restoration programs such as Section 1135 and 206 of the respective Water Resource Development Acts of 1986 and 1996.

3. The Corps should partner with CVFPB and implement projects which meet measurable objectives within the 2017 Conservation Strategy, an appendix to the 2017 Central Valley Flood Protection Plan. The Conservation Strategy was written to off-set flood projects as well as provide enhancements that would benefit species which have declined due to past flood protection projects.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation and conference on the SRBPP Phase II 80,000 LF Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service where discretionary federal agency involvement or control over the action has been retained or is authorized by law and:

(a) If the amount or extent of taking specified in the incidental take statement is exceeded;

(b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or

(d) If a new species is listed or critical habitat designated that may be affected by the identified action.

You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the critical habitat is designated. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project. After critical habitat is designated, reinitiation of consultation will occur.

If you have any questions regarding this biological opinion, please contact Jennifer Hobbs (jennifer_hobbs@fws.gov) or (916) 414-6541 or Doug Weinrich, Assistant Field Supervisor (douglas_weinrich@fws.gov) or (916) 414-6563 or both.

Sincerely,

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ec:
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Appendix B

Impacts to Swainson's Hawk

The Corps shall ensure the following measures are implemented to mitigate or avoid impacts to Swainson's hawks (*Buteo swainsoni*):

Conduct preconstruction surveys to determine if an active nest is within ½ mile of construction activities.

Avoid the removal of active Swainson's hawk nest trees until nestlings have fledged.

Provide a worker environmental awareness program.

Avoid any work within ½ mile of a nesting Swainson's hawk between March 1 and August 15, or until nestlings have fledged. If an active Swainson's hawk nest is found within ½ mile of the proposed work, consult CDFG for additional avoidance measures. Additional avoidance measures may include but are not limited to the following: a) a biological monitor to observe the nesting hawks for stressed/detrimental behavior that threatens nest success; b) if it is determined during construction that the birds appear stressed, the monitor will have authority to stop construction activities until it has been determined that the birds will not be harmed; c) construction will not commence until additional avoidance or mitigation measures are implemented that will ensure that the birds will not be harmed by construction activities. These measures will be coordinated and approved by CDFG and the monitor; and d) if no additional avoidance or mitigation measures can prevent harming the birds, construction will not commence until the chicks have fledged and can leave the area.

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U.S. Army Corps of Engineers Responses to Fish and Wildlife Coordination Act Report Recommendations for the Sacramento River Bank Protection Project Phase II

Responses to Recommendations

General Recommendations

Recommendation 1

The Service recommends that the Corps select Alternative 3 as their preferred alternative. The Service acknowledges that setback levees can be more costly and time intensive. However, given the lack of natural river processes, large decline in riparian and SRA habitats, and the benefits to flood protection, it would be worth the additional time and expense.

Response to Recommendation 1

The SRBPP site selection process includes evaluation of opportunities and constraints for each site along with hydraulic evaluation and other survey information to determine the most appropriate design that also fits within program authorization and policy guidelines. For each site, a full suite of design measures is considered, and the potential results and effects are analyzed in coordination with resource agencies and sponsors/districts. Typically, setback designs are always considered, but often not selected for several reasons. The SRBPP authorization requires erosion repair, and options are typically limited by economic considerations. However, there are other factors that can prevent a setback levee design from further consideration for a site. Erosion sites identified for repair are typically small (ranging from a few hundred feet to several thousand feet long), which can limit the effectiveness of a setback design in meeting project objectives and environmental objectives. A setback of this scale may also alter hydraulics and affect erosional processes. Although Alternative 3A (and Sub-Alternative 3B), “Minimize Habitat Impacts,” was not selected as the preferred alternative, the Corps will continue to consider setback designs and to seek opportunities to implement setbacks.

Recommendation 2

The Service recommends that the Corps, CVFPB, and DWR evaluate the existing system for long-term sustainability. This includes sustainability of the SRFCP System from a flood risk reduction perspective (lowering maintenance costs, preparing for climate change) and an ecosystem restoration perspective (providing more frequently inundated floodplain habitat and allowing natural river processes to continue). The current practice of site by site repair does not allow for system-wide benefits to occur.

Response to Recommendation 2

The SRBPP is authorized only to repair individual erosion sites to maintain the integrity and existing functionality of the SRFCP and beyond the scope and authorization of the SRBPP to address system-wide issues. The State is addressing long-term sustainability through the Central Valley Flood Protection Plan and 5-year updates.

Recommendation 3

The Service recommends the Corps continue the collaboration that has begun with the California Levee Vegetation Science Team to research the potential effects of woody vegetation on levee integrity by providing financial assistance and collaboration from the Corps' Engineering Research and Development Center.

Response to Recommendation 3

SRBPP will continue collaboration the DWR and ERDC on threats of vegetation to levee integrity and incorporating science into tree risk assessments for future repairs.

Recommendation 4

The Corps should work with the Service through the FWCA to analyze effects to fish, wildlife, and their habitat as the project proceeds and sites are selected for erosion repair.

Response to Recommendation 4

Resource agencies will continue to be engaged with SRBPP future sites through the Interagency Working Group.

River Processes Recommendations

Recommendation 5

The Corps should compensate for the loss of fluvial functioning which occurs with the armoring of banks by: building setback levees to reclaim floodplain habitat; providing areas for river meandering by purchasing lands adjacent the Sacramento River where either levees are not present or are already setback from the river; and removal of rock along sections of river where the levee is not threatened by erosion.

Response to Recommendation 5

The updated SBRPP Site Selection and Implementation Process described in EIR-S recognizes the need to protect environmental resources and allow natural processes to occur. As a result, there are several steps that incorporate conservation of environmental resources into the process. These include Step 5 (Identify Opportunities and Constraints) and Step 6 (Conceptual-Level Alternatives). Step 6 in particular involves evaluation of the feasibility of implementing a setback or an adjacent levee, either of which can allow natural river processes to continue. We can consider the various opportunities for protecting or restoring natural river processes, but only as an option for mitigation determined to be necessary. Many of the likely repair sites are located on armored lower reaches of the river where we are restoring the previous condition and function of the levee. Land purchases and rock removal opportunities are typically located in upper reaches of the Sacramento River. Specific to areas upstream of Colusa, this area currently does not contain economically justified basins. As a result, SRBPP would not implement projects in this reach. It should be noted that economic analyses are revisited approximately every 5 years and the status of individual basins could change.

Recommendation 6

The SRBPP should evaluate the river system, not just the individual sites, to determine if there are areas where a levee setback could repair multiple erosion sites. Less placement of rock would also lessen the need for future riprap maintenance. Additionally, this could also feed into the Central Valley Flood Protection Plan's Conservation Strategy goal of improving riverine geomorphic processes.

Response to Recommendation 6

The SRBPP is authorized only to repair individual erosion sites to maintain the integrity of the SRFCP. These sites are typically small (ranging from a few hundred to several thousand feet), and there are economic as well as environmental challenges involved in attempting setback levees at this scale. However, the Corps will continue to consider setback levees at each economically justified site. We would also consider setbacks along with other options as part of our Site Selection Process, especially in the case where of multiple erosion sites are close together. When repair sites are longer (like when you combined adjacent sites), there is more opportunity to consider alternatives which achieve the desired benefits, while still compliant with cost policy requirements.

Riparian Vegetation Recommendations

Recommendation 7

All sites should be planted with a diverse native mix of woody and herbaceous riparian vegetation. Sites should be diverse (a mix of riparian forest and scrub shrub) and fit into the surrounding landscape. The planting plan should take into account what is missing from the surrounding vegetation and attempt to create heterogeneous habitats. The Corps should develop a baseline map of existing vegetation communities. Given the amount of rock already placed and the amount proposed for placement, this can serve to create diverse and heterogeneous habitats.

Response to Recommendation 7

A fairly diverse revegetation native riparian planting palette riparian is usually include das part of the levee repair design. Resource agencies have the opportunity to review site designs and revegetation plans. Typical vegetation found on levee have limited vegetation community and not as complex as floodplain area within the channel or beyond the SRFCP.

Recommendation 8

The Corps, CVFPB, and DWR should include within the planting contract a provision for the contractor to plant understory species after some of the woody canopy has established. Studies have shown that planting late successional understory species after woody species canopy cover has been established provides better success for establishing these understory plants. Incorporating these species within the planting mix provides more diverse habitat for wildlife species (Johnston 2009).

Response to Recommendation 8

Future discussion item for IWG to see if feasible. Typical understory plant species cannot be incorporated in revegetation palette for levee repairs due to future visibility issues during high water events. Visibility to the waterside slope is required for Corps levee inspections.

Monitoring and Site Protection Recommendations

Recommendation 9

There has been very little monitoring of the success of older mitigation sites. In fact, there is a concern whether the location of all of the mitigation sites is even known. The Corps should work with the Service to create a GIS database which includes all mitigation sites for the entire SRBPP, and create a monitoring program which evaluates the success or failure of these sites.

Response to Recommendation 9

The Corps and DWR concur that many of the previously repaired sites should be revisited in the future to demonstrate the successful implementation of revegetation efforts included into berm, bank, and levee protection projects under SRBPP. A number of these sites are over 30+ years. The locations for many of these sites are known in a collection of USFWS reports, as-built drawings, and in the SRFCP O&M supplemental manuals. A list or database of sites older than 2006 have been created in GIS maps. Future IWG meetings should discuss the approach for identifying and revisiting older mitigation sites.

Recommendation 10

The Corps should require a conservation easement on future levee repair projects. This would provide long-term protection to the sites as compensation for project effects. Additionally, an endowment should be created for sites which would fund the long-term maintenance of the on-site habitat.

Response to Recommendation 10

SRBPP has acquired conservation easements on previous levee and bank repair projects by the non-federal sponsor. Previous issues on why conservation easements have not been recently acquired have not been fully vetted with current SRBPP team members but are likely due to the complexity of acquiring necessary easements for construction and maintenance. These issues also apply to many old and new easements for SRFCP levees. Levee construction projects are usually covered under existing levee easements for levee maintenance and areas below the ordinary high water mark are California sovereign lands leased by California State Lands Commission under their jurisdiction. Levee repair projects are protected long term under the SRFCP O&M manual, but language still needs to be flexible for a local maintaining agency to perform required levee maintenance at all flow conditions. When easements need to be acquired or revised, the current levee language, Rights 1 through 8 (revised in 1994) are as follows:

1. Construct, reconstruct, enlarge, fence, plant with trees, shrubs and other vegetation, preserve and retain all vegetative growth desirable for project purposes, repair and use flood control works, which shall include, but not be limited to, access, haul and patrol roads, levees, ditches,

embankments, channels, berms, fences and appurtenant structures, and operate and maintain said flood control works in conformity with the Code of Federal Regulations, Corps of Engineers' Standard O&M Manual, and State of California Standards.

2. Clear and remove from said flood control works any or all natural or artificial obstructions, improvements, trees and vegetation necessary for construction, operation, maintenance, repair, reconstruction and emergence flood fight.
3. Flow waters and materials and by said flow erode.
4. Place or deposit earth, debris, sediment or other material.
5. Excavate and remove earth, debris, sediment, or other material, including that placed or deposited as above.
6. Locate or relocate roads and public utility facilities by grantee or others.
7. Restrict the rights of the grantor, his successors and assigns, without limitations, to explore, extract, remove, drill, mine or operate through the surface or upper 100 feet of the subsurface in exercise of the grantor's interest in any minerals, including oil and gas.
8. Restrict any use by others which may interfere with any of the uses listed herein or any use necessary or incidental thereto.

Recommendation 11

The Corps should update the operations and maintenance manuals for all of the bank protection sites and include maintenance of planted vegetation and installed instream woody material where appropriate.

Response to Recommendation 11

After completion of the plant establishment phase, repaired and revegetated erosion sites are turned back over to the local maintaining agency for operations and maintenance. Site turnover includes location of repair, as-built drawing, and additional language for "environmental protection" of the mitigation plantings and installed instream woody material. There are no specific vegetation and IWM requirements other than to allow the sites to naturally developed without frequent O&M disturbance (herbicide spraying or heavy mechanical vegetation removal). Any alteration of mitigation plantings is to be reported to the Corps.

Recommendation 12

The Service has concerns that riparian vegetation on the erosion repair sites may not grow at the same rate as riparian vegetation in a natural substrate. The Corps should conduct a study which compares growth rates of various riparian plant species on erosion repair sites to either growth rates at natural sites or growth rates established through prior studies. This study should include the various substrates that have been used at bank protection sites including: rock-soil mixtures of various percentages; soil trenches; or other methods of incorporating soil into the rock substrate.

Response to Recommendation 12

Vegetation in rock/soil mix is not going to establish as well as native floodplain soil. This project has been collecting data regarding the performance of vegetation establishment at constructed project sites to help inform future considerations of design development and selection. The Corps and DWR will consider feasibility of better defining and implementation of this type of study to improve the environmental performance of future erosion repair designs. We will work with the resource agencies to evaluate this information for application on this project. We will also consider enlistment of scientific experts (ERDC, other agencies, or contractors) to help with this evaluation.

Recommendation 13

The Corps should initiate a monitoring program to determine the success of past and future erosion repair sites as habitat for wildlife. The Service is willing to work with the Corps, CVFPB, DWR, and CDFW, to develop this monitoring program. This is particularly important given the intent with many of these sites is to maintain connectivity along the rivers.

Response to Recommendation 13

The Corps has been implementing long term monitoring of project sites for establishment of vegetation and other habitat features. We can consider developing monitoring protocols to consider wildlife utilization as appropriate for the project. We can coordinate with the Service to determine the type of data that would be useful to meet this objective and consider its inclusion as part of our long-term monitoring efforts.

Recommendation 14

The Corps should review and incorporate as appropriate the Sacramento River Riparian Monitoring and Evaluation Plan (Shilling et al 2011). This document focuses on the middle Sacramento River, but would still benefit the Corps by providing standardized monitoring and indicators that are based on the best available science.

Response to Recommendation 15

This would be difficult to implement but a good idea to review the plan to see if feasible. Corps and DWR will evaluate this within the IWG coordination process, and consider during the development of future monitoring plans.

Recommendation 15

Section 2036(a) of the Water Resources Development Act of 2007 requires that any report submitted to Congress for authorization shall contain a specific recommendation with a specific plan to mitigate fish and wildlife losses unless the Secretary determines that the project will have negligible adverse impacts. While the Service recognizes that this project does not fall under Section 2036 (a) of the Water Development Act of 2007 since it already has an authorization from Congress, we do still recommend that the Corps comply with this section. The mitigation plan should comply with the mitigation standards and policies of the regulatory programs.

Response to Recommendation 15

Specific mitigation plans will be considered during the site-specific evaluation and design processes, as appropriate. Our Site Selection Implementation Process allows for this evaluation of effects and identification of opportunities, to support identification of appropriate mitigation and ratios.

Bank Swallow Recommendations

Recommendation 16

Work with the multi-agency Bank Swallow Technical Advisory Committee to determine and map areas which may have potential for use by bank swallows and have not been identified as active nesting since 1986 when surveys started. This information should be used for both protection of current and future bank swallow habitat for mitigation purposes and for the analysis of effects when evaluating alternatives at bank protection sites.

Response to Recommendation 16

SRBPP team will continue to coordinate with BANS-TAC.

Recommendation 17

The Corps, CVFPB, and DWR should follow the Bank Swallow Conservation Strategy for the Sacramento River Watershed, California when designing projects and determining mitigation for bank swallow.

Response to Recommendation 17

SRBPP will refer to the Bank Swallow Conservation Strategy when implementing project in areas with bank swallow presence.

Recommendation 18

When determining a bank protection measure for a site that is within the river reach where bank swallows could be found use the following steps:

a. Determine if the project site has existing or potential bank swallow habitat.

b. If the site does not have existing or potential bank swallow habitat and this determination is coordinated and agreed upon with CDFW and the Service then follow regular site selection criteria.

c. If site has existing or potential bank swallow habitat then the BPM should be either an adjacent levee or a setback levee.

d. If it can be demonstrated that an adjacent or setback levee is not feasible, then the Corps, CVFPB, and DWR will consult with CDFW regarding mitigation to offset any potential effects of the project on bank swallow. Mitigation would need to be completed prior to construction of the project such that temporal effects are reduced. Given that existing conditions for bank swallow are highly susceptible to stochastic extirpation of this species from the Sacramento Valley, mitigation for effects to existing or potential bank swallow habitat should be greater than just replacement of lost habitat and should use the Bank Swallow Conservation Strategy to determine mitigation.

Response to Recommendation 18

SRBPP team concurs with the steps to avoid potential bank swallow nesting areas.

Raptors and Migratory Birds Recommendations

Recommendation 19

The Corps should incorporate the protection of and planting of large trees within their erosion repair sites. Large trees provide habitat for numerous bird and mammal species, such as the California state listed Swainson's hawk, and are a future source of IWM.

Response to Recommendation 19

Policy Guidance on Implementation of Section 3031 of WRDA 2007, June 6, 2008 would likely not allow larger riparian vegetation be incorporated in site footprint.

Recommendation 20

Follow CDFW's avoidance and minimization measures for Swainson's hawk (Appendix B).

Response to Recommendation 20

SRBPP team concurs and will follow measures to avoid Swainson's Hawk.

Recommendation 21

For construction during any migratory bird nesting season, the Corps will perform preconstruction surveys to determine whether raptors or migratory birds are nesting or roosting at or adjacent to staging or construction areas. In the event nesting or roosting raptors or migratory birds are identified, the Corps will coordinate with the Service and CDFW to identify measures to ensure that construction or construction related activity does not cause nest failure and that raptors are not adversely affected. These measures may include implementation of suitable buffers and phasing of construction.

Response to Recommendation 21

Preconstruction nesting and roosting surveys will continue to be conducted at or adjacent to staging or construction areas. Construction activities will be delayed if nesting occurs within avoidance buffers and until juveniles birds are away from the nest and foraging independently.

Fisheries Recommendation

Recommendation 22

In a dry-water year, floodplains are not inundated and Sacramento splittail may spawn along the river margins. The Corps should conduct a study to determine the location of dry water-year spawning areas. Erosion repair work in potential spawning areas may adversely affect spawning Sacramento splittail. Additionally, knowing where spawning occurs could also provide information on the habitat features Sacramento splittail require when spawning on river margin habitat, which the Corps can incorporate into their future erosion repair sites.

Response to Recommendation 22

The SRBPP team concurs that a Sacramento splittail study should be implemented to determine potential spawning area and may be beneficial for multiple fish species. Recent juvenile salmonid dietary sampling as shown that cyprinid and catostomid fry is part of the riverine rearing and migrating fish in the early spring. The Corps will consider the appropriateness and feasibility of implementing this type of study.

We may also consider using an Acoustic Doppler Current Profiler to map low water elevation drought conditions during typical peak Sacramento splittail spawning in March and April. Low water conditions would likely increase water temperatures earlier and may trigger fish to spawn lower in the system with reduced migration timing. The study area would likely would be limited to the Sacramento River between Colusa (RM 145) downstream to near start of stronger tidal influence near Freeport (RM 46).

Appendix J

Sacramento River Bank Protection Project Phase II Supplemental Authorization Programmatic Mitigation Strategy

REVISED FINAL

Sacramento River Bank Protection Project Phase II Supplemental Authorization Programmatic Mitigation Strategy

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Acronyms and Abbreviations

BA	biological assessment
BMPs	best management practices
BO	biological opinion
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFGC	California Fish and Game Code
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers-Sacramento District
CVFPB	Central Valley Flood Protection Board
CWA	federal Clean Water Act
dbh	diameter at breast height
Delta	Sacramento–San Joaquin River Delta
DFW	California Department of Fish and Wildlife
DPS	distinct population segment
DWR	California Department of Water Resources
EFH	essential fish habitat
EIR	environmental impact report
EIS	environmental impact statement
ESA	federal Endangered Species Act
FR	Federal Register
FSHA	Floodplain Salmonid Habitat Assessment Model
IWG	interagency work group
IWM	instream woody material
LF	linear feet
LMAs	local maintaining agencies
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MBTA	Migratory Bird Treaty Act
MOU	memorandum of understanding
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service

NOAA Fisheries	National Oceanic and Atmospheric Administration
PAR	Property Analysis Record
PBA	programmatic biological assessment
PL	Public Law
RM	river mile
salmon FMP	Pacific Coast Salmon Fishery Management Plan
SAM	Standard Assessment Methodology
SRA	shaded riverine aquatic
SRA	shaded riverine aquatic
SRBPP	Sacramento River Bank Protection Project
SRFCP	Sacramento River Flood Control Project
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
Vegetation ETL	Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams, and Appurtenant Structures
VFZ	vegetation-free zone
WRDA 07	Water Resources Development Act of 2007

Revised Final Programmatic Mitigation Strategy

Purpose and Organization of Strategy

The purpose of this programmatic mitigation strategy is to establish the framework for the U.S. Army Corps of Engineers-Sacramento District (Corps) and the Central Valley Flood Protection Board (CVFPB) to provide mitigation for bank protection actions under Sacramento River Bank Protection Project (SRBPP) Phase II, 80,000 linear feet.

The mitigation strategy summarizes the potential role of on-site and off-site mitigation and the pros and cons of each, the applicability and availability of public and private compensation and mitigation banking projects, options for long term operation and maintenance of public or agency compensation/mitigation sites, an adaptive management plan, and an incremental cost analysis to compare cost implications of the various mitigation scenarios.

This strategy conforms to the Corps planning principles outlined in ER 1105-2-100 and is in compliance with the Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 (WRDA 07) – Mitigation for Fish and Wildlife and Wetland losses.

The following sections provide information on: the project background and proposed site-specific mitigation measures; regulatory policy; special-status species and project impact mechanisms; mitigation requirements and strategies from previous SRBPP actions including pertinent species-specific agency guidelines; anticipated mitigation needs; and mitigation strategies (including on-site and off-site options). Additionally, Appendix A describes the bank protection design options; Appendix B reviews the potential distribution of the design templates to currently identified erosion sites; Appendix C presents guidance from previous biological opinions, Appendix D describes the Standard Assessment Methodology (SAM) used to quantify aquatic impacts; and Appendix E addresses mitigation cost efficiency and incremental cost analysis.

Background

The Sacramento River Bank Protection Project

The Sacramento River Bank Protection Project (SRBPP) is a continuing construction program, originally authorized by the Flood Control Act of 1960, to provide protection for the existing levees and flood control facilities of the Sacramento River Flood Control Project (SRFCP). The SRFCP consists of over 1,000 miles of levees plus overflow weirs, pumping plants, and bypass channels that protect communities and agricultural lands in the Sacramento Valley and the Sacramento–San Joaquin River Delta (Delta).

The SRFCP was authorized by Congress and approved on March 1, 1917, then amended on May 15, 1928, August 26, 1937, August 18, 1941, August 17, 1954, and July 14, 1960 as the Flood Control Act of 1960, Public Law (PL) 86-645. Prior to 1960, the Federal government did not support continued participation in a project perceived as completed.

However, by 1960 the Federal government began to see the national value in investing funding in large scale flood protection projects in complicated watersheds. In the Flood Control Act of 1960, Congress authorized substantial support for flood protection for the Sacramento River Basin. This constituted Phase I of the SRBPP. Phase I was constructed from 1963 to 1975, and consisted of about 436,000 linear feet (LF) of bank protection completed.

In 1972, the Chief of Engineers found that "Although work under the initial phase [Phase I] has effectively controlled erosion at the critical sites, each year stream banks and levees at additional unprotected locations throughout the SRFCP are subject to erosion."

Accordingly in 1974, repair of 405,000 LF was authorized as SRBPP Phase II. Authorization was through the River Basin Monetary Authorization Act of 1974 (PL 93-251). Construction began in 1976 under Phase II, and current bank protection is being carried out under the original Phase II authorization. Only about 4,996 LF of authorization remain after the 2012 construction season and plans are under development to construct this additional increment.

Through the Water Resources Development Act of 2007, Phase II was modified to include an additional 80,000 LF of bank protection. The purpose of the SRBPP Phase II 80,000 LF is to ensure the continued integrity of the SRFCP levees, while protecting environmental resources and compensating for effects on environmental resources to the degree feasible. Levees within the SRBPP action area provide flood damage risk reduction for the Sacramento Valley and help convey water flowing from the surrounding mountain ranges to the Delta. Levees stressed by high winter flows can weaken and fail; to maintain the integrity of the flood control system, locations with a high failure potential are identified and remedied.

To protect property, as well as the health and safety of residents, bank repair and levee rehabilitation are needed at erosion sites. The proposed bank protection measures and mitigation work would: (1) minimize the loss of riparian vegetation and endangered species habitat resulting from construction activities; (2) greatly minimize erosion, limiting the eventual loss of nearshore aquatic habitat and riparian habitat that would likely occur as a result of continuing erosion if the project were not constructed; and (3) provide compensation, as needed, for project effects on existing riparian habitat and nearshore aquatic habitat.

SBRPP Program Area

The SRBPP program area extends along the Sacramento River from the town of Collinsville at river mile (RM) 3, which is the southernmost point in the program area, upstream to Chico at RM 194 (while the levees end at RM 184), the northernmost point, and includes reaches of lower Elder and Deer Creeks. The SRBPP program area also includes several tributary streams and distributary sloughs, including Cache Creek, the lower reaches of the American River (RM 0–13), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs. Sutter and Yolo bypass levees are also included in the program area.

For the supporting environmental documentation, the program area has been divided into four regions, organized south to north by the location of the downstream terminus of each watercourse with the mainstem Sacramento River. The four reaches are generally defined in a manner that captures the full range of environmental conditions within the program area while dividing them in a manner that recognizes differences in physical structure and species use among these four reaches. Region 1a includes the Yolo and Sacramento Bypasses, the Sacramento River below Isleton

(RM 20), and a distribution network of sloughs and channels. Region 1b includes the mainstem Sacramento River from Isleton (RM 20) in the Delta, upstream past the city of Sacramento, to the Feather River confluence (RM 80) at Verona. Region 1b also includes the lower American River from the confluence with the Sacramento River upstream to RM 13, Natomas East Main Drain, Natomas Cross Canal, and Coon Creek Group Interceptor Unit 6. Within Region 2, the mainstem Sacramento River flows from Colusa (RM 143) downstream of the Colusa Bypass to the confluences with the Feather River and Sutter Bypass at Verona (RM 80). Region 2 also includes the lower Feather River from its confluence with the Sacramento River upstream to RM 61, the lower Yuba River from its confluence with the Feather River upstream to RM 5, and Bear River from its confluence with the Feather River upstream to the end of its levees above State Route 65. Region 3 includes the Sacramento River downstream of Chico Landing (RM 194) to Colusa (RM 143) as well as portions of Elder Creek, Deer Creek, Chico Creek, and Mud Creek.

Erosion Sites

The Corps' Sacramento District, the proposed program's non-federal sponsor, the CVFPB, and the California Department of Water Resources conduct annual field reconnaissance reviews of the SFRCP. Specific criteria are used to identify erosion sites within the system as described in the Corps' Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking (Ayres Associates 2008). In most cases the criteria are based on bank and levee conditions that are threatening the function of individual basins within the system or the flood control system as a whole. An erosion site is defined as:

> A site that is at risk of erosion during floods and/or normal flow conditions; the term *critical* is used to indicate erosion sites that are an imminent threat to the integrity of the flood control system and of the highest priority for repair.

A site is typically identified as an erosion site if the erosion has encroached into the projected levee prism. A typical levee prism has a landside slope, a levee crown (top of the levee), and a waterside slope. The projected levee slope is the hypothetical extension of the landside and waterside slopes as the actual levee slopes "project" below the surrounding ground surface, forming the levee foundation. The Corps is currently in the process of updating its process for selecting erosion sites for repair. However, the environmental documentation is based on the representative sample of sites contained in the "Final Alternatives Report–80,000 LF" (Kleinfelder-Geomatrix 2009). The SRBPP program itself relies on annual field reconnaissance reports.

The representative sites selected for the "Final Alternatives Report—80,000 LF" were informed by the 2008 Field Reconnaissance Report (Ayres Associates 2009), which identified 154 erosion sites. Many of these 154 erosion sites are not classified as critical, but they do pose a substantial risk of erosion and threat to the flood control system and would continue to be considered erosion sites under the new site selection process. The 107 representative sites, totaling approximately 80,000 LF, are used for evaluation and identification of suitable design alternatives for bank protection in the "Final Alternatives Report–80,000 LF". Sites selected by the Corps for further evaluation and identification of suitable bank protection designs exhibited bank and levee conditions that are threatening the function of the flood control system (Kleinfelder-Geomatrix 2009). After publication, a discrepancy was found in the Final Alternatives Report regarding a site at Natomas Cross Canal 3.0 L. The site has since been removed from the evaluation list, leaving 106 sites.

For purposes of the environmental impact statement (EIS)/environmental impact report (EIR) under preparation for the Phase II Supplemental Authorization, the 106 selected eroding sites along the Sacramento River and its tributaries constitute a representative sample of the sites eventually proposed to be treated under the supplemental 80,000 LF. However, the number and extent of documented sites can change from year to year because of various factors, including newly identified sites, increased or decreased rates of erosion, repaired sites, reclassification of erosion sites to maintenance sites, and removed sites. Therefore, because streambank erosion is episodic and new erosion sites can appear each year, the environmental analysis is programmatic in nature, analyzing the 80,000 LF in its entirety, but relying on data associated with the 106 representative sites when appropriate in order to provide the most detailed programmatic analysis possible.

Proposed Site-Specific Bank Protection Measures

Appendix A describes the full suite of SRBPP site-specific bank protection measures with figures to support each measure. The following criteria have been developed for bank protection design, consistent with the project purpose and need.

- Restoring the flood damage risk-reduction capability of the originally-constructed levee through the use of structurally reliable erosion-control elements.
- To the extent practicable, maintaining fish and wildlife habitat and scenic and recreational values, and replacing habitat losses through the use of on-site mitigation elements overlying or integrated with erosion-control elements.
- Fully mitigating off-site significant residual fish and wildlife habitat losses to the extent justified.
- Minimizing costs of construction and maintaining both erosion-control and on-site habitat-mitigation elements.

The measures are intended to meet these criteria while also following the Corps vegetation management policy as prescribed in Engineering Technical Letter 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures (Vegetation ETL) (U.S. Army Corps of Engineers 2014).

The following measures are conceptual and will be modified to the degree necessary to be suitable for conditions at any given erosion site. Mitigation requirements will depend on which measures are implemented at which erosion sites within the program area.

- Setback Levee - A setback levee entails constructing a new levee some distance landward of the existing levee. A setback levee would avoid or minimize construction in the waterside or riparian areas and the land between the setback and existing levee would act as floodplain.
- Bank Fill Stone Protection – Installation of bank fill stone protection entails filling the eroded portion of the bank and installing quarry stone along the levee slope as needed. One bank fill stone protection measure allows no on-site woody vegetation while another approach allows six inches of soil cover to be placed on the revetment to support on-site vegetation. The long-term goal of planting vegetation would be to provide riparian and shaded riverine aquatic (SRA) cover habitat.
- Adjacent Levee –Utilization of an adjacent levee involves the construction of a new levee embankment adjacent to and landward of the existing levee. Depending on Corps vegetation policy compliance requirements, the existing levee could potentially host vegetation or instream woody material (IWM) or the levee could be degraded to riparian and/or wetland benches.

- Riparian and Wetland Benches - In general, construction of riparian and/or wetland benches involves the placement of clean quarry stone from the toe of the bank up to the summer/fall waterline and placing quarry stone and soil-filled quarry stone on the levee slope above the summer/fall waterline. These measures vary from one another with regard to the placement and extent of environmental features that are intended to increase habitat quality (bank construction, vegetation, and IWM).

Project Impacts

Implementation of the proposed site-specific bank protection measures will result in impacts that may be direct, indirect, and cumulative as well as short- and long-term. These impacts are identified at a programmatic level by qualitative and quantitative analysis in the SRBPP Programmatic EIS/EIR. The Programmatic EIS/EIR utilizes a set of 106 representative erosion sites with a combined bank length of 80,000 linear feet for its analyses. Appendix B contains a table showing which bank protection measures were applied to each site for the programmatic analyses. Quantitative impact analyses used Geographic Information System data to analyze riparian vegetation impacts and the SAM to analyze aquatic impacts. These impacts and their anticipated mitigation needs are addressed below in the section titled 'Anticipated Mitigation Needs'.

Regulatory- and Policy-Related Mitigation Requirements/Commitments

The requirement that a project must mitigate for adverse environmental impacts in order to meet environmental performance standards (e.g., regulatory standards) stems from a variety of regulatory mechanisms. A brief summary of the most relevant Federal and state laws and regulations follows.

Federal

National Environmental Policy Act

The National Environmental Policy Act (NEPA) process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment. Agencies are required to identify and include in the action all relevant and reasonable mitigation measures that could improve the action. Mitigation must be included as an integral part of the alternatives development and analysis process.

Endangered Species Act

The federal Endangered Species Act (ESA) of 1973 and subsequent amendments provide for the conservation of listed endangered or threatened species or candidates for listing and the ecosystems on which they depend. The U.S. Fish and Wildlife Service (USFWS) has jurisdiction over federally listed plants, invertebrates, wildlife, and resident fish and the National Marine Fisheries Service (NMFS) has jurisdiction over anadromous fish and marine fish and mammals.

Endangered Species Act Authorization Process for Federal Actions

Section 7 of ESA provides a means for authorizing take of threatened and endangered species by federal agencies. It applies to actions that are conducted, permitted, or funded by a federal agency.

Under ESA Section 7, the lead federal agency conducting, funding, or permitting an action must consult with USFWS or NMFS, as appropriate, to ensure that the proposed action will not jeopardize the continued existence of an endangered or threatened species or destroy or adversely modify designated critical habitat. If a proposed action may affect a listed species or designated critical habitat, the lead agency is required to prepare a biological assessment (BA) evaluating the nature and severity of the expected effect. In response, USFWS or NMFS issues a biological opinion (BO), with a determination that the proposed action would have one of two results.

- May jeopardize the continued existence of one or more listed species ("jeopardy finding") or result in the destruction or adverse modification of critical habitat ("adverse modification finding").
- Will not jeopardize the continued existence of any listed species ("no jeopardy finding") or result in adverse modification of critical habitat ("no adverse modification finding").

The BO issued by USFWS or NMFS may stipulate discretionary "reasonable and prudent" conservation measures. If is determined the proposed program would not jeopardize the continued existence of a listed species, USFWS or NMFS would issue an incidental take statement to authorize the proposed activity. A programmatic BA was prepared for the SRBPP for the 2007 program area which focused on approximately 24,000 LF remaining Phase II authorization of proposed erosion repair sites (Stillwater Sciences 2007). An updated BA and subsequent BO will be prepared for the current program area which contains approximately 80,000 LF of proposed erosion repair sites.

Endangered Species Act Prohibitions (Section 9)

Section 9 of ESA prohibits the "take" of any fish or wildlife species listed under ESA as endangered. Take, as defined by ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Harm is defined as "any act that kills or injures the species, including significant habitat modification." Take of threatened species also is prohibited under Section 9 unless otherwise authorized by federal regulations.[1] Additionally, Section 9 prohibits removing, cutting, and maliciously damaging or destroying federally listed plants on sites under federal jurisdiction.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) establishes a management system for national marine and estuarine fishery resources. This legislation requires all federal agencies to consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect essential fish habitat (EFH). EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation states that migratory routes to and from anadromous fish spawning grounds should also be considered EFH. The phrase "adversely affect" refers to the creation of any effects that reduce the quality or quantity of EFH. Federal activities that occur outside an EFH but that may, nonetheless, have an effect on EFH waters and substrate must also be considered in the consultation process. Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered.

[1] In some cases, exceptions may be made for threatened species under ESA Section 4[d]; in such cases, USFWS or National Marine Fisheries Service (NOAA Fisheries) issues a "4[d] rule" describing protections for the threatened species and specifying the circumstances under which take is allowed.

Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered. The Magnuson-Stevens Act states that consultation regarding essential fish habitat should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other Federal statutes, such as NEPA, Fish and Wildlife Coordination Act, federal Clean Water Act (CWA), and ESA. EFH consultation requirements can be satisfied through concurrent environmental compliance if the lead agency provides NMFS with timely notification of actions that may adversely affect EFH and if the notification meets requirements for essential fish habitat assessments.

The Corps has prepared a BA to be submitted to USFWS and NMFS pursuant to obtaining a BO. The consultation process will include consideration of and compliance with the Magnuson-Stevens Act to determine effects on EFH.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (Title 16, USC, Part 703) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and Russia, and authorizes the U.S. Secretary of the Interior to protect and regulate the taking of migratory birds. It establishes hunting seasons and capture limits for game species and protects migratory birds, their occupied nests, and their eggs (16 USC 703; 50 CFR 21; 50 CFR 10).

Executive Order 13186 (January 10, 2001) directs each federal agency taking actions that have or may have a negative effect on migratory bird populations to work with USFWS to develop a memorandum of understanding (MOU) that will promote the conservation of migratory bird populations. Protocols developed under the MOU must include the following agency responsibilities:

- avoid and minimize, to the extent practicable, adverse effects on migratory bird resources when conducting agency actions;
- restore and enhance migratory bird habitats, as practicable; and
- prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

The executive order is designed to assist federal agencies in their efforts to comply with the MBTA, and does not constitute any legal authorization to take migratory birds.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires consultation with USFWS and the state fish and wildlife agencies where the waters of any stream or other body of water are proposed, authorized, permitted, or licensed to be impounded, diverted, or otherwise controlled or modified under a federal permit or license. Consultation is undertaken for the purpose of preventing loss of and damage to wildlife resources.

USACE Guidance

This strategy is developed in compliance with Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 – Mitigation for Fish and Wildlife and Wetlands Losses (August 31, 2009). The guidance requires that each relevant project have a specific plan to mitigate fish and wildlife losses and that the project shall be determined by the Secretary of the Army to have negligible adverse impacts. The guidance also requires several additional steps be included in the plan, including monitoring, success criteria, availability of mitigation lands, and contingency/adaptive management plans.

State Laws and Regulations

California Environmental Quality Act

California Environmental Quality Act (CEQA) is the regulatory framework by which California public agencies identify and mitigate significant environmental impacts. A project normally has a significant environmental impact on biological resources if it substantially affects a rare or endangered species or the habitat of that species; substantially interferes with the movement of resident or migratory fish or wildlife; or substantially diminishes habitat for fish, wildlife, or plants. The State CEQA Guidelines define rare, threatened, or endangered species as those listed under ESA and California Endangered Species Act (CESA), and any other species that meet the criteria of the resource agencies or local agencies (e.g., California Department of Fish and Wildlife (DFW)-designated species of special concern). The guidelines state that the lead agency preparing an environmental impact report must consult with and receive written findings from DFW concerning project impacts on species listed as endangered or threatened. The effects of a proposed project on these resources are important in determining whether the project has significant environmental impacts under CEQA.

California Endangered Species Act

California implemented the CESA in 1984. CESA prohibits the unauthorized "take" of plant and wildlife species state-listed as endangered or threatened. Pursuant to Fish and Game Code 2081 et seq., DFW may authorize, by permit, the take of endangered, threatened, and candidate species if the take is incidental to otherwise lawful activities. The impacts of the authorized take of the species must be minimized and fully mitigated, and adequate funding must be ensured to implement all minimization and mitigation measures. In addition, DFW may issue a permit for take only if it determines that issuance of the permit does not jeopardize the continued existence of the species.

California Fish and Game Code

The California Fish and Game Code (CFGC) provides protection from take for a variety of species, referred to as fully protected species. The CFGC defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." Except for take related to scientific research, all take of fully protected species is prohibited. Protection of fully protected species is described in Sections 3511, 4700, 5050, and 5515 of the CFGC. These statutes prohibit take or possession of fully protected species and do not provide for authorization of incidental take of fully protected species. DFW has informed nonfederal agencies and private parties that their actions must avoid take of any fully protected species.

Section 401 Water Quality Certification and Wetlands Program

The California State Water Resources Control Board (State Water Board) administers the Section 401 Water Quality Certification and Wetlands Program to regulate discharges of fill and dredged material under Clean Water Act Section 401 and the Porter-Cologne Water Quality Control Act. This program protects all waters of the state in its regulatory scope, but has special responsibility for wetlands, riparian areas, and headwaters because these waterbodies have high resource value, are vulnerable to filling, and are not systematically protected by other programs. Through this program, the State Water Board is involved with protection of special-status species, and encourages basin-level analysis and protection. Most projects are regulated by the Regional Water Quality Control Boards; in the case of the SRBPP, the Central Valley Regional Water Quality Control Board would implement the program.

Action Area Special-Status Species and Impacts

As discussed in the EIS/EIR, numerous species could be affected by implementation of SRBPP Phase II Supplemental Authorization, including western pond turtle, white-tailed kite, osprey, loggerhead shrike, tricolored blackbird, yellow-headed blackbird, western yellow-billed cuckoo, purple martin, western snowy plover (inland nesting population), northern harrier, western burrowing owl, western mastiff bat, hoary bat, western red bat, and pallid bat, but the following are the species most likely to require mitigation and/or drive the quantity and types of mitigation needed. In most cases, mitigation that provides suitable habitat for the key species described below would also address mitigation needs for the species mentioned above. The discussions present background on each species as well as a describing the project impact mechanisms. Project impacts are both short- and long-term.

For fish species, in-water construction activities, including the placement of rock revetment, could result in direct, short-term effects to fish from the placement of rock into occupied habitat during peak migration periods. Localized, temporary disturbance of habitat conditions may alter natural behavior patterns of adult and juvenile fish and cause injury or death of individuals. These effects may include displacement, or impairment of feeding, migration, or other essential behaviors by adult and juvenile salmon, steelhead, and green sturgeon from noise, suspended sediment, turbidity, and sediment deposition generated during in-water construction activities.

Long-term effects to fish species are related to changes in river hydraulics at a site; changes in substrate conditions for low- and high-flow shorelines; and changes in overstory vegetation or IWM. The hydraulic changes can affect migration, foraging or resting use of a site as well as making a site more suitable for predators. Substrate changes can affect hydraulics, benthic organisms and in some locations spawning. Cover losses will initially reduce the availability of high quality shallow water habitat for juvenile Chinook salmon and steelhead, spawning and incubating delta smelt, and possibly juvenile green sturgeon during the annual high-flow period (late fall, winter, and spring). Mitigation is designed to offset these impacts but until fully restored these impacts continue although they diminish over time.

Vegetation communities on and around the levees include riparian forest, riparian scrub, oak woodlands, ruderal herbaceous vegetation, and emergent marsh. These habitats influence the aquatic environment by providing shade, IWR, substrate (emergent marsh), and by input of vegetative material or insects. These communities also provide important terrestrial habitat for a variety of terrestrial wildlife species including birds, mammals, rodents, reptiles and amphibians. These habitats provide nesting, roosting and foraging habitat for birds and provide similar functions for the other terrestrial species. The project would remove these habitats by implementing the proposed site-specific bank protection measures at erosion sites. Removal of some nest trees could also occur.

Chinook Salmon and Central Valley Steelhead

Chinook salmon are anadromous fish, meaning that adults live in marine environments and return to their natal freshwater streams to spawn. Juveniles rear in freshwater for a period of up to 1 year until smoltification (i.e., a physiological preparation for survival in marine environs) and subsequent ocean residence.

Four distinct runs of Chinook salmon occur in the Sacramento River system: winter-run, spring-run, fall-run, and late fall–run. The runs are named after the season of adult migration, with each run having a distinct combination of adult migration, spawning, juvenile residency, and smolt migration periods. In general, fall- and late fall–run Chinook salmon spawn soon after entering their natal streams, while spring- and winter-run Chinook salmon typically hold in their natal streams for up to several months before spawning.

All four Central Valley Chinook salmon runs are subject to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and regulated by the Pacific Coast Salmon Fishery Management Plan (salmon FMP). The salmon FMP includes designation of essential fish habitat (EFH) and requires consultation with the NMFS if a project or action would potentially affect EFH. All of the project areas are within EFH for all four Chinook salmon runs (Pacific Fishery Management Council 1999).

The Central Valley steelhead distinct population segment (DPS) is listed under the ESA as threatened (63 Federal Register [FR] 13347, March 19, 1998). Critical habitat for Central Valley steelhead includes the Sacramento River, Elder Creek, Deer Creek, American River, Feather River, Bear River, Yuba River, and Cache and Miner Sloughs (70 FR 52448, September 2, 2005).

Central Valley steelhead occur in the SRBBP project area, either as adults migrating upstream to their spawning habitat, or as juveniles rearing and migrating toward the ocean. Juvenile steelhead tend to use bank habitat more frequently than the main channel, as it provides increased protection, shade, and food.

Factors such as levee construction and bank armoring have altered habitat for Chinook salmon and steelhead and their critical habitat. These factors reduce floodplain habitat, change river bank substrate size, and decrease the amount of riparian and SRA habitat, which in turn, reduce habitat availability and quality (National Marine Fisheries Service 2006a). These changes have affected primarily adult and juvenile migration as well as juvenile rearing.

Bank armoring projects that have been conducted recently by the Corps and DWR, some of which are on-going, have incorporated design elements to offset the loss of habitat that generally results from placement of river bank protection materials. The creation of setback levees, and the restoration of floodplain, riparian, and SRA habitat have been implemented to improve conditions for listed salmon and steelhead in the action area. Other factors affecting Chinook salmon and steelhead, include increased water temperature, water quality, and flow diversions.

Green Sturgeon

The southern DPS of North American green sturgeon (*Acipenser medirostris*) currently is listed as threatened under the federal ESA (National Marine Fisheries Service 2006b) and is a California species of special concern (Moyle et al. 1995). The southern DPS boundary currently includes all populations of green sturgeon south of the Eel River, with the only known population being in the Sacramento River (Adams et al. 2002). On October 9, 2009, NMFS (74 Federal Register [FR] 52300) designated critical habitat for the green sturgeon Southern DPS throughout most of its occupied range.

Green sturgeon adults occur in the project area when migrating to and from upstream spawning habitat. Juveniles occur in the project area during downstream migration. Juveniles also may rear in the area.

Channelization of the action area has resulted in the removal of riparian and IWM, which simplify ecosystem functions. Simplification results in reduced food input and pollutant and nutrient processing (Sweeney et al. 2004 as cited in National Marine Fisheries Service 2006a). These factors have degraded habitat quality for larvae and post-larvae and to a lesser extent, rearing and migrating juvenile and/or adult green sturgeon (National Marine Fisheries Service 2006a).

As described for Chinook salmon and steelhead, incorporation of riparian plantings and SRA habitat into recent bank protection projects, and development of setback levees, have been implemented to improve conditions for green sturgeon in the action area.

Delta Smelt

The delta smelt is listed under both the ESA and CESA as a threatened species (58 FR 12854, March 5, 1993). The designated critical habitat for delta smelt encompasses the Delta and the Sacramento River upstream to the mouth of American River (RM 60).

Delta smelt occur in the lower Sacramento River, downstream of the confluence with the American River, and in the Delta sloughs. Delta smelt critical habitat is designated in the Sacramento River downstream of the American River and in the Delta. Adults may occur into the Sacramento River during the winter and early spring and most spawning appears to occur downstream in tidally influenced backwater sloughs and channel edgewaters of the upper Delta, including the Sacramento River above Rio Vista, Cache Slough, Lindsey Slough, and Barker Slough.

As discussed for Chinook salmon and steelhead, levee construction has altered waterside bank habitat resulting in the destruction of spawning and refugia areas for delta smelt. Loss of riparian habitat and overall habitat simplification also reduces food input and pollutant and nutrient processing (Sweeney et al. 2004 as cited in National Marine Fisheries Service 2006a), which may impair individuals. Revetment also fragments areas of high quality habitat and accelerates water velocity, which affects use of those areas by delta smelt and other native fishes (U.S. Fish and Wildlife Service 2006).

Incorporation of riparian plantings and SRA habitat into recent bank protection projects, as well as development of setback levees, has been implemented to improve conditions for delta smelt and their critical habitat in the action area.

Bank Swallow

The bank swallow (*Riparia riparia*) is a state-listed threatened species. Bank swallows nest in erodible soils on vertical or near-vertical banks and bluffs in lowland areas dominated by rivers, streams, lakes, and oceans. Foraging habitats surrounding nesting colony sites include wetlands, open water, grasslands, riparian forests, agricultural lands, shrublands, and occasionally upland woodlands (Garrison 1999).CNDDB (2009) indicates that bank swallow is known to nest extensively within all four program study area regions along the banks of the Sacramento River, Feather River, American River, and Cache Creek. Throughout the program area suitable nesting habitat occurs along the above mentioned river systems.

Bank protection and flood control projects damage suitable nesting habitat by engineering eroding banks to a 2:1 or 3:1 slope of length to height and the introduction of boulder-sized rock (riprap) on the new slope (Garrison 1998). Thus, suitable nesting habitat is lost as erosion processes are stopped, and areas of suitable Bank Swallow nesting habitat is reduced where these practices are employed. There are some reaches on the Sacramento River, particularly in Colusa, Sutter, Yolo, and Sacramento counties, where very few suitable banks remain due to extensive bank protection and channelization efforts." (Garrison 1998).

Bank protection activities have had several immediate and long-term adverse effects on bank swallow populations and habitat including: (1) coverage of steep, fresh surfaces that are suitable for bank swallow nesting, (2) destruction of individual birds (and in extreme cases entire colonies) when construction occurs during breeding season, and (3) localized reductions in the river's ability to create the steep, fresh bank surfaces required by nesting bank swallows. The river's ability to create nesting habitat for bank swallows has also been affected by human modifications to rates and patterns of sediment transport and flow, which together regulate the geomorphic processes that set the rate, type, and timing of bank erosion (Stillwater Sciences 2007).

Swainson's Hawk

Swainson's hawks are protected under the Migratory Bird Treaty Act (MBTA) and are state-listed as threatened. In California, Swainson's hawk habitat generally consists of large, flat, open, undeveloped landscapes that include suitable grassland or agricultural foraging habitat and sparsely distributed trees for nesting (England et al. 1997). Foraging habitat includes open fields and pastures. Swainson's hawks usually nest in large native trees such as valley oak, cottonwood, and willows. CNDDB (2009) records indicate that Swainson's hawks are known to nest within all four program study area regions.

Large trees located throughout the program area contain suitable nesting habitat for Swainson's hawk, and row and field agricultural lands and grasslands contain suitable foraging habitat. Tree removal, other vegetation clearing, grading, or other construction activities could remove or cause abandonment of active nests. Activities related to project implementation that impact Swainson's hawk is primarily the removal of potential nesting trees and foraging habitat.

Giant Garter Snake

The giant garter snake is listed as threatened under both ESA and CESA. Giant garter snakes are endemic to wetlands in the Sacramento and San Joaquin Valleys and inhabit marshes, sloughs, ponds, small lakes, low-gradient streams and other waterways, and agricultural wetlands such as irrigation and drainage canals and rice fields, as well as the adjacent uplands.

Giant garter snake populations that occur within the vicinity of the four SRBPP regions include the: (1) Yolo Basin/Willow Slough population in the vicinity of Davis in Region 1a, (2) the American Basin population, north of the city of Sacramento and east of the Sacramento River in Region 1b, and (3) Sutter Basin and Colusa Basin populations in Region 2. Giant garter snakes have been reported in the Colusa Main Drain, Feather River, Natomas Cross Canal, and south fork Putah Creek (California Natural Diversity Database 2009); however, in general, the SRBPP reaches are not suitable for giant garter snakes because they are larger waterways typified by steep banks and dense overhanging riparian vegetation. Several observations of giant garter snakes have been made within a few miles of the project reaches in or around small irrigation drainages, canals, and rice fields (California Natural Diversity Database 2009).

Activities in the program area that affect giant garter snakes are primarily related to flood control and agricultural activities. Flood control projects may result in mortality during construction and habitat degradation can be caused by the alteration of agricultural water conveyance systems providing suitable habitat or the implementation of a levee setback or widening of a levee on the landside.

Valley Elderberry Longhorn Beetle

Valley elderberry longhorn beetle is federally listed as threatened under ESA. Elderberry shrubs are the host plant for valley elderberry longhorn beetle and are a common component of the remaining riparian forests of the Central Valley. Based on CNDDB (2009) valley elderberry longhorn beetle is reported to occur within all four program study area regions.

Implementation of the SRBPP impacts the valley elderberry longhorn beetle because of the substantial amount of riparian woodland that requires removal. Elderberry shrubs can also be incidentally damaged by construction personnel or equipment.

Mitigation Requirements and Strategies from Previous Biological Assessment/Biological Opinions and Agency Guidance

Since issuance of jeopardy opinions for SRBPP by USFWS and NMFS in 2001, the development of project-level BAs by the project sponsors (Corps and CVFPB) and subsequent BOs by USFWS and NMFS, have become the key mechanisms for identifying and imposing mitigation requirements on SRBPP actions. In 2007, however, the Corps formulated a programmatic approach (instead of project-level, as before) for construction of the remaining 24,000 linear feet of bank protection, prepared a programmatic biological assessment (2007 PBA), and obtained concurrence with its conclusions from USFWS and NMFS through their respective BOs. The following sections summarize relevant mitigation requirements and strategies from these and other documents that have guided the development of the Phase II Supplemental Authority programmatic mitigation strategy.

Relevant Provisions of 2001 Jeopardy Biological Opinions

The 2001 jeopardy biological opinions for SRBPP required the Corps to initiate programmatic consultation for the remainder of Phase II. The biological opinion also required the Corps to develop a comprehensive aquatic monitoring plan; a standardized approach for evaluating project effects on federally-listed fish species; and an inventory of nearstream shade, IWM, and riprap (i.e., the riprap database) within the SRFCP area. The biological opinions also required the Corps to charter and chair an interagency work group (IWG) to provide technical, biological, and regulatory assistance and approval related to the development of these products. The IWG—comprising staff of NMFS, USFWS, DFW, and CVFPB/DWR—was formed shortly after the opinions were issued and continues to function today.

In 2003, the Corps, with the assistance of the USFWS' Sacramento Field Office, completed the riprap database. The database includes an interface with digital photo-enhanced GIS software. The purpose of the database is to evaluate the environmental baseline and potential cumulative effects of bank protection projects within the SRFCP.

In August 2004, Corps issued the final SAM for the SRBPP to provide a standardized approach for evaluating project effects on federally-listed fish species. The SAM was designed to systematically evaluate impacts and compensation requirements of SRBPP bank protection projects based on the needs of the listed fish species, at both programmatic and site-specific levels. It embodies six variables for each of four average seasonal water surface elevations—bank slope, bank substrate size, and percents of bankline having instream woody material, vegetative cover, and shade from overhanging vegetation—as well as a *floodplain inundation ratio* (ratio of width of 2-year flood to width of mean winter and spring flow)

Relevant Provisions of 2007/2008 Programmatic Biological Assessment/ Biological Opinions

The 2007 PBA for the remaining 24,000 linear feet of SRBPP authority, and concurring 2008 BOs from NMFS and USFWS, embodied state-of-the-art onsite mitigation and direction for offsite compensation where onsite mitigation was found to be insufficient.

The 2007 onsite mitigation design templates, while not identical to the current designs, are substantially consistent for purposes of SAM analysis, having utilized very similar riparian and wetland benches with anchored IWM.

The 2008 BOs cover the same species under study for the Phase II 80,000 LF and appear to be generally applicable to new bank protection constructed as part of the 80,000 Phase II supplemental authorization as well. Thus, the following summary of the programmatic BA and BOs is provided as the framework for considering mitigation actions for the supplemental authorization.

Construction Access and Timing Windows

The 2007 PBA and 2008 BOs required waterside construction to occur where it minimized noise and traffic disturbances and effects on existing vegetation. For sites downstream of RM 60 on the Sacramento River, including sloughs, all in-water construction was required to be conducted between August 1 and November 30 (unless approved otherwise by USFWS). For sites upstream of Colusa (RM 144), the construction window was limited to July 1 to August 31due to the presence and sensitivity of spring-run Chinook salmon. For all other sites, in-water construction was to occur between July 1 and November 30 of each year (unless approved otherwise by NMFS).

Impact Assessment and Compensation for Fish Effects

The 2008 BOs allowed for the use of off-site compensation measures when bank repair actions were not fully self-compensating as determined by the SAM. Compensation requirements were determined on a bank-length basis using a ratio of 1:1 (project site length to compensation site length), using the SAM, with a goal of achieving a net positive time-integrated relative response for the project and compensation sites at all times. The BOs allowed for the use of conservation/mitigation banks as a means to satisfy off-site compensation requirements, and required the Corps to submit and follow a detailed monitoring plan.

Conservation Recommendations in the Biological Opinions

The key conservation recommendation in the BOs stated that the Corps should conduct or fund studies to identify setback levee opportunities at various locations, whether or not the existing levees at each location were in need of repair, that could be built under the SRBPP authority or other appropriate Corps authority. In 2009, the Corps partnered with the University of California at Berkeley in developing a modeling tool (the "floodplain analysis tool for native fish habitat") to identify and prioritize potential setback levee sites along the Sacramento River; the results of this study are now under review by the Corps. The BOs also specified that existing riprap protecting levees abandoned because of construction of a new setback levee should be removed if flood safety would not be compromised. A number of reasonable and prudent measures to be undertaken during implementation of the SRBPP were specified in the 2008 BOs. A summary of these measures are included in Appendix C.

The BOs also specified measures, many of them best management practices (BMPs), to help conserve and minimize impacts on special-status species (valley elderberry longhorn beetle, giant garter snake, raptors, and bank swallow. These measures are summarized in Appendix C.

Recent Requirements for Mitigation of Impacts to Riparian Habitat

The SRBPP 2007 programmatic BA documented that the proposed mix of design templates would result in increases in marsh and riparian habitat over time, so no additional compensation of riparian/marsh habitat was needed.

To the extent feasible, loss or damage to existing cottonwood trees was avoided, and, whenever possible, damaged or killed cottonwood trees were replaced with cottonwood seedlings.

Under the Fish and Wildlife Coordination Act, the USFWS considers riparian forest and riparian scrub-shrub to represent Resource Category 2. Resource Category 2 reflects a planning goal of no net loss of in-kind habitat value. The USFWS notes that to achieve this goal any unavoidable loss would need to be replaced in-kind.

Anticipated Mitigation Needs

As documented in the EIS/EIR and Biological Assessment, there are a number of effects that will require mitigation. This is generally consistent with previous SRBPP analysis and implementation phases/contracts. Following is a summary of the anticipated mitigation needs, including those for biological (fish and wildlife) resources and other non-biological resources.

Mitigation Requirements for Biological Impacts

Both quantitative and qualitative methods are used to determine mitigation needs, depending on the type of resource and the information and tools available to make such a determination. Quantitative results are utilized where they are available and/or reasonable to generate. Qualitative results are utilized where quantitative data are not available.

Mitigation Needs Based on Quantitative Analysis

Two types of quantitative analyses were conducted:

- riparian resource impacts; and
- Standard Assessment Methodology (SAM) analysis.

Descriptions and results of each are described below.

Riparian Habitat Analysis

A site-specific analysis was conducted to determine approximate amounts of riparian woodland and scrub/shrub vegetation that would be removed as a result of implementing an additional 80,000 LF of bank protection under SRBPP Phase II. A summary of the analysis follows. The analysis utilized 2008 Digital Globe aerial imagery (1-foot resolution) in addition to levee centerline and upstream/downstream site limit data for the 106 sites.

Vegetation was mapped if it was considered to be riparian woodland or riparian scrub/shrub. Distinctions were made between these two types of vegetation to the extent practicable, and mapped as distinct GIS shape files by digitizing polygons representing areas with tree canopy (either woodland or scrub/shrub).

The extent of vegetation mapped included the area within the upstream and downstream site limits and from the levee centerline waterward to the low flow channel and landward approximately 100 feet. Vegetation within these site "boundaries" was designated and calculated as "existing vegetation."

Lines representing the approximate locations of the levee toes at each site were digitized based on aerial photo interpretation. A 15-foot buffer was applied to the outward edge of each levee toe. The area between the outermost edges of the waterside and landside 15-foot buffers is considered to be the vegetation-free zone (VFZ) under the Vegetation ETL, as applicable to each bank protection measure.

For purposes of assessing effects of the alternatives, vegetation was assumed to be removed (referred to as "removed vegetation") if it was within the footprint of features to be constructed (e.g., placement of rock or soil). Vegetation within the entire VFZ of each site was mapped but only the vegetation within the VFZ and project footprint is included in the "removed vegetation" calculation, as SRBPP is assumed to apply Vegetation ETL standards only within the construction footprint. The local maintaining agencies (LMAs) are responsible for O&M and applying the Vegetation ETL standards to the levees; however, the Corps will apply the Vegetation ETL standards to the levee repair and within the project footprint during construction. When the site is turned over to the LMA after levee repair construction, the LMA will assume responsibility for O&M and applying ETL standards to the repair site footprint.

It is important to note that during project implementation at any individual site, all native trees within the construction footprint, but outside of the VFZ, that are greater than 4 inches diameter at breast height (dbh) shall be retained to the greatest extent practicable. Tree removal shall be limited to situations where access, required equipment maneuverability, worker and public safety, and levee integrity are not reasonably possible without removal of trees. However, for purposes of this programmatic analysis a conservative approach was taken to assess the amount of riparian vegetation that will be impacted. As a result, actual tree removal during implementation is likely to be less than that quantified in this analysis.

More specifically, vegetation to be removed was calculated based on the features of each measure's design. Bank protection measure assumptions were applied as explained below:

- Bank Protection Measure 1: Setback Levee. Vegetation removal encompasses the areas where the new levee transitions into the existing levee at the upstream and downstream ends of the site.
- Bank Protection Measure 2: Rock Slope with No On-Site Woody Vegetation. All vegetation on the waterward levee slope and extending to the low-flow river channel is removed.
- Bank Protection Measure 3: Adjacent Levee. All vegetation landward of the levee centerline and extending 50 feet is removed.
- Bank Protection Measures 4a, 4b, 4c: Riparian Benches with Revegetation. Same assumptions as under Bank Protection Measure 2.
- Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation. Same as Bank Protection Measure 2 except that 25% of existing vegetation is retained.

Alternative 6, which relies on a variance from the Vegetation ETL, utilizes the following assumptions:

- Bank Protection Measures 1, 2 and 3 are the same as described above.
- Bank Protection Measures 4a, 4b, 4c, and 5 remove vegetation only in the area from the low-flow channel up to 15 feet from the waterside of the levee toe. Vegetation on the waterside levee slope and within 15 feet of the waterside levee toe is not removed.

Additionally, Bank Protection Measure 5 under Alternative 6 assumes that 25% of vegetation within the vegetation removal area is retained. Retained vegetation was calculated by subtracting removed vegetation from existing vegetation.

"Plantable area created" was calculated for each bank protection measure based on the amount of surface area that is suitable for planting riparian vegetation and outside of the VFZ. For example, bank protection measures with riparian benches were assumed to provide a planting surface that is 15 feet wide and the length of the entire site. Setback levees were assumed to provide a planting area 100 feet wide and the length of the entire site except for those areas at the upstream and downstream portions of the site where the new levee transitions into the existing levee. Rock slope with vegetation was assumed to create a plantable area equal to an area 15 feet wide for the length of the site. No plantable area created was assumed for rock slope without vegetation. While it is recognized that adjacent levees may provide opportunities for planting riparian vegetation on the waterside because the VFZ would shift landward with the footprint of the new adjacent levee, the plantable area depends on site-specific detail. Consequently, the assumption is that adjacent levees create no plantable areas.

Table 1 through Table 5 indicate the amounts of removed vegetation and plantable area created. Table 6 indicates the mitigation deficit for each alternative assuming a 1:1 mitigation ratio.

Table 1. Summary of Site-Specific Vegetation Analysis for Alternative 2 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	6.78	4.79	4.69	1.22	0.00
Region 1b	10.26	2.11	7.63	2.11	2.63	0.00	0.00
Region 2	9.04	0.68	4.73	0.68	4.31	0.00	0.00
Region 3	4.94	0.00	3.95	0.00	0.99	0.00	0.00
Subtotal	35.72	8.80	23.09	7.58	12.63	1.22	
Total	44.52		30.67		13.85		0.00

Table 2. Summary of Site-Specific Vegetation Analysis for Alternative 3 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	3.67	0.83	7.81	5.17	14.04
Region 1b	10.26	2.11	1.27	0.00	9.00	2.11	0.48
Region 2	9.04	0.68	1.81	0.00	7.23	0.68	9.61
Region 3	4.94	0.00	0.02	0.00	4.92	0.00	2.86
Subtotal	35.72	8.80	6.77	0.83	28.95	7.97	
Total	44.52		7.60		36.92		26.99

Table 3. Summary of Site-Specific Vegetation Analysis for Alternative 4 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	4.16	1.28	7.32	4.72	14.56
Region 1b	10.26	2.11	6.80	1.97	3.46	0.15	1.95
Region 2	9.04	0.68	6.39	0.68	2.65	0.00	7.85
Region 3	4.94	0.00	3.94	0.00	1.00	0.00	1.19
Subtotal	35.72	8.80	21.29	3.93	14.43	4.87	
Total	44.52		25.22		19.30		25.55

Table 4. Summary of Site-Specific Vegetation Analysis for Alternative 5 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	4.16	0.98	7.32	5.03	16.11
Region 1b	10.26	2.11	5.03	0.84	5.23	1.27	1.88
Region 2	9.04	0.68	6.21	0.68	2.82	0.00	16.28
Region 3	4.94	0.00	0.38	0.00	4.56	0.00	5.49
Subtotal	35.72	8.80	16.66	2.50	19.95	8.30	
Total	44.52		18.27		26.25		39.76

Table 5. Summary of Site-Specific Vegetation Analysis for Alternative 6 (acres)

	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
Region	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	4.03	3.39	7.45	2.62	8.01
Region 1b	10.26	2.11	5.62	1.61	4.64	0.51	2.59
Region 2	9.04	0.68	5.14	0.68	3.90	0.00	7.85
Region 3	4.94	0.00	3.95	0.00	0.99	0.00	1.19
Subtotal	35.72	8.80	18.75	5.68	16.97	3.12	
Total	44.52		24.43		20.09		19.65

Table 6. Summary of Mitigation Needs Assuming a 1:1 Mitigation Ratio for each Alternative (acres)

Alternatives	Removed Vegetation	Plantable Area Created	Mitigation Needed Assuming 1:1 Mitigation Ratio
1	0.00	0.00	0.00
2	30.67	0.00	30.67
3	7.60	26.99	(19.39)
4	25.22	25.55	(0.33)
5	18.27	39.76	(21.49)
6	24.43	19.65	4.78
( ) = surplus			

As previously described, these results are adequate for planning purposes. The results indicate that riparian vegetation mitigation needs vary among alternatives, ranging in a need from 0 to over 30 acres (assuming a 1:1 mitigation ratio). Some alternatives result in a surplus of restored vegetation which indicates a need for 0 acres of mitigation based on a 1:1 mitigation ratio.

Standard Assessment Methodology (SAM)

The SAM (U.S. Army Corps of Engineers 2004) was developed by the Corps and Stillwater Sciences, in consultation with NMFS, USFWS, DFW, and California Department of Water Resources (DWR), academic contributions from the University of California at Davis and Humboldt State University, and peer review by sixteen professionals in fish biology, river geomorphology, environmental sciences, and engineering. The SAM allows agencies to quantitatively assess the potential effects of bank protection and stream restoration projects to ensure that these activities do not jeopardize Chinook salmon, steelhead, green sturgeon, and delta smelt, or destroy or adversely modify their critical habitat. The SAM can also determine suitable compensation for habitat loss, by evaluating the benefits of certain design features (e.g., planted emergent vegetation) to target fish species.

For purposes of this strategy (and consistent with the analysis in the EIS/EIR), the SAM model was applied to each of the 106 sites and then rolled up to summarize changes in each region. Bank attributes of each erosion site were identified, such as bank slope, floodplain inundation, bank substrate size, IWM, aquatic vegetation, and shade. These values were analyzed using SAM, comparing the proposed action to the baseline. The assessment for each site utilized the bank protection measure selected for that specific site.

The methods and results of the SAM analysis are included in Appendix D. The largest impact value for each alternative is provided below in Table 7. It is important to note that the largest impact values for several alternatives were associated with Green sturgeon. However, it is expected that the impact values that will drive the determination of mitigation needs will be based on the impact values for salmonid species. As discussed more fully in the project's Biological Assessment, long-term changes in nearshore habitat resulting from project implementation are expected to have negligible effects on adult green sturgeon because adult sturgeon use deep, mid-channel habitat during migration. Additionally, the negative SAM results for green sturgeon are primarily a result of changes in nearshore slope. While these changes in slope do occur, the proposed action typically will not affect (i.e., change the slope of) the deeper parts of the channel that are utilized by adult green sturgeon. Conversely, these changes in habitat are very relevant to salmonids and their various life stages when present in the system. As such, Table 7 reports the largest impact values for salmonid species.

Table 7. Summary of Greatest SAM Deficits by Alternative (linear feet)

Alternative	Deficit	Species	Lifestage	Year
1	NA	NA	NA	NA
2	-14,151	Spring run chinook salmon	Juvenile migration	2070
3	-652	Spring, Fall, and Winter run chinook salmon	Adult migration	2018
4	-1,241	Fall run chinook salmon	Adult migration	2028
5	-653	Spring, Fall, Late Fall, and Winter run chinook salmon	Adult migration	2015
6	-2,320	Steelhead	Adult residence	2028

Mitigation Needs Based on Qualitative Analysis

Mitigation needs for several species were evaluated on a qualitative basis because site-specific information on their distribution was not sufficient for quantification. In contrast to quantitative, habitat based mitigation estimates (see previous section), mitigation for these species typically implements site-specific surveys and identified federal and state agency mitigation guidance. The qualitative analysis identified several species as potentially occurring at erosion sites but whose presence or absence requires site specific and timely information. These species include raptors (Swainson's hawk, white-tailed kite, osprey, burrowing owl), valley elderberry longhorn beetle, giant garter snake, and bank swallow.

The mitigation techniques for these species will all be similar in that once an erosion site has been identified site-specific species surveys will be conducted by an appropriately qualified biologist. These surveys will be conducted at the appropriate time period (or periods if appropriate overlap is not possible) based on survey protocols so that, if present, all potentially present species have the highest likelihood of detection. Site-specific avoidance and minimization measures will be identified such as setbacks or buffers around active nests or burrows and, in some cases, specific design features. If site specific-conditions prevent avoidance or minimization then the appropriate mitigation or habitat compensation will be instituted per agency guidelines and in consultation with USFWS or DFW (see Mitigation Requirements and Strategies from Previous Biological Assessment/Biological Opinions). These mitigation measures will include on-site and/or off-site mitigation as appropriate and will be determined in consultation with USFWS or DFW.

Supporting habitat for special-status plant species are generally not expected to be occur at erosion sites. The lack of potential impact is because construction, staging, and project access will be generally limited to the levees, established roadways, and previously disturbed areas that do not support natural topography and habitats. However, field surveys will be conducted for the presence of habitats that would contain special-status plant species. If such habitats occur, special-status plant field surveys would be conducted and avoidance, minimization or compensation actions would be identified.

Mitigation Needs for Other Impacts

In general, impacts and mitigation for some non-biological impacts are governed by various implementation regulations, and by State and local land-use laws. A majority of these impacts, including removal of various landowner improvements such as docks and staircases and agricultural infrastructure such as pumps and irrigation lines, are normally addressed by the local partner (in most cases the CVFPB) through acquisition of lands and easements.

Permanent and permitted landowner improvements (e.g., docks) may limit the suitability of a site for onsite habitat mitigation and should be considered during the design process. Appropriate mitigation, as warranted, for impacts to landowner improvements needs to be considered as a part of the project's real estate process in conjunction with applicable federal and state design, regulatory and operational considerations.

Mitigation Strategies

The following goals are recommended as an overall approach to mitigation during implementation of the SRBPP Phase II supplemental authorization:

- Over the long-term, develop mitigation methods that provide suitable habitat while reducing flood damage.
- For bank stabilization projects in the near term, maximize onsite mitigation without compromising flood safety, to minimize the need for offsite compensation.
- Establish the appropriateness of out-of-kind mitigation to help maximize onsite mitigation where in-kind mitigation is not possible (i.e., to compensate deficits arising from one SAM variable with surplus in another).
- Continually seek offsite compensation opportunities, through development or expansion of Corps' compensation projects, collaboration with other habitat enhancement programs, and use of commercial compensation/mitigation banks.
- Select mitigation methods that provide appropriate compensation in the most cost-effective manner as informed through an incremental cost analysis.

Following are brief summaries of the various types of mitigation for consideration.

- **In-lieu fee program.** This option, wherein a permittee/applicant pays the permitting agency to implement mitigation at its discretion, generally has low favorability with the agencies requiring mitigation because it shifts the burden of responsibility for providing replacement habitat from the applicant/permittee to the permitting agency. It is often regarded as a "last resort" and typically applies only to very small projects and impacts where other mitigation options may not be feasible, upon negotiation with the permitting agency. Approved in-lieu fee programs may not exist for all mitigation needs in the project area.

- **Out-of-kind replacement habitat.** This option involves replacement of habitat with a different type than that which was impacted, either on-site or off-site.
- **On-site replacement habitat.** This option involves replacement of affected habitat with new habitat of the same type and at the same location as the loss.
- **Off-site, in-kind replacement habitat.** This option involves replacement of affected habitat with new habitat of the same type but at a different location than the loss. This often allows for consolidation of mitigation at a single or small number of sites, allowing for economy of scale and higher quality habitat due to large patch size. There are two sub-types:
    - **Constructed mitigation.** Constructed offsite mitigation involves securing an appropriate mitigation site, implementing a mitigation plan, monitoring its performance, maintaining the site during the establishment period, developing a conservation mechanism, and arranging a source of funding for long-term protection of the site.
    - **Purchase of credits at commercial mitigation banks.** Purchase of mitigation bank credits involves utilizing a commercial mitigation bank or banks to fulfill the project's compensatory mitigation obligation. The mitigation bank or banks would need to have been approved by the permitting agencies for the habitat types and service area that covers the impact.

It is unlikely that a single mitigation approach can solely fulfill all of the project's mitigation requirements. Additionally, while each of the described methods may have some applicability, the in-lieu fee program has the least applicability while the on-site replacement habitat is the most applicable. Out-of-kind replacement habitat and off-site, in-kind replacement habitat both have strong potential to help address the program's overall mitigation needs. The applicability of the most relevant is expanded on below. A cost effectiveness and incremental cost analysis of the options for mitigating habitat and wetland impacts associated with the Program is provided in Appendix E.

Table 8. Mitigation Options Table

Approach	Advantages	Disadvantages
In-lieu fee program (off-site, can be in-kind or out-of-kind)	• Simple transaction • Useful option for small impacts • Useful option for types of mitigation that are new, difficult to successfully implement, or not widely available	• Few such programs available
Replacement (on-site, can be in-kind or out-of-kind)	• Often less costly than purchasing mitigation bank credits • Ability to locate multiple habitats at one location to fulfill multiple mitigation objectives	• On-going liability for habitat performance and long-term protection • Complex long-term process to establish, maintain, and protect created habitats that may involve many parties over multiple years
Mitigation Bank (off-site, can be in-kind or out-of-kind)	• Created credits are like any other commodity that can be purchased • Severance of liability for short- and long-term habitat performance, maintenance • Simple transaction	• Availability of appropriate credits with a service area that covers the impact site is inconsistent • Commercial mitigation credits are expensive, often costing more per credit-acre when compared with traditional mitigation projects
'Turn-key'/project specific mitigation (off-site, can be in-kind or out-of-kind)	• Similar benefits to purchasing mitigation credits • Relatively simple transaction • Some severance of liability • Can address in-kind and out-of-kind	• Similar price premium as purchasing mitigation credits • Severance of liability is not always as clear-cut in the eyes of the resource agencies when compared to purchasing credits

On-site Mitigation

On-site mitigation has historically contributed substantially to SRBPP's mitigation needs and should continue to make the primary contribution under the supplemental authorization. The most common on-site features include riparian vegetation, riparian benches, wetland benches, and setback levees. While adjacent levees are also included in the current suite of bank protection measures being considered for the supplemental authorization, they would most often result in preservation of habitat rather than mitigation.

The on-site mitigation approach obviously addresses the natural resource agencies' preference for on-site mitigation and it often can address the preference for in-kind mitigation. While the bank protection measures sometimes result in net onsite deficits in habitat values, requiring offsite mitigation in order to fully mitigate, site-specific design modifications can often minimize these deficits.

Bank protection designs should ultimately be site-specific; that is they should be tailored to accommodate the unique conditions at each site. For example, if no remnant berm is present, the height and bulk of the appropriate treatment may need to be greater than if some vegetated berm is still intact. The differences in this example are that berm vegetation often helps dissipate floodflow energy, resulting in less erosive potential on the upper bank and actual levee slope, and that the berm itself provides an erodible medium that increases the likelihood that erosion of the levee behind it will not develop so rapidly that floodfight actions cannot prevent failure in a single flood.

The onsite mitigation value of such modified templates should be applied in a manner that focuses on the replacement of riparian vegetation affected by the vegetation free zone as well as the six SAM variables. Full onsite mitigation has been achieved as measured by SAM for some previous site repairs utilizing a tailored design while still providing the necessary level of flood safety.

Additionally, on-site mitigation efforts that create substantially more compensation than necessary to fully offset on-site impacts may have the excess compensation credited, accounted for, and used through appropriate consultation processes, or under appropriate conservation and advance mitigation agreements.

Off-site Mitigation

If actions are not fully mitigating as determined by the final SAM analysis or other evaluation tools, off-site mitigation will be implemented. Off-site measures can include a variety of measures, such as planting shrubs and/or trees on natural or revetted slopes, installing IWM, or constructing setback levees. All of these approaches are intended to offset permanent, incremental adverse effects of revetment. The mitigation process would provide habitat gains, in terms of bank-line length or wetted-area, from the off-site mitigation site(s) to those sites where habitat losses are occurring as a result of bank repair actions.

Offsite habitat improvement projects would be pursued within each of the affected regions to fully compensate for the temporal and spatial effects of the action as quantified in the SAM model results. The region-specific habitat improvements will ensure that reach level deficits are fully compensated. The Corps and CVFPB are in various stages of developing compensation projects at the Furlan site at RM 82 along the Sacramento River, at RM 0.5 on the Lower American River, and at a site on Cache Slough. Some or all of these projects may be able to provide some compensation for impacts of the bank protection projects conducted under the supplemental authorization. If the Cache Slough site is utilized for compensation under the proposed program, the Corps would first coordinate with USFWS to reach an agreement on long-term maintenance and monitoring.

Following is a summary of a previous analysis (Stillwater Sciences 2007) that considered three offsite scenarios. However, opportunities exist for refining these compensation approaches and formulating others. Other approaches are noted following the summary of the three existing approaches.

Specific Off-site Mitigation Scenarios to Be Considered

The 2007 Programmatic Biological Assessment (Stillwater Sciences 2007) includes the results of applying SAM to a likely distribution of the 24,000 lf of bank protection projects, using the four standard design templates considered at that time. Net deficits in habitat values were predicted. The analysis also includes application of SAM to three offsite compensation scenarios to determine the extent of offsite compensation that may be required to offset these deficits. The three offsite compensation scenarios are setback levees, installation of instream woody material at offsite locations, and reductions in bank slope at offsite locations. The results of these analyses are described below and are instructive about the types and amounts of offsite mitigation that may be needed under the supplemental authorization.

Scenario 1 – Off-site Compensation Via Setback Levees

Under this scenario, setback levees would be constructed landward 500 feet from the existing river bank levees. Potential sites for setback levees may be identified through the floodplain analysis tool for native fish habitat developed by the University of California at Berkeley. Existing levees would be retained but would be breached in several locations so that seasonal high flows could inundate the restored floodplains between the existing levee and the newly constructed setback levee. Several habitat characteristics would evolve within the modeled 50-year time period in response to the increased floodplain areas at each setback levee site. The *Floodplain Inundation Ratio* would initially be significantly greater than existing conditions, but would gradually decrease due to channel migration into the floodplain. The channel at these sites is assumed to migrate laterally approximately 300 ft. from the current channel position over 50 years (i.e., 6 ft./yr.) based on a meander migration model performed for a proposed setback levee site along the Sacramento River at RM 79. During channel migration, the average bank slope of the existing levee and floodplain would likely remain relatively constant, especially in Regions 1b, 2, and 3, where existing average bank slopes are characteristic of eroding banks (<3:1). By Year 5, the median size of bank substrates would be reduced to natural silt and sand materials following natural revetment removal and initiation of bank erosion. The reduction in bank substrate size would benefit habitat quality for juvenile and smolt salmonids.

Anchored IWM would be installed on the restored floodplains, thus providing instream cover during winter and spring. The floodplain would additionally be revegetated using planting plans similar to those of the bank stabilization design templates. Instream cover from aquatic vegetation and shade from overhead tree canopy would therefore be expected to gradually increase over the modeled time period, when vegetation planted on the newly restored floodplain grows.

Scenario 2 – Off-site Compensation Via Installation of Instream Woody Material

This offsite habitat compensation measure involves installing anchored IWM along the banks of the compensation-site locations. Bank segments would be chosen that currently possess no large woody debris. IWM would be anchored to the existing bank at the average seasonal water surface elevation (which season is not defined), to provide year-round instream structure. Bank coverage would be 40%, and is assumed to remain constant over the modeled time period. The placement of IWM is assumed to augment other existing conditions at typical compensation sites.

Scenario 3 – Off-site Compensation Via Bank Slope Reduction

Construction of shallow bank slopes at bank revetment segments that lack IWM and shade coverage was selected as another potential off-site compensation measure. Under this compensation measure, fill material would be placed on the compensation site bank segments to construct shallow bank slopes at 3:1(dW:dH). In Region 1a typical existing bank slope is 4.6:1. Therefore, this compensation measure was only assessed in Regions 1b, 2, and 3. Construction of a shallow bank slope is assumed to augment other existing conditions at the compensation sites.

Other Possible Off-site Mitigation Approaches

Offsite mitigation for projects constructed under the supplemental authorization need not be limited to the three approaches identified programmatically for the completion of the original Phase II authorization, as described above. Other approaches should continuously be evaluated during implementation of the supplemental authorization and include:

- Improving floodplain salmonid habitat. This could be achieved by
  - planting trees and/or shrubs in revetment,
  - planting trees and/or shrubs in natural slopes,
  - enlarging floodplains,
  - reducing floodplain elevations to increase frequency of inundation,
  - improving the distribution of pulse flows resulting in more-frequent floodplain inundation during the juvenile rearing season,
  - ensuring annual floodplain inundation during drier years through pulse-flow management,
  - eliminating features causing fish trapping during recession flows (i.e., improving floodplain connectivity), and
  - increasing floodplain vegetation-type patchiness.

  The Corps-developed *Floodplain Salmonid Habitat Assessment Model* (FSHA), which includes variables of floodplain inundation frequency, seasonality, extent, and duration, as well as floodplain condition (connectivity and vegetation pattern), can be used to supplement the SAM valuation of extent of floodplains (Jones & Stokes 2008).

- **Revetment Removal.** Reestablishment of channel migration and IWM input, along with riparian habitat renewal, could be achieved by planting riparian vegetation on former floodplain and removing riprap protecting it. Some criteria to consider when identifying sites for rock removal are:
  - Revetment is adjacent to public or conservation ownership land or a willing private landowner;
  - Revetment is not protecting important public infrastructure;
  - Revetment removal does not create an obvious flood hazard;
  - Revetment is currently limiting meander on lands in the historic meander belt;
  - Revetment removal could result in ecosystem benefit (for example, land reworking/creation of riparian habitat, creation of new bank swallow habitat, recruitment of spawning gravel, new shaded riverine aquatic habitat, etc.); and
  - Revetment removal could help direct meander to protect public infrastructure (if applicable).

There are some unknowns related to revetment removal, including how it would be removed, what to do if valuable riparian habitat has become established on the revetment, and what to do with the revetment once it is removed (reuse versus landfill).

- **Habitat Nodes.** Developing habitat nodes at suitable specific locations within the existing levee system (e.g., Marys' Lake). Node development may involve enhancing remnant floodplain features such as oxbow lakes, rehabilitating or constructing sidechannels, replacing adjacent orchards with riparian habitats, introducing IWM into the site, and a variety of other actions to create high-value habitat nodes for the foraging and rearing of juvenile salmonids. Several inventories of sites offering such opportunities have been conducted, including the Identification of Mitigation Options and Offsite Mitigation Site Identification/Concept

Memorandum developed by Jones & Stokes (Jones & Stokes 1999) and the Corps' Comprehensive Study compilation of potential measures.

Estimating the Extent of Needed Off-site Mitigation

SAM, with appropriate supplements, should continue to be used to value onsite habitat deficits/offsite compensation requirements, and to value offsite mitigation projects. Mitigation requirements need to be based on achieving compensation as soon as possible after construction impacts occur, ideally in 1–2 years. To the degree that surplus habitat value accrues as onsite mitigation plantings mature, this surplus should first be treated as countering the *risk and uncertainty* associated with both onsite mitigation and offsite compensation projects. That is, an unknown fraction of the modeled onsite replacement and the offsite compensation can be expected to fail or perform at less-than-expected levels. In some cases, these undesirable results may not develop for several years. Nonetheless, if onsite mitigation surpluses are substantial, in consultation with USFWS and NMFS, a portion of such substantial surpluses might be considered bankable for compensation for impacts at other bank protection sites.

Off-site Compensation Estimates Based on the 2007 BA

The previously conducted SAM analysis of the benefits of providing the three alternative types of offsite compensation described above (Scenarios 1–3) revealed the extent of offsite compensation that might have been needed to offset habitat deficits associated with a large bank protection undertaking (24,000 lf in the case of that analysis). The previous programmatic SAM analysis indicated that substantial habitat-value deficits would result from the onsite actions, and that significant offsite compensation would likely be needed. Subsequent site-specific SAM evaluations indicated that not nearly as much was required, but that may not always be the case.

Results presented in the previous analysis (Stillwater Sciences 2007) were analyzed and summarized as mitigation ratios for purposes of this mitigation strategy by ICF; see Table 9. As the table shows, compensation ratios vary widely among reaches and among mitigation scenarios, reflecting the complexity of assumed site-specific conditions and/or the ability of the SAM model to accurately reflect certain habitat values. Accordingly, only the ratios specified for the total program are particularly instructive, and even these programmatic estimates may be found to be inaccurate as the subsequent site-specific SAM evaluations are conducted.

Table 9. Mitigation Ratios Developed by ICF from SAM Results in Corps' 2007 Programmatic Biological Assessment

			Estimate Ratio of Offsite Compensation Action		
Region	Assumed Extent of Bank Protection (ft)	Percent of Total	Setback Levee	Instream Woody Material	Shallow Bank Slope
1a	5,807	24%	4.6:1	1.1:1	na
1b	7,836	33%	8.3:1	1.7:1	12.6:1
2	8,717	36%	2.9:1	0.3:1	1.3:1
3	1,640	7%	2.2:1	0.4:1	1.1:1
Total	24,000	--	5.0:1	1.0:1	4.7:1

The conclusions pertinent to the 80,000 lf supplemental authorization are that use of the 2007 design templates could result in a moderately large extent of offsite compensation, if IWM placement is the chosen mode of providing the compensation. Using the SAM-predicted ratio of 1:1, construction of 80,000 lf of newly-authorized bank protection, if the same design templates are used, is likely to require about 80,000 lf of placement of IWM at other locations along the river system. IWM placement may be the most cost effective means of providing the needed compensation, because, as shown, the bank-length compensation ratios for both setback levees and earthwork to reduce bank slopes are 5:1, and considerably more effort would be required per foot of compensation.

Actual Off-site Compensation Requirements for Previously Constructed Sites

Subsequent site-specific SAM evaluations indicated that not nearly as much off-site compensation was required compared to the estimates presented in the 2007 BA. The 2008 SAM Analysis of 29 Constructed Bank Repair Sites for the Sacramento River Bank Protection Project (29-site SAM analysis) (U.S. Army Corps of Engineers 2008) details the post-construction SAM assessment of habitat-related impacts for 29 SRBPP bank protection sites totaling 24,728 LF. It also describes what off-site compensation measures were ultimately used to mitigate for these impacts. The majority of these 29 sites were constructed between 2002 and 2007, and most were identified as erosion sites in Ayres Associates' 2005 Sacramento River Erosion Site Inventory (Smith pers. comm.), which was one of the reports used by Stillwater to identify the representative sites used in the 2007 BA.

All of the sites were constructed with built-in habitat enhancements to mitigate for short-and longer-term construction-related effects on critical habitat for listed fish species. These are similar to some of the designs featured in the proposed program. The designs for the 29 sites included:

- Riparian bench above mean summer water level to provide aquatic habitat during lower and higher river stages in winter and spring,
- Placement of IWM for aquatic habitat, and
- Installation of pole and container plantings to stabilize the bank and provide riparian and SRA habitat.

In addition, inundated wetland benches were constructed below the mean summer water level at seven of the sites located within or near the Delta to provide year-round aquatic habitat.

According to the 29-site SAM analysis, SAM results for the 29 sites constructed under the SRBPP program between 2002 and 2007 showed short-term habitat deficits within Regions 1a and 1b after construction. In coordination with USFWS, the Corps utilized the maximum SAM deficits for juvenile rearing or smolt life stages to determine salmonid habitat impacts; these deficits were 488 LF and 168,801 square feet. For mitigation of these short-term effects, USACE agreed to purchase or develop created aquatic habitat with equivalent SAM values to provide 488 feet and 168,800 square feet of habitat (1:1 ratio).

Delta smelt SAM deficits for these 29 sites were mitigated by off-site compensation at the Cache Slough/Yolo Bypass Mitigation Area. The 29-site SAM analysis report describes 1,166 LF and 6.2 acres of SAM-related deficits for delta smelt habitat, plus an additional mitigation requirement of 1,365 LF and 15.70 acres due to out-of-work-window construction that occurred at critical sites. A total of 2,531 LF and 21.9 acres were used at the Cache Slough site for mitigation (1:1 ratio).

As described in the previous section, the 2007 BA identified a substantial need for off-site mitigation. However, based on the results of site-specific SAM analyses, the actual implementation of 24,000 linear feet of bank protection resulted in the need for substantially less off-site mitigation.

Other Habitat Valuation Methods

As previously noted, other forms of offsite compensation may also be considered. Floodplain improvement projects can be valued through the FSHA Model. Valuation methods for reestablished channel migration projects and habitat nodes projects are under development in coordination with the IWG and could provide valuable data in this process. The method of incorporating all of these habitat valuation methods into the SAM valuation process needs to be established.

One need/opportunity posed by the supplemental authorization is to conduct a system-wide analysis of the potential for the river system to accommodate the needed levels of offsite compensation, and possibly considering a likely Phase III authorization. It may be prudent to evaluate the system-wide capacity to provide a large extent of offsite compensation together with the extensive bank protection. Such analysis would reveal whether such offsite compensation of a large magnitude is feasible, and which scenarios for offsite compensation, or combinations of scenarios, ought to be targeted. Once again, efforts taking place under the IWG could provide valuable information to this process.

SAM does not, and is not intended to, value potential degradation of the riparian forest system from bank protection, except for trees that provide overhead cover to the various seasonal shorelines. In many locations the riparian forest extends significantly landward of these bank trees. In the past, modeling using HEP, focused on habitat requirements of particular riparian-dependent wildlife species, has been used to quantify impacts and compensation requirements for impacts to riparian vegetation communities. It may be desirable to consider supplementing the SAM with riparian-impact modeling or other riparian-habitat impact mitigation processes to ensure that the constraint on further degradation of the Sacramento Valley riparian systems is reflected in implementation of the Phase II supplemental authorization.

Commercial Mitigation Banks

Several permitted commercial mitigation banks with service areas covering the program area exist within the region. More specifically, both riparian and shaded riverine aquatic (SRA) mitigation credits are available commercially in the Sacramento Valley, as are other relevant credits such as VELB, GGS, and wetlands/vernal pools. The largest private mitigation banking firms, Wildlands and Westervelt Ecological Services, both have existing or proposed mitigation banks with these credits directly adjacent to the lower Sacramento River or in close proximity (i.e., with approved service areas that cover many of the potential project sites). Appendix E, the Cost Effectiveness and Incremental Cost Analysis, discusses these mitigation banks in more detail. Figures E-1 and E-2 depict the service areas of Wildlands and Westervelt, respectively. Tables E-9 and E-10 identify the types of mitigation available within each of the mitigation banks and related service areas.

Coordinating with Related Habitat Enhancement Programs

Relevant to meeting offsite compensation needs, opportunities may be presented by existing regional flood management plans and programs, future similar programs, and commercial mitigation banking projects. The State of California's Central Valley Flood Protection Plan and associated Conservation Strategy contain strategies for integrating ecosystem function improvements with flood-risk reduction projects, and could be used to help guide off-site compensation approaches. The Central Valley Integrated Flood Management Study being conducted by the Corps and CVFPB may offer similar opportunities. All of these programs and projects should be continuously monitored during implementation of the supplemental authorization, and, where appropriate to facilitating achievement of offsite compensation needs, the SRBPP program should engage and support them.

Options for Long-Term Operation

This section only addresses constructed mitigation, as compensatory mitigation not addressed below will be deemed satisfied and complete through purchase of credits from a commercial mitigation bank approved by the appropriate resource agencies.

Two primary options exist for long term ownership, operation, and maintenance of compensatory mitigation sites. These are non-profit land conservancies or a state or federal resource agency.

Land Conservancies

Non-profit land conservancies work with property owners, developers, public resource agencies, and other organizations to manage and protect open space land. This is done through fee title purchase of lands, acquisition of conservation easements, or receipt of land through donation. The factors that would largely influence whether a land conservancy will take fee title or management responsibility for a mitigation site is the adequacy of the endowment to fund long term monitoring and stewardship, the proximity of the site to other properties they control or manage, and the compatibility of the mitigation sites and its resources with other holdings the conservancy controls or manages.

Proper endowment calculations are necessary to ensure adequate long term funding of ongoing maintenance and monitoring activities for mitigation sites. Utilization of Property Analysis Record (PAR) software (or the equivalent) is the best method for calculating management costs over the long-term. Documentation of this process should accompany any endowment funding for mitigation lands.

State or Federal Resource Agency

Public resource agencies are another option for long-term management of the mitigation sites. The most appropriate agencies to do so would be the USFWS or the DFW. Both of these entities manage large open spaces throughout the state. Like land conservancies, these resource agencies would likely require an endowment to accompany fee title transfer or management responsibility to take place in order to reduce the financial burden of caring for the land and resources. In certain geographies, the mitigation sites may be adjacent to publicly owned open space which may make transfer and management by a public agency easier.

Coordination with Local Maintaining Agency

Because most of the mitigation sites will occur along water bodies that are adjacent to flood control facilities (i.e., levees), coordination with local maintaining authorities (i.e., reclamation districts or flood control agencies) may be required for access through mitigation sites with maintenance roads, flood control inspections, and maintenance activities. Close coordination between responsible entities is needed so that flood control maintenance activities do not conflict with habitat restoration goals and objectives.

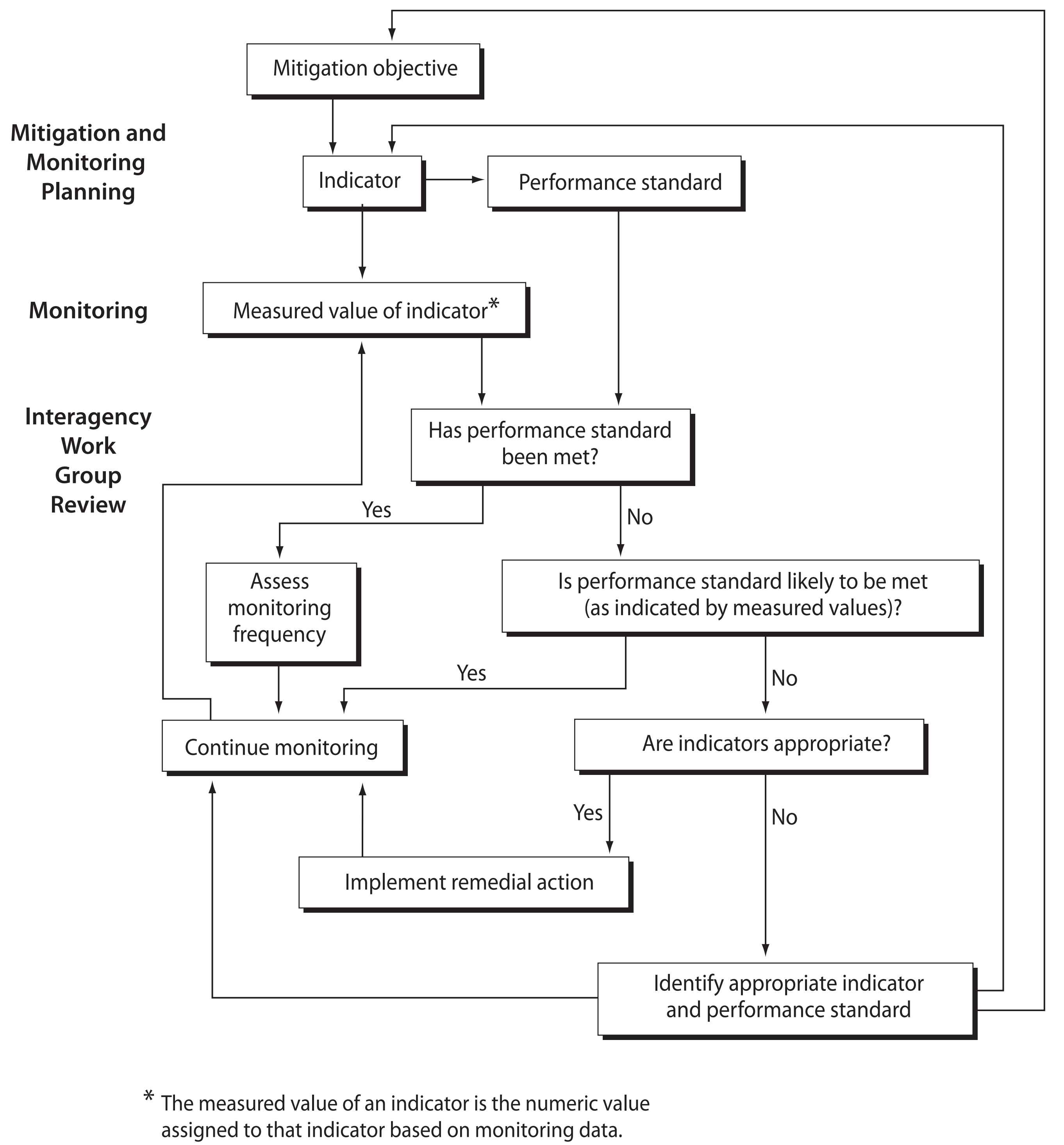

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Figure 1
Flow Chart of the Adaptive Management Process for Meeting Performance Standards

Adaptive Management

Adaptive management, in this case, is defined as a decision-making process to optimize the long-term implementation of mitigation measures for the SRBPP. One of the objectives of adaptive management is to ensure that ecological functions and habitat values affected by the SRBPP are reestablished. Key components of adaptive management are identifying indicators for ecological functions and habitat values, monitoring the indicators, setting performance standards (numerical and descriptive goals) for the indicators, and planning and implementing remedial actions. The adaptive management process provides a mechanism by which remedial actions for riparian and wetland mitigation, aquatic habitat mitigation, wildlife habitat mitigation and other resource monitoring efforts can be implemented if a performance standard is not achieved.

Figure 1 illustrates the adaptive management process, including selection of indicators and performance standards during the planning process, measurement of indicators as part of the monitoring phase, and assessment to determine achievement of mitigation objectives during the agency review phase. All three phases are ongoing until the mitigation objectives are achieved.

This programmatic mitigation strategy includes adaptive management as an integral component of the Program. The concepts of monitoring objectives and performance standards were previously described and, in some cases, have been detailed in the EIS/EIR.

Ongoing oversight of programmatic mitigation strategy implementation will be provided by the IWG. The IWG will amend the programmatic mitigation strategy, if necessary, on the basis of the monitoring results and through a consensus process subject to any necessary regulatory approvals. Fish population and environmental data collected under the SRBPP will be used, as appropriate, by the IWG in the adaptive management of this programmatic mitigation strategy. The IWG will also take an integrated watershed approach, to the extent possible, for implementation of mitigation measures in a manner that reflects the interconnectedness of flood protection and other projects in the program area.

The IWG will assure that mitigation measures successfully reestablish ecological functions and habitat values and that other adaptive management processes are in place to ensure that environmental commitments and mitigation measures are adequately implemented. The IWG will review monitoring results to determine whether the performance standards established by the programmatic mitigation strategy have been achieved.

The following describes the adaptive management process illustrated in Figure 1 and defines specific terms used in that figure.

- An “indicator” provides information about the condition of ecological functions and habitat affected by mitigation actions. For example, “survival” or “percent cover” could be indicators for riparian vegetation installed as mitigation.
- “Monitoring” provides specific data or values for each indicator affected by mitigation actions.
- “Performance standards” are numerical and descriptive goals for each indicator.

If a performance standard is not achieved, the IWG will determine whether the performance standard is likely to be met. This will be determined by IWG’s analysis of measured values. If the IWG decides that the performance standard is not likely to be met, then the IWG will determine whether the indicator is appropriate and, if the indicator was determined to be inappropriate, identify another indicator and performance standard. If the IWG determines that the indicator is the correct one to be using, the IWG will then identify a remedial action to ensure mitigation success. Monitoring will then continue until the performance standard is met.

Governance of Adaptive Management Program

The IWG will review annual monitoring reports. It will evaluate progress towards meeting performance standards in the programmatic mitigation strategy and the need to modify implementation of environmental commitments and adopted mitigation measures to achieve performance standards. It will make recommendations to designated Corps staff for such modifications, although it does not have the authority to require that the Corps adopt any such recommendations. The IWG will meet as needed to implement the adaptive management program.

The IWG's decisions, including those recommending that the SRBPP environmental commitments or mitigation measures be modified, will be by consensus of the members participating in a noticed meeting. In the event consensus is not reached on a proposed decision, the representatives will systematically propose and consider alternatives that may resolve the dispute. The IWG may engage a facilitator to assist in this effort. A dispute does not modify the Corps' authority and duty to implement each environmental commitment and adopted mitigation measure specified in the programmatic mitigation strategy.

This governance document does not modify the authority, right, or duty of any member under applicable law.

Application of Adaptive Management Program

For the SRBPP Supplemental Authorization, the following environmental commitments and mitigation measures, which are included in the Program's EIS/EIR, are the most likely to require application of an adaptive management process:

- Mitigation Measure VEG-MM-1: Compensate for the Loss of Woody Riparian Habitat
- Mitigation Measure VEG-MM-8: Compensate for the Loss of Wetlands and Other Waters
- Mitigation Measure VEG-MM-10: Compensate for the Loss of Protected Trees
- Mitigation Measure VEG-MM-13: Conduct a Follow-Up Weed Survey and Implement Eradication Methods if New Infestations Are Present
- Mitigation Measure FISH-MM-2: Compensate for Loss of Fish Habitat
- Mitigation Measure FISH-MM-3: Compensate for Loss of Spawning Habitat

The approaches included in this strategy are intended to ensure that the goals of these mitigation measures are achieved. In addition, the Corps has agreed to monitoring and adaptive management procedures for various efforts associated with multiple Biological Opinions. The following concept demonstrates a potential adaptive management procedure that may be relevant to these mitigation measures.

Sample Adaptive Management Strategy for Riparian and Wetland Habitat Replacement

Adaptive management for riparian and wetland vegetation mitigation sites will involve evaluation of the "survival" performance standard. Failure to meet the survival performance standard within an agreed-to period of time (e.g., 5 years) would result in IWG evaluation of the cause of failure and selection of appropriate remedial actions by the IWG. Remedial actions for riparian and wetland mitigation sites could include, but are not necessarily limited to:

- replanting appropriate species or alternative species if evaluation indicates that planted species are not suitable for the site;
- replanting to maintain overall species diversity;
- replanting at an alternative site if evaluation indicates that site conditions will not support riparian and/or wetland vegetation;
- modification of the planting area irrigation or hydrologic regime;
- treatment of disease, pest management, and soil treatment; and
- physical or chemical removal of competing nonnative species.

The IWG would revise the survival performance standard as appropriate and monitoring would resume to ensure success.

Conclusion

The information set forth above establishes an approach for mitigating impacts of the program that focuses on:

- maximizing onsite mitigation through (a) refinement of bank protection measure templates that reflect variations in site conditions and target the smallest project footprint that will accommodate the site-specific erosion problem, and (2) project-by-project refinement of the selected template to further maximize onsite mitigation to the degree possible.
- determining the cost effectiveness and the system-wide capacity to absorb various methods of providing offsite compensation, when onsite mitigation results in net losses of habitat value. Compensation alternatives will be enlarged to consider bankline treatments for improving IWM and slope, setback levees, floodplain salmonid-habitat improvements, restoration of channel migration, and development of multi-feature habitat nodes. Federal and state initiatives for habitat enhancement/restoration, and commercial compensation/mitigation banks, will be continuously considered as alternatives for providing needed compensation.

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Appendix A

Bank Protection Design Options

Appendix A
Bank Protection Design Options

Introduction

The suite of Sacramento River Bank Protection Project (SRBPP) site-specific bank protection measures in the proposed program is described below with figures to support each measure. A bank protection measure is a site-specific design solution to control an existing erosion site while minimizing and/or mitigating environmental impacts.

The following criteria have been developed for bank protection design, consistent with the project purpose and need.

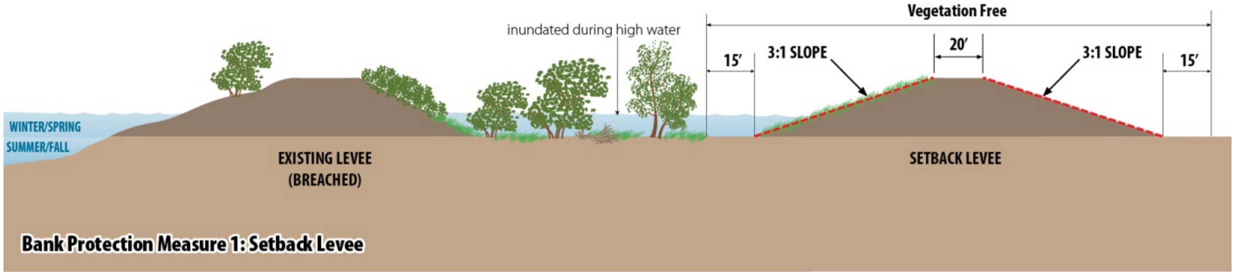
- Restoring the flood damage risk-reduction capability of the originally constructed levee through the use of structurally reliable erosion-control elements.
- To the extent practicable, maintaining fish and wildlife habitat and scenic and recreational values, and replacing habitat losses through the use of on-site mitigation elements overlying or integrated with erosion-control elements.
- Fully mitigating off-site significant residual fish and wildlife habitat losses to the extent justified.
- Minimizing costs of construction and maintaining both erosion-control and on-site habitat-mitigation elements.

The following measures are intended to meet these criteria while also meeting the Corps vegetation management policy as prescribed in Engineering Technical Letter 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures (Vegetation ETL). For purposes of this document, the vegetation-free zone (VFZ) is defined in the Vegetation ETL and encompasses the existing and new levee footprint area 15 feet outward of each levee toe where vegetation would be restricted to native grass. These measures are conceptual and will be modified to the degree necessary to be suitable for conditions at any given erosion site. As a result, dimensions in the following figures are typical and will vary based on site-specific conditions and designs.

Bank Protection Measure 1–Setback Levee:

This measure entails constructing a new levee some distance landward of the existing levee, and avoids or minimizes construction in the waterside or riparian areas. The land between the setback and existing levee would act as a floodplain. Land use in the new floodplain would be determined on a site-by-site basis. The old levee could be breached in several locations or degraded to allow high flows to inundate the new floodplain. Vegetation on the new setback levee, including 15 feet beyond each toe, would be restricted to grass. While vegetation could remain on the existing levee, the setback levee would be managed as a VFZ. New vegetation planted in the setback area could serve as mitigation to offset project losses. Additionally, vegetation on the existing levee could become newly available to aquatic species and contribute to a net increase in floodplain vegetation.

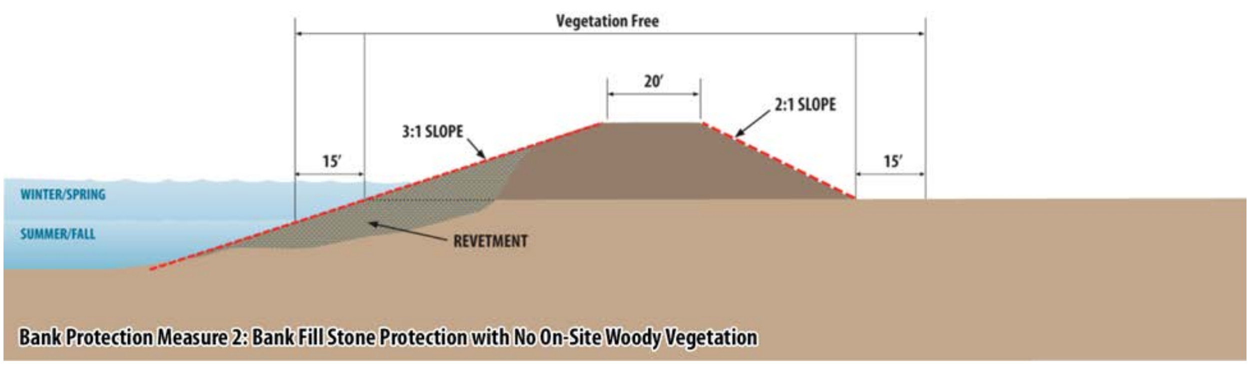
Measure 1 would be most applicable in areas where substantial habitat values exist along the channel and land uses in the setback area are not restrictive. Setback levees can be very effective, but real estate acquisition (including the need for willing sellers), existing land use, and technical issues limit opportunities for setback levees in the program area. Setback levees may offer opportunities for mitigation of riparian, bank swallow, and fish habitat loss at other bank protection sites and restore riverine processes. Setback levees may also provide other flood control benefits, such as addressing seepage issues, that other bank protection measures would not address.



Bank Protection Measure 1: Setback Levee

Bank Protection Measure 2–Bank Fill Stone Protection with No On-Site Woody Vegetation:

This measure, which entails filling the eroded portion of the bank and installing quarry stone along the levee slope, is needed as determined by site-specific analysis. The rock/soil ratio will vary by location and will be determined during site-specific design. Vegetation would be limited to native grass, and existing vegetation would be removed within the VFZ. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with revetment. Measure 2 would be most applicable in areas where there is inadequate space or substantial constraints (for example, critical infrastructure, homes, roadways, pump facilities, real estate issues), either landside or waterside, where hydraulic concerns would make it difficult to implement the other measures, or where existing habitat values are very limited.

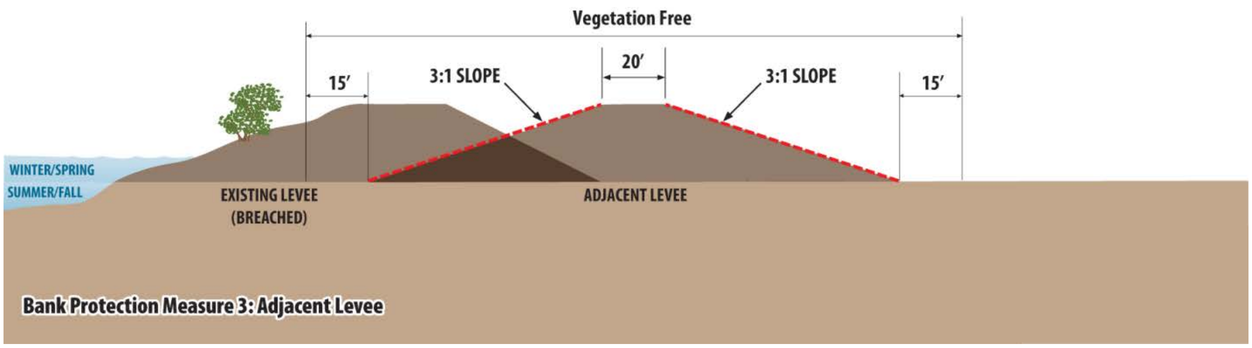


Bank Protection Measure 2: Bank Fill Stone Protection with No On-Site Woody Vegetation

Bank Protection Measure 3–Adjacent Levee:

This measure involves the construction of a new levee embankment adjacent to and landward of the existing levee. The adjacent levee would be constructed to Corps design standards, which require adjacent levees to be constructed with 3:1 slopes (distance width to distance height, or dW:dH) on both the waterside and landside. The landward portion of the existing levee would be an integral, structural part of the new levee. The waterward portion of the existing levee would remain. Vegetation and instream woody material (IWM) could be placed on the old levee if that portion is outside of the VFZ. However, a variance under the Vegetation ETL may be required if the existing levee is considered to be a waterside planting berm based on its dimensions and proximity to the new levee. The existing levee may also be degraded to riparian and/or wetland benches that comply with the Corps' vegetation management policy. Vegetation on the landward side of the existing levee and within the footprint of the new adjacent levee would be removed as a part of construction.

Measure 3 would be appropriate at many sites where waterside berms are narrow or non-existent but landside uses limit the use of a setback levee.



Bank Protection Measure 4–Riparian and Wetland Benches with Revegetation:

Measure 4 consists of three design variations presented as Measures 4a, 4b, and 4c. In general, Measure 4 involves the placement of clean quarry stone from the toe of the bank up to the summer/fall waterline and placing quarry stone and soil-filled quarry stone on the levee slope above the summer/fall waterline. The rock/soil ratio will vary by location and will be determined during site-specific design. The repairs would involve initial site preparation and construction of levee embankment. Measures 4a, 4b, and 4c would comply with the Vegetation ETL, requiring all woody vegetation within the VFZ to be removed.

Measures 4a, 4b, and 4c vary from one another with regard to the placement and extent of environmental features that are intended to increase habitat quality (bank construction, vegetation, and IWM). These variations are driven by a number of factors, most importantly the types of existing resources and the types of species likely to use those resources. For example, if the existing site is downstream of Sacramento River Mile 30 and likely to be used by delta smelt, the new design would not include IWM below the summer/ fall waterline, because IWM is not considered optimal habitat for delta smelt. New IWM would only be installed downstream of RM 30 to replace existing IWM removed during repair of the bank (1:1 ratio). Upstream of RM 30, new IWM is usually incorporated into the design, because delta smelt aren't likely to be present.

In general, plantings consistent with the Vegetation ETL and outside of the VFZ at each site could include box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), western sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), Valley oak (*Quercus lobata*), Goodding's willow (*Salix gooddingii*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), California wild rose (*Rosa californica*), and narrowleaf willow (*Salix exigua*).

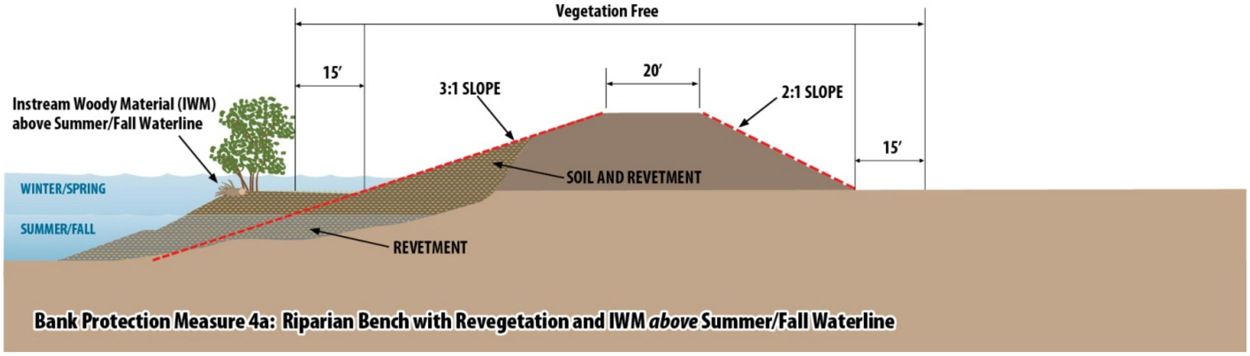
These measures are appropriate where the channel is wide enough to accommodate the installation of the stone and soil structure without substantially affecting the hydraulic capacity of the channel.

Bank Protection Measure 4a – Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline

Measure 4a entails installing revetment along the waterside levee slope or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. This design provides near-bank, shallow-water habitat and components of shaded riverine aquatic habitat for fish and is typically applicable to sites upstream of Sacramento River Mile 30. Treatment of existing vegetation, site preparation, and installation of revetment on the lower slope would be similar to the description under Measure 2. Measure 4a includes a riparian bench. The bench would be treated with soil-filled quarry stone.

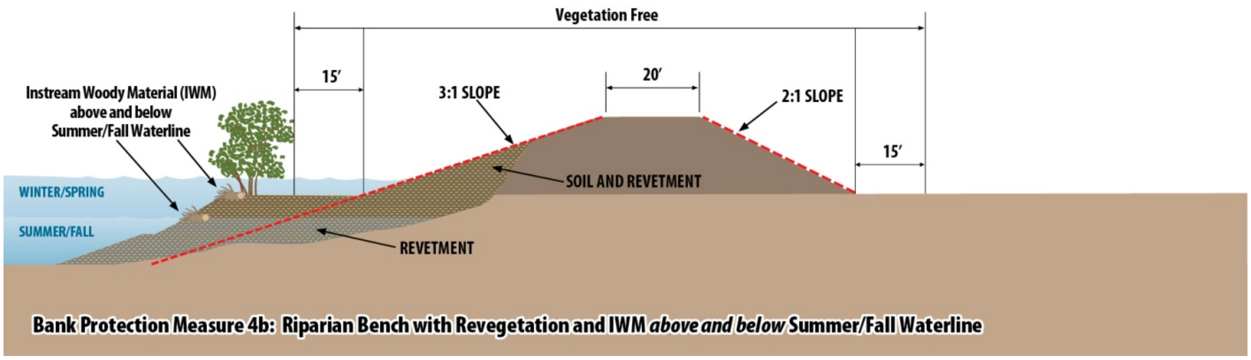
In this design, the riparian bench is intended to be inundated at river stages corresponding to high tide (where tidally influenced) or during average winter/spring flows. The riparian bench would be revegetated in a manner similar to recent SRBPP projects with riparian bench designs. Species planted would be in compliance with the Vegetation ETL. Planting plans would describe species to be planted within a specific elevation zone and would detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers.

The riparian bench would be constructed at a slope of 6:1 to 10:1 and the revetment portion above and below the bench would typically be 3:1. The width of the bench would be approximately 10–30 feet, depending on site conditions. Anchored IWM would be embedded on top of the riparian bench above the summer/fall waterline. The IWM would be available as accessible habitat along the banks only during winter/spring flows when the bench is inundated. Individual pieces of IWM would be placed to fit the project site's hydraulic conditions and based on other applicable guidance. Exact shoreline coverage amounts and complexity components will be determined during site-specific design.



Bank Protection Measure 4b–Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

This measure entails installing revetment along the waterside levee slope or bank as well as a rock/soil bench (as described for Measure 4a) to support riparian vegetation and provide a place to anchor IWM. In addition to the placement of IWM above the summer/fall waterline as described for Measure 4a, IWM also would be placed beyond the bench and below the summer/fall waterline, thereby increasing the types and extent of shallow-water fish habitat, providing year-round instream habitat for targeted fish species. This design is typically applicable to sites upstream of Sacramento River Mile 30. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone would be similar to Measure 2. Installation of soil-filled quarry stone and riparian bench would be similar to Measure 4a.

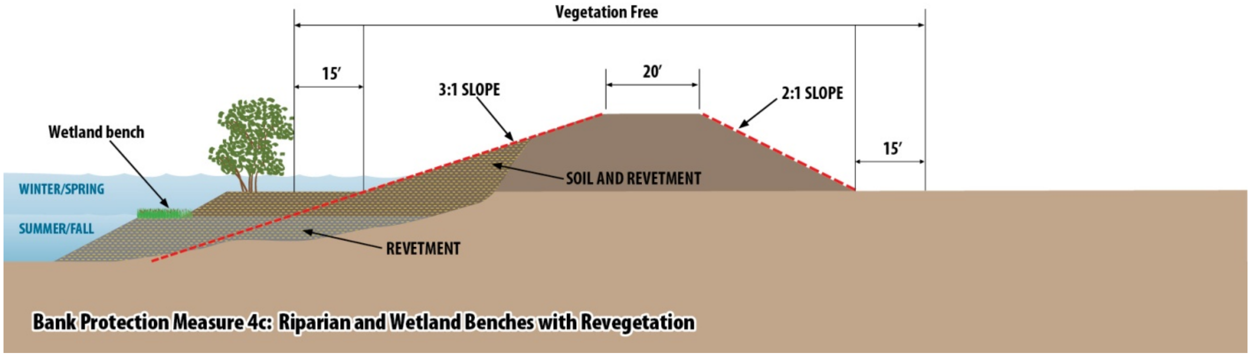


Bank Protection Measure 4c–Riparian and Wetland Benches with Revegetation

Measure 4c entails installing revetment along the waterside levee slope or bank, as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. Bench slopes would be the same as those described for Measure 4a. The design also includes a wetland bench below the summer/fall waterline to further increase habitat quality. This design is intended for sites downstream of Sacramento River Mile 30 and targets mitigation of impacts on delta smelt habitat.

Because IWM might increase habitat suitability of ambush predators, new IWM would only be installed to replace existing IWM removed during project construction (1:1 ratio).

The riparian and wetland benches are intended to flood at river stages corresponding to winter/spring (high) flows and summer/fall (low) flows, respectively. Existing vegetation would be removed within VFZ. Both benches would be revegetated in compliance with the Vegetation ETL and in accordance with appropriate planting plans. The wetland bench would typically be planted with hardstem bulrush (*Scirpus acutus*), California bulrush (*S. californicus*), or giant bur-reed (*Sparganium eurycarpum* ssp. *eurycarpum*).

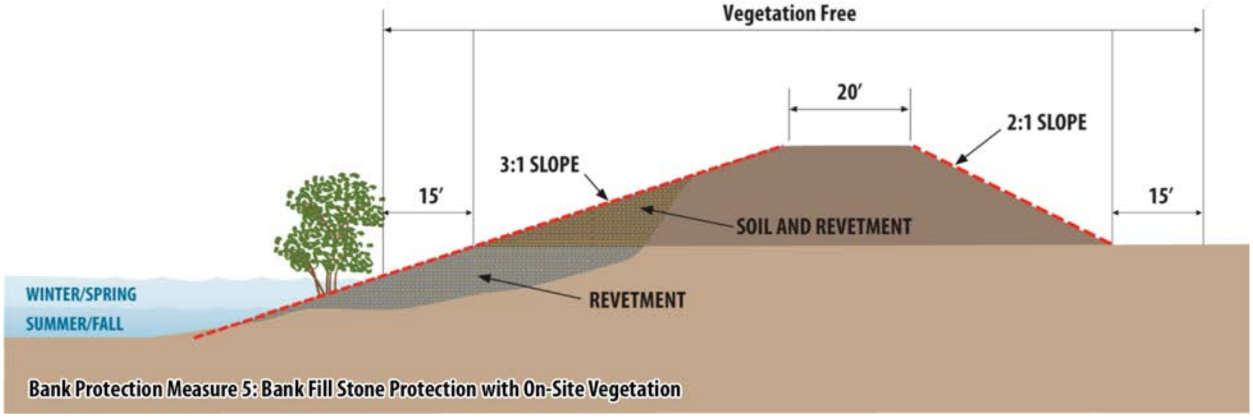


Bank Protection Measure 5–Bank Fill Stone Protection with On-Site Vegetation:

Measure 5 entails filling the eroded portion of the bank and installing revetment along the waterside levee slope and streambank from streambed to a height determined by site-specific analysis. The revetment would be placed at a slope of 3:1. All IWM would be removed from the bank and would not be replaced on the bank fill stone protection.

Existing vegetation would be removed within the VFZ; however, grass would be allowed in this area. Approximately 25% of existing vegetation that is outside of the VFZ on the waterside slope is estimated to be retained during construction. This assumption is made for analysis purposes and is based on past construction experience. The actual amount of retained vegetation could vary substantially from site to site during implementation. New vegetation would be limited to native grasses within the VFZ, while woody vegetation could be replaced by planting outside of the VFZ, as allowed by specific site conditions. The long-term goal of vegetation planting is to provide riparian and shaded riverine aquatic (SRA) cover habitat as defined by the U.S. Fish and Wildlife Service. Planting plans would describe species to be planted within a specific elevation zone and would detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers. Six inches of soil cover would be placed on the revetment to support on-site vegetation. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with revetment.

Similar to Measure 2, Measure 5 would be most applicable in areas where there is inadequate space or substantial constraints that would limit the applicability of the other measures. However, some amount of space to allow for the planting of vegetation is necessary.



Additional Measures

Additional measures may be considered and found to be appropriate during implementation of the site-specific repairs. Design and analysis of any additional measures would be carried out during the site-specific planning and design phase.

Examples of additional measures include toe protection, flow modification (e.g., impermeable groins) and alternative materials in place of riprap.

Toe Protection

Toe protection is authorized by SRBPP and could be considered for long-term erosion control. Toe protection entails filling the low-lying eroded portion of the bank with rock to curtail further loss of the toe and subsequent losses of the upper bank typically resulting from toe erosion. Because toe protection doesn’t replace existing losses of material on the upper bank, which is often the condition at critical sites, it is not considered a complete solution for critical sites. Consequently, toe protection has not been implemented recently because many erosion sites are considered to be at or near critical.

Flow Modification

Groins, or spurs, redirect or reduce erosive forces along the channel bank by diverting the stronger currents and deflecting water away from the bank. By deflecting the current away from the bank and causing sediment deposits, a spur or a series of spurs may protect the streambank more effectively and at a lower cost than revetment. Long spurs or groins may also be called spur dikes, and very long spurs can be referred to as dikes and jetties. Spurs are also used to channelize a wide, poorly defined stream into a well-defined channel that neither aggrades nor degrades, thus maintaining its location from year to year. Spurs on streams with suspended sediment induce sedimentation to establish and maintain the new alignment. Dikes fall in the category of an erosion control or flow diversion structure extending roughly perpendicular from a streambank that either diverts flow from the bank or reduces flow velocity adjacent to the bank. Flow diversion also can be accomplished through biotechnical methods in some locations. For example, log brush barriers are densely packed layers of branches and logs that divert stream flow from an eroding bank.

A bendway weir is an upstream-angled underwater sill. Water flowing over the weir is redirected at an angle perpendicular to the weir. When weirs are angled upstream, water is directed away from the outer bank and toward the inner part of the bend, breaking up the river's strong secondary currents. Weirs are typically built in sets (4 to 14 weirs per bend) and are designed to redirect current directions and velocities through the bend and well into the downstream crossing.

Alternative Materials and Construction Methods

Reinforced Soil Slopes and Mechanically Stabilized Earth Walls

Mechanically stabilized earth walls (MSEWs) are internally reinforced soil structures with faces angled 70 degrees to 90 degrees from horizontal. Structures with slope angles less than 70 degrees are termed reinforced soil slopes (RSSs).

MSEWs and RSSs use soil and rock with structural elements, such as geogrids, to provide for steeper stable slopes than typically occur naturally. These structures provide long-term stability yet can be porous enough to provide filtration and support vegetated growth. Vegetated MSEW and RSS structures can become stronger as root systems penetrate and grow throughout the retained mass, providing a long-term vegetated solution for erosion and soil retention issues. The engineered MSEWs and RSSs remain to provide stability during the time it takes vegetation to become established, as well as into the long term. The advantage of these structures is a more natural appearance in areas with limited rights-of-way or unacceptable encroachment within the channel compared with some other repair methods.

Floating Islands

Floating islands are modeled after natural floating islands formed when floating vegetation grows and accumulates gas, or nutrient rich peat soil becomes buoyant, rises to the surface, and is colonized by plants. Artificial floating islands are made of a recycled nontoxic plastic mesh injected with marine foam for initial buoyancy. Floating islands can be used to enhance fish habitat by simulating submerged, vegetated undercut banks and providing overhead shaded cover. The resulting underwater root structure may provide important habitat, including forage, refuge from predators, spawning substrate, and brood cover for many fish species. However, the potential for increased predation associated with floating islands is not well understood. Floating islands might be useful in absorbing wave and wake energy, modifying flows and hydraulic processes, complementing shoreline restoration, and providing shallow water habitat. Floating islands might be more useful and practical in the Delta than along river banks where the current is strong.

Appendix B

Application of Design Templates

Table B-1. Site-Specific Application of Bank Protection Measures by Alternative

Region	Site Identification				Site Length (feet)	Bank Protection Measures by Alternative									
						Alt 2A	Alt 2B	Alt 3A	Alt 3B	Alt 4A	Alt 4B	Alt 5A	Alt 5B	Alt 6A	Alt 6B
1a+	Cache Creek	LM	3.9	L	433	2	2	1	1	1	1	1	1	1	1
1a	Cache Slough	RM	15.9	L	182	2		3		2		1		4c	
1a	Cache Slough	RM	22.8	R	630	2		1		4c		4c		4c	
1a	Cache Slough	RM	23.6	R	1,209	2		3		2		1		4c	
1a	Deep Water Ship Channel	LM	5.0	L	N/A	N/A		N/A		N/A		N/A		N/A	
1a	Deep Water Ship Channel	LM	5.01	L	N/A	N/A		N/A		N/A		N/A		N/A	
1a	Georgiana Slough	RM	0.3	L	1,027	2		1		1*		1		4c	
1a	Georgiana Slough	RM	1.7	L	1,250	2		1		1*		1		4c	
1a	Georgiana Slough	RM	2.5	L	736	2		1		1*		1		4c	
1a	Georgiana Slough	RM	3.6	L	1,364	2		1		1*		1		4c	
1a	Georgiana Slough	RM	3.7a	L	209	2		1		1*		1		4c	
1a	Georgiana Slough	RM	3.7b	L	268	2		1		1*		1		4c	
1a	Georgiana Slough	RM	4.0	L	705	2		1		1*		1		4c	
1a	Georgiana Slough	RM	4.3	L	1,319	2		3		3*		3		4c	
1a	Georgiana Slough	RM	4.5	L	90	2		3		3*		3		4c	
1a	Georgiana Slough	RM	4.6	L	1,346	2		3		3*		3		4c	
1a	Georgiana Slough	RM	5.3	L	3,171	2		3		3*		3		4c	
1a	Georgiana Slough	RM	6.1	L	1,729	2		3		3		3		4c	

Bank Protection Measure Legend
N/A: No Action
1: Setback Levee
2: Bank Fill Stone Protection with No On-Site Woody Vegetation
3: Adjacent Levee
4a: Riparian Bank with Revegetation and Instream Woody Material above Summer/Fall Waterline
4b: Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline
4c: Riparian and Wetland Benches with Revegetation
5: Bank Fill Stone Protection with On-Site Vegetation

Table B-1. Continued

Region	Site Identification				Site Length (feet)	Bank Protection Measures by Alternative									
						Alt 2A	Alt 2B	Alt 3A	Alt 3B	Alt 4A	Alt 4B	Alt 5A	Alt 5B	Alt 6A	Alt 6B
1a	Georgiana Slough	RM	6.4	L	398	2		1		1*		1		4c	
1a	Georgiana Slough	RM	6.6	L	744	2		1		1*		1		4c	
1a	Georgiana Slough	RM	6.8	L	1,335	2		1		3		3		4c	
1a	Georgiana Slough	RM	8.3	L	483	2		3		3		3		4c	
1a	Georgiana Slough	RM	9.3	L	1,228	2		3		4c		4c		4c	
1a+	Knights Landing Ridge Cut	LM	0.2	R	768	2	2	3	3	2	2	2	2	5	5
1a	Knights Landing Ridge Cut	LM	3.0	L	1,279	2		2		2		2		5	
1a	Knights Landing Ridge Cut	LM	3.1	L	368	2		2		2		2		5	
1a	Knights Landing Ridge Cut	LM	4.3	L	577	2		2		2		2		5	
1a	Knights Landing Ridge Cut	LM	5.3	L	8,564	2		2		2		2		5	
1a	Steamboat Slough	RM	18.8	R	485	2		3		3		3		4c	
1a	Steamboat Slough	RM	23.2	L	N/A	N/A		N/A		N/A		N/A		N/A	
1a+	Steamboat Slough	RM	23.9	R	369	2	2	3	3	3	3	3	3	4c	4c
1a+	Steamboat Slough	RM	24.7	R	911	2	2	3	3	3	3	3	3	4c	4c
1a	Steamboat Slough	RM	25.0	L	272	2		3		3		3		4c	
1a+	Steamboat Slough	RM	25.8	R	244	2	2	3	3	3	3	3	3	4c	4c
1a	Steamboat Slough	RM	26.0	L	516	2		3		3		3		4c	
1a	Sutter Slough	RM	24.7	R	1,736	2		1		1		1		4c	

[1] **LEGEND**
NA: No Action
Bank Protection Measure 1: Setback Levee
Bank Protection Measure 2: Bank Fill Stone Protection with No On-Site Woody Vegetation
Bank Protection Measure 3: Adjacent Levee
Bank Protection Measure 4a: Riparian Bank with Revegetation and Instream Woody Material above Summer/Fall Waterline
Bank Protection Measure 4b: Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline
Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation
Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Table B-1. Continued

Region	Site Identification				Site Length (feet)	Bank Protection Measures by Alternative									
						Alt 2A	Alt 2B	Alt 3A	Alt 3B	Alt 4A	Alt 4B	Alt 5A	Alt 5B	Alt 6A	Alt 6B
1a+	Sutter Slough	RM	26.5	L	568	2	2	3	3	4c	4c	4c	4c	4c	4c
1a	Willow Slough	LM	0.2	L	N/A	N/A		N/A		N/A		N/A		N/A	
1a	Willow Slough	LM	0.7	L	N/A	N/A		N/A		N/A		N/A		N/A	
1a	Willow Slough	LM	6.9	R	869	2		3		2		2		5	
1a	Yolo Bypass	LM	0.1	R	430	2		3		2		2		5	
1a	Yolo Bypass	LM	2.0	R	563	2		3		2		2		5	
1a	Yolo Bypass	LM	2.5	R	148	2		3		5		5		5	
1a	Yolo Bypass	LM	2.6	R	N/A	N/A		N/A		N/A		N/A		N/A	
1a	Yolo Bypass	LM	3.8	R	1,860	2		3		2		2		5	
1b	Lower American River	RM	7.3	R	N/A	N/A		N/A		N/A		N/A		N/A	
1b	Sacramento River	RM	21.5	L	162	2		3		4c		4c		4c	
1b	Sacramento River	RM	22.5	L	852	2		3		4c		4c		4c	
1b	Sacramento River	RM	22.7	L	309	2		3		3		3		4c	
1b	Sacramento River	RM	23.2	L	589	2		3		3		3		4c	
1b	Sacramento River	RM	23.3	L	257	2		3		4c		4c		4c	
1b	Sacramento River	RM	24.8	L	782	2		3		2		3		4c	
1b	Sacramento River	RM	25.2	L	338	2		3		4c		4c		4c	
1b	Sacramento River	RM	31.6	R	446	2		3		5		5		5	

[1] **LEGEND**
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Bank Protection Measure 4b: Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline
Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation
Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Table B-1. Continued

Region	Site Identification				Site Length (feet)	Bank Protection Measures by Alternative									
						Alt 2A	Alt 2B	Alt 3A	Alt 3B	Alt 4A	Alt 4B	Alt 5A	Alt 5B	Alt 6A	Alt 6B
1b**	Sacramento River	RM	35.3	R	197	2		3		4a		4a		4a	
1b**	Sacramento River	RM	35.4	R	96	2		3		4a		4a		4a	
1b	Sacramento River	RM	38.5	R	359	2		1		5		5		5	
1b+	Sacramento River	RM	56.5	R	373	2	2	3	3	4b	4b	4b	4b	4b	4b
1b+	Sacramento River	RM	56.6	L	86	2	2	3	3	4a	4a	4a	4a	4a	4a
1b+	Sacramento River	RM	56.7	R	665	2	2	3	3	4b	4b	4b	4b	4b	4b
1b+***	Sacramento River	RM	58.4	L	707	2	2	3	3	5	5	5	5	5	5
1b+	Sacramento River	RM	60.1	L	455	2	2	3	3	4a	4a	3	3	4a	4a
1b+	Sacramento River	RM	62.9	R	175	2	2	3	3	4b	4b	4b	4b	4b	4b
1b+	Sacramento River	RM	63.0	R	87	2	2	3	3	4b	4b	4b	4b	4b	4b
1b	Sacramento River	RM	74.4	R	200	2		3		4b		4b		4b	
1b	Sacramento River	RM	75.3	R	2,761	2		3		5		3		5	
1b	Sacramento River	RM	77.7	R	224	2		3		5		5		5	
1b+	Sacramento River	RM	78.3	L	657	2	2	3	3	5	5	4b	4b	5	5
2	Bear River	RM	0.8	L	233	2		3		5		5		5	
2	Cherokee Canal	LM	14.0	L	N/A	N/A		N/A		N/A		N/A		N/A	
2	Cherokee Canal	LM	21.9	L	1,800	2		5		5		5		5	
2	Feather River	RM	0.6	L	288	2		3		4a		4a		4a	

[1] **LEGEND**
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Bank Protection Measure 4b: Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline
Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation
Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Table B-1. Continued

Region	Site Identification				Site Length (feet)	Bank Protection Measures by Alternative									
						Alt 2A	Alt 2B	Alt 3A	Alt 3B	Alt 4A	Alt 4B	Alt 5A	Alt 5B	Alt 6A	Alt 6B
2	Feather River	RM	5.0	L****	910	2		3		4a		4a		4a	
2	Sacramento River	RM	86.3	L	3,134	2		3		5		5		5	
2**	Sacramento River	RM	86.5	R	72	2		3		4b		4b		4b	
2	Sacramento River	RM	86.9	R	289	2		3		4b		4b		4b	
2	Sacramento River	RM	92.8	L	200	2		3		5		5		5	
2	Sacramento River	RM	95.8	L	190	2		3		5		5		5	
2	Sacramento River	RM	96.2	L	560	2		3		5		4b		5	
2	Sacramento River	RM	99.0	L	160	2		3		5		5		5	
2	Sacramento River	RM	101.3	R	352	2		1		4b		4b		4b	
2	Sacramento River	RM	103.4	L	N/A	2		N/A		N/A		N/A		N/A	
2	Sacramento River	RM	104.0	L	3,459	2		3		5		4b		5	
2	Sacramento River	RM	104.5	L	301	2		3		4a		4a		4a	
2	Sacramento River	RM	116.0	L	612	2		1		4a		4a		4a	
2	Sacramento River	RM	116.5	L	2,465	2		3		4a		1		4a	
2	Sacramento River	RM	122.0	R	248	2		3		4b		4b		4b	
2	Sacramento River	RM	122.3	R	341	2		1		4b		4b		4b	
2	Sacramento River	RM	123.3	L	208	2		3		4b		4b		4b	
2	Sacramento River	RM	123.7	R	120	2		3		4a		4a		4a	

[1] **LEGEND**
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Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Table B-1. Continued

Region	Site Identification				Site Length (feet)	Bank Protection Measures by Alternative									
						Alt 2A	Alt 2B	Alt 3A	Alt 3B	Alt 4A	Alt 4B	Alt 5A	Alt 5B	Alt 6A	Alt 6B
2	Sacramento River	RM	127.9	R	801	2		1		5		4a		5	
2	Sacramento River	RM	131.8	L	339	2		1		4a		1		4a	
2	Sacramento River	RM	132.9	R	363	2		1		4a		4a		4a	
2	Sacramento River	RM	133.0	L	1,291	2		3		4a		4a		4a	
2	Sacramento River	RM	133.8	L	197	2		3		4a		4a		4a	
2	Sacramento River	RM	136.6	L	615	2		3		4a		4a		4a	
2	Sacramento River	RM	138.1	L	1,365	2		1		4a		1		4a	
2	Yuba River	LM	2.3	L	1,356	2		1		1		1		1	
3	Deer Creek	LM	2.4	L	496	2		3		5		3		5	
3	Elder Creek	LM	1.44	L	334	2		3		4a		4a		4a	
3	Elder Creek	LM	3.0	R	65	2		3		4a		4a		4a	
3	Elder Creek	LM	4.1	L	N/A	N/A		N/A		N/A		N/A		N/A	
3+	Sacramento River	RM	152.8	L	198	2	2	3	3	4b	4b	4b	4b	4b	4b
3+	Sacramento River	RM	163.0	L	1,213	2	2	3	3	4b	4b	1	1	4b	4b
3+	Sacramento River	RM	168.3	L	546	2	2	1	1	4b	4b	1	1	4b	4b
3+	Sacramento River	RM	172.0	L	525	2	2	1	1	4b	4b	1	1	4b	4b

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Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation
Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Table B-1. Continued

+ Site is located within an economically justified basin.

* Design (setback or adjacent levee) combined with adjacent sites.

** Sacramento River 35.3R, 35.4R, and 86.5R have been repaired.

*** Though Sacramento River 58.4L is not a currently inventoried erosion site, nor has it ever been, it constitutes a representative site for the purposes of the programmatic SAM and EIS/EIR analyses. As previously described, additional project-level environmental documentation, tiering from this programmatic analysis, will be prepared to address those sites that will be constructed.

**** Feather River 5.0L was mistakenly called Feather River 4.9L in previous documents.

LM = levee mile; RM = river mile; L = left bank; R = right bank.

[1] **LEGEND**

NA: No Action

Bank Protection Measure 1: Setback Levee

Bank Protection Measure 2: Bank Fill Stone Protection with No On-Site Woody Vegetation

Bank Protection Measure 3: Adjacent Levee

Bank Protection Measure 4a: Riparian Bank with Revegetation and Instream Woody Material above Summer/Fall Waterline

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Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation

Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Appendix C

Recommendations and Requirements from Previous SRBPP Biological Opinions

Appendix C
Recommendations and Requirements from Previous SRBPP Biological Opinions

Conservation Recommendations from Previous SRBPP Biological Opinions

The 2008 BOs include the following types of reasonable and prudent measures to be undertaken when implementing the program.

- Minimize effects of habitat loss due to placement of riprap.
- Implement minimization and conservation measures, including BMPs to reduce construction-related impacts.
- Maintain, monitor, and adaptively manage all conservation measures throughout the life of the project to ensure their effectiveness.
- Minimize impacts on normal patterns of impacted special status species including, but not limited to, feeding, breeding, or sheltering.
- Minimize direct and indirect effects on special status species through construction timing restrictions.
- Within 12 months of the onset of construction, submit a detailed operations and maintenance plan for bank protection and conservation measures found at all new sites constructed by the SRBPP.
- Prepare a detailed monitoring plan that includes; (1) monitoring methods, performance standards for SAM variables, and success criteria for riparian vegetation and SRA cover; and (2) a protocol for implementing remedial actions should any success criteria not be met.
- Construction activities that must occur within the water, low flow channel, or within the area below the ordinary high water line shall be restricted as defined by the regulating agencies.
- Stockpiling of construction materials, including portable equipment, vehicles and supplies, including chemicals, shall be restricted to the designated construction staging areas and exclusive of the riparian and wetlands avoidance areas.
- Erosion control measures that prevent soil or sediment from entering the river shall be placed, monitored for effectiveness, and maintained throughout the construction operations.
- Avoidance activities to be implemented during final design and construction may include, but are not limited to, the following:
- Identifying all habitats containing, or with a substantial possibility of containing, listed terrestrial, wetland, and plant species in the potentially affected project areas.
- Minimizing effects by modifying engineering design to avoid potential direct and indirect effects.
- Incorporating sensitive habitat information into project bid specifications.

- Incorporating requirements for contractors to avoid identified sensitive habitats into project bid specifications.
- Minimizing vegetation removal to the extent feasible.
- Performing no grubbing or contouring of the sites.
- Ensuring all fill materials are placed with no excavation or movement of existing materials on site.
- Ensuring all construction activities, including clearing, pruning, and trimming of vegetation, is supervised by a qualified biologist to ensure these activities have a minimal effect on natural resources.
- If a cofferdam is needed during construction, constructing it by placing the sheet piles sequentially from the upstream to the downstream limits of the construction area (however, no cofferdams are anticipated to be needed at this time). Prior to the closure of the cofferdam, seining would be conducted within the cofferdam with a small-mesh seine to direct fish out of the cofferdam and remove as many fish as possible. Upon completion of seining, exclusionary nets would be placed in the river to prevent fish from entering the cofferdam before the cofferdam is closed.

  When the cofferdam is partially dewatered, a final seining effort would be conducted within the cofferdam. Only low-flow pumps with screened intakes would be used during dewatering operations. If seining cannot rescue all listed species, a qualified fisheries biologist would use electrofishing equipment to capture any remaining fish. All captured juveniles would be released downstream of the construction area.

  The USACE and CVFPB are fully committed to implementing the above measures to the fullest extent feasible. However, even with full implementation of these measures, some unavoidable effects are anticipated. The following sections discuss recent requirements for mitigation and conservation measures that would minimize impacts to special status species, and that are generally consistent with the formal consultation documents issued to USACE by USFWS (U.S. Fish and Wildlife Service 1996, 1997).

Requirements for Mitigation of Species-Specific Impacts from Previous SRBPP Biological Opinions

Valley Elderberry Longhorn Beetle

The following is a summary of measures based on the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (U.S. Fish and Wildlife Service 1999); these measures will be implemented to minimize any potential effects on valley elderberry longhorn beetles or their habitat.

- When a 100-foot (or wider) buffer is established and maintained around elderberry plants, complete avoidance (i.e., no adverse effects) will be assumed.
- Where encroachment on the 100-foot buffer has been approved by the USFWS, a setback of 20 feet from the dripline of each elderberry plant will be maintained whenever possible.

- In areas where work will need to occur within the 20-foot setback, a biological monitor will be on site to ensure that no unauthorized take of the beetle or its habitat occurs.
- During construction activities, all areas to be avoided will be fenced and flagged.
- Contractors will be briefed on the need to avoid damaging elderberry plants and the possible penalties for not complying with these requirements.
- Signs will be erected every 50 feet along the edge of the avoidance area, identifying the area as an environmentally sensitive area.

Restoration and Maintenance

- Any damage done to the buffer area will be restored.
- Buffer areas will continue to be protected after construction.
- No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas.
- Mowing of grasses/groundcover will occur July–April to reduce fire hazard. No mowing will occur within 5 feet of elderberry plant stems.

Elderberry Plants that Cannot be Avoided

- Trimming of elderberry plants will be subject to mitigation measures (Table).
- Elderberry plants will be transplanted to an appropriate riparian area at least 100 feet from construction activities.
- If possible, elderberry plants will be transplanted during their dormant season (approximately November, after they have lost their leaves, through the first two weeks in February). If transplantation occurs during the growing season, increased mitigation ratios will apply as presented in Table .
- A qualified biologist (monitor) will be on site for the duration of the transplanting of the elderberry plants. If unauthorized take occurs, the monitor will have the authority to stop work until corrective measures have been completed.

Transplanting Procedure

- Any plant requiring transplantation will be cut back 3 to 6 feet from the ground or to 50% of its height (whichever is taller).
- The plant will be excavated taking as much of the root ball as possible and replanted immediately.
- The planting area will be at least 1,800 square feet for each elderberry transplant.
- As many as five additional elderberry plantings (cuttings or seedlings) and up to five associated native species plantings will also be planted with the transplant.
- Fertilizers and other potentially deleterious substances will not be used on or around the plants.
- The plants will be monitored to ascertain whether additional watering is necessary.

Table C-1. Standard and Adjusted Mitigation Ratios for Elderberry Plant Transplantation

Location	Maximum Stem Diameter at Ground Level (Inches)	Exit Holes on Plant	Standard Elderberry Seedling Ratio[1] (November 1–February 15)	Native Plant Ratio[2]
Non-riparian	≥1 and ≤3	No	1:1	1:1
		Yes	2:1	2:1
	>3 and <5	No	2:1	1:1
		Yes	4:1	2:1
	>5	No	3:1	1:1
		Yes	6:1	2:1
Riparian	≥1 and ≤3	No	2:1	1:1
		Yes	4:1	2:1
	>3 and <5	No	3:1	1:1
		Yes	6:1	2:1
	>5	No	4:1	1:1
		Yes	8:1	2:1

[1] Standard ratios assume transplantation when elderberries are dormant. Mitigation ratios will increase by 2 times the standard ratio if transplantation occurs February 16–March 15; ratios increase by 2.5 times if transplantation occurs June 16–August 31, and 2 times the standard ratio if transplantation occurs September 1–October 31. Transplantation should not be conducted during the elderberry longhorn beetle flight season, March 16–June 15.

[2] Associated native species to be planted per elderberry (seedling or cutting) planting.

Planting of Additional Seedlings, Cuttings, and Associated Native Species

- Each adversely affected elderberry stem measuring 1 inch or greater in diameter at ground level (that is, every transplanted or destroyed elderberry plant) will be mitigated with elderberry seedlings or cuttings (Table). Stock will be obtained from local sources.
- Native plants associated with the elderberry plants at the project site, such as box elder (*Acer negundo*), Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), interior live oak (*Q. wislizenii*), western sycamore (*Platanus racemosa*), and wild grape (*Vitis californica*), will be planted at ratios ranging from 1:1 to 2:1 (native tree/plant species:elderberry seedling or cutting [Table]). Stock will be obtained from local sources.

Long-Term Protection

- Any areas that receive transplanted elderberries and elderberry cuttings will be protected in perpetuity.
- The Corps will work to develop off-site compensation areas prior to or concurrent with any take of valley elderberry longhorn beetle habitat.
- Management of these lands will include all measures specified in USFWS's conservation guidelines (1999) related to weed and litter control, fencing, and the placement of signs.
- Monitoring will occur for ten consecutive years or for seven non-consecutive years over a 15-year period. Annual monitoring reports will be submitted to USFWS.

Giant Garter Snake

The following measures will be implemented to minimize effects on giant garter snake habitat that occurs within 200 feet of any construction activity. These measures are based on USFWS guidelines for restoration and standard avoidance measures included as appendices in USFWS (1997).

- Unless approved otherwise by USFWS, construction will be initiated only during the giant garter snakes' active period (May 1–October 1, when they are able to move away from disturbance).
- Construction personnel will participate in a USFWS-approved worker environmental awareness program.
- Within 24 hours prior to commencement of construction activities, the site will be inspected by a qualified biologist approved by USFWS. The biologist will provide USFWS with a field report documenting the monitoring effort that occurred within 24 hours of commencement of construction activities. During construction, the biologist will be available; if a snake is encountered, the biologist will report any incidental take to USFWS.
- Giant garter snakes encountered during construction activities will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat.
- Giant garter snake habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel.

Compensation for Habitat Disturbance

- Habitat (including aquatic and upland) temporarily impacted for one season (May 1–October 1) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants .
- Habitat temporarily impacted for two seasons will be restored and replacement habitat will be created at a 1:1 ratio (disturbed to created acres).
- Habitat temporarily impacted for more than two seasons will be replaced at a 3:1 ratio (or restored plus 2:1 replacement).
- Habitat permanently impacted will be replaced at a 3:1 ratio. Preservation may be credited against, but will not exceed, 50% of the aquatic habitat replacement.
- Habitat permanently or temporarily impacted outside of the May 1–October 1 work window may require that replacement habitat be developed at a 6:1 ratio.
- All replacement habitats will include both upland and aquatic habitat components at a 2:1 ratio (upland to aquatic acres).
- One year of monitoring will be conducted for all restored areas. Five years of monitoring will be conducted for created habitats. A monitoring report with photo documentation will be due to USFWS each year following implementation of restoration or habitat creation activities.

- The Corps will work to develop appropriate mitigation prior to or concurrent with any disturbance of giant garter snake habitat.

Raptors

Program area raptors include Swainson's hawk, white-tailed kite, osprey and burrowing owls. Construction activities will seek to avoid nesting trees during the nesting season. A qualified biologist will survey sites prior to construction. If active nests occur appropriate buffers will be designated and approved by DFW. The width of the buffer zone shall be determined by a qualified biologist in coordination with the DFW. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate. A qualified biologist shall monitor any active raptor nests that are located within the construction easement. The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall 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, DFW shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with DFW and may include halting some or all construction activities until the young have fledged. For any nest sites that require biological monitoring, a monitoring report shall be submitted to the DFW within 2 weeks of termination of monitoring activities.

The same measures as described above would be implemented if a nesting tree must be removed.

Bank Swallow

Construction activities will seek to avoid bank swallow nesting areas. If avoidance of bank swallow nests is not possible, design measures to minimize impacts, including reducing the construction footprint to protect the upper bank from encroachment, will be considered. If nesting habitat is directly impacted, mitigation will include removal of existing rock at a former bank protection site, acquisition of a permanent easement, or participation in a conservation easement on an appropriate landform.

If active nests are found, the activities will not occur until nesting activities have ceased (i.e., after a qualified biologist determines that fledglings have left the nest) or DFW is contacted to determine an appropriate buffer area needed to protect nests from program activities.

If active bank swallow nests (nests containing eggs or young) are present within the construction easement, a no-disturbance buffer zone shall be established around the nest site. The width of the buffer zone shall be determined by a qualified biologist in coordination with the DFW. No construction activities shall occur within the buffer zone. The buffer zone shall be maintained until the young have fledged (as determined by a qualified biologist). The buffer zone shall be delineated with exclusionary fencing/flagging and/or signage as appropriate. A qualified biologist shall monitor any active bank swallow nests that are located within the construction easement. The first monitoring event shall coincide with the initial implementation of construction activities and monitoring shall 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, DFW shall be immediately notified. Measures to avoid nest failure shall be implemented in coordination with DFW and may include halting some or all construction activities until the young have fledged.

For any nest sites that require biological monitoring, a monitoring report shall be submitted to the DFW within 2 weeks of termination of monitoring activities.

References

U.S. Fish and Wildlife Service. 1996. Programmatic formal consultation permitting projects with relatively small effects on the valley elderberry longhorn beetle within the jurisdiction of the Sacramento field office, California. Letter to Mr. Tom Coe, Regulatory Branch, USACE, Sacramento, California. 19 September.

U.S. Fish and Wildlife Service. 1997. Programmatic formal consultation for U.S. Army Corps of Engineers 404 permitted projects with relatively small effects on the giant garter snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo counties, CA. File number 1-1-F-97-149. Sacramento, California.

U.S. Fish and Wildlife Service. 1999. *Conservation Guidelines for the Valley Elderberry Longhorn Beetle*. July 9. Sacramento, CA.

Appendix D

Standard Assessment Methodology

Appendix D
Fish Effects Assessment Methods Using the Standard Assessment Methodology

Introduction

This appendix describes the detailed methods of the Sacramento River Bank Protection Project (SRBPP) Phase II Supplemental Authority fish effect assessment using the Standard Assessment Methodology (SAM). SAM was applied to give a program-level analysis of potential effects by SRBPP region while recognizing that more refined SAM analyses will be undertaken to determine project-level effects at individual sites in the future.

The effects of the SRBPP Phase II Supplemental Authority for implementation of up to 80,000 linear feet (LF) of additional bank protection in the Sacramento River Flood Control Project area on fish habitat was assessed using the Standard Assessment Methodology Electronic Calculation Template (ECT) Version 3.0 beta edition (June 2009) developed for and in conjunction with the U.S. Army Corps of Engineers (Corps) and the Central Valley Flood Protection Board by Stillwater Sciences. SAM assesses changes in habitat condition for various focus fish species as a result of levee improvement or bank protection actions within the SRBPP area and has been used previously in both programmatic (U.S. Army Corps of Engineers 2007a) and project-level (e.g., Jones & Stokes 2007) bank protection effect analyses.

SAM quantifies habitat values in terms of weighted response indices (WRIs) that are calculated by combining habitat quality (fish response indices) with quantity (bank length) for each season, target year, and relevant species/life stage. SAM employs six habitat variables (described below) to characterize nearshore and floodplain habitats of listed fish species. The fish response indices are derived from hypothesized relationships between key habitat variables and the responses of individual species and life stages. The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (e.g., with or without project), SAM uses the fish response relationships to determine the response of individual species and life stages to changes in the habitat variables for each season and target year. The response indices for each variable are multiplied together to generate an overall species response index. The species response index is then multiplied by the area or linear feet of bank to which it applies to generate a species WRI, which is expressed as feet or square feet. The WRI provides a common metric that can be used to quantify habitat values over time, compare project alternatives with existing conditions, and evaluate the effectiveness of on-site and off-site mitigation actions. For example, the difference in WRIs between with- and without-project conditions in a given year and season provides a measure of the adverse effects (negative species response) or benefits (positive species response) of the project relative to baseline conditions. More detail on SAM is provided by Standard Assessment Methodology for the Sacramento River Bank Protection Project (U.S. Army Corps of Engineers 2004) and Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (U.S. Army Corps of Engineers 2007a).

Focus Species

SAM considers seven focus fish species, which are federally or state-listed as threatened or endangered under the Endangered Species Act (ESA) or California Endangered Species Act (CESA) or are subject to a Fishery Management Plan under the Magnuson-Stevens Fishery Conservation and Management Act (Table D-1). Longfin smelt, a CESA-listed species, is not included presently in SAM but may be in the future. The habitat requirements of some longfin smelt life stages in the SRBPP program area may be similar to those of delta smelt, although timing of upstream migration, spawning, juvenile recruitment, and downstream migration is earlier than delta smelt, and the species occupies waters of higher salinity well downstream of the SRBPP program area for much of the year (Moyle 2002).

Table D-1. Focus Fish Species Considered in the SAM Modeling of Effects on Fish from the SRBPP Phase II Additional Authorization

Species/ESUs	Federal Endangered Species Act Status	Magnuson-Stevens Fishery Act	California Endangered Species Act Status
Central Valley Spring-Run Chinook Salmon ESU	Threatened; Critical Habitat designated	Essential Fish Habitat defined	Threatened
Central Valley Fall- and Late Fall–Run Chinook Salmon ESU	Species of Concern	Essential Fish Habitat defined	-
Sacramento River Chinook Salmon Winter-Run ESU	Endangered; Critical Habitat designated	Essential Fish Habitat defined	Endangered
Central Valley Steelhead DPS	Threatened; Critical Habitat designated	-	-
Delta Smelt	Threatened; Critical Habitat designated	-	Endangered
Green Sturgeon Southern DPS	Threatened; Critical Habitat designated	-	-

ESU = Evolutionarily Significant Unit
DPS = Distinct Population Segment

Species Life Stages, Distribution, and Timing

The focus fish species occupy a variety of waterbodies within the SRBPP area. Different life stages are often found in different habitats at different times of the year. SAM accounts for this by dividing each species into several life stages (Stillwater Sciences 2009: 5).

- Adult upstream migration—the upstream movement of adults from higher salinity waters (e.g., the ocean or lower portions of the San Francisco Estuary) to freshwater. All focus fish species exhibit this life stage within the SRBPP area.
- Spawning and egg incubation—adults deposit eggs in streambed or nearshore bank substrates, or in nearshore aquatic vegetation. Within the SRBPP area, this life stage is mostly limited to delta smelt and green sturgeon.
- Larval, fry, and juvenile rearing—prior to migrating to the ocean, juveniles rear close to nearshore areas. All focus fish species exhibit this life stage within the SRBPP area.
- Juvenile/smolt outmigration—juvenile salmonids and sturgeon emigrate from the SRBPP area to the ocean. Salmonids physically change (i.e., smoltification) during their emigration to prepare for ocean life. Delta smelt do not migrate to the ocean nor exhibit the smolt life stage.
- Adult habitat/residence—steelhead, delta smelt, and green sturgeon reside within waterways of the SRBPP area prior to migrating downstream to the ocean or higher salinity portions of the San Francisco, or prior to migrating upstream to spawn.

All species are not necessarily distributed throughout the full SRBPP area. Distributions and life-history timings included in the SAM ECT are based on ESA Critical Habitat and Magnuson-Stevens EFH designations, a variety of scientific literature, data summaries of fish capture information for the SRBPP area, and known hydrologic connectivity to the Sacramento River (Table D-2). The default SAM distributions (grey shading in Table D-2) were adapted for region 1a of the SRBPP area to include all species within all waterbodies included in the SRBPP Phase II Supplemental Authority (diagonal shading in Table D-2), except for the Willow Slough Bypass. Examples of life-history timing for the focus species are provided for four reaches of the Sacramento River in Table D-3; the timing may differ between waterbodies but is substantially similar by SRBPP region. In calculating effects on focus species, the SAM ECT groups months into four seasons: spring (March–May), summer (June–August), fall (September–November), and winter (December–February).

Table D-2. Distribution of Focus Species in the SRBPP Area, as Applied in SAM

Region	Waterbody	Spring-run Chinook	Fall-run Chinook	Late-fall-run Chinook	Winter-run Chinook	Steelhead	Delta Smelt	Green Sturgeon
Region 1a	Cache Creek*							
	Cache Slough*	■	■	■	□	■	■	□
	Elk Slough	■				■	■	
	Georgiana Slough*	■	□	□	□	■	■	■
	Haas Slough						■	■
	Knights Landing Ridge Cut*							
	Lindsay Slough		■			■	■	
	Mainstem Sacramento River, RM 0–20	■	■	■	■	■	■	■
	Miner Slough	■				■	■	■
	Putah Creek		■				■	■
	Sacramento Bypass							■
	Steamboat Slough*	■	□	□	□	■	■	■
	Sutter Slough*	■	□	□	□	■	■	■
	Threemile Slough	■				■	■	■
	Ulatis Creek Bypass		■				■	■
	Willow Slough Bypass*							■
	Yolo Bypass*	■	■	□	□	■	■	■
Region 1b	American River	■	■			■		
	Coon Creek		■			■		
	Mainstem Sacramento River, RM 20–80*	■	■	■	■	■	■	■
	Natomas Cross Canal		■			■		
	Natomas East Main Drain		■			■		
Region 2	Bear River*	■	■			■		■
	Butte Creek	■	■	■		■		
	Cherokee Canal*							
	Colusa Basin Drain							
	Colusa Bypass	■	■	■		■		
	Feather River*	■	■			■		■
	Honcut Creek							
	Mainstem Sacramento River, RM 80–143*	■	■	■	■	■		■
	Marysville Units 1,2,3							
	Sutter Bypass	■	■	■	■	■		■
	Tisdale Bypass	■	■	■	■	■		
	Wadsworth Canal					■		
	Yuba River*	■	■			■		■
Region 3	Deer Creek*	■	■			■		
	Elder Creek*	■	■		■	■		
	Mainstem Sacramento River, RM 143–194*	■	■	■	■	■		■
	Mud Creek	■	■		■	■		

*Waterbodies included in the SRBPP Phase II Supplemental Authorization

Default distribution assumed in SAM ECT: ■

Additional distribution assumed for SRBPP Phase II Supplemental Authorization Analysis: □

Source: SAM ECT version 3.0 (beta).

Table D-3. Life-History Timing for Focus Species within the Sacramento River Portion of the SRBPP Area, as Applied in SAM

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Spring-run Chinook	Region 1a (RM 0–20)	Adult migration	■	■	■	■	■	■	■				■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■				■	■	■
		Adult residence												
	Region 1b (RM 20–80)	Adult migration		■	■	■	■	■	■	■	■			
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■				■	■	■
		Adult residence												
	Region 2 (RM 80–143)	Adult migration	■	■	■	■	■	■	■				■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■							
		Adult residence												
	Region 3 (RM 143–194)	Adult migration	■	■	■	■	■	■	■				■	■
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■							
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Fall-run Chinook	Region 1a (RM 0–20)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 1b (RM 20–80)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 2 (RM 80–143)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 3 (RM 143–194)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Late fall–run Chinook	Region 1a (RM 0–20)	Adult migration	■	■	■						■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing			■	■	■							
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence												
	Region 1b (RM 20–80)	Adult migration	■	■	■	■					■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing				■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■									■	■
		Adult residence												
	Region 2 (RM 80–143)	Adult migration	■	■	■						■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing			■	■	■							
		Juvenile migration	■										■	■
		Adult residence												
	Region 3 (RM 143–194)	Adult migration	■	■	■						■	■	■	■
		Spawning and egg incubation												
		Fry and juvenile rearing			■	■	■							
		Juvenile migration	■	■									■	■
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Winter-run Chinook	Region 1a (RM 0-20)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 1b (RM 20-80)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 2 (RM 80-143)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 3 (RM 143-194)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Steelhead	Region 1a (RM 0-20)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 1b (RM 20-80)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 2 (RM 80-143)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 3 (RM 143-194)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Delta smelt	Region 1a (RM 0-20)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 1b (RM 20-80)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 2 (RM 80-143)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												
	Region 3 (RM 143-194)	Adult migration												
		Spawning and egg incubation												
		Fry and juvenile rearing												
		Juvenile migration												
		Adult residence												

Population	Region	Life Stage	January	February	March	April	May	June	July	August	September	October	November	December
Green sturgeon	Region 1a (RM 0–20)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence		■	■	■	■	■	■	■	■	■	■	■
	Region 1b (RM 20–80)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation			■	■	■	■	■					
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration					■	■	■	■	■			
		Adult residence		■	■	■	■	■	■	■				
	Region 2 (RM 80–143)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation												
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence		■	■	■	■	■	■	■	■	■	■	■
	Region 3 (RM 143–194)	Adult migration		■	■	■	■	■	■	■				
		Spawning and egg incubation			■	■	■	■	■	■				
		Fry and juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■
		Juvenile migration	■	■	■	■	■	■	■	■	■	■	■	■
		Adult residence	■	■	■	■	■	■	■	■	■	■	■	■

Source: SAM ECT version 3.0 (beta).

Habitat Data Assembly

Interfacing Potential Bank Protection Sites with the Revetment Database

The Corps revetment database (U.S. Army Corps of Engineers 2007b) is based on surveys undertaken along segments of the waterbody within the SRBPP area. Each segment includes relatively homogenous river bank and a new segment begins when the bank habitat appreciably changes. Thus, each segment has a particular type and size class of rock/rubble revetment or is a class of natural bank, the latter differentiated among predominance of deposition or erosion. The revetment database includes geographic information system (GIS) files and an associated Excel database. The GIS files contain coordinates of the endpoints of each segment. In the database, each row represents a segment, and data for each segment are given for each of 24 attributes of the segments.

Critical erosion sites identified by the Corps (e.g., Ayres Associates 2008) are also identified by GIS coordinates and delimited by polygons. The Corps selected potential bank protection sites for construction under the 80,000 linear feet supplemental authority from the 2008 inventory of critical erosion sites; this consists of 106 erosion sites described in the Sacramento Riverbank Protection Project: Final Alternatives Report—80,000 LF (Final Alternatives Report) (U.S. Army Corps of Engineers 2009). This selection serves as a sample of sites that may eventually be provided bank protection under the supplemental authority.

Using GIS, the revetment and erosion-site datasets were intersected, and the revetment database segments, or portions of particular segments, corresponding to each potential bank protection site were identified and clipped from the revetment database.

Habitat Attributes

Six habitat attributes are considered in the SAM analysis: bank slope, floodplain availability, bank substrate size, instream structure, aquatic vegetation, and overhanging shade. These attributes describe features of the nearshore aquatic environment that are important to fish for refuge (Stillwater Sciences 2009: 4).

- Bank slope—average bank slope along each average seasonal water surface elevation.
- Floodplain availability—ratio of wetted channel and floodplain area during the 2-year flood (Q2) to the wetted channel area during average winter and spring flows.
- Bank substrate size—the median particle diameter of the bank (i.e., D_{50}) along each average seasonal water surface elevation.
- Instream structure—percentage of shoreline coverage of instream woody material (IWM) along each average seasonal water surface elevation.
- Aquatic vegetation—percentage of shoreline coverage of inundated aquatic or riparian vegetation along each average seasonal water surface elevation.

- Overhanging shade (cover)—percentage of the shoreline coverage of shade along each average seasonal water surface elevation.

Calculation of Habitat Attribute Values for Existing Conditions

The habitat attribute values representing existing conditions for the SAM analysis were based largely on the SRBPP GIS revetment database developed by the Corps (U.S. Army Corps of Engineers 2007b). Values of habitat attributes for each potential bank protection site were obtained by calculating length-based weighted averages of the habitat attributes that were clipped from the revetment database using the procedure described above. Calculation of the SAM input values needed for the averaging process is described below. Sites not included in the revetment database had habitat values estimated from nearby sites and the qualitative description provided in the Final Alternatives Report (U.S. Army Corps of Engineers 2009). These sites included:

- Cache Slough RM 15.9L
- Deer Creek LM 2.4L
- Elder Creek LM 1.44L

Bank Slope

Existing bank slope was estimated from the revetment database using the average value derived from the 5FT_DEPTH and 10FT_DEPTH attributes. These refer to observation points 5 feet and 12 feet from the low-flow shoreline, respectively. (There appears to be a discrepancy in the measuring distances between earlier U.S. Fish and Wildlife Service surveys, which used a 12-foot distance from shore, and the revetment database, which indicates a 10-foot distance; a value of 12 feet was assumed in this analysis.) Note that bank slopes associated with low-flow shorelines are not necessarily the same as bank slopes at higher elevations (e.g., in winter), which may be more relevant for assessing conditions encountered by species such as juvenile salmonids. However, data for high-flow shorelines were not available. Each depth class at each of the two depths estimated at each site was converted to slope by assuming that the actual depth was the midpoint of the depth class or 15 feet for the >10 feet depth class (Table D-4). Slope (change in width divided by change in depth, dW/dH, or run/rise) was calculated as the average of the two slopes obtained from the two observation points (5 feet and 12 feet from the low-flow shoreline). For example, a segment of a waterbody with depth at 5 feet estimated to be <2.5 feet (i.e., a slope of 4, from dW/dH = 5/1.25) and depth at 12 feet of 2.5–5 feet (i.e., a slope of 3.2, from dW/dH = 12/3.75) would have an estimated slope of 3.6 ([4+3.2]/2). The lack of more refined season-specific data necessitated using the resulting averages of the two values for all four seasonal SAM model runs.

Table D-4. Assumed SAM Input Values for Slope, as Derived from the Revetment Database

Revetment Database Depth Class (Assumed Value)	Slope, dW/dH	
	For Depth at 5 Feet Observation	For Depth at 12 Feet Observation
<2.5 feet (1.25 feet)	4	9.6
2.5–5 feet (3.75 feet)	1.33	3.2
5–10 feet (7.5 feet)	0.67	1.6
>10 feet (15 feet)	0.33	0.8

dW/dH = change in width divided by change in depth

Floodplain Availability

Floodplain availability, as represented by the SAM variable of floodplain inundation ratio, was calculated based on distances from the river centerline to shore under seasonal average and 2-year flood flow (Q2) water-surface elevations (WSEL). Because the length of the site is assumed to remain the same between existing and project conditions, the ratio of the centerline-shore distance between Q2 and winter and fall can be used to represent the floodplain inundation ratio. For summer and fall, when water levels are low, a value of 1.0 was used to indicate no floodplain availability (U.S. Army Corps of Engineers 2007a). Channel half-width in the summer/fall was estimated from aerial photography in GIS. Channel half-widths in winter and spring were estimated by taking the midpoint of the estimated summer WSEL from the Final Alternatives Report and applying predictive regressions developed for the Sacramento River from WSEL in a number of recent SAM analyses:

- Winter WSEL = 1.0179*(summer WSEL) + 3.0728, $r^2 = 0.9865$
- Spring WSEL = 1.01*(summer WSEL) + 1.3107, $r^2 = 0.9987$

In essence, these regression relationships suggested that the winter and spring WSEL are approximately 3 feet and 1.3 feet higher than the summer WSEL. The winter and spring channel half-widths were calculated by adding the distance from the summer WSEL to the winter and spring WSEL using site cross sections presented in Final Alternatives Report (U.S. Army Corps of Engineers 2009).

The Q2 WSEL was derived from values presented in Appendix D (Attachment D.1) of the Sacramento and San Joaquin River Basins Comprehensive Study (U.S. Army Corps of Engineers 2002). Estimates of Q2 WSEL for a given site included in the SAM analysis were made by developing predictive regressions between Q2 WSEL and river mile, then applying the regressions to the river miles of the sites included in the SAM analysis. For example, the regression used for sites in Georgiana Slough was based on two data points, giving the regression:

- Q2 WSEL (site) = 0.2023*(site river mile) + 7.0094, $r^2 = 1$

Floodplain inundation ratios were calculated as:

- Winter floodplain inundation ratio = Q2 channel half-width/winter channel half-width
- Spring floodplain inundation ratio = Q2 channel half-width/spring channel half-width

Bank Substrate Size

The revetment database includes eight rock/rubble revetment classes and three natural bank classes. Based on the Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (U.S. Army Corps of Engineers 2007a), all natural bank classes were considered to have a substrate size (D_{50}) of 0.25 inches. Table D-5 indicates how these revetment database attribute values were converted to single values for input to SAM. Following U.S. Army Corps of Engineers 2007a, these values were applied to all four seasons. (The revetment database attribute for rock height does not distinguish among heights less than 10 feet above the fall-summer WSEL, and average winter WSEL is commonly only about 5 feet above the fall-summer WSEL, so the rock-height attribute would not allow substrate differences at different seasonal WSELs to be distinguished.)

Table D-5. Conversion of Revetment Database Bank-Type Classes to SAM Variable Value for Bank Substrate Size

Revetment Database Substrate Class		SAM Input Value
Natural bank (all types)		0.25”
Rock riprap	small	11”
	medium	16”
	large	20”
Cobble riprap	small	6”
	medium	8”
	large	11”
Rubble	small	12”
	large	24”

Instream Structure

The revetment database uses four classes of instream structure, based on ranges of percent shoreline having IWM. Table D-6 indicates how these revetment database attribute values were converted to a single value for input to SAM. Although these observations were made during summer and fall, IWM submerged at that time will also be submerged during spring and winter periods. Thus, these values appropriately served for all seasons.

Table D-6. Conversion of Revetment Database Instream Woody Material Classes to SAM Variable Value for Instream Structure

Revetment Database IWM Class	SAM Input Value
None	0%
1–10%	5%
11–50%	30%
>50%	75%

Aquatic Vegetation

Following the approach used by U.S. Army Corps of Engineers 2007a, the revetment database attribute for emergent vegetation was used for fall and summer seasonal model runs, and the ground cover attribute was used for the spring and winter model runs. Upstream of the Delta, this approach generally gave a vegetation value of zero for fall and summer WSELs, which is appropriate given the relative scarcity of aquatic vegetation. Several classes were used for each attribute; Table D-7 indicates how these revetment database attribute values were converted to a single value for input to SAM.

Table D-7. Conversion of Revetment Database Emergent Vegetation and Ground Cover Classes to SAM Variable Values for Vegetation

	Revetment Database Class	SAM Input Value
Fall and Summer:		
Emergent Vegetation Attribute	False	0%
	PEM 1–5%	3%
	PEM 6–25%	15%
	PEM 26–75%	50%
	PEM >75%	85%
Spring and Winter:		
Ground Cover Attribute	<25%	13%
	26–50%	38%
	51–75%	63%
	>75%	88%

Overhanging Shade

The revetment database uses five classes of overhanging shade (cover), based on ranges of percent shoreline cover. Table D-8 indicates how these revetment database attribute values were converted to a single value for input to SAM. These values served as fall and summer values. Following U.S. Army Corps of Engineers 2007a, the values for spring and winter were assumed to be 75% and 25% of the summer/fall values, respectively, to reflect leaf-out and die-back conditions.

Table D-8. Conversion of Revetment Database Overhead Cover Classes to SAM Variable Value for Overhanging Shade

Revetment Database Shade Class	SAM Input Value
None	0%
1–5%	3%
6–25%	16%
26–75%	50%
>75%	88%

Seasonal Differences

The revetment database reflects the average of summer and fall conditions, but SAM requires inputs for each of four seasons. Consequently, certain assumptions must be made for the relationship of winter and spring to average summer/fall conditions, and summer and fall modeling is assumed to be identical for existing conditions. Also, representative values of the SAM variable for each revetment observation class (bin) must be adopted. The following sections set forth the modeling approach and methods of identifying input values for the six SAM variables. A summary of determining existing conditions variables from the revetment database is provided in Table D-9, and was also discussed above under the details for each SAM variable. The methodology is generally consistent with U.S. Army Corps of Engineers 2007a.

Table D-9. Determination of Existing Conditions Variables from the Revetment Database

	SAM Variable					
	Overhanging Shade	Aquatic Vegetation	Floodplain Availability (Floodplain Inundation Ratio)	Bank Substrate Size	Bank slope	Instream Structure
Fall and Summer	Use revetment database value for Overhead Cover attribute	Use revetment database Emergent Vegetation percent attribute	Not calculated using the revetment database	Use revetment database value for revetment database for all seasons	Use revetment database average value derived from Depth at 5’ and Depth at 12’ attribute for all seasons	Use revetment database value for Large Woody Debris attribute for all seasons
Spring	Use 75% of revetment database value	Use revetment database Ground Cover percent				
Winter	Use 25% of revetment database value					

Characterization of With-Project Conditions

Bank Protection Measures

Bank protection measures are site-specific design solutions that can be constructed at eroding sites in order to reduce flood damage risk from erosion-related levee breach. With-project conditions were generally derived from bank protection measures provided in the Final Alternatives Report (U.S. Army Corps of Engineers 2009) when those measures were compatible with the Corps policy for vegetation-free zones (see the discussion of the Proposed Site-Specific Bank Protection Measures in Appendix A of the Programmatic Mitigation Strategy). Site characteristics generally were based upon the main bank protection measure templates described in the Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (see Table D-10; Appendix A of the Programmatic Mitigation Strategy). Bank attributes that change based on vegetation growth over time (i.e., aquatic vegetation percentage cover and shade percentage) were assumed to have rates of change similar to those adopted in previous SAM analyses (U.S. Army Corps of Engineers 2007a), although a simplified calculation method (Table D-11) based on patterns of change from recent SAM analyses was used to estimate the values rather than a formal growth model (U.S. Army Corps of Engineers 2004).

Table D-10. Bank Protection and On-Site Enhancement Features That Are Specified In The Bank Protection Measure Templates. Individual Sites May Vary Based on Conditions

Bank Protection and Habitat Enhancement Features	Bank Protection Measure						
	1 (Setback Levee)	2 (Bank Fill Stone Protection with No On-Site Woody Vegetation)	3 (Adjacent Levee)	4a (Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline)	4b (Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline)	4c (Riparian and Wetland Benches with Revegetation)	5 (Bank Fill Stone Protection with On-Site Vegetation)
Revegetation	NA[1]	No	NA[1]	Yes	Yes	Yes	Yes
Riparian Bench	NA[1]	No	NA[1]	Yes	Yes	Yes	No
Wetland Bench	NA[1]	No	NA[1]	No	No	Yes	No
Benches							
Riparian Bench Flooded (Winter/Spring)	NA[1]	No	NA[1]	Yes	Yes	Yes	No
Wetland Bench Flooded (Year-round)	NA[1]	No	NA[1]	No	No	Yes	No
Bank Slope (Horizontal : Vertical)							
Average Across Revetment	As is	3:1	As is	3:1	3:1	3:1	3:1
Bench Areas	NA[1]	NA[2]	NA[1]	10:1	10:1	10:1	NA[2]
Substrate Median Diameter (D_{50}, inches)							
Above Bench (Winter/Spring)	NA[1]	8	NA[1]	0.25	0.25	0.25	8
Below Bench (Summer/Fall)	NA[1]	8	NA[1]	4	4	4	8
Instream Woody Material Coverage (Percentage of Shoreline)							
Above Bench (Winter/Spring)	NA[1]	0%	NA[1]	60%[3]	60%[3]	As is[4]	0%
Below Bench (Summer/Fall)	NA[1]	0%	NA[1]	0%	60%[3]	As is[4]	0%
Initial Retention of Existing Overhead Shade (%)	100%	0%	100%	25%	25%	25%	25%

Source: Adapted from USACE (2007a)

[1] Not applicable (NA) to setback or adjacent measures because these would retain the existing conditions on the waterside.

[2] Not applicable (NA) because benches are not included in the bankfill rock-slope measures.

[3] Instream woody material installed above pre-project levels upstream of RM 30 for Designs 4a and 4b may be used as off-site compensation for sites downstream of RM 30. A revision of SAM species response curves in ECT 3.0 requires at least 60% IWM coverage to provide essentially the same benefit as 100% coverage (compared with a requirement of 40% in prior SAM analyses).

[4] Instream woody material would be installed to pre-project conditions for bank protection measure 4c.

Table D-11. Assumed Change in Aquatic Vegetation and Shade (Both As Percentage of Shoreline Length) for with-Project Conditions

Construction Year[1]	Fall[2]	Winter	Spring	Summer
Aquatic Vegetation By Year (% Shoreline): Bank Protection Measures 4a, 4b, 5				
Year 0	Existing	Existing	Existing	0
Year 1	0	50	50	0
Year 5	0	85	85	0
Year 15	0	85	85	0
Year 25	0	85	85	0
Year 50	0	85	85	0
Aquatic Vegetation By Year (% Shoreline): Bank Protection Measure 4c				
Year 0	Existing	Existing	Existing	0
Year 1	50	50	50	50
Year 5	90	90	90	90
Year 15	100	100	100	100
Year 25	100	100	100	100
Year 50	100	100	100	100
Shade By Year (% Shoreline): All Bank Protection Measures				
Year 0	Existing	Existing	Existing	0.25 × Existing
Year 1	0.25 × Existing	(0.25 × Existing) + 1	(0.25 × Existing) + 1	0.25 × Existing
Year 5	0.25 × Existing	Year 1 × 2	Year 1 × 3	0.25 × Existing
Year 15	(0.25 × Existing) + 60	Year 5 + (0.67 × [25-Year 5])	Year 5 + (0.67 × [75-Year 5])	(0.25 × Existing) + 60
Year 25	100	25	75	100
Year 50	100	25	75	100

[1] Year = construction year (construction assumed to occur during summer).
[2] Fall indicates fall of the previous year (same water year).

There are relatively few data with which to examine the appropriateness of the bank protection measure assumptions related to changes over time (Table D-11). A recent examination of changes from 2008 to 2009 for 57 emergency repair sites constructed in 2006–2007 in the Sacramento River and a number of sites in the Brannan-Andrus Levee Maintenance District constructed in 2007 found the following (H. T. Harvey & Associates with PRBO Conservation Science 2010):

- Instream structure (IWM)
  - Low-elevation (summer-fall) shoreline: stayed approximately the same (average of 44.4% in 2008 and 42.8% in 2009)
  - High-elevation (winter-spring) shoreline: increased from 73.6% in 2008 to 81.5% in 2009
- Aquatic vegetation
  - Low-elevation (summer-fall) shoreline: increased from 34.4% in 2008 to 40.6% in 2009
  - High-elevation (winter-spring) shoreline: increased from 44.8% in 2008 to 53.7% in 2009

- Overhanging shade
  - Low-elevation (summer-fall) shoreline: increased from 1.8% in 2008 to 13.1% in 2009
  - High-elevation (winter-spring) shoreline: increased from 9.5% in 2008 to 32.8% in 2009

These data, although short-term and limited, generally suggest that the assumptions described in Table D-11 are appropriate and may be conservative in some respects (e.g., development of overhanging shade).

Site-Specific Bank Protection Measures

Bank protection measures were assumed to be applied to the representative project sites considered in this programmatic analysis, with a single measure per site (see Appendix B of the Programmatic Mitigation Strategy). To determine the repair sites to be included in the SAM analysis, it was necessary to refine data from the 106 erosion sites listed in Appendix B of the Programmatic Mitigation Strategy.

- Ten sites were determined in the Final Alternatives Report (U.S. Army Corps of Engineers 2009) not to require repair and so were omitted from the analyses.
- Sites within Cache Creek, Cherokee Canal, and Knights Landing Ridge Cut are assumed not to be within the SAM focal species' ranges (Stillwater Sciences 2009; Table D-2) and so were excluded from SAM analysis (seven sites totaling 13,789 LF, not including sites already excluded for the above reason). In addition, a site along the Yuba River far from the active river channel was also excluded (1,356 LF).
- Several sites had no revetment database coverage in their vicinity but their lengths were included in the calculation of repair length by region under the assumption that sites in the same region provided similar habitat features for the SAM calculation, with habitat features also being estimated from descriptions provided in the Final Alternatives Report. This is consistent with the method used in the Programmatic Biological Assessment for the Sacramento River Bank Protection Project, Phase II (U.S. Army Corps of Engineers 2007a) and assumes that the sites included in the analysis are representative of all potential erosion sites that could be repaired using the supplemental authority for 80,000 LF.

Across the full SRBPP program area, there are 96 sites at which construction was assumed to occur, totaling nearly 77,000 LF (Table D-12). Of these 96 sites, 88 sites are in SAM waterbodies (i.e., waterbodies considered to be habitat for SAM focal fish species) and these sites constitute nearly 62,000 LF (80%) of the total length of assumed bank protection sites to be constructed in the SRBPP Phase II Supplemental Authority. The greatest length of construction sites by SRBPP programmatic region is assumed to be in Region 1a, which would have slightly more than 40,000 LF of construction (53% of total construction length). Nearly 12,000 LF (30% of the Region 1a total) would be in non-SAM waterbodies (the aforementioned sites in Cache Creek and Knights Landing Ridge Cut). Around 30% of construction was assumed to occur in Region 2 (more than 22,000 LF), of which more than 19,000 LF (86%) would occur in SAM waterbodies. Construction lengths in Regions 1b and 3 were less than in the other regions and constituted around 14,000 LF (18%) of all construction, all of which was assumed to occur in SAM waterbodies (Table D-12).

Because the total length of sites is 76,806 LF, the results of the SAM analysis are considered representative of 96% of the full 80,000 LF included under the Phase II supplemental authority.

Therefore, a small multiplier (1/0.96 = 1.04) should be included in any potential offsite compensation needs as assessed from the SAM results for focal fish species.

Table D-12. Assumed Bank Repair Lengths (Linear Feet) By SRBPP Programmatic Region, With Number of Sites in Parentheses

Program Region	Length In Non-SAM Waterbodies, (Number of Sites)	Length In SAM Waterbodies, (Number of Sites)	Total length, (Number of Sites)
1a	11,989 (6)	28,394 (33)	40,383 (39)
1b	0 (0)	10,777 (22)	10,777 (22)
2	3,156 (2)	19,113 (26)	22,269 (28)
3	0 (0)	3,377 (7)	3,377 (7)
Total	15,145 (8)	61,661 (88)	76,806 (96)

Note: Only sites in SAM waterbodies were examined in the fish effect analysis.

Construction Schedule

In order to represent a realistic construction schedule for the 80,000 LF Phase II Supplemental Authority, it was assumed that approximately 10,000 LF of erosion sites were repaired each year (Dietl personal communication). Construction was assumed to begin in 2013 and to end in 2020, with SAM analysis including the period from 2013 to 2070 in order to capture short-term and long-term effects that include up to 50 years from the end of construction. Total annual length of construction ranged from around 8,800 LF in 2017, 2019, and 2020, to more than 11,700 LF in 2014 (Table D-13). The annual number of sites that were assumed to be constructed ranged from six in 2016 to 26 in 2020.

SAM Analysis Results

Baseline conditions were assumed to be static over 2013–2070 and were calculated for each site using the conventions described above in the Calculation of Habitat Attribute Values for Existing Conditions section. A static baseline is typical for SAM analyses (Jones & Stokes 2007; U.S. Army Corps of Engineers 2007a) and fulfills the requirements of the ESA. SAM analyses were conducted separately for each of the four program regions (1a, 1b, 2, and 3). Results were output at several time periods in order to assess short-term and long-term habitat responses: 2013, 2014, 2015, 2017, 2018, 2028, 2038, 2063, and 2070. The analyses provided estimates of bank-line weighted relative responses of all seven species in each of the four seasons.

Table D-13. Assumed Construction Schedule For SAM Analysis, With Length of Bank Protection By Year and SRBPP Program Region

Start Year	Program Region	Linear Feet In Non-SAM Waterbodies (Number of Sites)	Linear Feet In SAM Waterbodies (Number of Sites)	Total Linear Feet (Number of Sites)
2013	1a	1,647 (2)	3,529 (4)	5,176 (6)
2013	1b	0	665 (1)	665 (1)
2013	2	1,356 (1)	2,067 (3)	3,423 (4)
2013	3	0	525 (1)	525 (1)
2013	All	3,003 (3)	6,786 (9)	9,789 (12)
2014	1a	768 (1)	3,457 (5)	4,225 (6)
2014	1b	0	0	0
2014	2	1,800 (1)	3,134 (1)	4,934 (2)
2014	3	0	0	0
2014	All	2,568 (2)	6,591 (6)	9,159 (8)
2015	1a	8,564 (1)	3,171 (1)	11,735 (2)
2015	1b	0	0	0
2015	2	0	0	0
2015	3	0	0	0
2015	All	8,564 (1)	3,171 (1)	11,735 (2)
2016	1a	0	4,206 (4)	4,206 (4)
2016	1b	0	2,761 (1)	2,761 (1)
2016	2	0	3,459 (1)	3,459 (1)
2016	3	0	0	0
2016	All	0	10,426 (6)	10,426 (6)
2017	1a	1,010 (2)	3,540 (3)	4,550 (5)
2017	1b	0	1,439 (2)	1,439 (2)
2017	2	0	2,465 (1)	2,465 (1)
2017	3	0	334 (1)	334 (1)
2017	All	1,010 (2)	7,778 (7)	8,788 (9)
2018	1a	0	3,514 (4)	3,514 (4)
2018	1b	0	2,699 (5)	2,699 (5)
2018	2	0	2,429 (5)	2,429 (5)
2018	3	0	694 (2)	694 (2)
2018	All	0	9,336 (16)	9,336 (16)
2019	1a	0	4,154 (6)	4,154 (6)
2019	1b	0	1,262 (6)	1,262 (6)
2019	2	0	2,831 (4)	2,831 (4)
2019	3	0	546 (1)	546 (1)
2019	All	0	8,793 (17)	8,793 (17)
2020	1a	0	2,823 (6)	2,823 (6)
2020	1b	0	1,951 (7)	1,951 (7)
2020	2	0	2,728 (11)	2,728 (11)
2020	3	0	1,278 (2)	1,278 (2)
2020	All	0	8,780 (26)	8,780 (26)
All	Total	15,145 (8)	61,661 (88)	76,806 (96)

The results were used to assess the extent to which site designs provided sufficient compensation for alteration of habitat by bank protection over both the long term (project life of 50 years) and the short term. Short-term deficits were examined in relation to periods approximating the species' life spans (U.S. Army Corps of Engineers 2007a):

- Chinook salmon: 5 years (i.e., 2018);
- Steelhead: 4 years (i.e., 2017);
- Delta smelt: 2 years (i.e., 2015); and
- Green sturgeon: 15 years (i.e., 2028).

Although SAM results are presented in linear feet differences between baseline and project for each life stage of each species, these results are not comparable across species because habitat suitability (i.e., SAM species response indices) differs by species and life stage. In many cases the largest absolute differences (in terms of linear feet) are found for the least sensitive life stages because habitat suitability is high across a range of conditions. Therefore, the standard SAM results were categorized to indicate relative percentage change under the SRBPP from baseline[1]. The categories were:

- <5% difference in habitat suitability,
- 5–10% less habitat suitability,
- >10–25% less habitat suitability,
- >25–50% less habitat suitability,
- >50% less habitat suitability,
- 5–10% greater habitat suitability,
- >10–25% greater habitat suitability,
- >25–50% greater habitat suitability,
- >50% greater habitat suitability.

Note that the absolute linear footages reported in the SAM results represent the difference from baseline in terms of optimal habitat for a given species and life stage, i.e., the linear footage of habitat for which all six habitat variables are at optimum levels and have a response index of 1.

[1] For the Biological Assessment, SAM was only run for sites at which construction would affect the waterside of the river bank at each site; adjacent levees were not run. However, in order to properly represent the relative change from baseline under the project across a region, habitat value under existing conditions must be included for all sites. To accomplish this, existing conditions SAM values from Alternative 6 of the SRBPP Phase II Supplemental Authorization EIR/EIS were used because this alternative assumes construction at all sites and so the SAM was run for all sites.

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Appendix E
Mitigation Cost Efficiency and Incremental Cost Analysis

APPENDIX E

FINAL SACRAMENTO RIVER BANK PROTECTION PROJECT PHASE II SUPPLEMENTAL AUTHORIZATION
COST EFFECTIVENESS AND INCREMENTAL COST ANALYSIS

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List of Acronyms and Abbreviations

CE/ICA	cost-effectiveness/incremental cost analysis
CEQA	California Environmental Quality Act
Corps	U.S. Army Corps of Engineers
DFW	California Department of Fish and Wildlife
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ETL	Engineering Technical Letter
LF	linear feet
NEPA	National Environmental Policy Act
Project	Sacramento River Bank Protection Project Phase II Supplemental Authorization
RIBITS	Regulatory In-Lieu Fee and Bank Information Tracking System
RM	river mile
SAM	Standard Assessment Methodology
SRA	shaded riverine aquatic
SRBPP	Sacramento River Bank Protection Project
SRFCP	Sacramento River Flood Control Project
Vegetation ETL	Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams, and Appurtenant Structures
NMFS	National Marine Fisheries Service
USFWS	U.S. Fish and Wildlife Service
Wildlands	Wildlands, Inc.
VELB	Valley Elderberry Longhorn Beetle

Final Sacramento River Bank Protection Project Phase II Supplemental Authorization Cost Effectiveness and Incremental Cost Analysis

Analysis Scope and Objective

This appendix is a cost effectiveness and incremental cost analysis of the options for mitigating habitat and wetland impacts associated with the Sacramento River Bank Protection Project (SRBPP) Phase II Supplemental Authorization (Project). The project's Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) is being prepared at a programmatic level.

This analysis is presented in compliance with ER 1105-2-100 (April 22, 2000) and its included guidance on cost-effectiveness/incremental cost analysis (CE/ICA). It is intended to disclose differences between mitigation approaches and their associated costs.

Project Description

The project consists of up to 80,000 linear feet (LF) of additional bank protection in the Sacramento River Flood Control Project (SRFCP) area. The SRBPP area (or program area) is located along the Sacramento River and its tributaries and distributaries and spans Butte, Colusa, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties.

The program area extends south-to-north along the Sacramento River from the town of Collinsville at river mile (RM) 3 upstream to Chico at RM 194, and includes reaches of lower Elder and Deer Creeks. The SRBPP program area also includes Cache Creek, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs. Sutter and Yolo bypass levees are also located in the program area.

For the purposes of the EIS/EIR and this CE/ICA, 106 selected erosion sites along the SRFCP are considered for the supplemental 80,000 LF analysis. The number and extent of erosion sites may change from year to year because erosion is episodic and new erosion sites can appear each year. The analysis in this EIS/EIR is programmatic in nature, analyzing the 80,000 LF in its entirety. Additional site-specific environmental documentation tiering from this programmatic analysis will be conducted to address sites proposed to be repaired. This CE/ICA addresses the environmental impacts of constructing 80,000 LF of bank protection on SRFCP levees associated with increasing the existing Phase II authorization from 405,000 to 485,000 LF.

The EIS/EIR considers a suite of site-specific bank protection measures (See Appendix A of the Programmatic Mitigation Strategy). The bank protection measures considered include the following:

- Setback levee
- Bank fill stone protection with no on-site woody vegetation
- Adjacent levee

- Riparian and Wetland Benches with revegetation
- Bank fill stone protection with on-site vegetation.

Consistent with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), a reasonable range of alternatives that would meet most of the project purpose and need, while avoiding or substantially lessening project effects (as required under CEQA), was evaluated. To comply with NEPA, this EIS/EIR analyzes all alternatives at the program level on an equal, non-preferential basis and at an equal level of detail. As required under NEPA and CEQA, a no-action (no-project) alternative has been included to allow the Lead Agencies to compare the effects of the proposed alternatives with the effects of taking no action.

The NEPA/CEQA alternatives were developed using those bank protection measures considered to reasonably meet the project's purpose, need, and objectives. NEPA/CEQA Alternatives development also took into consideration an alternative's ability to eliminate significant adverse environmental impacts or reduce them to less-than-significant levels, as well as minimize any contribution to cumulative impacts.

In addition to the no-action alternative, five action alternatives are analyzed. The five action alternatives will apply a site-specific bank protection measure (design solution as listed above and described in Appendix A of the Programmatic Mitigation Strategy) to each of the 106 sites. In general, selection of bank protection measures at specific sites are based on consideration of the likely causes of erosion, local conditions that could impact repair and construction, and site-specific considerations for vegetation, wildlife, land ownership, and access. The site-specific bank protection measure applied to each site may vary from one alternative to another (Appendix B of the Programmatic Mitigation Strategy). For example, a setback levee may be applied to an erosion site under one alternative, while a bench alternative may be applied to that same site under a different alternative. These variations allow for meeting the objectives of each alternative (e.g., minimizing impacts).

The six alternatives are as follows:

- Alternative 1 – No Action
- Alternative 2 – Low Maintenance
- Alternative 3 – Minimize Habitat Impacts
- Alternative 4 – Habitat Replacement
- Alternative 5 – Habitat Replacement Reaching Environmental Neutrality
- Alternative 6 – Habitat Replacement with Engineering Technical Letter (ETL) Variance

For bank protection measures to be feasible, they must comply with the U.S. Army Corps of Engineers's (Corps's) Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams, and Appurtenant Structures (Vegetation ETL) (U.S. Army Corps of Engineers 2009). The key aspect of the Vegetation ETL that is relevant to the development of feasible alternatives is its requirement for a VFZ surrounding all levees and appurtenant structures. The VFZ must be free of obstructions to ensure access by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood-fighting. A secondary purpose is to provide a distance between root systems and levees to moderate reliability risks associated with 1) piping and seepage, and 2) structural damage (e.g., wind-driven tree overturning). However, the Vegetation

ETL does provide for the use of a variance which, when justified, allows for some vegetation to remain within the VFZ. Alternative 6 includes variations of the previously described bank protection measures in that there is sometimes vegetation within the VFZ. As a result, Alternative 6 would rely on a variance to the Vegetation ETL (an ETL variance). Other alternatives may also rely on a variance for specific sites, to be determined on a site-specific basis.

Existing Ecological Resources and Impacts

Land cover types located within the action area include riparian forest, riparian scrub, oak woodlands, ruderal herbaceous vegetation, emergent marsh, agricultural lands, and open water. Each of these habitat types plays an important role for one or many of the various special status species found in the action area. In fact, some of these habitats have been identified as "critical" for specific fish and wildlife species under the Endangered Species Act. Action area special status species are: Chinook salmon, Central Valley steelhead, green sturgeon, Delta smelt, bank swallow, Swainson's hawk, giant garter snake and valley elderberry longhorn beetle. More information about the land cover types and special-status species can be found in the EIS/EIR (Chapter 10, "Vegetation and Wetlands," and Chapter 12, "Wildlife").

Due to the programmatic nature of the analysis in the EIS/EIR, site-specific/quantitative information about the distribution of terrestrial species and their habitats (bank swallow, Swainson's hawk, giant garter snake and valley elderberry longhorn beetle) is not available. As a result of the analysis being conducted at a programmatic level, the mitigation options are similarly presented in a programmatic fashion. Detailed impacts will be identified through site-specific and time-appropriate field surveys.

The Project EIS/EIR conducted two types of quantitative analyses: one for riparian resource impacts and one using the Standard Assessment Methodology (SAM).

Riparian Resource Impacts

Tables E-1 through E-5 below identify the site-specific vegetation in the riparian zones that would be impacted at the 106 erosion sites analyzed for each of the action alternatives in the EIS/EIR (Alternatives 2–6). The data are presented by alternative and show existing, removed, and retained vegetation by type (woodland or scrub) and by region. Table E-1 through Table E-5 also show the plantable area created. Table E-6 indicates the mitigation deficit for each alternative assuming a 1:1 mitigation ratio.

Table E-1. Summary of Site-Specific Vegetation Analysis for Alternative 2 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	6.78	4.79	4.69	1.22	0.00
Region 1b	10.26	2.11	7.63	2.11	2.63	0.00	0.00
Region 2	9.04	0.68	4.73	0.68	4.31	0.00	0.00
Region 3	4.94	0.00	3.95	0.00	0.99	0.00	0.00
Subtotal	35.72	8.80	23.09	7.58	12.63	1.22	
Total	44.52		30.67		13.85		0.00

Table E-2. Summary of Site-Specific Vegetation Analysis for Alternative 3 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	3.67	0.83	7.81	5.17	14.04
Region 1b	10.26	2.11	1.27	0.00	9.00	2.11	0.48
Region 2	9.04	0.68	1.81	0.00	7.23	0.68	9.61
Region 3	4.94	0.00	0.02	0.00	4.92	0.00	2.86
Subtotal	35.72	8.80	6.77	0.83	28.95	7.97	
Total	44.52		7.60		36.92		26.99

Table E-3. Summary of Site-Specific Vegetation Analysis for Alternative 4 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	4.16	1.28	7.32	4.72	14.56
Region 1b	10.26	2.11	6.80	1.97	3.46	0.15	1.95
Region 2	9.04	0.68	6.39	0.68	2.65	0.00	7.85
Region 3	4.94	0.00	3.94	0.00	1.00	0.00	1.19
Subtotal	35.72	8.80	21.29	3.93	14.43	4.87	
Total	44.52		25.22		19.30		25.55

Table E-4. Summary of Site-Specific Vegetation Analysis for Alternative 5 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	4.16	0.98	7.32	5.03	16.11
Region 1b	10.26	2.11	5.03	0.84	5.23	1.27	1.88
Region 2	9.04	0.68	6.21	0.68	2.82	0.00	16.28
Region 3	4.94	0.00	0.38	0.00	4.56	0.00	5.49
Subtotal	35.72	8.80	16.66	2.50	19.95	8.30	
Total	44.52		18.27		26.25		39.76

Table E-5. Summary of Site-Specific Vegetation Analysis for Alternative 6 (acres)

Region	Existing Vegetation		Removed Vegetation		Retained Vegetation		Plantable Area Created
	Woodland	Scrub	Woodland	Scrub	Woodland	Scrub	
Region 1a	11.48	6.01	4.03	3.39	7.45	2.62	8.01
Region 1b	10.26	2.11	5.62	1.61	4.64	0.51	2.59
Region 2	9.04	0.68	5.14	0.68	3.90	0.00	7.85
Region 3	4.94	0.00	3.95	0.00	0.99	0.00	1.19
Subtotal	35.72	8.80	18.75	5.68	16.97	3.12	
Total	44.52		24.43		20.09		19.65

Table E-6. Summary of Mitigation Needs for Each Alternative (acres)

Alternatives	Removed Vegetation	Plantable Area Created	Mitigation Needed
1	0.00	0.00	0.00
2	30.67	0.00	30.67
3	7.60	26.99	(19.39)
4	25.22	25.55	(0.33)
5	18.27	39.76	(21.49)
6	24.43	19.65	4.78
( ) = surplus			

As Table E-6 demonstrates, there are many differences between the alternatives with regard to the amounts of removed vegetation and plantable area created. This is the result of several differences between the bank protection measures that comprise the alternatives. For example, Alternative 2 only utilizes the bank fill stone protection with no on-site woody vegetation bank protection measure. This measure removes substantial amounts of vegetation and doesn't create any plantable area. As a result, the impacts to vegetation and, in turn, the need for mitigation is substantial. On the contrary, Alternative 3 only utilizes setback and adjacent levees. These measures remove minimal vegetation and create substantial plantable areas. This alternative results in a surplus of habitat and all of the mitigation needs are presumably satisfied by habitat components incorporated into the alternative itself.

Standard Assessment Methodology Impacts

The SAM (U.S. Army Corps of Engineers 2004) provides a quantitative analysis of the Project impacts on the listed fish species (Chinook salmon, Central Valley steelhead, green sturgeon, Delta smelt). The SAM was developed by the Corps and Stillwater Sciences, in consultation with National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (DFW), and California Department of Water Resources (DWR), academic contributions from the University of California at Davis and Humboldt State University, and peer review by sixteen professionals in fish biology, river geomorphology, environmental sciences, and engineering.

SAM quantifies habitat values in terms of weighted response indices that are calculated by combining habitat quality (fish response indices) with quantity (bank length) for each season, target year, and relevant species/life stage. SAM employs six habitat variables (described in Appendix D, *Standard Assessment Methodology (SAM) Analysis Process*) to characterize nearshore and floodplain habitats of listed fish species. The fish response indices are derived from hypothesized relationships between key habitat variables and the responses of individual species and life stages. The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (e.g., with or without project), SAM uses the fish response relationships to determine the response of individual species and life stages to changes in the habitat variables for each season and target year. The response indices for each variable are multiplied together to generate an overall species response index, which is then multiplied by the area or linear feet of bank to which it applies to generate a species weighted response indices (expressed as feet or square feet[1]). The weighted response indices provides a common metric that can be used to quantify habitat values over time, compare project alternatives to existing conditions, and evaluate the effectiveness of on-site and off-site mitigation actions. For example, the difference in weighted response indices between with- and without-project conditions in a given year and season provides a measure of the adverse effects (negative species response) or benefits (positive species response) of the project relative to baseline conditions.

The effects, as determined by SAM, were calculated for each listed fish species for each life history stage and by EIS/EIR alternative. Although SAM estimates changes in habitat extent for a number of listed fishes and different life stages, arguably the most relevant in the consideration of impacts from the SRBPP is the fry/juvenile rearing life stage of Chinook salmon. This life stage has the greatest sensitivity to bank protection actions, reflecting the state of knowledge regarding its propensity to occur in nearshore, shallow-water areas (U.S. Army Corps of Engineers 2004). The impact of bank protection actions for with-project conditions may appear relatively large for other species, e.g., there is an overall deficit across all regions of 3,667 linear feet for green sturgeon adult residence under Alternative 4 (in winter-spring). However, this represents only a modest relative deficit (-6.3%) compared to without-project conditions. In contrast, the 126-linear-foot deficit for late-fall run Chinook salmon fry/juvenile rearing in summer for Alternative 4 represents a 27.3% deficit for this life stage. Although such differences partly reflect differences in the assumptions regarding species distribution in the Action Area, these differences mainly result from differences between the species in the value of the existing habitat: because Chinook salmon fry/juveniles have

[1] It is important to note that the habitat units are indices and so are only equivalent to actual lengths or areas when all habitat attributes are optimal; otherwise, the habitat units represent actual lengths or areas that are greater than the indices represented by the habitat units.

greater sensitivity to changes in river-bank attributes, the without-project conditions represent a relatively low extent of habitat units (i.e., site extent multiplied by site quality) compared to green sturgeon adults, for which a much broader range of conditions are assumed to be optimal and for which most attributes hold no sensitivity. Detailed discussion of the project impacts may be found in the Project's EIS/EIR and Biological Assessment. From these results, the greatest SAM deficits for Chinook salmon fry/juvenile rearing vary by race, alternative, and season; these are given in Table E-7 for Alternatives 2 and 4.

Table E-7. Summary of Greatest SAM Deficits by Alternative (linear feet), Chinook Salmon Fry/Juvenile Rearing

Alternative	Fall	Winter	Spring	Summer
2	-1,955 (-68%): SR, 2070	-485 (-72%): LFR, 2070	-2,874 (-79%): FR, 2070	-1,835 (-77%): FR, 2070
4	-81 (-18%): LFR, 2028	-42 (-6%): LFR, 2028	No deficit	-126 (-27%): LFR, 2018

Note: FR = fall run, LFR = late-fall run, SR = spring run. Year of greatest deficit is noted.

Mitigation Goals and Potential Mitigation Strategies

The Programmatic Mitigation Strategy (Final Sacramento River Bank Protection Project Phase II Supplemental Authorization Programmatic Mitigation Strategy) of which this CE/ICA is an appendix, details the Project mitigation strategies. The following summarizes the goals and types of mitigation.

The following goals are recommended as an overall approach to mitigation during implementation of the SRBPP Phase II supplemental authorization:

- Over the long-term, develop mitigation methods that provide suitable habitat while reducing flood damage.
- For bank stabilization projects in the near term, maximize onsite mitigation without compromising flood safety, to minimize the need for offsite compensation.
- Establish the appropriateness of out-of-kind mitigation to help maximize onsite mitigation where in-kind mitigation is not possible (i.e., to compensate deficits arising from one SAM variable with surplus in another).
- Continually seek offsite compensation opportunities, through development or expansion of Corps' compensation projects, collaboration with other habitat enhancement programs, and use of commercial compensation/mitigation banks.
- Select mitigation methods that provide appropriate compensation in the most cost-effective manner as informed through an incremental cost analysis.

Following are brief summaries of the various types of mitigation for consideration.

- **In-lieu fee program.** This option, wherein a permittee/applicant pays the permitting agency to implement mitigation at its discretion, generally has low favorability with the agencies requiring mitigation because it shifts the burden of responsibility for providing replacement habitat from the applicant/permittee to the permitting agency. It is often regarded as a "last resort" and typically applies only to very small projects and impacts where other mitigation options may not be feasible, upon negotiation with the permitting agency. Approved in-lieu fee programs may not exist for all mitigation needs in the project area.

- **Out-of-kind replacement habitat.** This option involves replacement of habitat with a different type than that which was impacted, either on-site or off-site.
- **On-site replacement habitat.** This option involves replacement of affected habitat with new habitat of the same type and at the same location as the loss.
- **Off-site, in-kind replacement habitat.** This option involves replacement of affected habitat with new habitat of the same type but at a different location than the loss. This often allows for consolidation of mitigation at a single or small number of sites, allowing for economy of scale and higher quality habitat due to large patch size. There are two sub-types:
    - **Constructed mitigation.** Constructed offsite mitigation involves securing an appropriate mitigation site, implementing a mitigation plan, monitoring its performance, maintaining the site during the establishment period, developing a conservation mechanism, and arranging a source of funding for long-term protection of the site.
    - **Purchase of credits at commercial mitigation banks.** Purchase of mitigation bank credits involves utilizing a commercial mitigation bank or banks to fulfill the project's compensatory mitigation obligation. The mitigation bank or banks would need to have been approved by the permitting agencies for the habitat types and service area that covers the impact.

Mitigation Costs

This section presents mitigation costs associated with off-site, in-kind constructed mitigation and the availability and purchase of credits at commercial mitigation banks.

On- and Off-Site, In-Kind Constructed Mitigation Costs

Table E-8 provides a summary of on- and off-site, in-kind constructed mitigation and the estimated costs. The costs shown apply to riparian trees, elderberry plantings, giant garter snake habitat, and jurisdictional waters. The costs include items such as mobilization, plant purchase, irrigation systems and 10 years of monitoring. The costs are for a known, readily accessible site and may be somewhat less to 20% greater than indicated depending on site specific circumstances. Additionally, these costs assume that land is available and does not include the associated real estate costs or the creation of plantable areas via construction of riparian or wetland benches.

Table E-8. Estimated Constructed Mitigation Costs

Mitigation Type	Unit	Cost per Unit
Riparian Tree	Acres	$33,000.00
Non-Riparian Native Tree	Acres	$33,300.00
Elderberry (New Plantings)	Units	$1,850.00
Elderberry (Transplants)	Each	$1,200.00
Giant Garter Snake	Acres	$48,300.00
Jurisdictional Waters	Acres	$301,000.00
Shrubs in Revetment	Linear Foot	$13.30
Trees in Revetment	Linear Foot	$13.30
Shrubs/Trees in Revetment	Linear Foot	$13.30
Shrubs in Natural Slope	Linear Foot	$13.30
Trees in Natural Slope	Linear Foot	$13.30
Shrubs/Trees in Natural Slope	Linear Foot	$13.30

Mitigation Bank Costs

Purchase of mitigation bank credits involves utilizing a commercial mitigation bank or banks to fulfill the project's compensatory mitigation obligation. The mitigation bank or banks would need to have been approved by the resource agencies for the habitat types and service area that covers the impact.

A variety of commercial mitigation banks serve the program area. Wildlands, Inc. (Wildlands) and Westervelt Ecological Services (Westervelt) have numerous mitigation banks in the region and are used here for discussion purposes. Information on these and other mitigation banks are accessible through the USFWS website (www.fws.gov/endangered/landowners/conservation-banking.html) and the Corps Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS) website (https://rsgisias.crrel.usace.army.mil/ribits/f?p=107:2:1673722609111988).

The Wildlands and Westervelt mitigation banks and their associated service areas are mapped in Figure E-1 and Figure E-2, respectively. Table E-9 (Wildlands) and Table E-10 (Westervelt) identify, by Project reach, the individual mitigation banks and their bank types. Bank type is the specific mitigation type offered. The bank types that are likely most relevant for the Project include: Chinook salmon and steelhead; giant garter snake; Delta smelt and salmonid; valley elderberry longhorn beetle; and wetlands shaded riverine aquatic (SRA). As shown in Table E-9, Wildlands mitigation banks for Chinook salmon and steelhead and Valley Elderberry Longhorn Beetle (VELB) are widespread with respect to Project reaches. Wildlands mitigation banks for Delta smelt and salmonid service area are fairly widespread. Wildlands mitigation banks for giant garter snake are limited. Table E-10 shows that Westervelt has additional giant garter snake mitigation banks distributed throughout the program area. Westervelt also has a number of mitigation banks for wetland SRA available for Project reaches.

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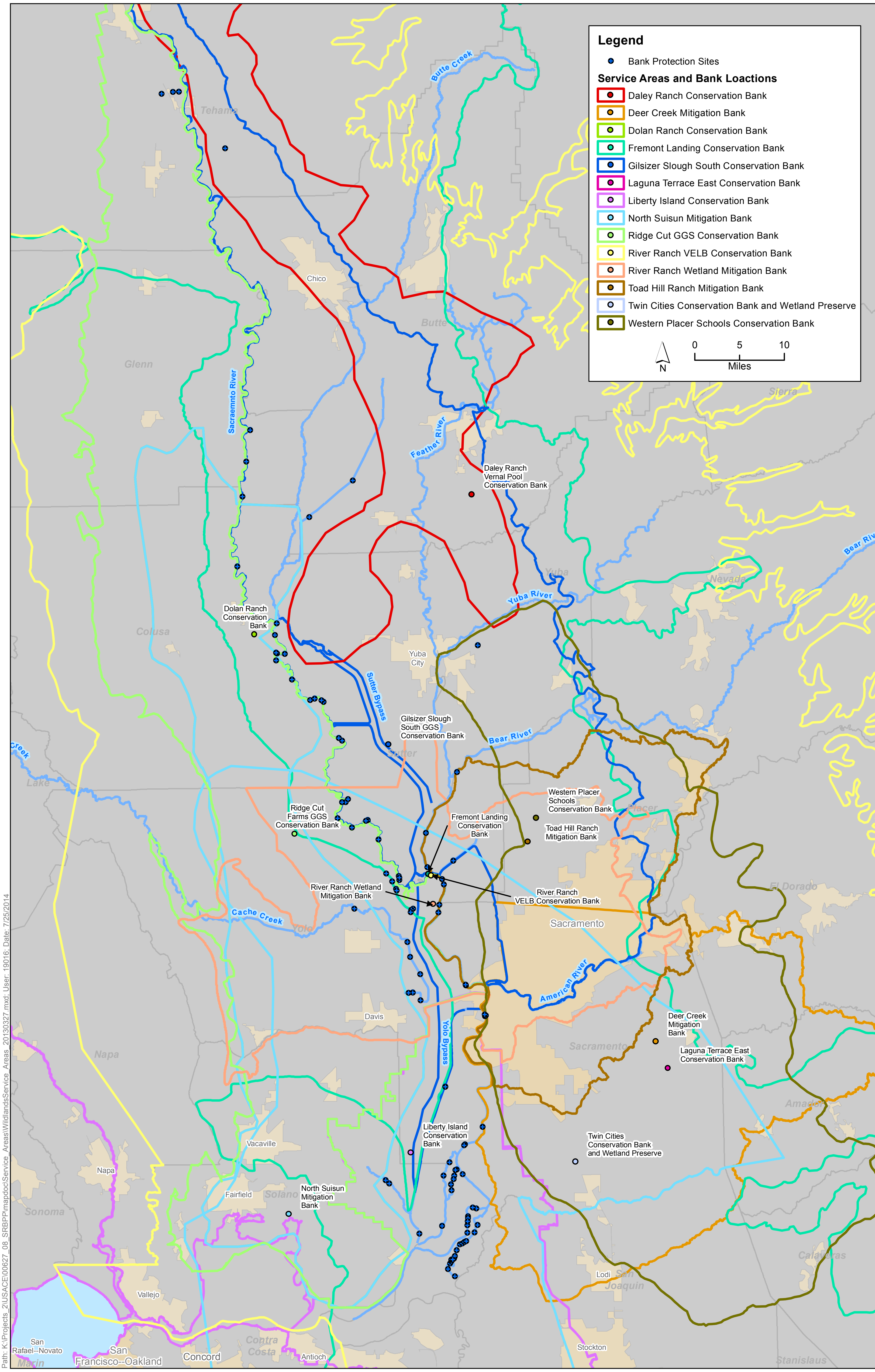

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Figure E-1
Wildlands Mitigation Bank Locations and Service Areas

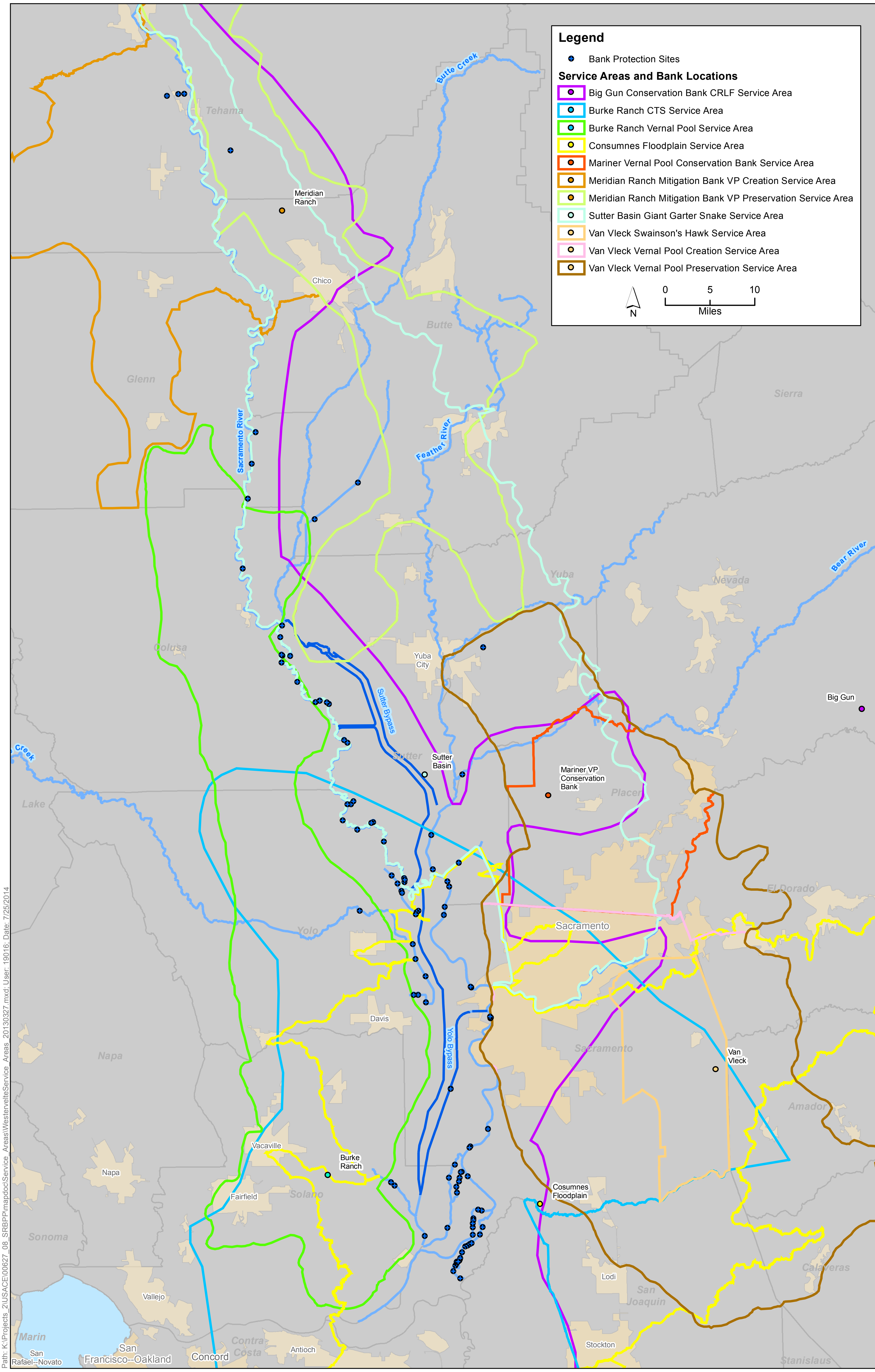

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Figure E-2
Westervelt Mitigation Bank Locations and Service Areas

Table E-9. Wildlands Mitigation Bank Service Areas and Credit Types

Bank	Daley Ranch Conservation Bank	Deer Creek Mitigation Bank	Dolan Ranch Conservation Bank	Fremont Landing Conservation Bank	Gilsizer Slough South Conservation Bank	Laguna Terrace East Conservation Bank	Liberty Island Conservation Bank		North Suisun Mitigation Bank		Ridge Cut GGS Conservation Bank	River Ranch VELB Conservation Bank	River Ranch Wetland Mitigation Bank	Toad Hill Ranch Mitigation Bank	Twin Cities Conservation Bank and Wetland Preserve	Western Placer Schools Conservation Bank
Bank Type	Vernal Pool Preservation	Seasonal & Vernal Pool Wetland	Vernal Pool Preservation	Chinook Salmon and Steelhead	Giant Garter Snake	Vernal Pool Preservation	Delta Smelt and Salmonid Service Area	Longfin Smelt Service Area	California Tiger Salamander	Vernal Pool Preservation and Creation	Giant Garter Snake	VELB	Wetlands	Seasonal Wetland and Vernal Pool Creation	Vernal Pool Preservation	Vernal Pool Preservation
Reach																
CacheSloughRM15.9L				X			X	X	X			X				
CacheSloughRM22.8R				X			X	X	X			X				
CacheSloughRM23.6R				X			X	X	X			X				
CherokeeCanalLM14.0L				X	X							X				
CherokeeCanalLM21.9L				X	X							X				
DeepWaterShipChannelLM5.01L				X			X	X	X			X				
DeepWaterShipChannelLM5.0L				X			X	X	X			X				
DeerCreekLM2.4L	X			X	X							X				
ElderCreekLM1.4L				X							X	X				
ElderCreekLM3.0R				X							X	X				
ElderCreekLM4.1L				X							X	X				
FeatherRiverRM0.6L				X	X				X			X	X			
FeatherRiverRM5.0L				X	X				X			X	X			
GeorgiannaSloughRM0.3L				X			X	X	X			X				
GeorgiannaSloughRM1.7L				X			X	X	X			X				
GeorgiannaSloughRM2.5L				X			X	X	X			X				
GeorgiannaSloughRM3.6L				X			X	X	X			X				
GeorgiannaSloughRM3.7aL				X			X	X	X			X				
GeorgiannaSloughRM3.7bL				X			X	X	X			X				
GeorgiannaSloughRM4.0L				X			X	X	X			X				
GeorgiannaSloughRM4.3L				X			X	X	X			X				
GeorgiannaSloughRM4.5L				X			X	X	X			X				
GeorgiannaSloughRM4.6L				X			X	X	X			X				
GeorgiannaSloughRM5.3L				X			X	X	X			X				
GeorgiannaSloughRM6.1L				X			X	X	X			X				
GeorgiannaSloughRM6.4L				X			X	X	X			X				
GeorgiannaSloughRM6.6L				X			X	X	X			X				
GeorgiannaSloughRM6.8L				X			X	X	X			X				
GeorgiannaSloughRM8.3L				X			X	X	X			X				

Table E-9. Wildlands Mitigation Bank Service Areas and Credit Types (Continued)

Bank	Daley Ranch Conservation Bank	Deer Creek Mitigation Bank	Dolan Ranch Conservation Bank	Fremont Landing Conservation Bank	Gilsizer Slough South Conservation Bank	Laguna Terrace East Conservation Bank	Liberty Island Conservation Bank		North Suisun Mitigation Bank		Ridge Cut GGS Conservation Bank	River Ranch VELB Conservation Bank	River Ranch Wetland Mitigation Bank	Toad Hill Ranch Mitigation Bank	Twin Cities Conservation Bank and Wetland Preserve	Western Placer Schools Conservation Bank
Bank Type	Vernal Pool Preservation	Seasonal & Vernal Pool Wetland	Vernal Pool Preservation	Chinook Salmon and Steelhead	Giant Garter Snake	Vernal Pool Preservation	Delta Smelt and Salmonid Service Area	Longfin Smelt Service Area	California Tiger Salamander	Vernal Pool Preservation and Creation	Giant Garter Snake	VELB	Wetlands	Seasonal Wetland and Vernal Pool Creation	Vernal Pool Preservation	Vernal Pool Preservation
Reach																
GeorgiannaSloughRM9.3L				X			X	X	X			X				
KnightsLandingRidgeCutLM0.2R									X		X	X	X			
KnightsLandingRidgeCutLM3.0L									X		X	X	X			
KnightsLandingRidgeCutLM3.1L									X		X	X	X			
KnightsLandingRidgeCutLM4.2L									X		X	X	X			
KnightsLandingRidgeCutLM5.3L									X		X	X	X			
NatomasCrossCanalLM3.0R				X	X				X			X	X	X		
SacramentoRiverRM101.3R				X					X			X	X			
SacramentoRiverRM103.4L				X	X				X			X	X			
SacramentoRiverRM104.0L				X					X			X	X			
SacramentoRiverRM104.5L				X					X			X	X			
SacramentoRiverRM116.0L				X	X							X				
SacramentoRiverRM116.5L				X	X							X				
SacramentoRiverRM122.0R				X							X	X				
SacramentoRiverRM122.3R				X							X	X				
SacramentoRiverRM123.3L				X								X				
SacramentoRiverRM123.7R				X							X	X				
SacramentoRiverRM127.9R			X	X						X	X	X				
SacramentoRiverRM131.8L			X	X	X					X		X				
SacramentoRiverRM132.9R				X							X	X				
SacramentoRiverRM133.0L				X	X							X				
SacramentoRiverRM133.8L				X								X				
SacramentoRiverRM136.6L				X	X							X				
SacramentoRiverRM138.1L				X								X				
SacramentoRiverRM152.8L			X	X						X		X				
SacramentoRiverRM163.0L				X	X							X				
SacramentoRiverRM168.3L				X	X							X				
SacramentoRiverRM172.0L				X	X							X				
SacramentoRiverRM21.5L				X			X	X	X			X				
SacramentoRiverRM22.5L				X			X	X	X			X				

Table E-9. Wildlands Mitigation Bank Service Areas and Credit Types (Continued)

Bank	Daley Ranch Conservation Bank	Deer Creek Mitigation Bank	Dolan Ranch Conservation Bank	Fremont Landing Conservation Bank	Gilsizer Slough South Conservation Bank	Laguna Terrace East Conservation Bank	Liberty Island Conservation Bank		North Suisun Mitigation Bank		Ridge Cut GGS Conservation Bank	River Ranch VELB Conservation Bank	River Ranch Wetland Mitigation Bank	Toad Hill Ranch Mitigation Bank	Twin Cities Conservation Bank and Wetland Preserve	Western Placer Schools Conservation Bank
Bank Type	Vernal Pool Preservation	Seasonal & Vernal Pool Wetland	Vernal Pool Preservation	Chinook Salmon and Steelhead	Giant Garter Snake	Vernal Pool Preservation	Delta Smelt and Salmonid Service Area	Longfin Smelt Service Area	California Tiger Salamander	Vernal Pool Preservation and Creation	Giant Garter Snake	VELB	Wetlands	Seasonal Wetland and Vernal Pool Creation	Vernal Pool Preservation	Vernal Pool Preservation
Reach																
SacramentoRiverRM22.7L				X			X	X	X			X				
SacramentoRiverRM23.2L				X			X	X	X			X				
SacramentoRiverRM23.3L				X			X	X	X			X				
SacramentoRiverRM24.8L				X			X	X	X			X				
SacramentoRiverRM25.2L				X			X	X	X			X				
SacramentoRiverRM31.6R				X			X	X	X			X				
SacramentoRiverRM35.3R				X			X	X	X			X				
SacramentoRiverRM35.4R				X			X	X	X			X				
SacramentoRiverRM38.5R				X			X	X	X			X				
SacramentoRiverRM56.5R		X		X			X	X	X			X				
SacramentoRiverRM56.6L		X		X				X	X			X				
SacramentoRiverRM56.7R		X		X			X	X	X			X				
SacramentoRiverRM62.9R				X					X			X	X	X		
SacramentoRiverRM63.0R				X					X			X	X	X		
SacramentoRiverRM74.4R				X					X		X	X	X	X		
SacramentoRiverRM75.3R				X					X		X	X	X	X		
SacramentoRiverRM77.7R				X					X			X	X	X		
SacramentoRiverRM78.3L				X					X			X	X	X		
SacramentoRiverRM86.3L				X					X			X	X			
SacramentoRiverRM86.5R				X					X			X	X			
SacramentoRiverRM86.9R				X					X			X	X			
SacramentoRiverRM92.8L				X	X				X			X	X			
SacramentoRiverRM95.8L				X					X			X	X			
SacramentoRiverRM96.2L				X					X			X	X			
SacramentoRiverRM99.0L				X					X			X	X			
SteamboatSloughRM18.8R				X			X	X	X			X				
SteamboatSloughRM23.2L				X			X	X	X			X				
SteamboatSloughRM23.9R				X			X	X	X			X				
SteamboatSloughRM24.7R				X			X	X	X			X				
SteamboatSloughRM25.0L				X			X	X	X			X				

Table E-9. Wildlands Mitigation Bank Service Areas and Credit Types (Continued)

Bank	Daley Ranch Conservation Bank	Deer Creek Mitigation Bank	Dolan Ranch Conservation Bank	Fremont Landing Conservation Bank	Gilsizer Slough South Conservation Bank	Laguna Terrace East Conservation Bank	Liberty Island Conservation Bank		North Suisun Mitigation Bank		Ridge Cut GGS Conservation Bank	River Ranch VELB Conservation Bank	River Ranch Wetland Mitigation Bank	Toad Hill Ranch Mitigation Bank	Twin Cities Conservation Bank and Wetland Preserve	Western Placer Schools Conservation Bank
Bank Type	Vernal Pool Preservation	Seasonal & Vernal Pool Wetland	Vernal Pool Preservation	Chinook Salmon and Steelhead	Giant Garter Snake	Vernal Pool Preservation	Delta Smelt and Salmonid Service Area	Longfin Smelt Service Area	California Tiger Salamander	Vernal Pool Preservation and Creation	Giant Garter Snake	VELB	Wetlands	Seasonal Wetland and Vernal Pool Creation	Vernal Pool Preservation	Vernal Pool Preservation
Reach																
SteamboatSloughRM25.8R				X			X	X	X			X				
SteamboatSloughRM26.0L				X			X	X	X			X				
SutterSloughRM24.7R				X			X	X	X			X				
SutterSloughRM26.5L				X			X	X	X			X				
WillowSloughBypassLM0.6L									X		X	X	X			
WillowSloughBypassLM2.2L									X		X	X	X			
WillowSloughBypassLM6.9R									X		X	X	X			
YoloBypassLM0.1R									X		X	X	X			
YoloBypassLM2.0R									X		X	X	X			
YoloBypassLM2.5R				X					X		X	X	X			
YoloBypassLM2.6L				X					X		X	X	X			
YoloBypassLM3.8R									X		X	X	X			
YubaRiverLM2.3L				X	X	X						X			X	X

Table E-10. Westervelt Mitigation Bank Service Areas and Credit Types

Bank	Big Gun Conservation Bank	Burke Ranch Conservation Bank		Consumnes Floodplain Mitigation Bank	Meridian Ranch Mitigation Bank		Sutter Basin Conservation Bank	Van Vleck Ranch Mitigation Bank
Bank Type	California Red Legged Frog	California Tiger Salamander	Vernal Pool Preservation	Wetlands, SRA	Vernal Pool Creation	Vernal Pool Preservation	Giant Garter Snake	Vernal Pool Preservation
Reach								
BearRiverRM0.8L	X						X	
CacheCreekRM3.9L		X	X					
CacheSloughRM5.9L		X		X				
CacheSloughRM22.8R		X		X				
CacheSloughRM23.6R		X		X				
CherokeeCanalRM4.0L	X						X	
CherokeeCanalRM2.9L	X						X	
DeepWaterShipChannelRM5.0L		X		X				
DeepWaterShipChannelRM5.0L		X		X				
DeerCreekRM2.4L					X	X	X	
ElderCreekRM1.4L					X			
ElderCreekRM3.0R					X			
ElderCreekRM4.1L					X			
FeatherRiverRM0.6L		X					X	
FeatherRiverRM5.0L		X					X	
GeorgiannaSloughRM0.3L		X		X				
GeorgiannaSloughRM1.7L		X		X				
GeorgiannaSloughRM2.5L		X		X				
GeorgiannaSloughRM3.6L		X		X				

Table E-10. Westervelt Mitigation Bank Service Areas and Credit Types (Continued)

Bank	Big Gun Conservation Bank	Burke Ranch Conservation Bank		Consumnes Floodplain Mitigation Bank	Meridian Ranch Mitigation Bank		Sutter Basin Conservation Bank	Van Vleck Ranch Mitigation Bank
Bank Type	California Red Legged Frog	California Tiger Salamander	Vernal Pool Preservation	Wetlands, SRA	Vernal Pool Creation	Vernal Pool Preservation	Giant Garter Snake	Vernal Pool Preservation
Reach								
GeorgiannaSloughRM3.7aL		X		X				
GeorgiannaSloughRM3.7bL		X		X				
GeorgiannaSloughRM4.0L		X		X				
GeorgiannaSloughRM4.3L		X		X				
GeorgiannaSloughRM4.5L		X		X				
GeorgiannaSloughRM4.6L		X		X				
GeorgiannaSloughRM5.3L		X		X				
GeorgiannaSloughRM6.1L		X		X				
GeorgiannaSloughRM6.4L		X		X				
GeorgiannaSloughRM6.6L		X		X				
GeorgiannaSloughRM6.8L		X		X				
GeorgiannaSloughRM8.3L		X		X				
GeorgiannaSloughRM9.3L		X		X				
KnightsLandingRidgeCutRM0.2R		X		X				
KnightsLandingRidgeCutRM3.0L		X						
KnightsLandingRidgeCutRM3.1L		X						
KnightsLandingRidgeCutRM4.2L		X						
KnightsLandingRidgeCutRM5.3L		X						
NatomasCrossCanalRM3.0R		X						
SacramentoRiverRM101.3R		X						

Table E-10. Westervelt Mitigation Bank Service Areas and Credit Types (Continued)

Bank	Big Gun Conservation Bank	Burke Ranch Conservation Bank		Consumnes Floodplain Mitigation Bank	Meridian Ranch Mitigation Bank		Sutter Basin Conservation Bank	Van Vleck Ranch Mitigation Bank
Bank Type	California Red Legged Frog	California Tiger Salamander	Vernal Pool Preservation	Wetlands, SRA	Vernal Pool Creation	Vernal Pool Preservation	Giant Garter Snake	Vernal Pool Preservation
Reach								
SacramentoRiverRM103.4L		X					X	
SacramentoRiverRM104.0L		X					X	
SacramentoRiverRM104.5L		X					X	
SacramentoRiverRM122.0R							X	
SacramentoRiverRM127.9R			X					
SacramentoRiverRM131.8L			X					
SacramentoRiverRM132.9R							X	
SacramentoRiverRM133.0L							X	
SacramentoRiverRM133.8L							X	
SacramentoRiverRM136.6L							X	
SacramentoRiverRM138.1L							X	
SacramentoRiverRM152.8L			X					
SacramentoRiverRM163.0L							X	
SacramentoRiverRM172.0L							X	
SacramentoRiverRM21.5L		X		X				
SacramentoRiverRM22.5L		X		X				
SacramentoRiverRM22.7L		X		X				
SacramentoRiverRM23.2L		X		X				
SacramentoRiverRM23.3L		X		X				
SacramentoRiverRM24.8L		X		X				

Table E-10. Westervelt Mitigation Bank Service Areas and Credit Types (Continued)

Bank	Big Gun Conservation Bank	Burke Ranch Conservation Bank		Consumnes Floodplain Mitigation Bank	Meridian Ranch Mitigation Bank		Sutter Basin Conservation Bank	Van Vleck Ranch Mitigation Bank
Bank Type	California Red Legged Frog	California Tiger Salamander	Vernal Pool Preservation	Wetlands, SRA	Vernal Pool Creation	Vernal Pool Preservation	Giant Garter Snake	Vernal Pool Preservation
Reach								
SacramentoRiverRM25.2L		X		X				
SacramentoRiverRM31.6R		X		X				
SacramentoRiverRM35.3R		X		X				
SacramentoRiverRM35.4R		X		X				
SacramentoRiverRM38.5R		X		X				
SacramentoRiverRM56.5R		X		X				
SacramentoRiverRM56.6L		X		X				
SacramentoRiverRM56.7R		X		X				
SacramentoRiverRM62.9R		X		X				
SacramentoRiverRM63.0R		X		X				
SacramentoRiverRM74.4R		X		X				
SacramentoRiverRM75.3R		X		X				
SacramentoRiverRM77.7R		X		X				
SacramentoRiverRM78.3L		X		X				
SacramentoRiverRM86.3L		X					X	
SacramentoRiverRM86.5R		X					X	
SacramentoRiverRM86.9R		X						
SacramentoRiverRM92.8L		X					X	
SacramentoRiverRM95.8L		X						
SacramentoRiverRM96.2L		X						

Table E-10. Westervelt Mitigation Bank Service Areas and Credit Types (Continued)

Bank	Big Gun Conservation Bank	Burke Ranch Conservation Bank		Consumnes Floodplain Mitigation Bank	Meridian Ranch Mitigation Bank		Sutter Basin Conservation Bank	Van Vleck Ranch Mitigation Bank
Bank Type	California Red Legged Frog	California Tiger Salamander	Vernal Pool Preservation	Wetlands, SRA	Vernal Pool Creation	Vernal Pool Preservation	Giant Garter Snake	Vernal Pool Preservation
Reach								
SacramentoRiverRM99.0L		X					X	
SteamboatSloughRM18.8R		X		X				
SteamboatSloughRM23.2L		X		X				
SteamboatSloughRM23.9R		X		X				
SteamboatSloughRM24.7R		X		X				
SteamboatSloughRM25.0L		X		X				
SteamboatSloughRM25.8R		X		X				
SteamboatSloughRM26.0L		X		X				
SutterSloughRM24.7R		X		X				
SutterSloughRM26.5L		X		X				
WillowSloughBypassRM0.6L		X		X				
WillowSloughBypassRM2.2L		X		X				
WillowSloughBypassRM6.9R		X		X				
YoloBypassRM0.1R		X		X				
YoloBypassRM2.0R		X		X				
YoloBypassRM2.5R		X		X				
YoloBypassRM2.6L		X						
YoloBypassRM3.8R		X		X				
YubaRiverRM2.3L	X						X	X

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Table E-11 provides a summary of the cost per unit of agency-approved mitigation credits available at the banks in the service area of the impacts. With the exception of giant garter snake mitigation, a substantial amount of mitigation is available at banks within the project area. However, due to service area boundaries, it is likely there are situations where a given bank protection site would have specific mitigation needs that are not presently served by mitigation banks servicing that area.

Table E-11. Representative Mitigation Bank Costs

Mitigation Type	Unit	Cost per Unit
Riparian Tree	Acres	$100,000
Non-Riparian Native Tree	Acres	$50,000*
Elderberry (New Plantings)	Units	$4,000
Elderberry (Transplants)	Each	$1200
Giant Garter Snake	Acres	$40,000
Jurisdictional Waters	Acres	$100,000
Salmonid Preservation	Acres	$80,000
Salmonid-Delta smelt Preservation	Acres	$125,000

* Estimate; no market credits are available at this time.

Mitigation Cost Effectiveness/Incremental Cost Analysis

The ability to determine cost effectiveness at the programmatic level is somewhat limited. The limitations stem from the uncertainty of factors such as the amount of vegetation lost at any given site, the ability to provide on-site mitigation at any given site, and the suitability of mitigation bank credits to satisfy the specific mitigation needs of a project site(s). This analysis attempts to identify the cost differential between the two approaches (e.g., off-site, in-kind permittee responsible mitigation costs; mitigation bank costs) and, as a result, the effectiveness of each.

Similarly, the incremental cost analysis utilizes a modified approach based on the type of project and a limited amount of quantified data. It is assumed that full mitigation will be required and implemented. Therefore, different mitigation approaches are considered rather than true “increments” of mitigation.

Mitigation strategies to address impacts to terrestrial species will be by on-site replacement habitat or off-site, in-kind replacement. Table E-8 shows the costs associated with on- and off-site replacement habitat if done by the Corps. The costs are less than mitigation bank costs (Table E-11) except for giant garter snake and jurisdictional waters costs. Giant garter snake and valley elderberry mitigation may be available at mitigation banks; however, ecologically, first consideration is for on-site mitigation if the planting does not conflict with the Vegetation ETL guidance or a site’s long-term maintenance requirements. Another cost advantage of on-site mitigation is that it will typically not incur additional real estate costs if implemented within the erosion site footprint. Conversely, if on-site replacement requires additional real estate costs, then off-site mitigation may become equally or more cost effective.

Similar to the elderberry and giant garter snake discussion, riparian tree mitigation is more cost effective if done on-site (approximately $33,000 versus $100,000, Table E-8 and Table E-11, respectively). The real estate costs are still important for riparian tree mitigation but less than for elderberry and giant garter snake because of the riparian tree cost difference. Vegetation ETL guidance also applies to riparian tree mitigation.

A rather unique situation exists with mitigation for bank swallow habitat. Created habitat, for which costs have not been recently developed, is generally not considered feasible/acceptable mitigation. Habitat preservation has been used in the past, but this approach is also not preferred by the resource agencies. Habitat avoidance through use of an adjacent levee is an option, but is not really mitigation because no impacts to the habitat are expected to occur under that scenario.

A more detailed cost analysis of mitigation strategies for impacts to riparian/fish habitat is possible using the project-specific SAM data and analysis. The EIS/EIR SAM data evaluates a range of riparian- and levee-associated habitat features (e.g., riparian bench, trees in revetment [see 'Habitat Features' in Table E-12]) to quantify impacts associated with the 106 Project erosion sites. The costs associated with the replacement of these habitat features is quantified in Table E-12 with respect to Chinook salmon fry and juvenile rearing. The analysis reflects on-site replacement habitat at specific erosion sites or off-site, in-kind replacement. Off-site in this case may involve areas upstream or downstream from an erosion site along the low-flow shoreline or remnant berm. Alternatively, off-site may involve large habitat 'nodes' where several mitigation habitat types are developed in one location within reasonable proximity to one or more erosion sites. Costs per linear foot of the primary mitigation features considered and associated SAM fish benefits are also calculated (Table E-12). These values allow calculation of a fish benefit per cost.

Attachment E.1, "Mitigation Cost Tables" provides the detailed cost estimates for the individual habitat features shown in Table E-12. The cost estimates consider items such as mobilization, plant and seedlings, irrigation systems, and construction materials. This data is consolidated into a cost per LF. The "Estimation of Benefit Per Cost" section of Attachment E.2, "Standard Assessment Methodology Cost Approach" provides the background information and assumptions used to develop the "fish benefit" and "fish benefit per cost" in Table E-12.

The cost analysis indicates that creation of off-site replacement habitat features results in a variety of fish benefit per cost ratios. Table E-12 illustrates the benefits per cost in spring and summer, the seasons that generally have the highest and lowest benefit per cost. For spring, some of the higher fish cost benefits range from 8% for shrubs in revetment or natural slope, to 11% for trees in revetment and trees in natural slope, to a high of 30% for shrubs/trees in revetment or natural slopes. The fish benefit for these habitat features ranges from 100% to 400%. Rock removal also has a moderately high fish benefit of 67% and a fish benefit per cost of 6%. The fish benefit of 67% for simple rock removal illustrates the high value that the SAM model places on the basic habitat improvement of a reduction in substrate size from large-diameter rock (D_{50} greater than 20 inches) to small substrate (D_{50} of 0.25 inches or less).

The bank protection measures that include riparian bench and wetland bench (implemented in Measures 4A, 4B, 4C) have the highest costs per linear foot and the highest fish benefits (Table E-12). These higher fish benefit values are not surprising because these bank protection measures have been specifically designed to provide the maximum possible fish habitat benefit per implemented unit (linear feet as used in SAM). However, the fish benefit per cost for these mitigation measures is low because of their high cost per linear foot.

The placement of instream woody material has a fish benefit per cost of 0.60% which is higher than the riparian bench and wetland bench mitigation measure values. The setback levee off-site replacement habitat has a high cost, a moderate fish benefit[2] and a low fish benefit per cost of 0.05%. Bank slope reduction also has a 0.05% fish benefit per cost value. These estimates are specific to the assumptions described in Attachment E.2.

Table E-12. Cost, Fish Benefits and Fish Benefit per Cost for Various Habitat Mitigation Features and Bank Protection Measures (based on SAM data).

Habitat Feature	Bank Protection Measure	Cost per Linear Foot	Fish Benefit (Spring/Summer)**	Fish Benefit per Cost (Spring/Summer)***
Riparian Bench*	Measures 4A, 4B, 4C	$2,571.00	1182%/394%	0.5%/0.2%
Wetland Bench*	Measure 4C	$2,586.00	420%/420%	0.2%/0.2%
Shrubs in Revetment	Off-site	$13.30	100%/0%	8%/0%
Trees in Revetment	Off-site	$13.30	146%/150%	11%/11%
Shrubs/Trees in Revetment	Off-site	$13.30	393%/150%	30%/11%
Shrubs in Natural Slope	Off-site	$13.30	100%/0%	8%/0%
Trees in Natural Slope	Off-site	$13.30	146%/150%	11%/11%
Shrubs/Trees in Natural Slope	Off-site	$13.30	393%/150%	30%/11%
Setback Levee*	Off-site	$2,439.00	116%/0%	0.05%/0%
Bank Slope Reduction	Off-site	$655.89	33%/33%	0.05%/0.05%
Instream Woody Material	Measure 4A, 4B	$250.00	149%/149%	0.60%/0.60%
Rock Removal	Off-site	$12.00	67%/67%	6%/6%

* Costs are based on the median cost for similar habitat features from the March 2012 Sacramento River Bank Protection Project cost estimates

** Benefit is % increase in habitat index from SAM for Chinook salmon fry/juvenile rearing, in comparison to a poor-quality existing site (See Attachment E.2 for assumptions)

*** Benefit is % increase in habitat index from SAM for Chinook salmon fry/juvenile rearing, divided by cost per linear foot

The fish benefit per cost values in Table E-12 indicate that relatively straightforward off-site replacement habitat provides the most cost-effective mitigation. Attachment E.2, *Standardized Assessment Methodology Cost Analysis* includes estimation of the off-site compensation required to offset habitat deficits for Alternatives 2 and 4, based on planting shrubs and trees or installing instream woody material. This analysis illustrated that the most cost-effective habitat feature for full mitigation would be planting of shrubs and trees: for Alternative 2, nearly 43,000 lf costing $570,000 would need to be planted, whereas for Alternative 4, planting nearly 2,800 lf for $37,000 would be required to offset deficits (see Table E.2-8 in Attachment E.2). Attachment E.2 also includes estimation of the off-site compensation required to offset habitat deficits for Alternatives 2 and 4, based on planting shrubs and trees in combination with installing instream woody material. These estimates indicate a high likelihood of increased fish benefit per cost as a result of combining multiple on-site habitat replacements.

However, implementation of these mitigation measures would have to address other issues that alter the incremental cost. First, the off-site replacement habitat required for these measures may

[2] Note that the moderate benefit is a function of the assumed moderate extent of floodplain achieved by setting back levees to a similar extent as assumed for the EIR-EIS, i.e., floodplain inundation ratio of 3 (see Table E.2-2 in Attachment E.2).

incur a substantial real estate cost that is not reflected in the Table E-12 analysis. Any real estate costs would quickly escalate the cost per linear foot because the moderate fish benefit level requires substantial linear distance. Second, the shrub and tree planting on revetments and natural slopes will have to comply with Vegetation ETL guidance. Such compliance, assuming a variance is not issued, may substantially restrict the area suitable for shrub and tree planting. The Vegetation ETL guidance may also exacerbate the real estate costs because of the need to acquire more linear distance and the likely need to work with numerous landowners which also has the potential to increase costs.

The implementation of the riparian bench and wetland bench mitigation would have some advantages when considered in the context of the real estate costs and the Vegetation ETL guidance described above. First, the real estate costs would already be accounted for in the erosion site costs and additional costs are unlikely. Additionally, individual erosion sites could provide opportunities to implement multiple on-site habitat replacements that would increase the fish benefit per cost or add needed terrestrial habitat mitigation for one or more species such as Swainson's hawk or valley elderberry longhorn beetle. These combined terrestrial and fish benefits are not accounted for in the SAM model or Table E-12 fish benefit per cost values. Both of these benefits could substantially improve the riparian bench and wetland bench cost benefit and would have to be evaluated on a site-specific basis. This synergistic potential between fish and terrestrial wildlife habitats and the resulting benefits associated with the riparian bench and wetland bench measures reflects their coordinated development with the Corps and the resource agencies with the expressed intent of maximizing total benefits.

The terrestrial species and terrestrial habitat needs described in the previous paragraph are not reflected in the SAM analysis. In particular the SAM does not, and was not intended to, value potential degradation of the riparian forest system from bank protection, except for trees that provide overhead cover to the various seasonal shorelines. In many locations the riparian forest extends significantly landward of these bank trees. In the past, modeling using HEP, which is focused on habitat requirements of particular riparian-dependent wildlife species, has been used to quantify impacts and compensation requirements for impacts to riparian vegetation communities. It may be desirable to consider supplementing the SAM with riparian-impact modeling or other riparian-habitat impact mitigation processes to ensure that the constraint on further degradation of the Sacramento Valley riparian systems is reflected in implementation of the Phase II supplemental authorization.

Conclusion

As previously described, on-site mitigation is typically preferred by the natural resource regulatory agencies from an ecological perspective because it replaces the values in the same location they existed pre-project. There can also be cost advantages to on-site mitigation if the real estate costs were already incurred as a part of implementing the erosion control component of the project. However, there are substantial exceptions. The primary exception has to do with the fish benefit cost ratios associated with several off-site mitigation approaches. In particular, planting shrubs and trees off-site, either in existing revetment or natural slopes, provides substantial habitat value (assuming habitat index values from SAM) at a relatively low cost. While on-site measures such as riparian and/or wetland benches provide more fish benefit, their costs are substantially greater and, as a result, the overall fish benefit per cost is considerably less than several off-site measures. Key variables that need to be considered are: 1) the uncertainty of real estate needs and costs for off-site mitigation; 2) the costs associated with an ETL variance that may be needed to allow for the implementation of off-site mitigation; and 3) the uncertainty associated with Resource Agencies accepting the value and use of the off-site scenarios which are less complex than the on-site benches. Given these variables, the on-site approaches, while likely more expensive, have a higher degree of certainty.

References

U.S. Army Corps of Engineers. 2004. *Standard Assessment Methodology for the Sacramento River Bank Protection Project*. Final report. Prepared by Stillwater Sciences, Davis, CA, and Dean Ryan Consultants & Designers, Sacramento, CA, for and in conjunction with U.S. Army Corps of Engineers and The Reclamation Board. Sacramento, CA.

U.S. Army Corps of Engineers. 2009. *Environmental Assessment/Initial Study for Levee Repair of 25 Erosion Sites, Sacramento River Bank Protection Project*. Draft. Prepared by North State Resources, Redding, CA, and Stillwater Sciences, Berkeley, CA.

Attachment E.1

Mitigation Cost Table by Habitat Feature

Table E.1-1. Mitigation Cost Table by Habitat Feature

Habitat Feature	Bank Protection Measure	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Riparian benches (low)	Measure 4A, 4B, 4C	Mobilization	LS	$50,000.00	1	$50,000.00	
		Container plant	EA	$20.00	503	$10,060.00	Assumes 10' O.C. spacing
		Seeding	AC	$600.00	1	$600.00	
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
		Bench construction - quarry stone	LF	$1,071.00	4356	$4,665,276.00	Assumes 16.05 tons per LF (Sacramento River 163.0L)
		Bench construction - SF quarry stone	LF	$73.00	4356	$317,988.00	Assumes 0.95 tons per LF (Sacramento River 163.0L)
		Bench construction - soil cover	LF	$25.00	4356	$108,900.00	Assumes 0.55 CY per LF (Sacramento River 163.0L)
					Total	**$5,161,324.00**	
					Cost per LF	**$1,184.88**	
Riparian benches (high)	Measure 4A, 4B, 4C	Mobilization	LS	$100,000.00	1	$100,000.00	
		Container plant	EA	$20.00	503	$10,060.00	Assumes 10' O.C. spacing
		Seeding	AC	$600.00	1	$600.00	
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
		Bench construction - quarry stone	LF	$1,244.00	4356	$5,418,864.00	Assumes 16.9 tons per LF (Sacramento River 56.7R)
		Bench construction - SF quarry stone	LF	$4,280.00	4356	$18,643,680.00	Assumes 51.01 tons per LF (Sacramento River 56.7R)
		Bench construction - soil cover	LF	$80.00	4356	$348,480.00	Assumes 2.5 CY per LF (Sacramento River 56.7R)
					Total	**$24,530,184.00**	
					Cost per LF	**$5,631.36**	

Habitat Feature	Bank Protection Measure	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Wetland benches (low)	Measure 4C	Mobilization	LS	$50,000.00	1	$50,000.00	
		Plug planting	EA	$3.00	12575	$37,725.00	Assumes 2' O.C. spacing
		Seeding	AC	$600.00	1	$600.00	
		Bench construction - quarry stone	LF	$320.00	4356	$1,393,920.00	Assumes 5.93 tons per LF (Cache Slough 22.8R)
		Bench construction - SF quarry stone	LF	$168.00	4356	$731,808.00	Assumes 2.71 tons per LF (Cache Slough 22.8R)
		Bench construction - soil cover	LF	$27.00	4356	$117,612.00	Assumes 0.74 CY per LF (Cache Slough 22.8R)
					Total	**$2,331,665.00**	
					Cost per LF	**$535.28**	
Wetland benches (high)	Measure 4C	Mobilization	LS	$100,000.00	1	$100,000.00	
		Container plant	EA	$20.00	503	$10,060.00	Assumes 2' O.C. spacing
		Seeding	AC	$600.00	1	$600.00	
		Bench construction - quarry stone	LF	$2,420.00	4356	$10,541,520.00	Assumes 44.81 tons per LF (Georgiana Slouth 9.3L)
		Bench construction - SF quarry stone	LF	$133.00	4356	$579,348.00	Assumes 2.15 tons per LF (Georgiana Slough 9.3L)
		Bench construction - soil cover	LF	$34.00	4356	$148,104.00	Assumes 0.91 CY per LF (Georgiana Slough 9.3L)
					Total	**$11,379,632.00**	
					Cost per LF	**$2,612.40**	
Shrubs in revetment	Off-site	Mobilization	LS	$10,000.00	1	$10,000.00	
		Container planting	EA	$40.00	503	$20,120.00	Assumes 15' wide planting area with 10' O.C. spacing planting in existing rock
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
					Total	**$38,620.00**	
					Cost per LF	**$13.30**	

Habitat Feature	Bank Protection Measure	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Trees in revetment	Off-site	Mobilization	LS	$10,000.00	1	$10,000.00	
		Container planting	EA	$40.00	503	$20,120.00	Assumes 15' wide planting area with 10' O.C. spacing planting in existing rock
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
					Total	**$38,620.00**	
					Cost per LF	**$13.30**	
Shrubs /Trees in revetment	Off-site	Mobilization	LS	$10,000.00	1	$10,000.00	
		Container planting	EA	$40.00	503	$20,120.00	Assumes 15' wide planting area with 10' O.C. spacing planting in existing rock
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
					Total	**$38,620.00**	
					Cost per LF	**$13.30**	
Shrubs in natural slope	Off-site	Mobilization	LS	$10,000.00	1	$10,000.00	
		Container planting	EA	$40.00	503	$20,120.00	Assumes 15' wide planting area with 10' O.C. spacing planting in existing rock
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
					Total	**$38,620.00**	
					Cost per LF	**$13.30**	
Trees in natural slope	Off-site	Mobilization	LS	$10,000.00	1	$10,000.00	
		Container planting	EA	$40.00	503	$20,120.00	Assumes 15' wide planting area with 10' O.C. spacing planting in existing rock
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
					Total	**$38,620.00**	
					Cost per LF	**$13.30**	

Habitat Feature	Bank Protection Measure	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Shrubs/Trees in natural slope	Off-site	Mobilization	LS	$10,000.00	1	$10,000.00	
		Container planting	EA	$40.00	503	$20,120.00	Assumes 15' wide planting area with 10' O.C. spacing planting in existing rock
		Irrigation system	AC	$8,500.00	1	$8,500.00	Assumes on-grade overhead spray system
					Total	**$38,620.00**	
					Cost per LF	**$13.30**	
Setback levee	Measure 1 (Off-site)	Land acquisition	LF	$2,000.00	5280	$10,560,000.00	
		Levee construction	LF	$2,100.00	5280	$11,088,000.00	
		Engineering and design	LS	$2,217,600.00	1	$2,217,600.00	20% of levee construction cost
		Floodplain planting	EA	$20.00	12192	$243,840.00	assumes 200' wide x 5280' long setback; plant spacing at 10' O.C.
		Irrigation system	AC	$8,500.00	24.24	$206,040.00	Assumes on-grade overhead spray system
		Seeding	AC	$600.00	24.24	$14,544.00	
					Total	**$24,330,024.00**	
					Cost per LF	**$4,607.96**	
Bank slope reduction	Off-site	Mobilization	LS	$75,000.00	1	$75,000.00	
		Quarry stone	TN	$458.72	2761	$1,266,525.92	assumes channel profile similar to Sacramento River 75.3R
		Soil-filled quarry stone	TN	$133.48	2761	$368,538.28	assumes channel profile similar to Sacramento River 75.3R
		Soil cover	CY	$33.60	2761	$92,769.60	assumes channel profile similar to Sacramento River 75.3R
		Container planting	EA	$20.00	478	$3.29	Assumes 15' wide planting area with 10' O.C. spacing
		Irrigation system	AC	$8,500.00	0.95	$8,075.00	Assumes on-grade overhead spray system
					Total	**$1,810,912.09**	
					Cost per LF	**$655.89**	

Habitat Feature	Bank Protection Measure	Task Description	Unit	Unit Cost	Quantity	Total Cost	Assumptions
Instream woody material	Measure 4A, 4B	Instream woody material	EA	$2,500.00	1	$2,500.00	Assume 1 (one) root wads covers 10 lf of bank; root wad includes bole with root mass anchored in with rip rap
					Cost per LF	**$250.00**	
Rock removal	Off-site	Rock removal	LF	$12.00	1	$12.00	assumes 15' wide removal area and 20 cf of rock (0.7 cy or .91 tons)
					Cost per LF	**$12.00**	

Reference cost estimates from Sacramento River Bank Protection Project Phase II Cost Estimates March 2012	
Riparian bench (median)	$2,550
Riparian and wetland bench (median)	$2,560
Setback levee (median)	$2,439

Attachment E.2
Standard Assessment Methodology (SAM) Cost Analysis

Estimation of Benefit Per Cost

Benefit per cost of habitat features was estimated in relation to poor-quality offsite locations, using Standardized Assessment Methodology (SAM) index values for Chinook salmon fry/juvenile rearing. The assumptions for the poor-quality offsite locations are shown in Table E.2-1; the overall SAM index value is 0.0062 for sites with large-diameter substrate (>20 inches) or 0.010 for sites with small-diameter substrate (0.25 inches or less). These assumptions apply to all seasons.

Table E.2-1. Assumptions for Poor-Quality Offsite Location Used To Estimate Benefit Per Cost, Based on Standardized Assessment Methodology (SAM) Indices for Chinook Salmon Fry/Juvenile Rearing

Attribute	Assumed Value	SAM Index*
No overhanging cover (no shade)	0% (percent of shoreline)	0.40
Steep slope (1:1)	1 (run/rise)	0.64
No inundated aquatic vegetation	0% (percent of shoreline)	0.50
No instream structure (woody material)	0% (percent of shoreline)	0.40
No floodplain availability	1 (2-year-flood channel area/average winter-spring channel area)	0.20
Full coverage by large-diameter substrate (rip-rap or equivalent, with D_{50}>20 inches)**	24 (D_{50})	0.60

* Values obtained from SAM Electronic Calculation Template version June 2009 (ECT_v3.0_beta.mdb)

** Where the mitigation measure is shrubs/trees in natural slope, the site is assumed to have small-diameter substrate (D_{50} = 0.25 inches), giving a SAM index of 1 for that attribute

The assumptions for bank attributes incorporating 12 different habitat features are shown in Table E.2-2 (winter), Table E.2-3 (spring), and Table E.2-4 (summer/fall). It is assumed that the habitat features have reached their greatest projected extents, particularly with respect to shade from planted riparian trees.

Table E.2-2. Assumptions Regarding Changes in Habitat Features and Associated SAM Indices, With Resultant Percentage Change Compared to Poor Quality Location, For Chinook Salmon Fry/Juvenile Rearing in Winter

Habitat Feature	Overhanging Cover (Shade)		Slope		Aquatic Vegetation		Instream Structure (Woody Material)		Floodplain Inundation		Substrate Grain Size		Overall SAM Index		% Change Compared to Poor-Quality Location
	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	With Habitat Feature	Poor-Quality Location	
Riparian Bench	25%	0.747745894	10	1	85%	1	0%	0.40	1	0.20	0.25	1.00	0.060235315	0.006192445	873%
Wetland Bench	0%	0.40	10	1	100%	1	0%	0.40	1	0.20	0.25	1.00	0.032226875	0.006192445	420%
Shrubs in Revetment	0%	0.40	1	0.64	85%	1	0%	0.40	1	0.20	24	0.60	0.012385248	0.006192445	100%
Trees in Revetment	25%	0.747745894	1	0.64	0%	0.50	0%	0.40	1	0.20	24	0.60	0.011574311	0.006192445	87%
Shrubs/Trees in Revetment	25%	0.747745894	1	0.64	85%	1	0%	0.40	1	0.20	24	0.60	0.023149292	0.006192445	274%
Shrubs in Natural Slope	0%	0.40	1	0.64	85%	1	0%	0.40	1	0.20	0.25	1.00	0.02064208	0.010320741	100%
Trees in Natural Slope	25%	0.747745894	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.019290518	0.010320741	87%
Shrubs/Trees in Natural Slope	25%	0.747745894	1	0.64	85%	1	0%	0.40	1	0.20	0.25	1.00	0.038582152	0.010320741	274%
Setback Levee	0%	0.40	1	0.64	0%	0.50	0%	0.40	3	0.44	24	0.60	0.013380005	0.006192445	116%
Bank Slope Reduction	0%	0.40	3	0.85	0%	0.50	0%	0.40	1	0.20	24	0.60	0.008206349	0.006192445	33%
Instream Woody Material	0%	0.40	1	0.64	0%	0.50	60%	1.00	1	0.20	24	0.60	0.015417895	0.006192445	149%
Rock Removal	0%	0.40	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.010320741	0.006192445	67%

Table E.2-3. Assumptions Regarding Changes in Habitat Features and Associated SAM Indices, With Resultant Percentage Change Compared to Poor Quality Location, For Chinook Salmon Fry/Juvenile Rearing in Spring

Habitat Feature	Overhanging Cover (Shade)		Slope		Aquatic Vegetation		Instream Structure (Woody Material)		Floodplain Inundation		Substrate Grain Size		Overall SAM Index		% Change Compared to Poor-Quality Location
	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	With Habitat Feature	Poor-Quality Location	
Riparian Bench	75%	0.985265865	10	1	85%	1	0%	0.40	1	0.20	0.25	1.00	0.079368941	0.006192445	1182%
Wetland Bench	0%	0.40	10	1	100%	1	0%	0.40	1	0.20	0.25	1.00	0.032226875	0.006192445	420%
Shrubs in Revetment	0%	0.40	1	0.64	85%	1	0%	0.40	1	0.20	24	0.60	0.012385248	0.006192445	100%
Trees in Revetment	75%	0.985265865	1	0.64	0%	0.50	0%	0.40	1	0.20	24	0.60	0.015250868	0.006192445	146%
Shrubs/Trees in Revetment	75%	0.985265865	1	0.64	85%	1	0%	0.40	1	0.20	24	0.60	0.030502618	0.006192445	393%
Shrubs in Natural Slope	0%	0.40	1	0.64	85%	1	0%	0.40	1	0.20	0.25	1.00	0.02064208	0.010320741	100%
Trees in Natural Slope	75%	0.985265865	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.025418112	0.010320741	146%
Shrubs/Trees in Natural Slope	75%	0.985265865	1	0.64	85%	1	0%	0.40	1	0.20	0.25	1.00	0.050837695	0.010320741	393%
Setback Levee	0%	0.40	1	0.64	0%	0.50	0%	0.40	3	0.44	24	0.60	0.013380005	0.006192445	116%
Bank Slope Reduction	0%	0.40	3	0.85	0%	0.50	0%	0.40	1	0.20	24	0.60	0.008206349	0.006192445	33%
Instream Woody Material	0%	0.40	1	0.64	0%	0.50	60%	1.00	1	0.20	24	0.60	0.015417895	0.006192445	149%
Rock Removal	0%	0.40	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.010320741	0.006192445	67%

Table E.2-4. Assumptions Regarding Changes in Habitat Features and Associated SAM Indices, With Resultant Percentage Change Compared to Poor Quality Location, For Chinook Salmon Fry/Juvenile Rearing in Summer/Fall

Habitat Feature	Overhanging Cover (Shade)		Slope		Aquatic Vegetation		Instream Structure (Woody Material)		Floodplain Inundation		Substrate Grain Size		Overall SAM Index		% Change Compared to Poor-Quality Location
	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	Value	SAM Index	With Habitat Feature	Poor-Quality Location	
Riparian Bench	100%	1	2	0.759796509	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.030602146	0.006192445	394%
Wetland Bench	0%	0.40	10	1	100%	1	0%	0.40	1	0.20	0.25	1.00	0.032226875	0.006192445	420%
Shrubs in Revetment	0%	0.40	1	0.64	0%	0.50	0%	0.40	1	0.20	24	0.60	0.006192445	0.006192445	0%
Trees in Revetment	100%	1	1	0.64	0%	0.50	0%	0.40	1	0.20	24	0.60	0.015478936	0.006192445	150%
Shrubs/Trees in Revetment	100%	1	1	0.64	0%	0.50	0%	0.40	1	0.20	24	0.60	0.015478936	0.006192445	150%
Shrubs in Natural Slope	0%	0.40	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.010320741	0.010320741	0%
Trees in Natural Slope	100%	1.00	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.025798226	0.010320741	150%
Shrubs/Trees in Natural Slope	100%	1.00	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.025798226	0.010320741	150%
Setback Levee	0%	0.40	1	0.64	0%	0.50	0%	0.40	1	0.20	24	0.60	0.006192445	0.006192445	0%
Bank Slope Reduction	0%	0.40	3	0.85	0%	0.50	0%	0.40	1	0.20	24	0.60	0.008206349	0.006192445	33%
Instream Woody Material	0%	0.40	1	0.64	0%	0.50	60%	1.00	1	0.20	24	0.60	0.015417895	0.006192445	149%
Rock Removal	0%	0.40	1	0.64	0%	0.50	0%	0.40	1	0.20	0.25	1.00	0.010320741	0.006192445	67%

Characterization of Off-site Conditions

In order to provide perspective on the extent of potential off-site compensation needs, it was necessary to characterize off-site conditions. Estimates of off-site habitat characteristics were developed from values presented in USACE (2008: Table A-3). The values were calculated as weighted averages of the non-erosion site habitat attributes from each SRBPP region, and the associated SAM index was calculated for these weighted-average values across all regions (Table E.2-5).

Table E.2-5. Off-site Habitat Attribute Values Used To Estimate Off-Site Compensation Needs, With Associated Standard Assessment Methodology (SAM) Indices for Chinook Salmon Fry/Juvenile Rearing

Attribute	Region 1a	Region 1b	Region 2	Region 3	Combined	
Length (linear feet)	596,771	718,054	1,090,650	568,147	2,973,622	SAM Index
Shade %[1], summer/fall	0.29	0.24	0.26	0.24	0.26	0.755603286
Shade %, spring[2]	0.22	0.18	0.20	0.18	0.19	0.679395319
Shade %, winter[2]	0.07	0.06	0.07	0.06	0.06	0.496669593
Slope (run/rise)	2.3	2.3	1.7	1.7	1.97	0.635851752
Aquatic veg. (%), summer/fall[3]	0.16	0	0.0001	0	0.03	0.62343178
Aquatic veg. (%), winter/spring[3]	0.77	0.77	0.82	0.52	0.74	1
Instream structure (IWM, %)	0.19	0.16	0.21	0.17	0.19	0.741603881
Floodplain (inundation ratio), summer/fall[4]	1.00	1.00	1.00	1.00	1.00	0.201375941
Floodplain (inundation ratio), winter/spring	1.70	1.80	5.6	7.8	4.32	0.616652789
Substrate size (D_{50}, inches)	13.10	12.50	4.6	2.3	7.77	0.973928231

Source: USACE (2008)

1 All percentages are expressed as proportions in this table

2 Shade in spring and winter are assumed to be 75% and 25%, respectively, of shade in summer/fall

3 Summer/fall aquatic vegetation is estimated from emergent vegetation percentage; winter-spring aquatic vegetation is estimated from maximum of emergent vegetation or ground cover vegetation percentages

4 Summer/fall floodplain inundation is assumed to be zero

Estimation of Off-site Compensation Requirements to Offset Deficits

The potential increase in existing off-site habitat values (Table E.2-5) was estimated in relation to the application of 100 linear feet of three potential habitat feature improvements: planting of shrubs and trees; installation of instream structure (woody material); and both planting shrubs/trees and installing instream woody material. The resulting habitat values are shown in Table E.2-6.

Table E.2-6. Habitat Values At Off-Site Areas Under Existing Conditions, Compared to Habitat Values Assuming 100 Linear Feet of Planting Trees/Shrubs, Installing Instream Woody Material, or Both

Attribute	Existing Off-site	Plant Shrubs/Trees	Instream Woody Material	Shrubs/Trees + Instream Woody Material
Shade %, summer/fall	25.73699112	25.73948851	25.73699112	25.73948851
Shade %, spring	19.30274334	19.30461638	19.30274334	19.30461638
Shade %, winter	6.434247779	6.434872127	6.434247779	6.434872127
Slope (run/rise)	1.97	1.97	1.97	1.97
Aquatic veg. (%), summer/fall	3.214679774	3.214679774	3.214679774	3.214679774
Aquatic veg. (%), winter/spring*	74.05731764	74.05768563	74.05731764	74.05768563
Instream structure (IWM, %)	18.62700168	18.62700168	18.62839302	18.62839302
Floodplain (inundation ratio), summer/fall	1.00	1.00	1.00	1.00
Floodplain (inundation ratio), winter/spring	4.32	4.32	4.32	4.32
Substrate size (D_{50}, inches)	7.77	7.77	7.77	7.77

* Although planting shrubs would increase ground cover and therefore aquatic vegetation during winter and spring (per typical SAM assumptions), the ground cover under existing conditions was already sufficient to give the maximum (optimum) value on the SAM curve for aquatic vegetation—therefore this attribute was not changed.

Using the estimates in Table E.2-6, it was possible to estimate the change in habitat units for Chinook salmon fry/juvenile rearing that could be achieved per 100 linear feet applying each of the three potential habitat features (shrubs/trees, instream woody material, or both). Thus, the change in habitat units ranged from 4 lf for IWM in summer/fall to 36 lf for shrubs/trees + IWM in spring (Table E.2-7).

Table E.2-7. Change in Habitat Units (Linear Feet) from Applying 100 Linear Feet of Different Habitat Features, Chinook Salmon Fry/Juvenile Rearing

Habitat Feature	Fall	Winter	Spring	Summer
Shrubs and Trees	5	8	20	5
Instream Woody Material*	4	11	15	4
Shrubs/Trees + Instream Woody Material	8	19	36	8

* It is assumed that 60% of the 100-lf bank line would have IWM placed along it

Considering the greatest deficits for Chinook salmon fry/juvenile rearing in each season for Alternatives 2 and 4 (Table E-7 in Appendix E), the necessary off-site compensation for these Alternatives was calculated by considering the change per 100 lf of the three example habitat features (Table E.2-7). For Alternative 2, fall was the season with the greatest deficit (1,955 lf); the off-site compensation needed to offset this deficit ranged from just over 24,000 lf ($6.4 M) for shrubs/trees + IWM to nearly 56,000 lf ($14.0 M) for IWM alone (Table E.2-8). The most cost-effective measure was planting nearly 43,000 lf with shrubs and trees ($570 K). For Alternative 4, summer was the season with the greatest deficit (126 lf); the off-site compensation needed to offset this deficit ranged from nearly 1,600 lf ($411 K) for shrubs/trees + IWM to nearly 3,600 lf ($900 K) for IWM alone. The most cost-effective measure was planting nearly 2,800 lf with shrubs and trees ($37 K; Table E.2-8).

Table E.2-8. Off-site Compensation Needs (Length and Cost) to Offset Deficits in Habitat for Chinook Salmon Fry/Juvenile Rearing Under Alternatives 2 and 4

Alternative	Habitat Feature	Cost (Per Linear Foot)	Fall		Winter		Spring		Summer	
			Length (Linear Feet)	Cost	Length (Linear Feet)	Cost	Length (Linear Feet)	Cost	Length (Linear Feet)	Cost
Alternative 2	Shrubs/Trees	$13.30	42,826	$569,585	6,122	$81,428	14,044	$186,785	40,197	$534,623
	IWM	$250	55,839	$13,959,689	4,291	$1,072,637	18,587	$4,646,681	52,411	$13,102,828
	Shrubs/Trees + IWM	$263.30	24,237	$6,381,532	2,523	$664,211	7,999	$2,106,253	22,749	$5,989,827
Alternative 4	Shrubs/Trees	$13.30	1,774	$23,599	530	$7,051	0	$0	2,760	$36,710
	IWM	$250	2,314	$578,381	372	$92,888	0	$0	3,599	$899,704
	Shrubs/Trees + IWM	$263.30	1,004	$264,401	218	$57,519	0	$0	1,562	$411,291

Appendix K

U.S. Fish and Wildlife Service Programmatic Biological Opinion, December 19, 2017

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2014-F-0708

DEC 19 2017

Ms. Alicia Kirchner
Chief, Planning Division
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Formal Consultation on the Sacramento River Bank Protection Project, Phase II 80,000 Linear Feet, Sacramento, Solano, Sutter, Yolo, Butte, and Colusa Counties, California

Dear Ms. Kirchner:

This letter is in response to the U.S. Army Corps of Engineers (Corps) May 5, 2014, request for initiation of formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Sacramento River Bank Protection Project Phase II 80,000 Linear Feet (SRBPP) (LF), in Sacramento, Solano, Sutter, Yolo, Butte, and Colusa Counties, California. The Corps has revised the biological assessment in coordination with the Service and National Marine Fisheries Service (NMFS) since the initial May 5, 2014, initiation package. The current biological assessment and request for formal consultation is dated January 20, 2017, and was received by the Service on January 26, 2017. The biological assessment presents an evaluation of the proposed project's effects on the federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) and its critical habitat, delta smelt (*Hypomesus transpacificus*) and its critical habitat, giant garter snake (*Thamnophis gigas*), and western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) and its proposed critical habitat. This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

The federal action we are consulting on is levee bank erosion repair projects on up to 30,000 LF of levee within the Sacramento River Flood Control Project (SRFCP). The Corps is the federal action agency and the Central Valley Flood Protection Board (CVFPB) is the non-federal sponsor of the project. Pursuant to 50 CFR 402.12(j), you submitted the biological assessment for our review and requested concurrence with your findings. These findings conclude that the proposed project may affect, and is likely to adversely affect the valley elderberry longhorn beetle and its critical habitat; delta smelt and its critical habitat; giant garter snake; and western yellow-billed cuckoo and its proposed critical habitat. Because individual sites that will be proposed for repair are unknown at this time, the Corps requested and the Service is providing a programmatic biological and conference opinion (PBO). This programmatic biological and conference opinion is consistent with the Service's recent update to our implementing regulations for section 7 of the Act. This biological opinion meets the definition of a framework programmatic action which will have subsequent consultations tiered off of it.

In considering your request, we based our evaluation of the biological assessment's findings on the following: (1) the revised January 2016 biological assessment; (2) numerous meetings with the Corps, NMFS, and California Department of Fish and Wildlife (DFW); (3) e-mail correspondence between the Service and the Corps; and (4) other information available to the Service.

CONSULTATION HISTORY

February 2009: The Service, Corps, NMFS, DFW, began meeting to discuss developing a programmatic consultation for the Water Resources Development Act 2007 authorization of an additional 80,000 LF of erosion repair on the SRFCP. This group has met regularly between then and now. During these meetings the methods of evaluating effects, developing a programmatic analysis, and conservation measures were discussed.

May 5, 2014: The Corps submitted their biological assessment to the Service,

August 18, 2014: The Service provided comments on the project description to the Corps via e-mail.

December 4, 2014: The Corps submitted a revised biological assessment to the Service.

March 19, 2015: The Service provided comments on the project description and the need to include the yellow-billed cuckoo in the consultation via e-mail.

January 22, 2016: The Corps provided a revised biological assessment and a letter requesting consultation with the Service on the SRBPP 80,000 LF project.

January 20, 2017: The Corps provided a further revised biological assessment which revised the project description to only include economically justified basins. This had the result of reducing the linear footage which is being consulted on to 30,000 LF.

June 21, 2017: The Corps provided an e-mail with additional conservation measures for the yellow-billed cuckoo and delta smelt to include in the biological assessment.

BIOLOGICAL AND CONFERENCE OPINION

Description of the Action

The SRBPP Phase II additional authorization will ensure the continued integrity of the SRFCP levees through erosion protection. Levees within the SRFCP provide flood control for the Sacramento Valley and help convey water flowing from the surrounding mountain ranges to the Sacramento-San Joaquin Delta (Delta). Levees stressed by high winter flows can weaken and fail. To maintain the integrity of the flood control system, locations with a high failure potential are identified and remedied.

The SRBPP project area encompasses over 1,000 miles of levees and weirs. This area extends south-to-north along the Sacramento River, from the town of Collinsville (river mile [RM] 0) upstream to Chico at RM 184. The SRBPP also includes Cache Creek, the lower reaches of Elder and Deer Creeks, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs, as well as a number of flood bypasses and distributaries (Figure 1).

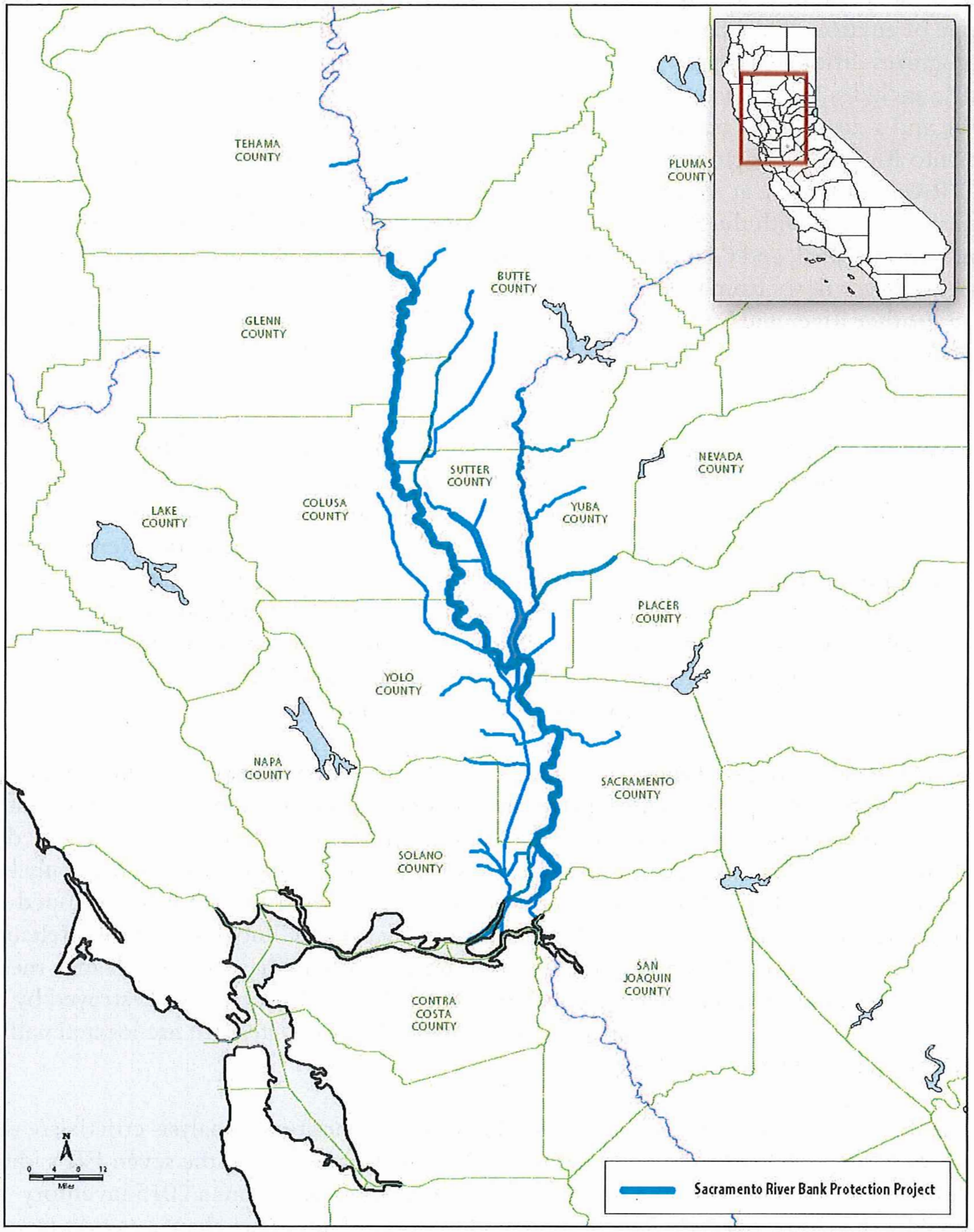

Figure 1. Program Area

For the purpose of the project description, the program area has been divided into four regions, organized south to north by the location of the downstream terminus of each watercourse with the mainstem Sacramento River. The four reaches were generally defined in a manner that captures the full range of environmental conditions within the project area while breaking them up in a manner that recognizes differences in physical structure and fish use among these four reaches (Figure 2). Region 1a includes the Yolo and Sacramento Bypasses, the Sacramento River downstream of Isleton (RM 20), and a distribution network of sloughs and channels. Region 1b includes the mainstem Sacramento River from Isleton (RM 20) in the Delta, upstream past the city of Sacramento, to the Feather River confluence at Verona (RM 80). Region 1b also includes the lower American River from the confluence with the Sacramento River upstream to RM 13, Natomas East Main Drain, Natomas Cross Canal, and Coon Creek Group Interceptor Unit 6. Within Region 2, the mainstem Sacramento River flows from Colusa (RM 143) downstream of the Colusa Bypass to the confluences with the Feather River and Sutter Bypass at Verona (RM 80). Region 3 includes the lower reaches of Elder and Deer Creeks, Mud Creek, Chico Creek, and the Sacramento River downstream of Chico Landing (RM 184) to Colusa (RM 143).

The erosion sites that need to be repaired can be found throughout the SRBPP program area. However, current implementation of the erosion repairs is influenced by a benefit-cost analysis, in accordance with Corps policy. This policy dictates that all water resources projects must be justified by showing beneficial outputs greater than project costs to determine a Federal interest. While the traditional approach has been to look at the erosion sites in the aggregate (i.e., all the authorized LF together), current policy dictates that economic flood damages within individual basins or reclamation districts, maintenance areas, or levee districts are evaluated independently, which influences the sites selected for repair. For the Post Authorization Change Report (PACR), the floodplains of the SRFCP were divided into 50 economic impact basins.

A preliminary analysis of 24 of these basins indicates that erosion repair projects in certain less-developed regions in the program area, primarily agricultural lands with fewer damageable structures, are not likely to meet the benefit-cost criteria. During the implementation phase, it may be difficult to justify bank protection for levees in these regions. As a result, bank protection may only be considered economically justified in certain portions of the program area. In less developed areas, risk to life safety can be managed through other means, such as the Public Law 84-99 Rehabilitation and Inspection Program, which allows the Corps to undertake activities such as advance measures, emergency operations, and rehabilitation of flood control works threatened or destroyed by floods. Accordingly, this biological opinion only considers erosion control sites that are located within seven economically justified basins (EJB).

The seven basins that are most likely to satisfy the positive benefit-cost analysis criteria are shown in Figure 3. This proposed action is restricted to only repairs located within the seven EJBs identified in Table 1. Table 1 also includes the number of known erosion sites from a 2015 inventory conducted by the Corps per EJB. The number and location of sites may change as new inventories update the list. The number and extent of documented sites can change from year to year due to the episodic nature of erosion and new erosion sites can appear each year. The analysis at this point is programmatic in nature, analyzing the 30,000 LF in its entirety but not the specific sites. For the purposes of this consultation, the project description describes 30,000 LF of bank protection within the seven EJBs, while not specifically covering any individual site.

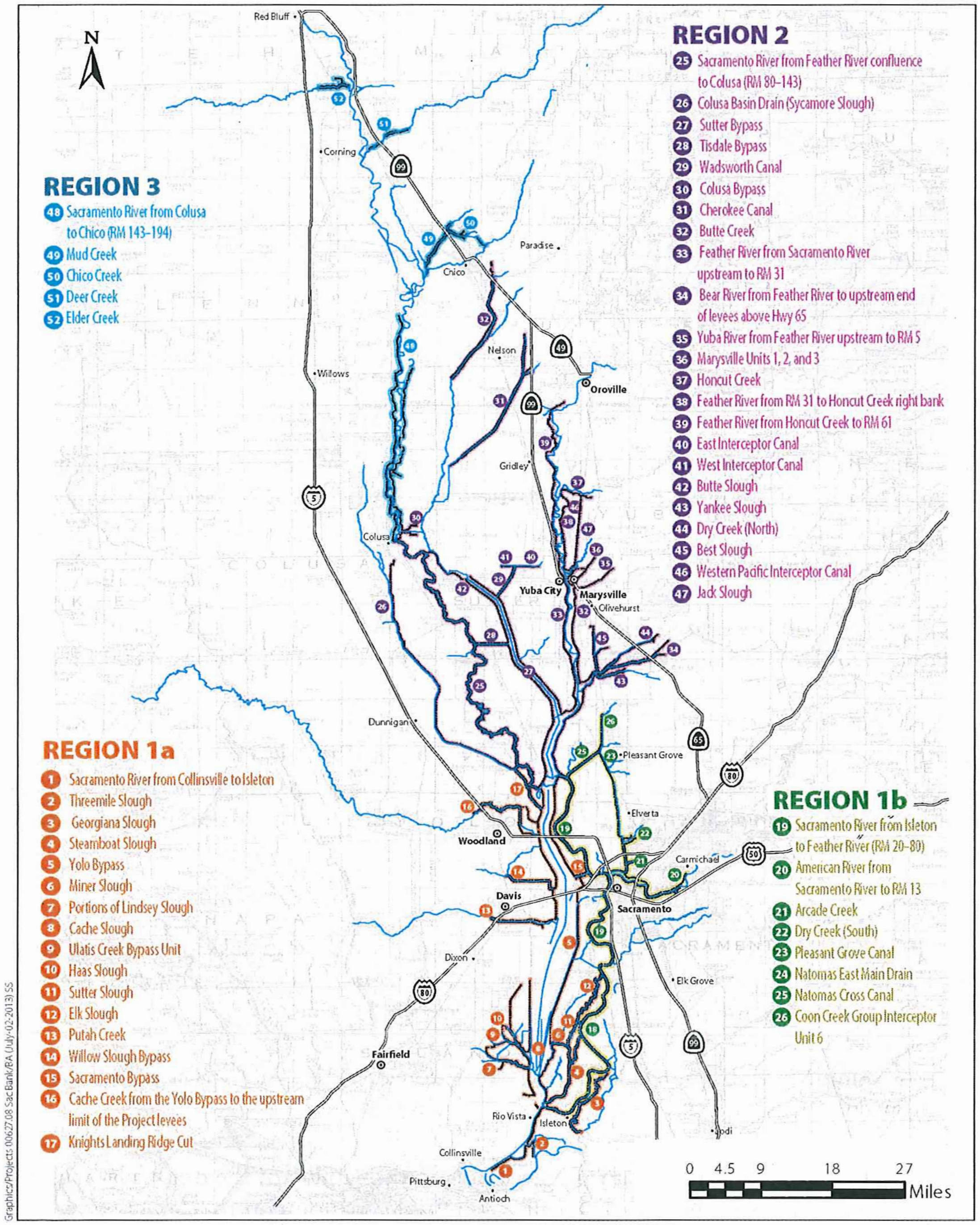

Figure 2. Program Regions

Table 1 – Justified Economic Impact Areas

Impact Area	Environmental Sub-Region	# Erosion Sites	LF Levee	Benefit/Cost Ratio	Annual Benefit ($1,000s)
Butte Basin	2, 3	4	3,549	1.9 to 1	1,028
Natomas	1B	1	654	145 to 1	17,524
Rio Oso	1B, 2	12	9,386	2.4 to 1	796
Sacramento	1B	10	2,932	332 to 1	18,577
Southport	1A, 1B	3	2,277	30 to 1	13,345
West Sacramento	1A, 1B	1	537	147 to 1	13,995
Yolo	1A	4	1,200	3.2 to 1	770
	TOTAL	35	20,535		

The economic analysis is required to be updated every 5 years and new sites in basins not previously analyzed may be evaluated. In the event new basins are identified as economically-justified, a separate consultation will be done. Therefore, this consultation is covering erosion repair to 30,000 LF constructed over a timeframe of 5 years.

The 35 selected erosion sites along the Sacramento River and its tributaries constitute a representative sample of the sites eventually proposed to be treated under the 30,000 LF.

Future site specific projects will be evaluated to determine if they meet conditions outlined in this PBO. The Service will evaluate the effects as discussed in this PBO and related to the current baseline of the species. Future bank protection projects will be tiered off of the PBO with specific conservation measures, specific effects analysis, and a specific incidental take statement for that particular site.

Proposed Bank Protection Measures
The suite of SRBPP site-specific bank protection measures are described below with figures to support each measure. A bank protection measure is a site-specific design solution to control an existing erosion site while minimizing and/or mitigating environmental impacts.

The following criteria have been developed for bank protection design, consistent with the project purpose and need:

- Restoring the flood damage risk-reduction capability of the originally-constructed levee through the use of structurally reliable erosion-control elements;

- To the extent practicable, maintaining fish and wildlife habitat and scenic and recreational values, and replacing habitat losses through the use of on-site mitigation elements overlying or integrated with erosion-control elements;

- If it is not possible to fully mitigate for fish and wildlife habitat losses on-site, full mitigation of residual habitat losses will occur off-site to the extent justified; and

- Minimizing costs of construction and maintaining both erosion-control and on-site habitat-mitigation elements.

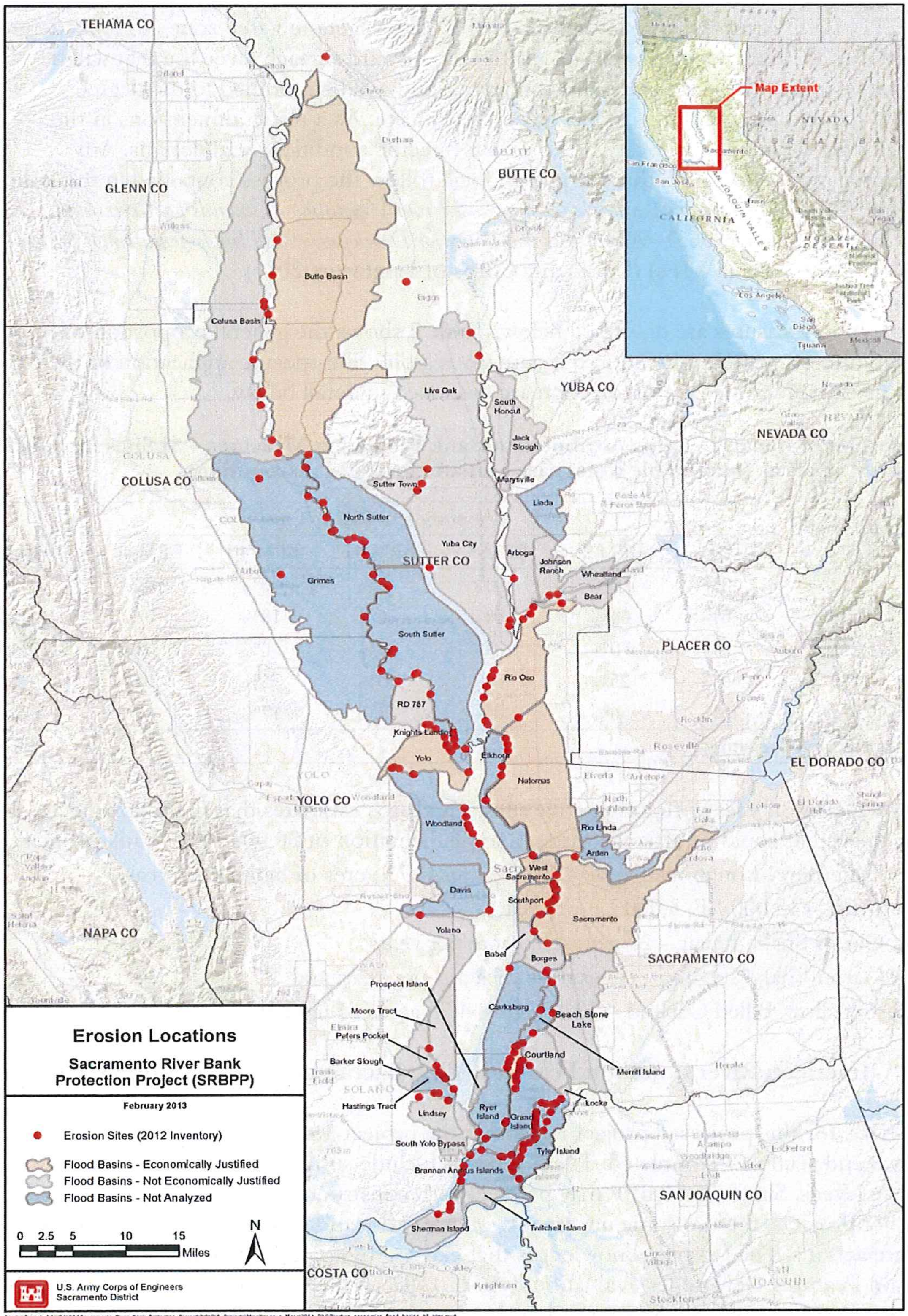

Figure 3. Economically Justified Basins

The following measures are intended to meet these criteria while also meeting the Corps' vegetation management policy as prescribed in *Engineering Technical Letter 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams, and Appurtenant Structures* (Vegetation ETL) (U.S. Army Corps of Engineers 2014). The vegetation-free zone (VFZ) is defined in the Vegetation ETL and encompasses the area 15 feet outward of each levee toe that will be restricted to native grass. These measures are conceptual and will be modified to the degree necessary to be suitable for conditions at any given erosion site. As a result, dimensions in the following figures are typical and will vary based on site-specific conditions and designs. Any variances from the Vegetation ETL that are pursued will follow the process contained in the Policy Guidance Letter (PGL)—*Process for Requesting a Variance From Vegetation Standards for Levees and Floodwalls* (77 Federal Register 9637–9650) and the *Policy for Development and Implementation of System-Wide Improvement Frameworks* (SWIFs) (U.S. Army Corps of Engineers 2011).

The bank protection measures are described below. Table 2 shows the general proportion of repair lengths attributed to each bank protection measure (by region). Site-specific application of the bank protection measures under the proposed action are discussed in detail below.

Table 2. Proportion of Repair Lengths Attributed to Bank Protection Measures – 31 Sites included in upper range SAM analysis (reasonable worst case scenario for BPM distribution)

Region	Repair Length (LF)	Proportion of Repair Types						
		BPM 1	BPM 2	BPM 3	BPM 4a	BPM 4b	BPM 4c	BPM 5
1a	1,752	0%	100%	0%	0%	0%	0%	0%
1b	9,838	0%	64%	0%	6%	18%	0%	12%
2	13,210	0%	70%	0%	20%	0%	0%	10%
3	5,182	0%	25%	0%	0%	75%	0%	0%
Total	29,982	0%	66%	0%	8%	17%	0%	9%

BPM = bank protection measure.

Using the known erosion sites as representative sites, the Corps estimates that the following are the amounts of habitat that could be affected through implementation of 30,000 LF of bank protection:

- Valley Elderberry Longhorn Beetle – 32.15 acres, 4.75 acres of habitat per year;
- Delta Smelt – 15,000 LF, 3,000 LF per year;
- Giant Garter Snake repair – 2.5 acres, 0.5 acre per year;
- Giant Garter Snake staging – 12.5 acres, 2.5 acres per year; and
- Western Yellow-Billed Cuckoo – 32.15 acres, 4.75 acres of habitat per year.

Overlap with American River Common Features, West Sacramento and Southport Projects

Some of the EJBs for this proposed project fall within the project area for other projects that have Corps approval and section 7 completed. These projects include similar types of actions to repair/improve levees. Since the SRBPP may proceed with construction actions that are coincidental with these other projects, there is some uncertainty on authority and take authorization to be applied on these future actions. The Corps acknowledges that existing biological opinions, e.g. American River Common Features General Re-evaluation Report (GRR) and West Sacramento (GRR), exist which must be considered by the SRBPP program when planning potential construction projects, and coordination must occur between the projects/programs and the resource agencies. When this occurs, it is likely that any action undertaken by SRBPP authority will be designed and constructed in alignment with these other project actions, and any take associated with the action may already have been evaluated under the respective biological opinions.

Bank Protection Measures

Bank Protection Measure 1—Setback Levee
This measure (Figure 4) entails constructing a new levee some distance landward of the existing levee and will avoid or minimize construction in waterside riparian areas. The land between the setback and existing levee will become floodplain. Land use in the new floodplain will be determined on a site-by-site basis. The old levee could be breached in several locations and/or degraded to allow high flows to inundate the new floodplain. Vegetation on the new setback levee including 15 feet beyond each toe will be restricted to grass, and managed as a vegetation-free zone, while vegetation could remain on the old levee. New vegetation planted in the setback area could serve as mitigation to offset project losses. Additionally, vegetation on the existing levee could become available to aquatic species and contribute to a net increase in floodplain vegetation.

Measure 1 will be most applicable in areas where substantial habitat values exist along the channel and land uses in the setback area are not restrictive. Setback levees can be very effective but real estate acquisition (including the need for willing sellers), existing land use, and technical issues limit opportunities for setback levees in the program area. Setback levees can restore riverine processes and may offer opportunities for mitigation of riparian, bank swallow, and fish habitat loss at other bank protection sites. Setback levees may also provide other flood control benefits such as addressing seepage issues that other bank protection measures will not address.

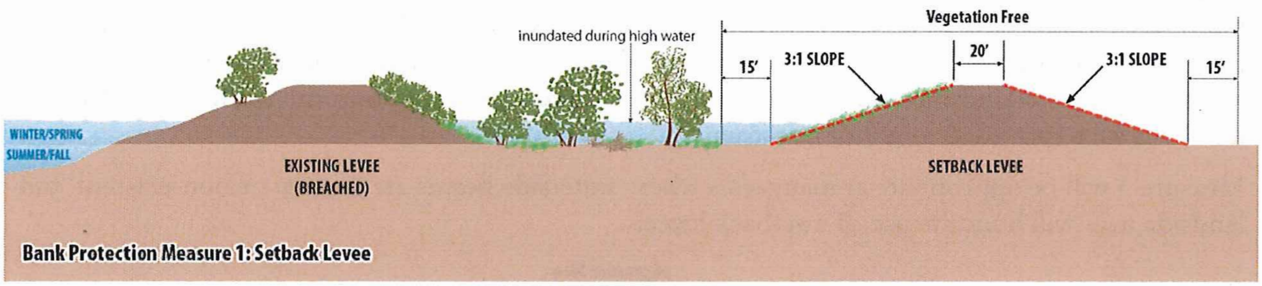

Figure 4. Bank Protection Measure 1: Setback Levee

Bank Protection Measure 2—Bank Fill Stone Protection with No On-Site Woody Vegetation
This measure (Figure 5) entails filling the eroded portion of the bank and installing soil-filled revetment along the levee slope. The rock/soil ratio will vary by location and will be determined during site-specific design. Vegetation will be limited to native grass, and existing vegetation will be removed only within the footprint of features to be constructed (e.g. placement of rock or soil). Vegetation within the VFZ but outside of the construction footprint will be left in place. If there is a natural bank, distinct from the levee that requires erosion protection, it will be treated with revetment. Measure 2 will be most applicable in areas where there is inadequate space or substantial constraints (for example, critical infrastructure, homes, roadways, pump facilities, real estate issues, etc.), either landside or waterside, where hydraulic concerns will make it difficult to implement the other measures, or where existing habitat values are very limited.

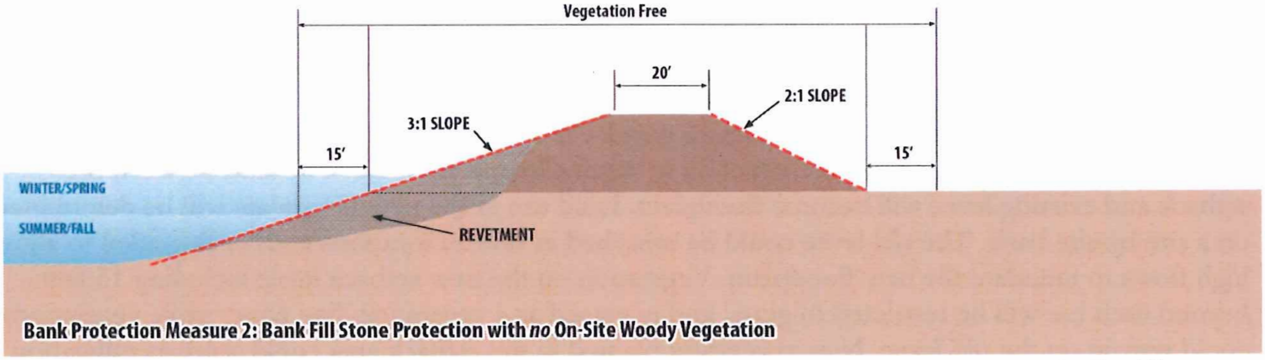

Figure 5. Bank Protection Measure 2: Bank Fill Stone Protection with *No* On-Site Vegetation

Bank Protection Measure 3—Adjacent Levee

This measure (Figure 6) involves the construction of a new levee embankment adjacent to and landward of the existing levee. The adjacent levee will be constructed to Corps design standards, which require adjacent levees to be constructed with 3:1 slopes on both the waterside and landside. The landward portion of the existing levee will be an integral, structural part of the new levee. The waterward portion of the existing levee will remain. Vegetation and instream woody material (IWM) could be placed on the old levee if that portion is outside of the vegetation free zone. However, a variance under the ETL may be required if the existing levee is considered to be a waterside planting berm based on its dimensions and proximity to the new levee. The levee may also be degraded to riparian and/or wetland benches that comply with the Corps' vegetation management policy. Vegetation on the landward side of the existing levee and within the footprint of the new adjacent levee will be removed as a part of construction.

Measure 3 will be appropriate at many sites where waterside berms are narrow or non-existent, but landside uses will limit the use of a setback levee.

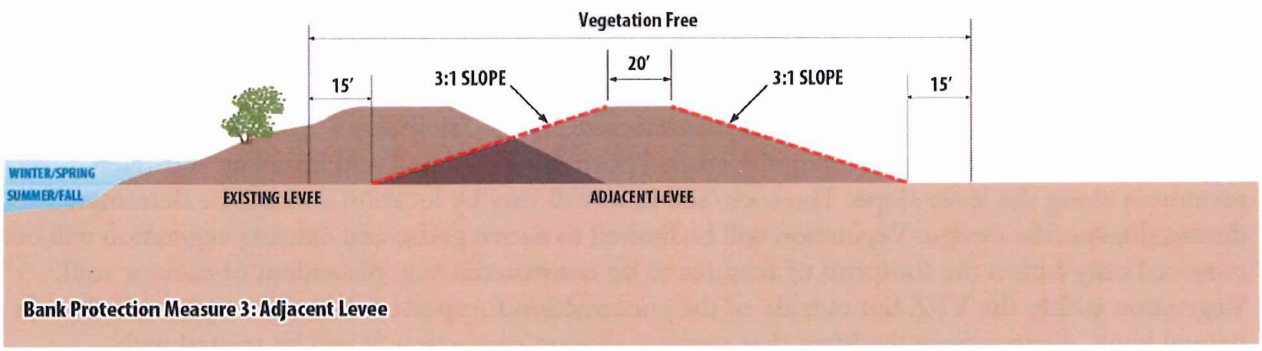

Figure 6. Bank Protection Measure 3: Adjacent Levee

Bank Protection Measure 4—Riparian and Wetland Benches with Revegetation

Measure 4 consists of three design variations presented as Measures 4a, 4b, and 4c. In general, this measure involves the placement of clean quarry stone from the toe of the bank up to the summer/fall waterline and placing quarry stone and soil-filled quarry stone on the levee slope above the summer/fall waterline. The rock/soil ratio will vary by location and will be determined during site-specific design. The repairs will involve initial site preparation and construction of levee embankment. Measures 4a, 4b, and 4c will comply with the Vegetation ETL, requiring all woody vegetation within the vegetation-free-zone to be removed.

Measures 4a, 4b, and 4c vary from one another with regard to the placement and extent of environmental features that are intended to increase habitat quality (bank construction, vegetation, and IWM). These variations are driven by a number of factors, most importantly the types of existing resources and the types of species likely to use those resources.

In general, plantings consistent with the Vegetation ETL and outside of the vegetation free zone at each site could include box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), western sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), Goodding's willow (*Salix gooddingii*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), California wild rose (*Rosa californica*), and narrowleaf willow (*Salix exigua*).

These measures are appropriate where the channel is wide enough to accommodate the installation of the stone and soil structure without substantially affecting the hydraulic capacity of the channel.

Bank Protection Measure 4a—Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline

The low riparian bench with revegetation and IWM above the summer/fall waterline measure (Figure 7) entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. This design provides near-bank, shallow-water habitat and components of shaded riverine aquatic habitat for fish. Treatment of existing vegetation, site preparation, and installation of revetment on the lower slope will be similar to the description under Measure 2. This measure includes a riparian bench. The bench will be treated with soil-filled quarry stone.

In this design, the riparian bench is intended to be inundated at river stages corresponding to high tide (where tidally influenced) during average winter/spring flows. The riparian bench will be revegetated with species that are in compliance with the standard VFZ of the ETL. Planting plans will describe species to be planted within a specific elevation zone and will detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers.

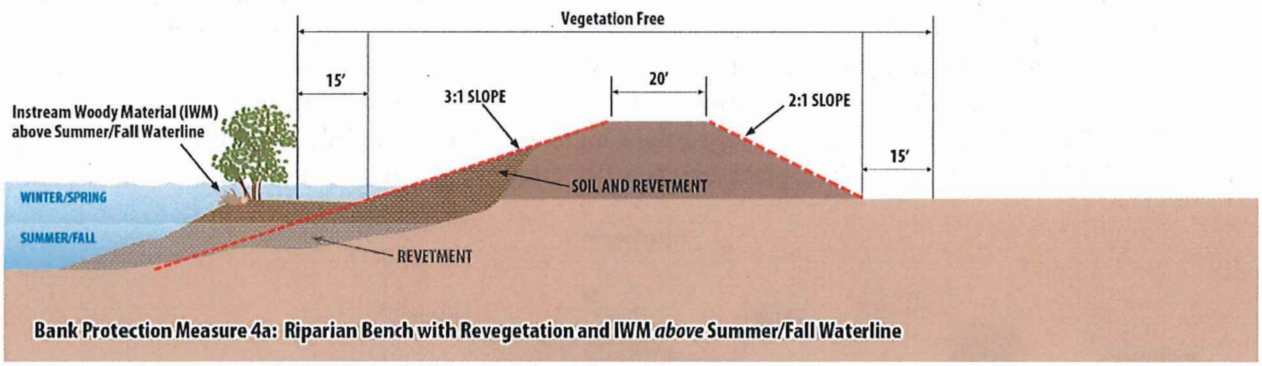

Figure 7. Bank Protection Measure 4a: Riparian Bench with Revegetation and Instream Woody Material *above* Summer/Fall Waterline

The riparian bench will be constructed at a slope of 6:1 to 10:1 and the revetment portion above and below the bench will typically be 3:1 (distance width to distance height, or dW:dH). The width of the bench will be about 10–30 feet, depending on site conditions. Anchored IWM will be embedded on top of the riparian bench above the summer/fall waterline. The IWM will be available as habitat along the banks only during winter/spring flows when the bench is inundated. Individual pieces of IWM will be placed to fit the project site's hydraulic conditions and other applicable guidance. The Corps assumes 60% IWM shoreline coverage and a high level of complexity. Exact shoreline coverage amounts and complexity components will be determined during site-specific design.

Bank Protection Measure 4b—Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

The low riparian bench with revegetation and IWM above and below the summer/fall waterline measure (Figure 8) entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench (as described for Measure 4a) to support riparian vegetation and provide a place to anchor IWM. In addition to the placement of IWM above the summer/fall waterline as described for Measure 4a, IWM also will be placed beyond the bench below the summer/fall waterline, thereby increasing the types and extent of mitigation for shallow-water fish habitat, providing year-round instream habitat for targeted fish species. Treatment of existing vegetation, site preparation, and installation of lower slope quarry stone will be similar to Measure 2. Installation of soil-filled quarry stone and riparian bench will be similar to Measure 4a.

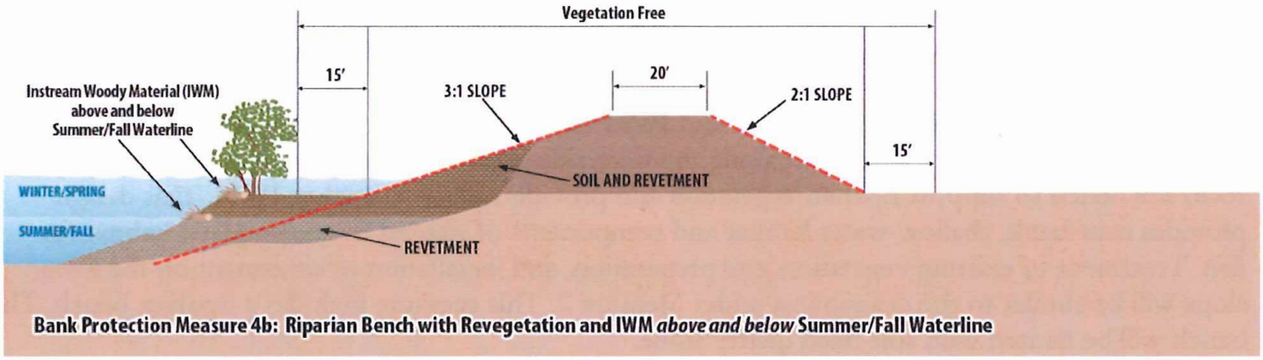

Figure 8. Bank Protection Measure 4b: Riparian Bench with Revegetation and Instream Woody Material *above and below* Summer/Fall Waterline

Bank Protection Measure 4c—Riparian and Wetland Benches with Revegetation

Measure 4c (Figure 9) entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. Bench slopes will be the same as those described for Measure 4a. The design also includes a wetland bench below the summer/fall waterline to further increase habitat quality. Existing vegetation will be removed only within the footprint of features to be constructed (e.g. placement of rock or soil). Grass will be allowed in this area. Vegetation within the VFZ, but outside of the construction footprint will be left in place. Because IWM might increase habitat suitability of ambush predators, new IWM will only be installed to replace existing IWM removed during project repair (1:1 ratio).

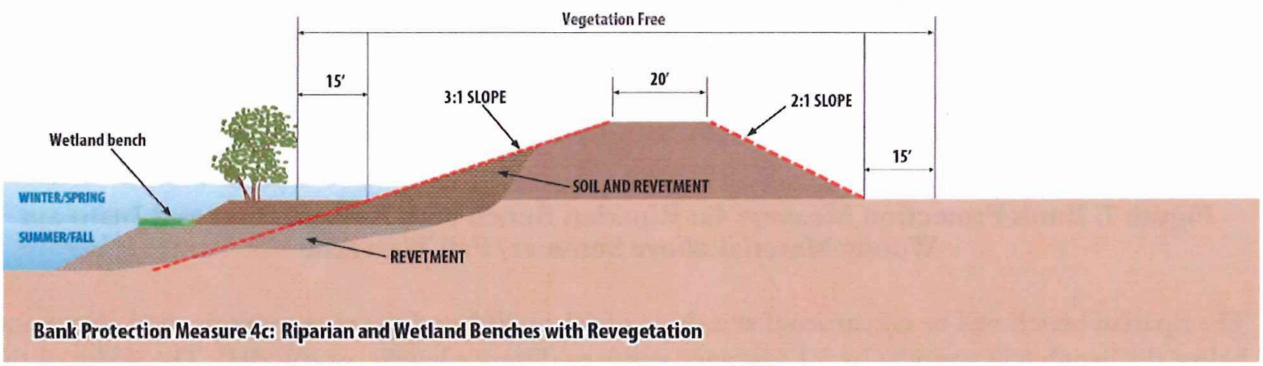

Figure 9. Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation

The riparian and wetland benches are intended to flood at river stages corresponding to winter/spring (high) flows and summer/fall (low) flows, respectively. Both benches will be revegetated in compliance with the Vegetation ETL and in accordance with appropriate planting plans. The wetland bench will typically be planted with hardstem bulrush (*Scirpus acutus*), California bulrush (*S. californicus*), and/or giant bur-reed (*Sparganium eurycarpum* ssp. *eurycarpum*).

Bank Protection Measure 5—Bank Fill Stone Protection with On-Site Vegetation
Measure 5 (Figure 10) entails filling the eroded portion of the bank and installing revetment along the waterside levee slope and streambank from streambed to a height determined by site-specific analysis. The revetment will be placed at a slope of 3:1. All IWM will be removed from the bank; following construction and will not be replaced.

Existing vegetation will be removed only within the footprint of features to be constructed (e.g. placement of rock or soil). Vegetation within the VFZ, but outside of the construction footprint will be left in place. Approximately 25% of existing vegetation that is outside of the VFZ on the waterside slope is estimated to be retained during construction. This assumption is made for analysis purposes and is based on past construction experience; however, the actual amount of retained vegetation could vary substantially from site to site during implementation. New vegetation will be limited to native grasses within the VFZ, while woody vegetation could be replaced by planting outside of the VFZ, as allowed by site-specific conditions. The long-term goal of vegetation planting is to provide riparian and shaded riverine aquatic (SRA) cover habitat. Planting plans will describe species to be planted within a specific elevation zone and will detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers. Six inches of soil cover will be placed on the revetment to support on-site vegetation. If there is a natural bank distinct from the levee that requires erosion protection, it will be treated with revetment.

Similar to Measure 2, Measure 5 will be most applicable in areas where there is inadequate space or substantial constraints that will limit the applicability of the other measures. However, some amount of space to allow for the planting of vegetation is necessary.

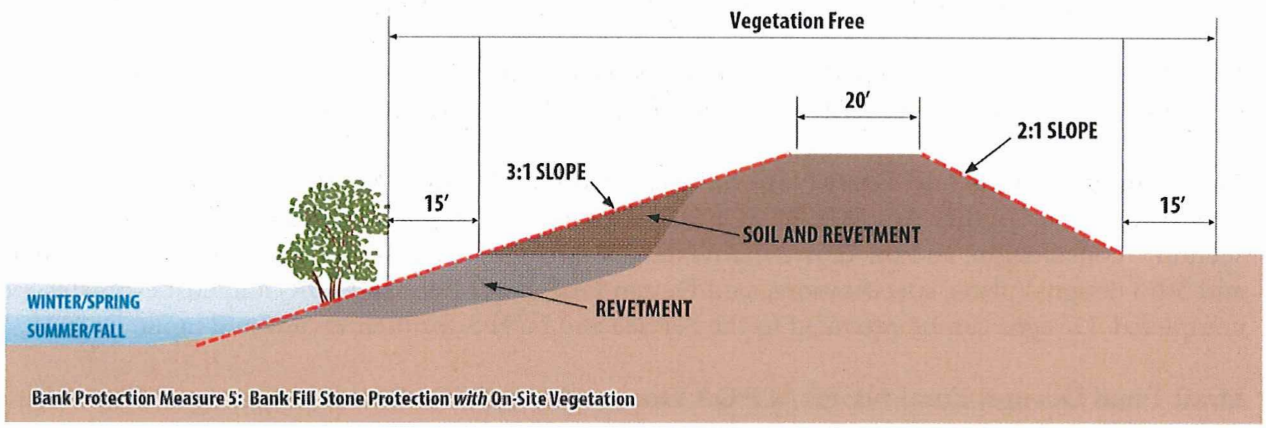

Figure 10. Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation

Design Selection Process
As described above, the Corps has identified seven bank protection measures based on the project delivery team's best professional judgment for the 30,000 LF in this PBO. Also noted above, additional measures and alternative materials may also be appropriate. The following process will be followed prior to selecting final bank protection measures for specific erosion sites.

Reconnaissance/Erosion Inventory. During the reconnaissance trip, a team reviews the existing erosion sites, identifies new sites, and checks the previously repaired sites.

Critical Site Decision. Determine if the erosion site is critical. This decision step of the site selection procedure allows for a fast-track path for critical sites.

Engineering Ranking and Report. The third step of the site selection process involves development of a report and an engineering site ranking based on the information collected during the erosion reconnaissance inventory. This information is provided to the Service and NMFS to inform them of the potential sites that may need to move forward for repair.

Identify Opportunities and Constraints. During this step of the process, all the potential issues and opportunities associated with each site are identified. This step addresses real estate, environmental, constructability, cultural resources, and grouping of sites. Opportunities and constraints are presented and discussed with the Inter-Agency Working Group. This step identifies sites where a variance will be applicable and is when the first steps of the variance request process will be initiated. This step provides the Service and NMFS with the opportunity to provide science and agency perspectives, identify specific issues, and help identify opportunities to minimize adverse effects and potential mitigation alternatives.

Conceptual Level Alternatives. Under this step, the project development team (PDT) develops conceptual-level designs and costs.

Site Lock-in Procedure. During step 6, sites are selected for inclusion on the "lock-in" list for site repairs. The sites on the "lock-in" list are generally anticipated to be repaired over the 3- year period that makes up each construction cycle.

Site Selection Lock-in List and Report. For step 7, the top sites chosen in step 6 and the fast-tracked critical sites are considered the locked-in sites selected for repair in each construction cycle. A report is written to document how and why the "locked-in" sites were selected for repair.

Data Collection. For this step, the PDT collects the data needed to develop the repair designs. The exact information and the level of detail collected at each site vary from site to site.

Preliminary Designs and Draft National Environmental Policy Act/California Environmental Quality Act (NEPA/CEQA) Document. Step 9 begins the design process, section 7 consultation, and the draft NEPA/CEQA document. The design alternatives are selected and 30% designs (plans, specifications, and Design Document Report (DDR) and cost estimates are completed. Designs can be provided to the Service and NMFS for their review and input.

Draft Final Design, Final NEPA/CEQA Document, and Pre-Construction Activities. After an internal review of the plans, the 90% Plans and Specifications are developed, and the final NEPA/CEQA document is completed. The Corps will provide the Service and NMFS an additional review during this step.

Review and Final Design. The official Agency Technical Review (ATR) and Independent External Peer Review (Type II IEPR, Safety Assurance Review) is performed throughout the development of the Plans and Specifications and the DDR. Revisions to the designs and contract documents are made based on these reviews, resulting in the 100% DDR and Plans and Specifications for Contract advertisement.

Contracting Procedure. The Corps compiles the final plans and specifications, provides the signed Biddability, Constructability, Operability and Environmental (BCOE) Review, and processes the funding element for construction.

Construction. The contractor constructs the bank repair following the Notice to Proceed.

Mitigation Monitoring. On-site mitigation requires monitoring to ensure the establishment criteria is met for vegetation growth and survival. The monitoring period must be sufficient to demonstrate that the compensatory mitigation has met performance standards, at least 5 years post establishment. Monitoring reports are required on a yearly basis and will be provided to the Service and NMFS.

Site Turn-over. Once the construction and mitigation monitoring is complete, the Corps turns the site over to the CVFPB, which then turns the site over to the local maintaining agency. Mitigation and monitoring will be incorporated into the operations and maintenance manual.

The Corps will review all repair sites to determine if the recommended repair is consistent with the repairs described in this project description. Additionally, the Corps will determine if the effects of the individual site repair were analyzed in this PBO and include any site specific effects that were not considered at the programmatic scale. The Corps will submit a biological assessment to the Service and request that the site be appended to the PBO.

The proposed action applies a combination of the selected site-specific bank protection measures to the erosion sites. A major aspect of selecting bank protection measures for each site is avoiding, minimizing, and mitigating negative impacts to fish and wildlife habitat. The process also includes preliminary Standard Assessment Methodology (SAM) evaluations to determine likely losses and necessary gains to habitat for salmonid species. For example, a setback levee measure may off-set losses of riparian vegetation at a rock slope bank protection site. This will depend on timing of the various measures to ensure that habitat losses are mitigated for at the time of the impact.

Off-site mitigation may be acceptable to the Corps, CVFPB, and resource agencies on a site-specific basis provided that it compensates for the values being lost, and will be provided within the region of impact (e.g., 1a, 1b, 2 or 3). The proposed action utilizes the approach taken over the last decade, which primarily focused on recreating streambank habitats through the use of constructed benches with riparian vegetation, but makes adjustments to account for implementation of the Vegetation ETL.

The extent to which actual measures are implemented in each region may vary from what is shown in Tables 1 and 2. It is intended to serve as an example of how the work could reasonably be accomplished and it provides a basis for evaluating potential effects to listed species. Thus, it is an approximation and not a formal commitment by the Corps. This approach allows the magnitude of the habitat compensation needs to be determined for the entire program while not prescribing the exact designs for site-specific actions. A radical change in the types of measures employed by the Corps could necessitate the re-initiation of consultation due to a change in effects.

Operations and Maintenance

Once repairs are complete, a project site may require limited maintenance. During the initial establishment period, maintenance activities are anticipated to be required for 3 to 5 years, and include: removing invasive vegetation detrimental to project success; pruning and watering planted vegetation to promote optimal growth; replacing plantings, monitoring navigational hazards; and placing fill and rock revetment if the site is damaged during high flow events or by vandalism. Once established, the riparian vegetation should be self-maintaining. Annual maintenance at each site will be limited to placement of no more than 600 cubic yards of material, which corresponds to a disturbance length of less than 300 feet; should more material be required in any year, the operating and maintaining agency (i.e., Central Valley Flood Protection Board) will obtain the necessary permits from the regulatory agencies. The Corps will be responsible for ensuring that conservation measures and environmental standards are stipulated in permits and all required documentation is maintained. Similarly, if outside alterations of a project site are proposed by other agencies or private entities, the Corps will work with the Service and NMFS to ensure that environmental features at the project sites are maintained, or that off-site compensation is implemented to make up for any deficits.

Conservation and Mitigation Measures

Off-Site Compensation for Chinook Salmon, Steelhead, Delta Smelt, and Green Sturgeon

Bank repair actions that are not fully self-mitigating will implement off-site compensation measures in advance of the proposed action through the use of advanced conservation measures or conservation banks. If necessary, and only in consultation with resource agencies, off-site compensation measures may be implemented concurrently or following the completion of project construction, but the amount of area to be compensated with will be adjusted to account for temporal losses. Whether constructed as part of a suite of bank protection sites or established under an agreement between the federal agencies, off-site compensation will focus on replacing and enhancing habitat values for listed species. SAM, which was specifically created to assist with quantifying effects and compensation amounts for salmonids, will be utilized to the extent practicable. The quantification methodology does not adequately reflect how delta smelt and its habitat are being affected by bank protection projects. Therefore, it will be necessary for the Service and Corps to review the sites within the range of the delta smelt and determine qualitatively and quantitatively how best to offset the effects to delta smelt. This is further described below in the delta smelt section. Proposed off-site conservation measures include the use of one or more of the following elements:

1. Setback levees to reestablish natural bank conditions along the channel provide a seasonally inundated floodplain with a mosaic of habitat types including riparian forest and shallow open water areas (Figure 4). Under these conditions, active channel migration could re-initiate and will be subject to the natural cycles of habitat disturbance and renewal.
2. Construction of in-channel and off-channel wetland benches or less steeply sloping banks to provide juvenile salmonid rearing habitat.
3. Planting riparian trees for bank shading and long-term production of instream wood for salmonid aquatic habitat.
4. Installation of instream wood for the creation of instream cover and feeding areas for salmonids.
5. Removal of rock revetment, which will allow the river to reclaim its natural geomorphic processes and move freely throughout the floodplain.

Similar compensation values may also be obtained through purchase of third party mitigation bank credits.

Off-Site Compensation Process

Sections 7(a)(1) and 7(a)(2) of the Act, 16 U.S.C. Sections 1636(a)(1) and (2), require all federal agencies to support and implement programs for the conservation of listed species, and to insure that federal actions do not jeopardize the continued existence of any endangered species or threatened species or result in destruction or adverse modification of critical habitat. Impacts to listed species are minimized by including conservation measures in the federal agency's project description. These conservation measures may include off-site enhancement of listed species habitat as part of an individual project or as part of a conservation banking agreement. The general off-site compensation process is outlined below:

1. Off-site compensation requirements for one or more individual project sites will be determined in coordination with the Service and the Corps. A combination of pre-construction survey data, shallow water habitat delineation, or post-construction survey data will be used to verify assumptions used.

2. Existing conditions will be surveyed at proposed compensation sites. Recommended compensation measures will be submitted for approval of the Service. If significant setback levee action (or other significant restorative action) is designed and developed with the intent of off-setting future SRBPP bank protection impacts, the action, shall be subject to the appropriate advance mitigation guidance, including the Service's December 27, 2016, *Compensatory Mitigation Policy*.

3. The functional value of the project sites and compensation sites will be determined by using the SAM or other assessment tool available to evaluate site locations (e.g., compensation sites located where they can be colonized by the affected life stages of the focus fish species), site attributes (e.g., potential exchanges between one or more attributes such as IWM, substrate, shade, etc.), relative sizes of the sites, and compensation timing. Functional values will be used to determine the appropriate functional equivalent of losses at the project site(s) compared to the compensation site(s).

4. Timing of project site construction, compensation site construction, and habitat evolution will be evaluated; the goal will be to achieve net positive results for the project and compensation sites at all times. This will require a balance between compensation sites and construction sites at any given time.

5. Compensation requirements shall be completed prior to impacts occurring.

Location of Compensation Sites
There is a history of policy positions favoring local or on-site mitigation over more distant compensation. Prior policy positions of NMFS have stated that the use of distant sites (>50 miles) is unacceptable because it does not ensure "in-kind" compensation, or that local populations which have been affected by the project benefit from the habitat enhancement (National Marine Fisheries Service 2001). 33 CFR Section 332 *et seq.* establishes compensatory mitigation standards and criteria for projects permitted by the Corps pursuant to Section 404 of the Clean Water Act, 33 U.S.C. Section 1344. In general, 33 CFR Section 332.3(b)(1) states that compensation sites should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions and services, taking into account such watershed scale features as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, trends in land use, ecological benefits, and compatibility with adjacent land uses.

For the purposes of the proposed action, compensation requirements will generally be determined within each of the four regions (Figure 2) with the intent of completing the proposed conservation measures at sites selected as close as practicable to bank protection project sites. Whether two potential project and compensation sites are ecologically interchangeable can primarily be assessed by determining whether fish species or specific life stages could inhabit the two sites at the same time of year. In select situations, compensation sites may be acceptable if fish species utilize the two sites at various times or during different life stages.

The Corps has proposed two potential compensation sites: rock removal at Kopta Slough in Region 3 and the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project in Region 1a. Neither site has been approved by the Service or NMFS at this time and will be evaluated in the future against current mitigation policies. Additional compensation sites within these regions and in Regions 1b and 2 will address the needs of the proposed action. Final compensation site locations may be constrained by: (1) limited potential for habitat benefits to listed species from planned acquisition or enhancement; (2) location of property relative to site(s) requiring off-site compensation; (3) compatibility of nearby land uses with proposed land use at the compensation site; (4) available funding; and (5) the willingness of landowners to sell their properties. Due to the unique qualities of some mitigation opportunities or sites (e.g. rock removal at Kopta Slough), it may be appropriate to mitigate for impacts to certain species outside of the region where the effects occurred.

Guidelines for Off-Site Compensation

Protection of listed species habitat through the use of advance mitigation sites constructed by the Corps or the CVFPB may be considered as one means to satisfy off-site compensation requirements when on-site mitigation alternatives are not feasible or will provide better conservation outcomes at a different location as described in the Service's Mitigation Policy (Service 2016a). For compensation sites constructed in advance of proposed bank repair sites, medium- to long-term habitat benefits will potentially accumulate for use in offsetting future bank repair sites. Conceptually, advance mitigation is a compensation strategy in which habitat resources are restored, created, or enhanced expressly for the purpose of providing compensatory mitigation in advance of authorized impacts. Within the SRBPP context, the goal of advance mitigation will be to offset adverse impacts to the federally listed and fish species addressed in this PBO. Purchase of mitigation credits from third-party mitigation banks may also be considered as a strategy for off-site habitat compensation.

Advance mitigation agreements will be consistent with established criteria and guidelines of the involved agencies. The Service has recently finalized the *Endangered Species Act Compensatory Mitigation Policy* (Service 2016b). This policy outlines standards and criteria for developing mitigation sites. The policy clarifies guidance given in the Service's *Guidance for the Establishment, Use, and Operation of Conservation Banks* (Service 2003).

Although relevant federal and state guidance documents for conservation and mitigation banking provide the fundamental precepts under which advance mitigation for the SRBPP shall be undertaken, SRBPP advance mitigation actions and proposals will be unique and variable. Therefore, some of the more important additional guidelines that shall also apply to advance mitigation relative to the SRBPP are as follows:

- The Interagency Working Group (IWG) shall support an independent re-analysis of the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project in Solano County, California, to determine how conservation credits may be applied to future SRBPP compensation needs. Application and use of such credits will be subject to appropriate conservation and advance mitigation agreements;
- On-site compensation efforts that create significantly more compensation than necessary to fully offset on-site impacts, may have the excess compensation credited, accounted for, and used through appropriate consultation processes, or under appropriate conservation and advance mitigation agreements;
- The project service area for each advance mitigation site may vary and shall be defined at the time each site is established;
- Advance mitigation credits may either be withdrawn directly by the Corps and CVFPB, or conservation bank credits may be purchased from an intermediate, private seller/bank operator. Regardless of the origin, the Corps will base all accounting of compensatory credits for salmonids, on the SAM (U.S. Army Corps of Engineers 2004) or other methodology approved by the resource agencies;
- Each agency shall be given an opportunity to participate in development and to

become a party to any advance mitigation or conservation banking agreements which are developed;

- The Corps and CVFPB declare their intent to routinely subrogate, to private entities capable of providing such services and that are agreeable to IWG agencies, their responsibilities for: (1) preparing advance mitigation and/or conservation banking agreements, and (2) conducting operations, maintenance, monitoring, and accounting for advance mitigation sites and/or conservation banks; and
- Protections and management of advance mitigation sites shall be established in perpetuity. Management measures shall be implemented to ensure adequate control of undesirable activities (e.g., trash dumping, tree-cutting, off-road vehicle use, and invasions by exotic vegetation). Management elements that maintain the habitat for the various listed species shall also be included, as necessary. However, for management and maintenance of all advance mitigation sites, the guiding principle shall be to achieve to the extent feasible, a largely unmanaged operation based on natural river functions and processes.

The Cache Slough advanced mitigation site was built in 1992. The site is comprised of 176 acres with 12,000 LF of exterior bank line and 138 wetted acres. It is located within designated delta smelt critical habitat on Cache Slough in the northern Sacramento-San Joaquin Delta, west of the Sacramento River, about 8 miles north of Rio Vista. The site is owned and maintained by the California Department of Water Resources (DWR) with the purpose of supplying advanced mitigation credits to address off-site mitigation requirements for SRBPP actions where compensation for habitat loss cannot be completed on-site. However, the Corps, CVFPB, DWR, and Service must reach agreement on ways in which the agencies can meet the criteria set out in the Service's *Endangered Species Compensatory Mitigation Policy*. This will include protecting the land in perpetuity through a conservation easement, a long-term monitoring and maintenance plan for the site, and a means of providing in-perpetuity funding of the plan such as an endowment. It is unclear as to how the Corps and CVFPB can provide the above protections and is unlikely to be resolved in the foreseeable future. Until this is resolved the Corps and CVFPB are unable to use any credits from this site.

Delta Smelt Conservation Measures

- All work within waters where there is potential for delta smelt to occur, as defined by the most recent data, will be confined to a seasonal work window of August 1 through November 30 when delta smelt are least likely to be present along the Sacramento River.
- Work windows may be adjusted with approval by the Service based on information from the various Delta monitoring programs.
- Permanent loss of habitat will be compensated for by purchasing credits at a Service-approved conservation bank at a 3:1 ratio. Habitat effects resulting in a change of substrate will be compensated by purchasing credits a Service-approved conservation bank at a 1:1 ratio.

Valley Elderberry Longhorn Beetle Conservation Measures

The following measures will be implemented to minimize any potential effects on valley elderberry longhorn beetles or their habitat:

- The Corps will avoid elderberry shrubs by creating and maintaining a buffer of at least 20 feet around elderberry plants.

- When encroachment upon the 20-foot buffer will occur, the Corps will provide a biological monitor to be on-site to ensure that the beetle's habitat is not damaged.
- During construction activities, all areas to be avoided will be fenced and flagged.
- Contractors will receive worker awareness training which will include the status of the valley elderberry beetle, the habitat it uses, the need to avoid damaging elderberry plants, and the possible penalties for not complying with these requirements.
- Construction work will be avoided within 165 feet of elderberry shrubs during the beetle's flight season (March – July).

Restoration and maintenance

- Areas disturbed during the construction will be restored to pre-project conditions.
- Herbicides will not be used within the drip-line of the shrub. Insecticides will not be used within 100 feet of an elderberry shrub. All chemicals will be applied using a backpack sprayer or similar direct application method.
- Mowing will be limited to the months of July – February and will avoid damaging elderberry stems.
- The Corps will update the Operations and Maintenance Manuals with these conservation measures upon completion of construction.

Elderberry plants that cannot be avoided

- Elderberry shrubs that cannot be protected in place will first be analyzed for trimming so they can remain on-site. Trimming will occur between November and February and will minimize the removal of branches or stems that exceed 1 inch in diameter. Prior to trimming the stems will be examined for exit holes. Any exit holes found will have the GPS location and number of holes provided the California Natural Diversity Database (CNDDB).
- Elderberry shrubs that must be transplanted to allow for work to occur will be transplanted to an appropriate riparian area at least 100 feet from construction activities or to a Service-approved conservation bank. Appropriate riparian areas will have some level of protection such as a conservation easement.
- Elderberry shrubs will be transplanted during their dormant season (November, after they have lost their leaves, through the first 2 weeks in February). In cases where transplantation cannot occur during the dormant season the Corps will provide additional mitigation. Elderberry shrubs will not be transplanted during the beetle's flight season (March – July).
- A qualified biologist will be on-site to monitor for the duration of the transplanting of the elderberry plants to ensure the correct shrubs are transplanted and other habitat is not disturbed. The monitor will have the authority to stop work if necessary.

Transplanting Procedure

- Exit-hole surveys will be completed immediately prior to transplanting. The number of exit holes found, global positioning system (GPS) location of the plant to be relocated, and the GPS location of where the plant is transplanted will be reported to the Service and to the CNDDB.
- Any plant requiring transplantation will be cut back the least amount in order to safely remove and move the shrub.
- The plant will be excavated taking as much of the root ball as possible and replanted immediately.

Mitigation

- For every elderberry shrub trimmed the Corps will create the same area of valley elderberry longhorn beetle habitat or purchase mitigation credits at a valley elderberry longhorn beetle conservation bank. When the Corps creates habitat for the beetle they will coordinate with the Service to ensure appropriate site selection, planting plan, long-term protection, and long-term funding for maintenance and monitoring.
- For every elderberry shrub that is transplanted the Corps will mitigate at a 3:1 ratio for the loss of habitat. The Corps will coordinate with the Service to ensure appropriate site selection, planting plan, long-term protection, and long-term funding for maintenance and monitoring are created for the site. Conversely, the Corps could purchase credits at a valley elderberry longhorn beetle conservation bank.

Giant Garter Snake Conservation Measures

The following measures will be implemented to minimize effects on giant garter snake habitat that occurs within construction activity:

- Unless approved otherwise by the Service, construction in or near giant garter snake habitat will be initiated only during the giant garter snake's active period (May 1–October 1, when they are better able to move away from disturbance).
- Construction personnel will participate in a Service-approved worker environmental awareness program describing the status of the snake identifying giant garter snake habitat avoidance areas. This should also include a discussion of the possible penalties for not complying with avoidance and minimization measures.
- Within 24 hours prior to commencement of construction activities, the site will be inspected by a qualified biologist approved by the Service. The biologist will provide the Service with a field report documenting the monitoring effort that occurred within 24 hours of commencement of construction activities. During construction, the biologist will be available; if a snake is encountered, the biologist will immediately report any incidental take to the Service.
- Giant garter snakes encountered during construction activities will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat.
- Giant garter snake habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel.
- Equipment should be checked daily to ensure that giant garter snakes are not on any part of the equipment.

Compensation for Habitat Disturbance

- Habitat (including aquatic and upland) temporarily impacted for one season (May 1–October 1) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants.
- Habitat affected for two seasons will be replaced on-site and compensated off-site at a 1:1 ratio. Habitat affected for more than two seasons will be replaced on-site and compensated off-site at a 2:1 ratio. Permanently affected habitat will be compensated at a ratio of 3:1 off-

site.

- Replacement habitats will typically include both upland and aquatic habitat components.
- One year of monitoring will be conducted for all restored areas. Five years of monitoring will be conducted for newly created on-site or off-site habitat features. A monitoring report with photo documentation will be due to the Service each year following implementation of restoration or habitat creation activities.
- The Corps will work to develop appropriate mitigation prior to any disturbance of giant garter snake habitat.

Western Yellow-Billed Cuckoo Conservation Measures

The following measures will be implemented to minimize effects on western yellow-billed cuckoos and their habitat within the construction area:

- In areas where suitable habitat exists in the project footprint or within 500 feet of the project area, work will occur between October 1 and June 1 to avoid affecting nesting and migrating cuckoos.
- Where work must occur between May 1 and September 1 in suitable habitat, surveys will be conducted by a biologist with a federal recovery permit to determine if cuckoos are in or near the project area.
- If cuckoo activity is detected in the survey area, no-disturbance buffers will be established around the cuckoo habitat to avoid disturbance or destruction of the habitat until the end of the breeding season (about September 1) or until a qualified wildlife biologist determines that the bird has moved out of the project area. The extent of the buffers will be determined by the biologists in coordination with the Service and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers.
- The permanent loss of nesting habitat for the yellow-billed cuckoo will be either creating habitat for the cuckoo or purchasing credits at a Service-approved conservation bank at a 3:1 ratio. Potential mitigation actions include:

    - Prioritizing the construction of setback levees or adjacent levees to the extent possible to minimize effects to adjacent riparian habitat and provide increased space for lateral migration of the river channel and allow for dynamic riverine processes to occur.
    - Protecting existing vegetation in place and plant vegetation on-site.
    - Purchase of inter-levee farmland and conversion to riparian woodland forest where channel migration is occurring to increase availability of suitable habitat for the cuckoo.
    - Exploring available options to remove existing revetment on banks or levees located within cuckoo proposed critical habitat areas to the extent possible consistent with the Corps policies and regulations. This will allow channel migration to occur and restore riverine processes important for the cuckoo.
    - Conduct off-site mitigation by purchasing credits from a mitigation bank or by participating in an in-lieu fee compensatory mitigation program.

Monitoring Plan

The Corps shall submit a detailed monitoring plan for on- and off-site habitat mitigation for each individual site as part of the request to tier off of the PBO. The monitoring plan will include, at a minimum: (1) monitoring methods, performance standards for SAM variables, and success criteria for riparian vegetation and SRA cover; and (2) a protocol for implementing remedial actions should any success criteria not be met. The monitoring plan will follow the protocol presented in the *Vegetation and Habitat Monitoring Methodology Protocol for Sacramento River Bank Protection Project* (SRBPP) Sites, which was developed through collaborative discussion with the Corps, Gulf South Research Corporation, CVFPB, the Service, and the Sacramento Area Flood Control Agency. The monitoring plan will be reviewed to ensure it is adequately measuring performance standards for all listed species including valley elderberry longhorn beetle, giant garter snake, and western yellow-billed cuckoo.

An annual monitoring report that evaluates how the site meets the mitigation success criteria will be submitted to the resource agencies by December of each year. Monitoring will be conducted until the projected benefits of mitigation actions are either substantially confirmed or discounted.

To ensure that on-site and off-site habitat features that were designed to specifically benefit federally protected fish species are functioning as intended, fishery monitoring efforts will be reported separately from the monitoring efforts described above. Fisheries monitoring efforts have been conducted since 2005 and efforts are still ongoing in coordination with the resource agencies. These efforts will provide key information about habitat utilization by key fish species within the project area and will continue to help determine the effects of SRBPP bank protection actions. Yearly adjustments and expansion of the fisheries monitoring plan to include new repair sites or control reaches will be made through the IWG; the Corps will submit a draft monitoring plan to the Service and NMFS by November 30 of each year and draft monitoring report will be submitted to the Services by December 30 of each year for the duration of the agreed-upon monitoring term for each site.

Once the site establishment monitoring requirements have been monitoring term is over, the site will be turned over to the local maintaining agency for long-term operations and maintenance as specified in supplements to the appropriate operations and maintenance manuals.

Additional Minimization and Conservation Measures

The Corps will avoid and minimize construction effects on listed species and their critical habitat to the extent feasible. A number of measures will be applied to the entire project or specific actions, and other measures may be appropriate at specific locations within the action area. Avoidance and minimization activities to be implemented during final design and construction may include, but are not limited to, the following:

- Where feasible, preventative measures to treat failure mechanisms that minimize project size.
- Identifying all habitats containing, or with a substantial possibility of containing, listed terrestrial, wetland, and plant species in the potentially affected project areas.
- Minimizing effects by modifying engineering design to avoid potential direct and indirect effects, limiting vegetation removal to the extent feasible, limiting site access to the smallest area possible, and limiting to the extent possible, grubbing and contouring activities.
- Incorporating sensitive habitat information into project bid specifications.
- Incorporating requirements for contractors to avoid identified sensitive habitats into project bid specifications.
- Whenever possible, placing fill materials with no excavation or movement of existing materials on site.
- Stockpiling of construction materials such as portable equipment, vehicles, and supplies, including chemicals, at designated construction staging areas and barges, exclusive of any riparian and wetlands areas.

- Erosion control measures (best management practices [BMPs]) that minimize soil or sediment from entering the river. BMPs shall be installed, monitored for effectiveness, and maintained throughout construction operations.
- Daily removal of all litter, debris, unused materials, equipment, and supplies from the project area. Such materials or waste will be deposited at an appropriate disposal or storage site.
- Immediate (within 24 hours) cleanup and reporting of any spills of hazardous materials to the resource agencies. Any such spills, and the success of the efforts to clean them up, shall also be reported in post-construction compliance reports.
- Ensuring all construction activities, including clearing, pruning, and trimming of vegetation, is supervised by a qualified biologist to ensure these activities have a minimal effect on natural resources.
- Designating a Corps-appointed biological representative as the point-of-contact for any contractor who might incidentally take a living, or find a dead, injured, or entrapped threatened or endangered species. This representative shall be identified to the employees and contractors during an all-employee education program conducted by the Corps.
- An on-site inspection tour, led by the Corps' biologist/environmental manager or contractor, if requested by the Service or NMFS personnel or other resource agencies, during or upon completion of construction activities.
- Screening any water pump intakes as specified by NMFS and Service screening specifications. Water pumps will maintain an approach velocity of 0.2 feet per second or less when working in areas that may support delta smelt.
- A Corps representative assigned to work closely with the contractor(s) through all construction stages, to ensure that any living riparian vegetation or IWM within vegetation clearing zones is avoided and left undisturbed to the extent feasible.
- If a cofferdam is needed during construction, constructing it by placing the sheet piles sequentially from the upstream to the downstream limits of the construction area. If substrate, cover, and water depths allow, seining will be conducted within the cofferdam with a small-mesh seine to remove as many fish as possible before the cofferdam is closed; upon completion of seining, exclusionary nets will be placed in the river to prevent fish from re-entering the dammed area. Once the cofferdam is closed the area will be partially dewatered, and a final seining and dip netting effort will be conducted to capture any remaining fish. Only low-flow pumps with screened intakes will be used during dewatering operations. Any captured fish will be released downstream of the construction area.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." For the proposed project, the action area encompasses the seven economically-justified basins specifically identified in Table 1 as well as areas used for staging, borrow, and haul routes. The lateral extent of the action area as it relates to wildlife species varies by bank protection measure, but is generally assumed to include the entire width of each bank protection measure to the extent that habitat for protected species is present. For aquatic species, the lateral action area is assumed to be the near-shore aquatic environment up to the ordinary high water mark, and including adjacent terrestrial habitat of value to protected aquatic species (e.g., overhanging shade).

Analytical Framework for the Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed federal action, and any cumulative effects, on the rangewide survival and recovery of the listed species. It relies on four components: (1) the *Status of the Species*, which describes the rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the species; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the species.

Analytical Framework Adverse Modification

Section 7(a)(2) of the ESA requires that federal agencies insure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification" (DAM) was published on February 11, 2016 (81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states:

1. "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The DAM analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat*, which describes the range-wide condition of the critical habitat in terms of the key components (i.e., essential habitat features, primary constituent elements, or physical and biological features) that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the conservation value of the affected critical habitat; and (4) *Cumulative Effects*, which evaluate the effects of future non-federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the conservation value of the affected critical habitat.

For purposes of making the DAM determination, the Service evaluates if the effects of the proposed federal action, taken together with cumulative effects, are likely to impair or preclude the capacity of critical habitat in the action area to serve its intended conservation function to an extent that appreciably diminishes the rangewide value of critical habitat for the conservation of the listed species. The key to making that finding is understanding the value (i.e., the role) of the critical habitat in the action area for the conservation/recovery of the listed species based on the *Environmental Baseline* analysis.

Status of the Species

Valley Elderberry Longhorn Beetle

For the most recent comprehensive assessment of the species' range-wide status, please refer to the *Withdrawl of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened Wildlife* (Service 2014a). Ongoing threats to the valley elderberry longhorn beetle include habitat loss due to flood control projects, development projects, and invasive species. While these threats continue to affect the valley elderberry longhorn beetle within the Sacramento Valley, to date no project has proposed a level of effects for which the Service has issued a biological opinion of jeopardy for the valley elderberry longhorn beetle.

Delta Smelt

For the most recent comprehensive assessment of the species' range-wide status, please refer to page 6 of the 2010 delta smelt 5 year review (Service 2016b) and page 87264 of the 2016 Candidate Notice of Review of the status of the species (Service 2016c). Electronic copies of these documents are available at Http://ecos.fws.gov/docs/five_year_review/doc3570.pdf and https://www.gpo.gov/fdsys/pkg/FR-2016-12-02/pdf/2016-28817pdf.

Currently, the spawning stock of delta smelt appears to be at its second lowest abundance on record, the lowest having been recorded during Water Year 2016 (Table 6). The 2016 Fall Midwater Trawl (FMWT) Index was 8, the second lowest value on record. The CDFW Spring Kodiak Trawl (SKT) monitors the adult spawning stock of delta smelt and serves as an indication for the relative number and distribution of spawners in the system. The Service has calculated an absolute abundance estimate for adult spawners in water year 2017 using January and February SKT data. This absolute abundance estimate is also the second lowest on record (Table 6). The population size of adult delta smelt January-February (2017) was estimated to be between 22,000 and 92,000 fish with a point estimate of 47,786. The January-February (2016) point estimates were the lowest values since 2002 and suggested delta smelt experienced increased mortality during extreme drought conditions occurring during 2013-2015. While 2017 estimates likely represent an increase in recruitment and survival from the prior year, the continued low parental stock of delta smelt relative to historical numbers suggest the population will continue to be vulnerable to stochastic events and operational changes that may occur in response until successive years of increased population growth result in a substantial increase of abundance.

Table 6 shows various indices for waters years from 2002 to 2017. Column 2 is the CDFW FMWT by water year (i.e., the indices for calendar years 2001-2016). Column 3 is the CDFW SKT Index. Column 4 is an estimate of adult delta smelt abundance during January and February that the Service calculates from the SKT Survey.

Delta Smelt Critical Habitat

The Service designated critical habitat for the delta smelt on December 19, 1994 (Service 1994). The geographic area encompassed by the designation includes all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma sloughs; and the existing contiguous waters contained within the legal Delta (as defined in section 12220 of the California Water Code).

In designating critical habitat for the delta smelt, the Service identified the following primary constituent elements (PCEs) essential to the conservation of the species:

Primary Constituent Element 1: "Physical habitat" is defined as the structural components of habitat. Because delta smelt is a pelagic fish, spawning substrate is the only known important structural component of habitat. It is possible that depth variation is an important structural characteristic of pelagic habitat that helps fish maintain position within the estuary's low-salinity zone (LSZ) (Bennett *et al.* 2002, Hobbs *et al.* 2006).

Primary Constituent Element 2: "Water" is defined as water of suitable quality to support various delta smelt life stages with the abiotic elements that allow for survival and reproduction. Delta smelt inhabit open waters of the Delta and Suisun Bay. Certain conditions of temperature, turbidity, and food availability characterize suitable pelagic habitat for delta smelt. Factors such as high entrainment risk and contaminant exposure can degrade this PCE even when the basic water quality is consistent with suitable habitat.

Primary Constituent Element 3: "River flow" is defined as transport flow to facilitate spawning migrations and transport of offspring to LSZ rearing habitats. River flow includes both inflow to and outflow from the Delta, both of which influence the movement of migrating adult, larval, and juvenile delta smelt. Inflow, outflow, and Old and Middle Rivers flow influence the vulnerability of delta smelt larvae, juveniles, and adults to entrainment at Banks and Jones Pumping Plants. River flow interacts with the fourth primary constituent element, salinity, by influencing the extent and location of the highly productive LSZ where delta smelt rear.

Table 6. Three indicators of adult delta smelt status for water years 2002-2017.

Water Year	FMWT Index (unitless)	SKT Index (unitless)	January and February SKT Abundance Estimate (number of delta smelt) [Lower; Upper Confidence Interval]
2002	603	N/A	739,877 [506,889; 1,043,891]
2003	139	N/A	634,000 [340,811; 1,081,388]
2004	210	99.7	654,492 [370,200; 1,074,662]
2005	74	52.9	477,775 [308,015; 708,388]
2006	26	18.2	186,797 [133,663; 254,133]
2007	41	32.5	291,964 [155,148; 502,239]
2008	28	24.1	325,333 [147,533; 626,188]
2009	23	43.8	365,946 [151,439; 748,841]
2010	17	27.4	169,417 [106,837; 255,665]
2011	29	18.8	290,792 [99,502; 670,574]
2012	343	130.2	772,311 [420,904; 1,303,955]
2013	42	20.4	212,504 [95,804; 410,659]
2014	18	30.1	207,595 [110,373; 356,969]
2015	9	13.8	139,310 [66,314; 259,301]
2016	7	1.8	16,159 [7,403; 30,886]

2017	8	3.8	47,786 [21,709; 91,864]

Primary Constituent Element 4: "Salinity" is defined as the LSZ nursery habitat. The LSZ is where freshwater transitions into brackish water; the LSZ is defined as 0.5-6.0 psu (parts per thousand salinity) (Kimmerer 2004). The 2 psu isohaline is a specific point within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby *et al.* 1995). By local convention the location of the LSZ is described in terms of the distance from the 2 psu isohaline to the Golden Gate Bridge (X2); X2 is an indicator of habitat suitability for many San Francisco Estuary organisms and is associated with variance in abundance of diverse components of the ecosystem (Jassby *et al.* 1995, Kimmerer 2002). The LSZ expands and moves downstream when river flows into the estuary are high. Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from San Pablo Bay (45 kilometers) to as far upstream as Rio Vista on the Sacramento River (95 kilometers). At all times of year, the location of X2 influences both the area and quality of habitat available for delta smelt to successfully complete their life cycle. In general, delta smelt habitat quality and surface area are greater when X2 is located in Suisun Bay. Both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence.

Giant Garter Snake

For the most recent assessment of the species' range-wide status please refer to the *Giant Garter Snake (Thamnophis gigas) 5-year Review: Summary and Evaluation* (Service 2012) for the current status of the species. Ongoing threats to giant garter snake include habitat loss from water transfers, rice fallowing due to drought conditions, habitat disturbance and loss from irrigation and drainage ditch maintenance, climate change, and invasive species. While these threats continue to effect the giant garter snake throughout its range, to date no project has proposed a level of effects for which the Service has issued a biological opinion of jeopardy for the giant garter snake.

Recent studies by USGS (Halstead *et al.* 2015) have bearing on the effects of the proposed project. It has been common knowledge that giant garter snakes spend half the year, roughly November to April, brumating in uplands. Review and analysis of previous giant garter snakes across the Sacramento Valley has shown that giant garter snakes spend more than half of the time during the summer in terrestrial environments. While in terrestrial habitat in the summer the snake is often underground, particularly during high temperatures. Animal burrows, brush piles, and riprap can be used as upland refugia in order to escape predation, thermoregulate, shed, and give birth. In his paper, Halstead found that the average giant garter snake is within 10 meters of aquatic habitat during the summer.

Western Yellow-Billed Cuckoo

For the most recent comprehensive assessment of the species' range-wide status, please refer to the October 3, 2014, *Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus occidentalis)* (79 FR 59991) (Service 2014b). Ongoing threats to the yellow-billed cuckoo include habitat loss from flood control projects and maintenance, alterations to hydrology, climate change, and invasive species. While these threats continue to affect the yellow-billed cuckoo throughout its range, no project, to date, has proposed a level of effects for which the Service has issued a biological opinion of jeopardy for the yellow-billed cuckoo.

Western Yellow-Billed Cuckoo Proposed Critical Habitat

The Service proposed critical habitat for the yellow-billed cuckoo on August 15, 2014 (79 FR 48548)(Service 2014c). Critical habitat was proposed in California, Nevada, Arizona, New Mexico, Texas, Idaho, Wyoming, Utah, and Colorado. Critical habitat is defined in section 3 of the Act as: (1) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species. In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b)). The Service is required to list the known PCEs together with the critical habitat description. Such physical and biological features include, but are not limited to, the following:

1. Space for individual and population growth, and for normal behavior;
2. Food, water, air, light, minerals, or other nutritional or physiological requirements;
3. Cover or shelter;
4. Sites for breeding, reproduction, rearing of offspring, or dispersal; and
5. Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The PCEs proposed for the yellow-billed cuckoo were derived from its biological needs. In designating critical habitat for the yellow-billed cuckoo, the Service identified the following primary constituent elements essential to the conservation of the species: riparian woodlands, adequate prey base, and dynamic riverine processes:

1. Riparian woodlands are defined as mixed willow-cottonwood vegetation, mesquite-thorn-forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are greater than 325 feet in width and 200 acres or more in extent. These habitat patches contain one or more nesting groves, which are generally willow-dominated, have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats.

2. Adequate prey base is defined as the presence of a prey base consisting of large insect fauna (for example cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas.

3. Dynamic riverine process is defined as hydrological processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). This allows habitat to regenerate at regular intervals, leading to riparian vegetation with variously aged patches from young to old.

Environmental Baseline

Valley Elderberry Longhorn Beetle

Elderberry shrubs, the host plant of the valley elderberry longhorn beetle occur in riparian habitat along the waterways within the SRBPP action area. Riparian habitat that includes elderberry shrubs exists in greater amounts along the Sacramento River north of the City of Colusa where the levees are setback but they are found sporadically along the remainder of the Sacramento River down to RM 0. Riparian habitat exists in fragmented patches along the Feather, Yuba, Bear, and American Rivers. There has not been a survey of riparian habitat specifically for areas that support elderberry shrubs. Habitat loss and fragmentation are the leading threats for the valley elderberry longhorn beetle within the action area. Lang *et al.* (1989) observed fewer numbers of elderberry shrubs in the lower reach (i.e., between Sacramento and Colusa) of the Sacramento River than the northern reach (i.e., Chico to Red Bluff). They attributed this difference to the loss of elderberry shrubs and riparian habitat in the southern reach as a result of extensive flood control activities such as the construction and maintenance of levees. The Central Valley Historic Mapping Project (CSUC 2003) observed similar decreases in the amount of riparian habitat. Loss of riparian habitat between 1900 and 1990 in the Central Valley was about 80% in the Sacramento Valley (Sacramento and Solano Counties to Shasta County) (96,000 acres remaining).

Channelization, levee construction, dam construction, and flood control maintenance has resulted in loss and degradation of riparian habitat within the Sacramento Valley. The remaining riparian areas tend to be narrow, fragmented, and lack natural river processes which sustain successional processes. Fragmentation has resulted in patchy distribution of valley elderberry longhorn beetles across their range. Fragmentation of habitat makes it difficult for the poorly dispersing valley elderberry longhorn beetle to colonize restored riparian habitat planted with elderberry shrubs. Past and current maintenance of the flood control system results in the removal of woody plants on levees, in the floodplain to allow for adequate capacity, and suppresses the recruitment of new habitat in the flood system because in many areas of the flood system newly recruited vegetation is prevented from establishing on the floodplain. Additionally, while at least 6,000 acres of riparian habitat have been restored along the Sacramento River (Golet *et al.* 2013), creating natural floodplain and riverine processes along dammed rivers has not been achieved. Previous phases of the SRBPP have resulted in the rocking of 837,500 LF of bank within the SRFCP. Placement of rock for erosion control has limited the ability of natural river processes to occur. Natural river processes serve to disturb senescent riparian habitat and create early successional riparian habitat. An additional factor responsible for the degradation of valley elderberry longhorn beetle habitat in the action area is pesticide use. Pesticide use on adjacent agricultural areas and flood control levees can kill or harm the elderberry plants nearby and may adversely affect the beetle itself if insecticides are applied.

The Recovery Plan for the Valley Elderberry Longhorn Beetle was written in 1984 (Service 1984). At the time of the writing of the recovery plan there was insufficient information on the life history, distribution, and habitat requirements of the valley elderberry longhorn beetle to determine actions necessary to achieve recovery. Only interim actions that will secure known populations are discussed in the recovery plan and the 1984 recovery plan did not include delisting criteria. To date the recovery plan has not been revised or updated.

Numerous valley elderberry longhorn beetle localities are documented in the California Natural Diversity Database (CNDDB 2017). Because of the programmatic nature of this biological opinion and the lack of site specificity for future erosion repairs, the Service at this point cannot delineate the extent of valley elderberry longhorn beetle habitat on sites that will be repaired under this PBO.

Given the number of documented occurrences within the SRBPP area it is likely that valley elderberry longhorn beetle habitat will occur on some of the erosion sites.

Delta Smelt and Critical Habitat

The proposed project occurs along the Sacramento River and its tributaries. Some of the action area falls within the range of the delta smelt. EJBs that are within delta smelt habitat include Natomas, Sacramento, West Sacramento, and Southport. These areas are on the upper end of the northern range for delta smelt. Beach seine data done along the banks of the Sacramento River between Isleton and the city of Sacramento suggests that delta smelt use the this portion of the river as a migratory corridor and spawning habitat. Because of the swift currents of the Sacramento River in the action area, larval and juvenile delta smelt are transported quickly downstream to outside of the action area. It is therefore unlikely that juvenile delta smelt rear in the action area. Delta smelt are typically absent from this area between August and November. Habitat conditions in the project area have been altered due to flood control, water operations, and drought. EJBs in delta smelt habitat are highly channelized with little to no floodplain. What little floodplain is present is typically a narrow band of vegetation on benches adjacent to the levees. Drought conditions and some drought management actions have decreased suitable and available aquatic habitat in the Delta for delta smelt breeding and survival, thereby reducing the overall population. Fish surveys indicate that the relative abundance of delta smelt is very low. In the last 5 years, the fall midwater trawl (FMWT), tow net survey (TNS), and 20 mm survey results have produced some of the lowest adult and larval delta smelt abundance indexes on record. The 2016 FMWT abundance index which determines the relative population status for the delta smelt was set at 8. The 2017 SKT index is 3.8, a modest increase from the record low of 1.8 in 2016. The SKT monitors the adult spawning stock of delta smelt. The Service has recently begun the Enhanced Delta Smelt Monitoring Program to estimate abundance of delta smelt.

The Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes was written in 1996 (Service 1996). The Service is in the process of revising the Recovery Plan for delta smelt. The Service has used the most up-to-date, best available information to outline the recovery needs of delta smelt. Based on information the Service has reviewed, the Service proposes that, in order to recover, delta smelt need a substantially more abundant population, an increase in the quantity and quality of habitat, and other needs such as increasing resilience to climate change, reducing aquatic invasive macrophytes, reducing cyanobacteria blooms, and reducing disease.

Giant Garter Snake

The action area for the project encompasses snake population within the Sacramento Valley. The areas within the action area that are covered in this biological opinion consist of waterways in the form of sloughs, drainage canals, and bypass canals which provide foraging opportunities, breeding, thermoregulation, cover, and movement corridors. Adjacent to these areas are the uplands which provide basking, cover, thermoregulation, and overwintering habitat. Giant garter snake populations within the action area are believed to be relatively stable compared to the San Joaquin Valley (Service 2012). However the populations with the action area are still affected by the following threats. Urbanization in the Sacramento area, Yuba City/Marysville area, and Chico area has reduced the amount of habitat available for the giant garter snake. Rice fields in the Sacramento Valley have provided an alternate habitat for lost wetland habitat. Urbanization has resulted in the loss of rice agriculture near the above urbanizing areas. As the Sacramento Valley's population continues to grow, land use changes in the form of rice conversion are expected to continue. Previous flood control projects and the maintenance of these features can result in mortality to giant garter snakes (Hansen 1988, Brode and Hansen 1992, Hansen and Brode 1993). Maintenance activities can fragment and isolate giant garter snake habitat, prevent dispersal, and reduce availability of cover and overwintering sites. Clearing, scraping and/or re-contouring canals, ditches, and levees, destroys burrows and crevices that are used as over-wintering habitat and during the summer for thermoregulation, shedding, and giving birth. These activities are being conducted by local maintaining agencies throughout the action area. The Small Erosion Repair Program is an existing maintenance program in which DWR repairs small levee erosion projects. This project can repair up to 15,000 LF of levee per year for a 5-year period. This program incorporates on-site plantings to minimize long term effects to giant garter snake habitat.

Agricultural practices and waterways, while providing alternative habitat when farmed in rice, can also negatively affect giant garter snakes through waterway maintenance, weed abatement, discharge of contaminants into waterways, water transfers, and crop rotations. Loss of rice has been shown to reduce or exclude giant garter snakes compared to areas which are actively irrigated in rice (Wylie *et al.* 2002a, b, 2004). One of the other effects of rice fallowing is the dewatering of adjacent and nearby ditches that snakes may use as foraging habitat and movement corridors. Other factors which effect the giant garter snake population in the action area include vehicular mortality particularly where canals or aquatic habitat are bordered by roads such as the crown of the levees.

The *Recovery Plan for the Giant Garter Snake* (Service 2017) subdivided the range of the species into nine recovery units that also define nine genetically unique populations. The action area for the proposed project is located within the Colusa Basin, Sutter Basin, Butte Basin, American Basin, and Delta Basin recovery units. Recovery criteria for the giant garter snake involves creating and protecting a minimum number of habitat block pairs that are all connected hydrologically within each recovery unit and between recovery units. Features in the action area can support recovery by providing movement corridors between the populations. These waterways include: Yolo Bypass, Willow Slough Bypass, Sacramento Bypass, Knights Landing Ridge Cut, Natomas East Main Drain, Natomas Cross Canal, Coon Creek Interceptor Unit 6, Colusa Basin Drain, Sutter Bypass, Tisdale Bypass, Wadsworth Canal, Colusa Bypass, Cherokee Canal, and Butte Creek. These waterways in the action area provide important aquatic and upland habitat for snakes in areas with otherwise limited habitat and can serve as movement corridors for the snake.

Previous SRBPP have affected giant garter snake habitat. Erosion protection along the Colusa Basin Drain included monitoring by USGS (Wylie and Amarello 2008) to look at effects of three different bank stabilization treatment sections on giant garter snakes. Monitoring in 2006 found more snakes along the control section of levee than along any of the treatment sites. Of the treatment sites more snakes were found along the section with soil covered rock planted in native grasses. Snakes did use the solely rock/riprap, though at lesser numbers.

Western Yellow-Billed Cuckoo

Yellow-billed cuckoo detections have occurred most frequently in the upper Sacramento River where levees are setback from the river or do not exist and riparian habitat is present in large contiguous areas. The large historic loss of riparian habitat in the Central Valley has contributed to the decline of yellow-billed cuckoos in the Central Valley. Cuckoos have been extirpated from the San Joaquin Valley and current surveys have detected the lowest numbers ever in the Sacramento Valley (Dettling *et al.* 2015). While there has been some level of restoration done along the Sacramento River, a little over 6,000 acres as of 2012 (Golet *et al.* 2013), it is possible that the long-term loss of riparian habitat within the Central Valley and the resultant decline in population numbers cannot be offset with the amount of riparian restoration done to date. Additional threats to the cuckoo in the action area include the change in river processes due to the construction of large dams on the mainstem rivers in the Sacramento Valley and construction of levees adjacent to the bank of the river channel which does not allow for natural river processes of accretion and erosion. Control of water releases from the dams have lowered sediment supply to downstream reaches of rivers through holding sediment behind dams, changed when water is released causing the loss of spring pulses which are important for establishing native riparian habitat particularly cottonwood forests, releasing water in the summer months for irrigation purposes where historically flows were reduced, which allowed floodplains plant species to reestablish and grow, and diverting water for agricultural and municipal purposes which reduces streamflow and disallows for activation of floodplains. Erosion protection projects such as the previous phases of the SRBPP have been active since the 1960s. Flood control levees were placed close to the river banks to facilitate the transport of hydraulic mining debris. This has resulted in long-term erosion issues for the levees. Typical erosion protection involves the placement of rock rip on the bank and levee to prevent the channel from moving. Channel meander is important in the development of new riparian habitat. As older stands of riparian forest erode away through channel migration, younger stages of habitat begin to develop on accreted point bars within the river. When these natural river processes do not occur due to flood control structures, habitat does not regenerate and the riparian habitat reaches senescence with no opportunity for renewal. Long-term this will cause a decline in the habitat that yellow-billed cuckoo use for breeding.

An additional threat to yellow-billed cuckoo in the action area includes the habitat loss and degradation due to agricultural activities. In the Sacramento Valley large areas of historic floodplain have been converted to agriculture. Conversion of habitat within the last 20 to 30 years to agriculture has slowed considerably, however the operation of existing agriculture continues to affect yellow-billed cuckoos. Overspray of pesticides onto foraging habitat or pesticide drift onto surrounding riparian areas may affect prey populations. Yellow-billed cuckoos may forgo breeding in years of inadequate food supplies (Veit and Petersen 1993) which effects reproductive success.

A recovery plan has not yet been developed for the recently listed yellow-billed cuckoo. Over the last 20 years a large amount of riparian restoration has occurred in the upper Sacramento River. Habitat in the action area various from narrow and linear strips of riparian to larger tracts of floodplain riparian habitat. Above Colusa on the Sacramento and along some of the Feather River the levee is setback from the river channel allowing for the larger patches of riparian habitat that cuckoos use for breeding. Less restoration has occurred on the very constrained lower portion of the Sacramento River. There are some patches large enough to support nesting yellow-billed cuckoos, though cuckoos have not been observed nesting along the American River.

Yellow-Billed Cuckoo Proposed Critical Habitat

The action area for the proposed project is located within the yellow-billed cuckoo's proposed critical habitat Unit 2: CA-2, Sacramento River. The Sacramento River unit is about 35,418 acres and is located along the Sacramento River through Colusa, Glenn, Butte, and Tehama Counties. This unit has served as a major nesting area in the recent past along a predominately active reach of the river (PCE-1 and 3). Given the previous nest success within this unit it must also provide an adequate prey base (PCE-2). The unit is an important area to maintain for occupancy during species recovery.

Areas within critical habitat that will be affected by the project include riparian habitat that occurs at along the waterside toe of the levee or on the levee itself along the Unit 2's section of the Sacramento River. This riparian habitat could contain one or all of the three PCEs. Threats to the critical habitat in these units include bank stabilization, levee maintenance, and pesticide drift from adjacent agricultural activities.

Effects of the Proposed Action

Valley Elderberry Longhorn Beetle

Valley elderberry longhorn beetle may be affected by the bank protection projects when elderberry shrubs are present on the repair site with any of the bank protection measures. Valley elderberry longhorn beetles inhabiting elderberry shrubs that are present on project sites will be affected during construction. If present in the erosion repair footprint elderberry shrubs will either be transplanted, protected in place, or, if deemed unsafe for transplantation, destroyed on-site. Transplanting or destroying elderberry shrubs will cause mortality of the beetle because the beetle spends the majority of its life cycle in the shrub. Over the long-term even shrubs that are left in place may suffer from reduced viability due to the placement of bank protection materials near their roots. While conservation measures include restoring and creating additional riparian habitat both on-site and off-site, elderberry seedlings require 5 or more years to become large enough to provide habitat for the beetle.

Removal of elderberry shrubs from the repair sites could also lead to further degradation and of habitat and fragmentation of beetle populations. Since floodplain along the Sacramento River near the Cities of Sacramento and West Sacramento is very narrow and confined by levees very little riparian vegetation remains in that area. This is also the case along other parts of the Sacramento River and on some of the tributaries in the SRBPP. Additionally, levee maintenance over the preceding decades has removed and suppressed much of the riparian habitat, including elderberry shrubs, creating areas with no riparian habitat. Because valley elderberry longhorn beetles do not disperse far (they are relatively poor fliers) removal of individual elderberry shrubs can isolate elderberry populations through habitat fragmentation and eventually cause site extirpation of valley elderberry longhorn beetles.

The Corps has proposed a number of conservation measures to minimize effects to the valley elderberry longhorn beetle and its habitat. Reducing footprints and leaving shrubs in place through on-site protection and use of trimming will reduce habitat fragmentation. In cases where elderberry shrubs cannot remain in place the Corps is proposing to transplant elderberry shrubs to a valley elderberry longhorn beetle conservation bank. The Corps has also proposed to purchase additional acres at a valley elderberry longhorn beetle conservation bank for the transplanting and trimming of elderberry shrubs. The purchase of credits will have the effect of protecting and managing lands for valley elderberry longhorn beetle in perpetuity. The compensatory lands will provide suitable habitat for breeding, feeding, and sheltering commensurate with or better than habitat lost as a result of the proposed project. Providing this compensatory habitat as part of a relatively large, contiguous block of conserved land may contribute to other recovery efforts for the species. The Corps proposes to minimize effects to elderberry habitat connectivity by limiting the number of elderberry shrubs that are removed on a bank protection site.

Valley Elderberry Longhorn Beetle Critical Habitat

Critical habitat for the valley elderberry longhorn beetle was designated at two locations along the lower American River. One location does not have any SRFCP levees nearby and therefore will not be affected by any erosion protection projects, and the other site is on the landside of the levee which also will not be subject to bank protection. Therefore, the SRBPP will not affect valley elderberry longhorn beetle critical habitat.

Delta Smelt

Effects to delta smelt at an individual site depend on the type of bank protection measure used at the erosion site. The various bank protection measures which involve the placement of riprap will have similar effects to delta smelt. Construction of the repair site will be short-term in nature and since the Corps proposes to work when delta smelt are located further downstream and unlikely to be in construction footprint and therefore effected by construction. Placement of riprap can temporarily increase suspended sediment levels in the Sacramento River. BMPs implemented by the Corps and its contractor will minimize soil and sediment from entering the water through monitoring of water quality. Additionally, the Corps is proposing BMPs to minimize any hazardous material spill as described in their conservation measures. BMPs which will minimize any contaminant release will be fully described for each site when that site is requested to be appended to the PBO.

Riprap placement changes the substrate from natural soil or sand to rock. Delta smelt use shallow open water (0 to 3 meters) areas for rearing and breeding. Changing the substrate can reduce spawning success of delta smelt when sandy beaches previously existed at the site. Eggs laid over riprap are more likely to fall into interstitial spaces precluding the egg from rolling along the substrate to hatch. While there will be a permanent change to the substrate by the placement of rock delta smelt will still be able to use the shallow water habitat for foraging. However, the placement of riprap has been known to attract predatory fish that can prey on delta smelt. Filling erosion sites with riprap creates a homogenous velocity that is typically higher since there isn't anything to break up the water velocities. As discussed in the environmental baseline for delta smelt above, adult delta smelt that migrate up the Sacramento River are likely using it as a migratory corridor and for spawning habitat. They typically use the edges of the channel where the velocities are slower. Once they have spawned, adults and larvae are likely transported downstream in the faster currents but do not use the Sacramento River between RM 45.5 and RM 80 as juvenile rearing habitat. With all of the placement of riprap in the last 40 years and the plans to place additional riprap along the Sacramento River from the Corps' West Sacramento Flood Control Project and American River Common Features Project spawning habitat for delta smelt in the action area is very sparse. Additionally, it changes from year to year depending on the flows and the amount of sediment in the water. While delta smelt do migrate within the action area, the Service believes that low numbers of delta smelt migrate this far upstream, therefore the SRBPP is expected to affect a small proportion of the population. The Corps is proposing to mitigate the effects of riprap placement through purchase of credits at a Service-approved delta smelt conservation bank. It is our expectation that compensatory mitigation will off-set the habitat effects.

Bank protection measures that involve constructing setback or adjacent levees will have a much lesser effect on delta smelt. Adjacent levees do not involve any in-water work and would therefore avoid any adverse effects to delta smelt. Setback levee construction may not involve in-water work. Some minor in-water work may occur when the old levee is either removed or breached to open the newly established floodplain to the river. Typically, in-water work is avoided as much as possible and work is conducted when river levels are low. The Corps will incorporate BMPs to minimize any sediment entering the rivers. Long-term there is a benefit to delta smelt when constructing setback levees. Opening up more land to the river will create habitat heterogeneity. New floodplain will become revegetated either naturally or through planting native species which will increase the productivity of the river. With the loss of so much floodplain and floodplain vegetation in the action area, any additional habitat will benefit delta smelt as well as other fish species by providing increased food in the system.

Delta Smelt Critical Habitat

The SRBPP will only affect PCE #1. The placement of rock or construction of setback or adjacent levees will not affect water (PCE#2), river flows (PCE #3), or salinity (PCE #4). PCE #1 is physical habitat and that is being changed either through a substrate change from natural bank and bed materials to riprap or through the creation of additional habitat with the construction of a setback levee. Because adjacent levees will not involve any waterside work, there will be no affect to delta smelt critical habitat with this bank protection measure.

Construction of a setback levee will benefit delta smelt critical habitat by providing more available habitat for delta smelt. This new area would be new critical habitat that is only inundated during high flows in the winter. Some water years the floodplain will not be activated. However, when it is activated it will provide additional primary productivity which will benefit delta smelt by increasing their prey base. It is not expected that delta smelt will use the new floodplain for spawning, though it is possible if large sandy beaches develop on part of the floodplain that they could spawn there during wet years. Given that fewer delta smelt disperse to the action area then other areas of the estuary it is not likely that it will have a large benefit to delta smelt spawning.

Placement of rock will change the substrate of the physical habitat which will result in a loss of up to 15,000 LF (2.8 miles) of shallow water habitat. It is impossible to determine how much of the 2.8 miles of shallow water habitat has substrate that is suitable for spawning for delta smelt, especially as the substrate can change from year to year as the various water years move sediment around the river channel. The Corps is proposing to mitigate for all shallow water habitat affected from placement of riprap at a Service-approved delta smelt conservation bank. Current conservation banks are located in vicinity of Liberty Island in an area of high delta smelt concentrations and will minimize the loss of critical habitat from the riprap placement.

Giant Garter Snake

Portions of Rio Oso, Butte Basin, Yolo, West Sacramento, and Southport economically justified basins have habitat which can support the giant garter snake. Snakes have been identified in Yolo, and Sacramento Bypasses, Cherokee Canal, Knights Landing Ridge Cut, Natomas East Main Drain, Natomas Cross Canal, Yankee Slough, Pleasant Grove Canal, Coon Creek Intercept, Butte Slough, and Butte Creek. Snakes are generally not found on major rivers such as the Sacramento River due to the presence of riparian vegetation and predatory fish, which means it is possible that some project repair sites will not affect giant garter snakes or their habitat. Sites will be assessed in the planning phase for giant garter snake habitat. Either upland or aquatic habitat could be affected due to construction at the repair site, use of haul routes, and staging areas.

Bank protection repairs that involve the placement of rock that have aquatic and upland giant garter snake habitat will be affected due to conversion of natural substrate to a rock substrate. This will limit the ability of some aquatic vegetation to establish. Aquatic habitat can provide cover not just for the giant garter snake but also for their prey base, small fish and tadpoles. Snakes have been observed using riprap in upland habitat as overwintering habitat though the inability for herbaceous cover to establish, exposes the snake to increased predation. Therefore the change in substrate is still usable by the snake but at a diminished capacity. The earthmoving work that occurs when applying rock to an erosion site can crush burrows in uplands that snakes use both in winter and summer. Filling and/or crushing of burrows can both kill snakes that are in underground but also temporarily remove overwintering and refugia habitat for the snake. This is especially damaging to snakes within 10 meters of aquatic habitat as that is where snakes can predominantly be found when using upland refugia.

Use of haul roads and staging areas can also adversely affect giant garter snakes. Fuel or oil spills during construction can lead to loss of prey. Snakes may be crushed or entombed due to construction equipment movement. Increased traffic on roads can crush snakes that may be basking. Construction and staging areas can cause snakes to change movement patterns as portions of their habitat are not available for their use. This can expose them to increased risk of predation.

Upon completion of construction the upland habitat on site will be restored. Rock will be covered with soil above the ordinary high water mark and then seeded with grasses and forbs which will provide cover for the snake when moving through the upland. Over time it is likely that cracks and burrows will form on the levee surface and will provide refugia habitat for the snake.

Bank Protection Measures 1 and 3 involve building either a setback levee or an adjacent levee. While it is unclear how many of these will be built, these measures can adversely affect giant garter snake through the conversion of habitat. Typically a setback levee would convert the most giant garter snake habitat. If aquatic habitat is present on the landside of the levee in the form of emergent wetlands, rice, or canals these would be converted to either levee or floodplain. Snakes evolved with flooding, however current flood control systems have created areas that can flood quickly and deeply. Historically flooding was spread out over the valley. Therefore, converting upland or aquatic giant garter snake habitat is likely to adversely affect snakes as flooding occurs during brumation when snakes are less mobile. Snakes do not use habitat that is flooded frequently. The earthmoving activities, haul roads, and staging areas necessary for these two alternatives will have the same effects as described for the riprap bank protection measures.

The SRBPP will affect relatively small amounts of habitat over a large area within the range of the giant garter snake. This has the potential to affect connectivity that the snake relies on to disperse and move between populations. The draft recovery plan relies on some of the same waterways that are covered in this PBO for movement corridors, such as: Butte Creek; Cherokee Canal; and Knight's Landing Ridge Cut. Implementation of the bank protection measures will not remove habitat along any of the above movement corridors. Bank protection measures on these creeks and canals will likely involve measures which involve riprap. While riprap could lessen the value of the upland because snakes are more susceptible to predators, it can still function as brumation habitat and provide thermoregulation for the snake which means the waterways will still be utilized by the snake for dispersal and migration. Lands affected due to setback or adjacent levees, or as staging areas or haul routes will either be mitigated for at a Service-approved conservation bank or only temporarily affected and returned to pre-project conditions.

Conservation measures proposed by the Corps will minimize effects to the giant garter snake. Working between May 1 and October 1, when the snake is more active, will allow some snakes to move out of the construction area. Permanent habitat effects will be mitigated for as described in the conservation measures. Compensatory lands will provide suitable habitat for breeding, feeding, and sheltering commensurate with or better than habitat lost as a result of the proposed project. Providing this compensatory habitat as part of a relatively large, contiguous block of conserved land may contribute to other recovery efforts for the giant garter snake.

Western Yellow-Billed Cuckoo

Bank protection measures involving riprap placement will adversely affect yellow-billed cuckoo. Riprap placement limits or halts meandering which is a method to renew and replace riparian habitat which the yellow-billed cuckoo relies upon for breeding. This has led to much of the upper Sacramento River riparian habitat being older with less early successional habitat along the river. Adding additional rock along the river particularly between Butte Slough and Sacramento River RM

175 will further constrain the Sacramento River limiting habitat for the yellow-billed cuckoo. Under SRBPP placement of riprap typically removes a narrow bank of vegetation along the edge of the river. The Corps is proposing to construct outside of the nesting season for yellow-billed cuckoo (June through August) and should therefore avoid directly affecting yellow-billed cuckoos or their nests. Because the cuckoo nests in large habitat patches, removing a narrow band of habitat could have a relatively small effect to the overall habitat patch. The Corps will include an analysis of the effects to patch size when they consult on a site. If the vegetation removal reduces the habitat quality for nesting yellow-billed cuckoos through removal of either the area or width the mitigation proposed by the Corps will offset the larger habitat loss. The Corps has proposed a number of measures to mitigate for loss of yellow-billed cuckoo habitat. Given that it can take 10 to 20 years for riparian forest to mature to a state that the yellow-billed cuckoo can use it for nesting there will be a temporal loss of habitat for yellow-billed cuckoo. The Corps has proposed to provide a ratio of 3:1 mitigated acres to affected acres to offset the temporal effects. While it is uncertain where the future mitigation will occur the Corps has proposed to locate it in areas where active channel meandering is occurring to provide long-term riparian habitat renewal and allow for optimum prey production. Additionally, mitigation areas will follow current Service policy on mitigation including providing a conservation easement, long-term monitoring, maintenance, and funding of the site. Mitigation sites should be selected where they are either large enough to serve as nesting habitat or are contiguous with other riparian habitat to create a habitat patch that will support nesting yellow-billed cuckoos.

Riparian habitat along the Sacramento River downstream of Butte Slough, and along the American River still has potential to be used as migratory stopover habitat. This habitat is used for feeding, resting, and sheltering. It is unknown at this time how much riparian habitat will be removed due to riprap placement, but the Corps intends to protect vegetation in place on the sites and mitigate the loss of any woody riparian off-site, which over the long-term will replace loss yellow-billed cuckoo habitat.

Construction of setback and adjacent levees could have short-term negative effects to yellow-billed cuckoos. Adjacent levee construction can result in the removal of riparian vegetation that could be used for migratory stopover habitat or if could be part of a larger riparian patch that is used for breeding. As with riprap placement the Corps is proposing to mitigate the loss of riparian habitat either on-site or off-site. Mitigation sites will be selected which increase riparian habitat connectivity and/or patch sizes to benefit yellow-billed cuckoo. Because setback levees create additional floodplain habitat they are a long-term benefit for yellow-billed cuckoos particularly when the setback is large enough to allow for the river to meander and the floodplain is inundated fairly frequently in order to distribute fine sediments which aid in regeneration of riparian vegetation. However there can be short-term adverse effects to yellow-billed cuckoo habitat. If riparian vegetation exists in the footprint of the setback levee, this will be removed to allow for construction. This will be off-set through the planting of the floodplain area in riparian habitat that the cuckoo can use for foraging, sheltering, and breeding. Having riparian vegetation in the floodplain is likely to be beneficial for the cuckoo as the prey they rely reach high densities in moist sites as opposed to arid or dry sites.

Proposed Yellow-Billed Cuckoo Critical Habitat

Areas with the action area that fall within proposed critical habitat for the cuckoo include the east bank of the Sacramento River north of Colusa (about RM 145) to the end of the levee system (RM 176). This reach of levee is located in Unit 2 of the proposed yellow-billed cuckoo critical habitat. As noted above there are three PCEs specific to western yellow-billed cuckoos. The SRBPP will affect PCEs 1 and 3. Construction of the repairs will remove riparian woodland vegetation. However, because of the nature of the SRBPP erosion repairs are made where the river has meandered close to or within the levee prism. In general this means that only a narrow band of vegetation is affected when any of the BPMs are employed. For all BPMs except BPM 2 the erosion repair or setback levee will plant vegetation once construction of the site is completed. And in areas where riparian vegetation is not replaced it will be mitigated off-site on areas that do not currently support riparian habitat. Therefore, the SRBPP will not adversely modify this PCE.

BMPs such as the adjacent and setback levee will not affect PCE #3, dynamic river processes. All of the BMPs that include rock placement will negatively affect dynamic river processes as the placement of riprap does not allow the river to move across the landscape moving sediment, and promoting plant growth. The setback and adjacent levee BMPs will allow dynamic river processes to continue as they currently exist. Placement of riprap will stop erosional forces that are allowing the river to migrate across the floodplain. River migration allows for the renewal of riparian vegetation through the erosion of older vegetation and allows for accretion of sediment which over time becomes vegetated and becomes early succession riparian habitat. In an unconstrained river this will occur at regular intervals and constantly be regenerating riparian habitat that the cuckoos use for breeding. To mitigate the loss of dynamic river process the Corps is proposing mitigation measures including: removal riprap on other portions of the river and restoring riparian habitat in areas that it does not currently exist. The Corps is estimating that 5,000 LF of levee would be repaired with riprap BMPs as part of this programmatic opinion. This is out of 168,960 LF of levee within proposed yellow-billed cuckoo critical habitat on the east side of the Sacramento River and a total of 1,013,760 LF of river bank within all of Unit 2 on the Sacramento River. The 5,000 LF represents a very small amount of bank protection and will not adversely modify critical habitat.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Valley Elderberry Longhorn Beetle
State, local, and private actions which occur within the action area and effect valley elderberry longhorn beetle include agricultural activities, flood maintenance activities, and recreation. Elderberry shrubs adjacent to agricultural fields are exposed to pesticide drift. If insecticides are applied during the beetle's flight season it can cause the death of the beetle or disruption of its reproduction cycle. Levee and channel maintenance requires vegetation removal which can both remove elderberry shrubs and suppress their regeneration, limiting the areas that shrubs can grow. Additionally, many levee maintainers spray herbicides along the levee to kill vegetation in order to inspect levees. In urban areas recreational activities can affect valley elderberry longhorn beetle habitat. Fisherman have cut down shrubs to gain access to the rivers and fires started by people out on the river have spread and burned acres of habitat along the lower American River. All of these activities are expected to continue in the future.

Delta Smelt

In the action area the following actions affect delta smelt: agricultural practices; urbanization and industrialism; and greenhouse gas emissions. Agricultural practices introduce nitrogen, ammonium, and other nutrients into the watershed. Additionally, numerous pesticides and herbicides applied to the fields enter irrigation discharges and may negatively affect delta smelt reproductive success.

Urbanization in the cities of West Sacramento and Sacramento will result in an increase of contaminants such as pesticides, oil and gasoline, pharmaceuticals, and ammonia entering the Sacramento River. These contaminants may adversely affect delta smelt reproductive success, survival rates, and food supply.

It is extremely likely that human activities increasing greenhouse gases have caused global warming (Huber and Knutti 2012). A variety of climate models have been used to estimate warming projections and all project increasing global warming through the end of this century. Climate change will likely adversely affect delta smelt through sea level changes and overall wet and dry cycles which may result in changes to availability and distribution of habitat and prey, and/or increase numbers of predators, parasites, diseases, and non-native competitors.

Giant Garter Snake

Non-federal activities that affect the giant garter snake in the action area include agricultural practices and levee and canal maintenance. Agricultural practices such as pesticide application particularly in rice fields can affect snakes in the fields or the drainage canals which carry away the water. Additionally, rice markets change from year to year resulting with a changing amount of habitat available to the snake. Levee and canal maintenance can adversely affect giant garter snakes through direct contact such as removing sediment from canals. Many local landowners and reclamation districts then place the spoils on the adjacent uplands which is where the majority of snakes use upland habitat (within 10 meters of aquatic habitat) and become entombed in burrows. Additional levee maintenance such as mowing and burning can adversely affect giant garter snakes. Any earth moving activities along the levees within 200 feet of aquatic habitat could hurt or injure a giant garter snake. Traffic both from agricultural activities and levee maintenance has the potential to kill basking giant garter snakes. Filling of ground squirrel holes in levees by pumping grout into the hole will entomb giant garter snakes in the burrows.

Western Yellow-Billed Cuckoo

Activities that could affect yellow-billed cuckoos in the action area include creation of recreation trails, conversion of riparian to agriculture, and flood maintenance activities. Recreational trails can disturb or harass yellow-billed cuckoos when trails are located adjacent or within cuckoo breeding habitat. Construction equipment that is used for creation of the trail has the potential to disrupt nesting yellow-billed cuckoos. While a lot of the conversion of riparian to agriculture occurred early in the 20th century, there are still instances of landowners converting riparian habitat to agriculture particularly when certain crops such as nuts become more profitable. Agriculture adjacent to riparian habitat that could be used by the yellow-billed cuckoo also has the potential to affect the cuckoo and its habitat through the use of pesticides and drift of pesticides damaging both the riparian vegetation as well as the prey base of the cuckoo. Flood maintenance activities which primarily affect cuckoo include vegetation removal and suppression. DWR is responsible for keeping the floodways clear and open to maintain capacity and will remove vegetation or suppress vegetation in areas of limited capacity. This has resulted in discontinuous riparian habitat throughout the system.

Conclusion

Listed Species/Critical Habitat

After reviewing the current status of valley elderberry longhorn beetle, delta smelt, giant garter snake, and western yellow-billed cuckoo, the environmental baseline for the action area, the effects of the proposed Sacramento River Bank Protection Phase II 80,000 LF, and the cumulative effects, it is the Service's biological opinion that projects which meet the qualifications for this PBO are not likely to jeopardize the continued existence of the valley elderberry longhorn beetle, delta smelt, giant garter snake, and western yellow-billed cuckoo. The Service reached this conclusion because the project-related effects to the species, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding recovery or reducing the likelihood of survival of the species based on the minimization measures, the work windows proposed for construction, and the purchase of mitigation credits at conservation banks.

After reviewing the current status of designated critical habitat for the valley elderberry longhorn beetle and delta smelt, the environmental baseline for the action area, the effects of the proposed Sacramento River Bank Protection Phase II 80,000 LF, and the cumulative effects, it is the Service's biological opinion that the Sacramento River Bank Protection Phase II 80,000 LF, as proposed, is not likely to destroy or adversely modify designated critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of the valley elderberry longhorn beetle and delta smelt critical habitat to serve its intended conservation role for the species based on the following. The effects to critical habitat are small and discrete, relative to the entire area designated as critical habitat, and are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of the valley elderberry longhorn beetle and delta smelt.

Proposed Critical Habitat

After reviewing the current status of proposed critical habitat for the western yellow-billed cuckoo, the environmental baseline for the action area, the effects of the proposed Sacramento River Bank Protection Phase II 80,000 LF, and the cumulative effects, it is the Service's conference opinion that the Sacramento River Bank Protection Phase II 80,000 LF, as proposed, is not likely to destroy or adversely modify proposed critical habitat. The Service reached this conclusion because the project-related effects to the designated critical habitat, when added to the environmental baseline and analyzed in consideration of all potential cumulative effects, will not rise to the level of precluding the function of the western yellow-billed cuckoo critical habitat to serve its intended conservation role for the species based on the following. The effects to critical habitat are small and discrete, relative to the entire area designated as critical habitat, and are not expected to appreciably diminish the value of the critical habitat or prevent it from sustaining its role in the conservation of the western yellow-billed cuckoo.

INCIDENTAL TAKE STATEMENT

The proposed action addressed in this biological opinion conforms to a "framework programmatic action" as that term is defined at 50 CFR 402.02 of the implementing regulations for section 7. On that basis, no take is anticipated to be caused by the proposed action. Pursuant to the authority under 50 CFR 402.14(i)(6), an incidental take statement is not required at the programmatic level for such an action. Incidental take resulting from any action subsequently authorized, funded, or carried out under such a program will be addressed in subsequent section 7 consultation, as appropriate, on that action(s). For these reasons, no take exemption is provided herein for the proposed action.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. The Service recommends the Corps develop and implement restoration measures in areas designated in the Delta Fishes Recovery Plan (Service 1996). These include: develop additional habitat and vegetation zones within the Delta (particularly the Cache Slough Complex); restore marshland within the Delta; manage bypasses for fish; and develop and implement alternative levee maintenance practices such as the incorporation of natural river berms setback from current levee alignments.

2. The Corps, under the authority of section 7(a)(1) of the Act, should implement project which benefit the valley elderberry longhorn beetle, delta smelt, giant garter snake, and yellow-billed cuckoo. The Corps could make use of ecosystem restoration programs such as Section 1135 and 206 of the respective Water Resource Development Acts of 1986 and 1996.

3. The Corps should partner with CVFPB and implement projects which meet measurable objectives within the 2017 Conservation Strategy, an appendix to the 2017 Central Valley Flood Protection Plan. The Conservation Strategy was written to off-set flood projects as well as provide enhancements that would benefit species which have declined due to past flood protection projects.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation and conference on the SRBPP Phase II 80,000 LF Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service where discretionary federal agency involvement or control over the action has been retained or is authorized by law and:

(a) If the amount or extent of taking specified in the incidental take statement is exceeded;

(b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or

(d) If a new species is listed or critical habitat designated that may be affected by the identified action.

You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the critical habitat is designated. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the project. After critical habitat is designated, reinitiation of consultation will occur.

If you have any questions regarding this biological opinion, please contact Jennifer Hobbs (jennifer_hobbs@fws.gov) or (916) 414-6541 or Doug Weinrich, Assistant Field Supervisor (douglas_weinrich@fws.gov) or (916) 414-6563 or both.

Sincerely,

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Appendix L

National Marine Fisheries Service Programmatic Biological Opinion, August 30, 2019

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Refer to NMFS No: WCRO-2019-01893

August 30, 2019

Ms. Alicia Kirchner
Chief, Planning Division
Department of the Army
United States Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations for the Sacramento River Bank Protection Project Post Authorization Change Report.

Dear Ms. Kirchner:

Thank you for your letter of July 11, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for Sacramento River Bank Protection Project Post Authorization Change Report (SRBPP PACR).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action. NMFS' review concludes that the program will adversely affect the EFH of Pacific Coast Salmon in the action area, and has included conservation recommendations to minimize these effects.

The enclosed biological opinion (BO) analyzes the effects of the U.S. Army Corps of Engineer's (USACE) SRBPP PACR as a "Framework Programmatic" action. This is considered a Framework Programmatic BO because the biological assessment (BA) included general project details including design, possible locations, effects, and because subsequent bank protection actions are to be developed in the future. Any take of a listed species associated with implementation of SRBPP PACR would be covered under future ESA section 7 consultation (50 CFR Part 402.02) associated with each action. Therefore, an Incidental Take Statement is not included as part of this Framework Programmatic BO. Rather, USACE will request consultation on individual actions or suites of actions under the SRBPP PACR, including a description of the expected effects to species and critical habitat, and any avoidance or minimization measures, in order for NMFS to complete ESA consultation, including exempting incidental take as appropriate.

The enclosed BO, based on the BA and best available scientific and commercial information, concludes that the proposed SRBPP PACR is not likely to jeopardize the continued existence of the federally-listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU), the threatened Central Valley spring-run Chinook salmon ESU (*O. tshawytscha*), the threatened southern distinct population segment DPS of the North American green sturgeon (*Acipenser medirostris*), and the threatened California Central Valley steelhead (*O. mykiss*) (DPS) and is not likely to destroy or adversely modify their designated critical habitats.

Because the proposed action will modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources under the Fish and Wildlife Coordination Act (16 U.S.C. § 662(a)).

Please contact Ally Lane in the NMFS West Coast Region's California Central Valley Office at (916) 930-5617 or via email at Allison.Lane@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Maria Rea

Maria Rea
Assistant Regional Administrator
California Central Valley Office

Enclosure

cc: To the file 151422-WCR2017-SA00268
Environmental Planning Section, U.S. Army Corps of Engineers, Sacramento District
Brian Mulvey, Brian.M.Mulvey@usace.army.mil
Patricia Goodman, Patricia.K.Goodman@usace.army.mil

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations

Sacramento River Bank Protection Project Post Authorization Change Report

National Marine Fisheries Service Environmental Consultation Organizer Number: WCRO-2019-01893

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central Valley spring-run Chinook Salmon ESU (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
California Central Valley steelhead Distinct Population Segment (DPS (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon (*A.medirostris*)	Threatened	Yes	No	Yes	No
Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*)	Endangered	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: Maria Rea

Maria Rea
Assistant Regional Administrator

Date: August 30, 2019

LIST OF ACRONYMS

ADCP	acoustic Doppler current profiler
BA	biological assessment
BMP	best management practices
BO	biological opinion
BPM	bank protection measure
CCV	California Central Valley
CCVO	California Central Valley Office
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CNFH	Coleman National Fish Hatchery
CRR	cohort replacement rate
CV	Central Valley
CVP	Central Valley Project
CVFPB	Central Valley Flood Protection Board
Delta	Sacramento-San Joaquin Delta
DPS	distinct population segment
DQA	Data Quality Act
DWR	California Department of Water Resources
DWSC	Deep Water Ship Channel
EBMUD	East Bay Municipal Utilities District
EFH	Essential Fish Habitat
EJB	Economically-Justified Basins (*per* USACE connotation)
ERDC	USACE Engineer Research and Development Center
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ETL	Engineering Technical Letter
FWCA	Fish and Wildlife Coordination Act
FRFH	Feather River Fish Hatchery
HMMP	green sturgeon habitat, mitigation, and monitoring plan
ITS	Incidental Take Statement
IWG	Inter-Agency Working Group
IWM	instream woody material
JPE	juvenile production estimate
LF	linear feet
LM	levee mile
LSNFH	Livingston Stone National Fish Hatchery
LWM	large woody material
mm	millimeter
MMP	Mitigation and Monitoring Plan
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

O&M	Operation and Maintenance
PACR	Post Authorization Change Report
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
PDT	Project Development Team
PED	Preconstruction Engineering and Design
PL	Public Law
PVA	Population Viability Analysis
RBDD	Red Bluff Diversion Dam
RD	Reclamation District
Reclamation	United States Department of the Interior, Bureau of Reclamation
RM	River Mile
RPA	Reasonable and Prudent Alternative
RST	rotary screw trap
SAM	Standard Assessment Methodology
sDPS	southern Distinct Population Segment
SJRRP	San Joaquin River Restoration Program
SRA	shaded riverine aquatic
SRBPP	Sacramento River Bank Protection Project
SRFCP	Sacramento River Flood Control Project
SWP	State Water Project
USACE	United State Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VFZ	vegetation free zone
VSP	Viable Salmonid Populations
WRDA	Water Resources Development Act

NOTE: Throughout this document there are references cited as CDFG, which refers to the California Department of Fish and Game. This name was changed to California Department of Fish and Wildlife (CDFW) on January 1, 2013. However, for consistency on publications, references prior to January 1, 2013, will remain cited as CDFG.

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

This introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (BO) portion of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR Part 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR Part 600.

Because the proposed action would modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources, and enabling the Federal agency to give equal consideration with other project purposes, as required under the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661 et seq.).

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the NMFS California Central Valley Office.

1.2 Proposed Federal Action

“Action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR Part 402.02).

Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR Part 600.910).

Under the FWCA, an action occurs whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license” (16 USC 662(a)).

The U.S. Army Corps of Engineers (USACE) proposes to implement levee protection measures and flood risk management improvements under the authorization of the Sacramento River Bank Protection Project Post Authorization Change Report (SRBPP PACR), a smaller portion of the overall and long running SRBPP. The future actions associated with this programmatic BO include levee bank repair projects that would occur within the SRBPP PACR program area, which encompasses the levees and weirs of various basins within the Sacramento River Flood Control Project (SRFCP). The overall SRBPP PACR program encompasses over 1,000 miles of levees and weirs. This area extends south-to-north along the Sacramento River, from the Town of Collinsville, river mile (RM) zero, upstream to Chico at RM 184. The SRBPP PACR also includes Cache Creek, the lower reaches of Elder and Deer Creeks, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), portions of Three mile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs, as well as a number of flood bypasses and distributaries (Figure 1).

According to the USACE, the Federal government maintains oversight, but has no ownership of, or direct responsibilities for, performing maintenance of the Federal levee system, except for a few select features that continue to be owned and operated by USACE. This should not be confused with the limited maintenance that may occur during site establishment following an erosion repair completed as part of the SRBPP as described in Section 1.3.5. USACE would be responsible for ensuring that conservation measures and environmental standards are clearly stipulated in permits and all required documentation is maintained. USACE would provide the Central Valley Flood Protection Board (CVFPB) with an updated Operations and Maintenance (O&M) manual detailing any changes made to the levee as the result of the repair and any additional long-term maintenance requirements, including vegetation maintenance. A CVFPB Permit is required for every proposal or plan of work, including the placement, construction, reconstruction, removal, or abandonment of any landscaping, culvert, bridge, conduit, fence, projection, fill, embankment, building, structure, obstruction, encroachment or works of any kind, and including the planting, excavation, or removal of vegetation, and any repair or maintenance that involves cutting into the levee, wholly or in part within any area for which there is an Adopted Plan of Flood Control, as defined by California Code of Regulations (CCR) Title 23, Division 1, and must be approved by the CVFPB prior to commencement of work. (CVFPB, 2014)

USACE asserts that they have no discretion in regards to the continuing existence and operation of the flood control structures of the SRFCP. USACE asserts that the responsibility to maintain Civil Works structures, so that they continue to serve their congressionally authorized purposes, is inherent in the authority to construct them and is therefore non-discretionary. Furthermore, USACE asserts that they have a non-discretionary duty to maintain the SRFCP and that perpetuating the project's existence is not an action subject to consultation. USACE maintains that only Congressional actions to de-authorize the structures can alter or terminate this responsibility and thereby allow the maintenance of the structures to cease. Therefore, USACE concludes, that impacts attributable the existence of the levees or to non-discretionary operations are subsumed within the impacts of the environmental baseline rather than the effects attributable to the proposed action.

The proposed action is based on the framework for implementation of the SRBPP PACR. The framework primarily consists of USACE site Selection process, which outlines the steps for implementation from annual inventories of erosion sites all the way through to project construction and site turnover to the local sponsor. This process applies many evaluation steps and considers a variety of site-specific Bank Protection Measures (BPMs) to identified erosion sites within the seven identified economically-justified basins (EJBs). The selection of BPMs for each site will be based on the unique characteristics of each site.

USACE compiled a list of known erosion sites from the latest inventory to show the locations of potential future repairs (Table 2-2). There are a total of 35 erosion sites identified within the seven EJBs (see Figure 1) with estimated total site length of 20,535 feet. Table 2-1 shows how many erosion sites and total site length are located within each EJB. For the purposes of this consultation, there is no limit to the number of erosion sites, but limiting the linear footage to 30,000 linear feet (LF) within these seven basins to be covered programmatically.

Major considerations of selecting BPMs for each site are avoiding, minimizing, and mitigating negative impacts to fish and wildlife habitat. The process also includes preliminary Standard Assessment Methodology (SAM) evaluations to determine likely losses and necessary gains to habitat, which is described in further detail later in this BO. For some of the sites on this list, there is some preliminary information identified for future repair within the EJBs. These sites were identified in earlier inventories and designs were tentatively developed for economic analysis purposes in 2007. These sites will need to be re-evaluated, and designs will need to be revised under the proposed site selection process, in order to consider and incorporate other opportunities or constraints, most of the sites have not been evaluated yet for developing potential designs.

While attempting to optimize habitat features and function in the designs, fully replacing habitat loss is not always feasible. These deficits may require additional mitigation, either in the form of off-site habitat creation or enhancement, or through the purchase of off-site mitigation credits as appropriate. Off-site mitigation may be acceptable to USACE, CVFPB, and resource agencies on a site-specific basis provided that it compensates for the values being lost, and will be provided within the environmental sub-region of impact (e.g., 1a, 1b, 2 or 3). The proposed action utilizes the approach taken over the last decade, which primarily focused on recreating streambank habitats on-site through the use of constructed benches with riparian vegetation, with adjustments to account for implementation of the *Engineer Pamphlet* (EP) 1110-2-18, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures (USACE 2019).

Table 1. List of Currently Identified Erosion Sites within the Seven Economically-Justified Basins with Proposed Bank Protection Measures, if Available.

Region	Site Identification				Length (ft.)	BPM	Includes SAM Species?
1a	Cache Creek	LM	2.4	L	218	ND	No
1a	Cache Creek	LM	5.4	L	198	ND	No
1a	Knights Landing Ridge Cut	LM	3.5	R	418	ND	No
1a	Knights Landing Ridge Cut	LM	3.9	R	366	ND	No
1b	Lower American River	RM	1.8	L	190	ND	Yes
1b	Natomas Cross Canal	LM	3.0	R	191	ND	Yes
1b	Sacramento River	RM	50.3	L	89	ND	Yes
1b	Sacramento River	RM	52.4	L	117	ND	Yes
1b	Sacramento River	RM	52.7	L	158	ND	Yes
1b	Sacramento River	RM	53.8	L	155	ND	Yes
1b	Sacramento River	RM	54.8	L	325	ND	Yes
1b	Sacramento River	RM	55.2	L	866	ND	Yes
1b	Sacramento River	RM	55.5	L	384	ND	Yes
1b	Sacramento River	RM	55.7	R	1,150	ND	Yes
1b	Sacramento River	RM	56.5	R	465	4b	Yes
1b	Sacramento River	RM	56.6	L	262	4a	Yes
1b	Sacramento River	RM	56.7	R	662	4b	Yes
1b	Sacramento River	RM	58.5	L	386	5	Yes
1b	Sacramento River	RM	62.9	R	537	4b	Yes
1b	Sacramento River	RM	78.3	L	654	5	Yes
1b	Yankee Slough	LM	1.7	L	147	ND	Yes
2	Bear River	RM	0.8	L	452	5	Yes
2	Bear River	RM	1.9	L	432	ND	Yes
2	Bear River	RM	2.5	L	222	ND	Yes
2	Feather River	RM	0.6	L	901	4a	Yes
2	Feather River	RM	1.0	L	1,054	ND	Yes
2	Feather River	RM	3.8	L	2,094	ND	Yes
2	Feather River	RM	5.0	L	1,666	4a	Yes
2	Feather River	RM	5.8	L	1,030	ND	Yes
2	Feather River	RM	6.0	L	487	ND	Yes
2	Feather River	RM	6.6	L	710	ND	Yes
3	Sacramento River	RM	152.6	L	1,555	ND	Yes
3	Sacramento River	RM	152.8	L	299	4b	Yes
3	Sacramento River	RM	168.3	L	149	4b	Yes
3	Sacramento River	RM	172.0	L	1,546	4b	Yes

Table 1 (continued). List of Currently Identified Erosion Sites within the Seven Economically-Justified Basins with Proposed Bank Protection Measures, if Available.

LM = levee mile; RM = river mile; L = left bank; R = right bank; BPM = bank protection measure; ND = not determined.

Bank Protection Measure Legend

4a: Riparian Bank with Revegetation and Instream Woody Material above Summer/Fall Waterline 4b: Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

4c: Riparian and Wetland Benches with Revegetation

5: Bank Fill Stone Protection with On-Site Vegetation

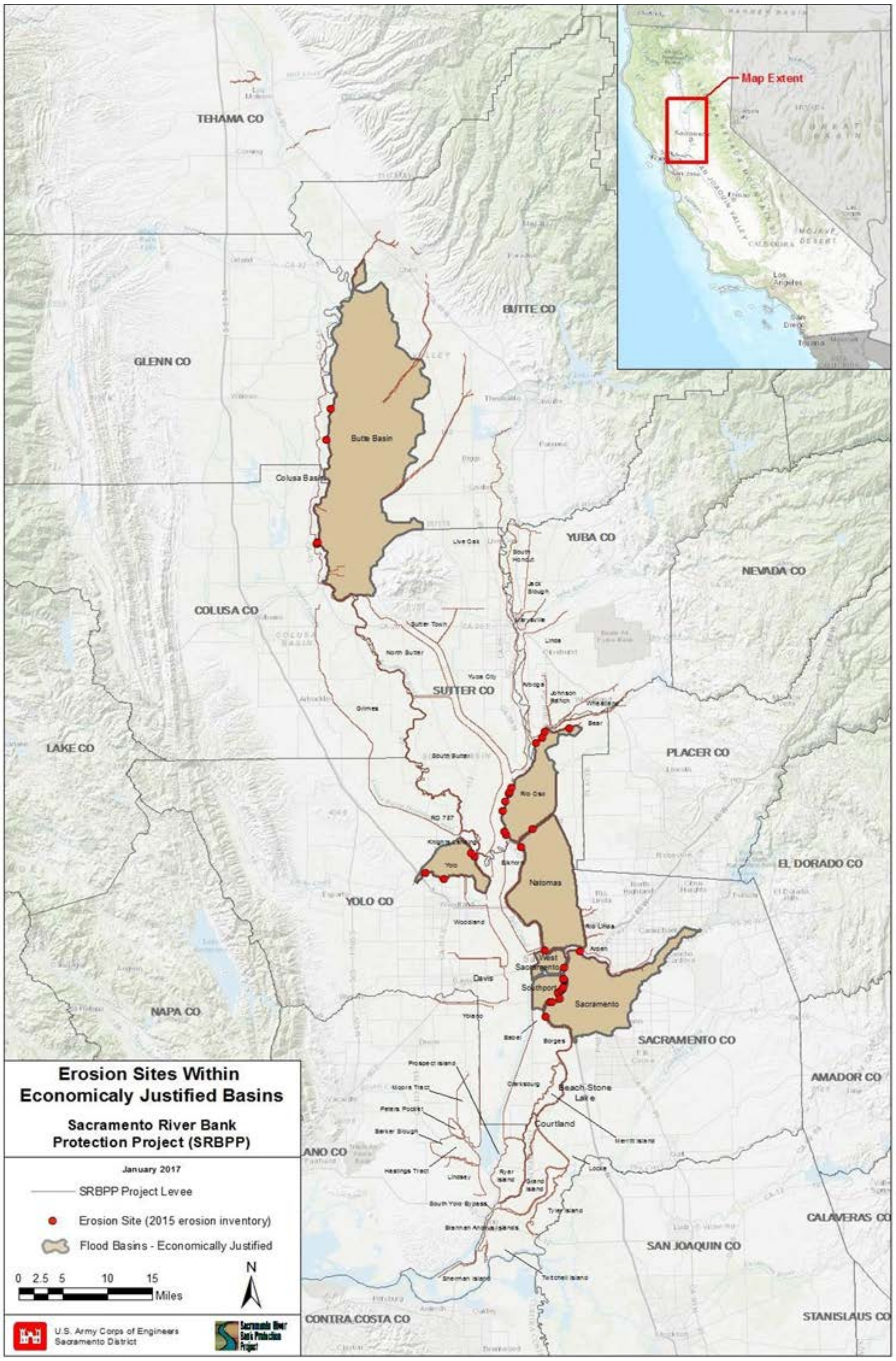

Figure 1. Erosion Sites Identified in Economically Justified Basins.

1.2.1 Site Selection Process

The framework for implementation of this program primarily consists of the Site Selection Process, summarized below, which identifies the steps and pathway from identification of erosion sites to construction and ultimately site turnover to the local sponsor. It includes several steps where project decisions can be influenced to assure environmental effects are appropriately identified, characterized, addressed and mitigated, if needed. Appendix B provides a full description of the Site Selection Process.

The following process will be followed prior to selecting final BPMs for specific erosion sites:

1. **Reconnaissance/Erosion Inventory.** During the reconnaissance trip, a team reviews the existing erosion sites, identifies new sites, and checks the previously repaired sites. This is typically done annually, and it is possible for resource agency staff to participate in these inventories, to help identify potential issues and opportunities.
2. **Critical Site Decision.** This decision step of site selection allows for a fast-track path for critical sites.
3. **Engineering Ranking and Report.** The third step of site selection involves the development of a report and an engineering site ranking based on the information collected during the erosion reconnaissance inventory.
4. **Justification Screening.** This step includes an economic analysis and other work necessary to determine if repairing a site is justified using a risk-based approach. While Step 3 looks only at the likelihood of a breach, this step examines the consequences as well. All sites deemed critical will be recorded in the Critical Site Memorandum. Since critical sites will go through an expedited pathway, this Memorandum serves the purpose of documenting which sites were identified as critical.
5. **Identify Opportunities and Constraints.** During this step of the process, all the potential issues and opportunities associated with each site are identified. This step addresses real estate, environmental resources, constructability, cultural resources, and the grouping of sites. Opportunities and constraints are presented and discussed with the Interagency Working Group (IWG), which includes representatives from NMFS, USFWS, CDFW, project partners, and appropriate stakeholders. This step identifies sites where a variance would be applicable and is when the first steps of the variance request process would be initiated. This is a key opportunity for resource agencies to provide input about listed species concerns and opportunities to avoid/minimize impacts or improve/optimize habitat function.
6. **Conceptual Level Alternatives.** Under this step, the team develops conceptual-level designs and costs. Historically, SRBPP sites have been repaired mostly with riprap. As the SRBPP has progressed, a need has been identified to repair sites with design alternatives that minimize environmental impact while providing bank protection. The PDT is now looking at multiple design alternatives such as planting benches and setback levees. If a site is selected for repair, further analysis and data collection will

occur during the preconstruction engineering and design (PED) phase to verify and refine conceptual alternatives as necessary.

7. **Site Lock-in Procedure.** Step 7 will select which of the sites will move on to the list for site repairs. Selected sites are generally anticipated to be repaired over a three year period, which makes up a construction cycle. If a site becomes critical (critical only in terms of likelihood of breach and not considering consequences) before the next site selection and implementation cycle, then it may be fast-tracked to Step 8.

8. **Site Selection Lock-in List and Report.** For Step 8, the top sites chosen in Step 7 and the fast-tracked critical sites will be considered the locked-in sites selected for repair in the construction cycles. A report will be written to document how and why the locked-in sites were selected for repair. This report will primarily be for USACE to use and to keep a historical record of the process. The identified sites will be grouped into construction cycle-years, based on the required time needed to acquire real estate and similar construction repair methods or site proximity in order to enhance the value per dollar spent.

9. **Data Collection.** For this step, the PDT will start collecting the data needed to develop the designs. The exact information and the level of detail collected at each site will vary from site to site. Some of the data to be collected includes topographic surveys, geotechnical explorations, tree inventory, potentially impacted endangered species and associated habitat, Hazardous Toxic Radioactive Waste survey, cultural information, and utility survey. Topographical surveys, tree surveys, and bathymetry data will be used to evaluate if a site will require a variance request. After sites have been selected, the PDT will look at the preliminary evaluation results of “unlikely, likely, or unknown” made in Step 1 and compare them with the survey data. Then a determination of “yes or no” will be made to identify which of the selected sites will likely require a variance or design deviation request, based on the chosen design alternative. This step may provide an opportunity for resource agencies to identify data collection to address uncertainties related to impacts to listed species.

10. **Preliminary Designs and Draft Environmental Document.** This step begins the PED process and the drafting of documentation to comply with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), including an Environmental Analysis (EA) and Initial Study (IS) or an EIS/EIR as needed. The designs for each site are confirmed and 30% designs (plans, specifications, and Design Document Report [DDR]) and cost estimates are completed. The cultural resources personnel will consult with the State Historic Preservation Office and the Native American Tribes. USACE will initiate Section 7 consultation during this step, and will include site-specific details and analysis with the request to append this to the programmatic consultation.

11. **Draft Final Design, Final NEPA/CEQA Document, and Pre-Construction Activities.** After an internal review of the plans, the 90% Plans and Specifications are developed,

Section 7 consultation is completed, and the Final NEPA/CEQA decision document is signed.

12. **Review and Final Design.** The official Agency Technical Review and Independent External Peer Review (Type II IEPR, Safety Assurance Review) is performed throughout the development of the plans and specifications and the DDR. Revisions to the designs and contract documents are made based on these reviews, resulting in the 100% DDR and Plans and Specifications for contract advertisement.
13. **Contracting Procedure.** USACE compiles the final plans and specifications, provides the signed “Biddability” (the ability to get a bid), Constructability, Operability and Environmental review, and processes the funding element for construction. Any offsite mitigation is purchased during this time prior to commencement of construction.
14. **Construction.** The contractor constructs the bank repair following the Notice to Proceed.
15. **Mitigation Monitoring.** On-site mitigation requires monitoring to ensure the establishment criteria is met for vegetation growth and survival. The monitoring period must be sufficient to demonstrate that the compensatory mitigation has met performance standards, but not less than five years (see 33 CFR Part 332.6(b)). Monitoring reports are required on a yearly basis. Mitigation monitoring will be planned and coordinated with resource agencies to assure adequacy of monitoring and success of mitigation actions.
16. **Site Turn-over.** Once the construction and mitigation monitoring is complete, USACE turns the site over to the CVFPB, which then turns the site over to the local maintaining agency. USACE provides an amended O&M manual describing any changes made to the levee and new requirements for O&M, including maintenance of any onsite mitigation features in perpetuity.

As described in Section 1.4, “Future Consultation Approach”, if the site meets conditions outlined in the Programmatic BO, USACE will provide additional site-specific information and evaluation with a request to have the site appended to the Programmatic BO and covered under the associated incidental take statement. Figure 2-5 shows a flow chart that illustrates the Site Selection Process. For more detail on USACE’s site selection process, included is a full description in Appendix B. As identified in steps 1, 5, 6, 9, 10 and 15 above, there are several opportunities for resource agencies to contribute ideas and help guide the decisions for individual erosion site repairs prior to the NEPA and ESA consultation processes. In addition, USACE is committed to regular IWG meetings to regularly discuss project sites as they move through this Site Selection Process.

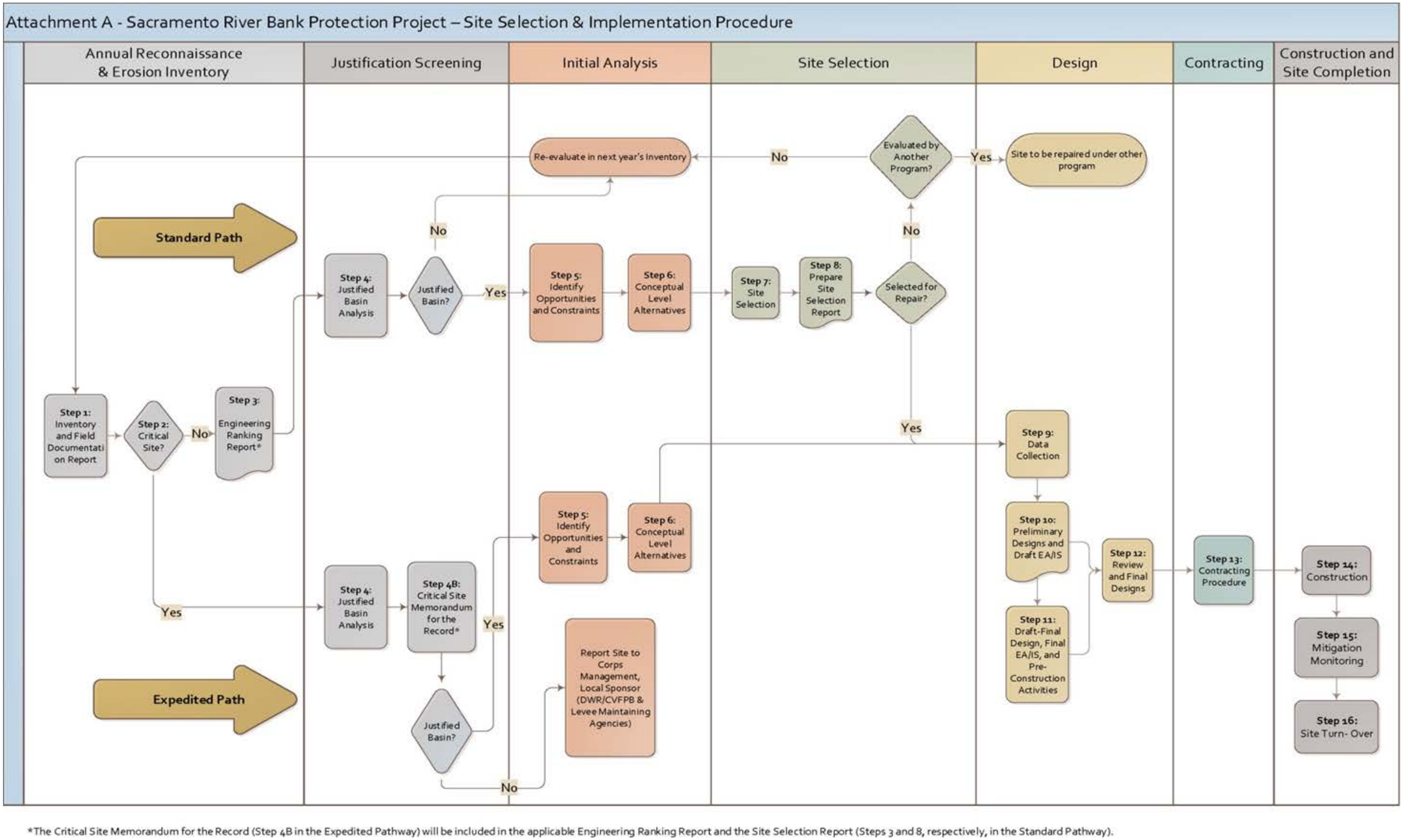

Figure 2. Flow Chart Illustrating the Site Selection Process.

1.2.2 Risk Based Assessment and Requests for Variances

The proposed action includes full compliance with the *EP 1110-2-18* (USACE 2019) and *Implementation Guidance for Section 3013 of the Water Resources Reform and Development Act* [WRRDA] *of 2014, Vegetation Management Policy* (USACE 2017). At many erosion sites, it is likely that there will be limited to minimal on-site design features that may benefit target fish species without securing a variance or design deviation. Requesting a variance or design deviation requires a risk-based assessment that informs decisions more specifically regarding vegetation on levees, and may allow for inclusion of additional features to increase habitat value for various species. This process requires conducting a semi-quantitative risk assessment (SQRA) consisting of the following steps:

1. The facilitator presents an in briefing including a schedule, the objective of the Vegetation Risk Assessment, and a description of the steps in the SQRA process based on the Institute for Water Resources Risk Management Center PowerPoint training presentation for conducting an SQRA.
2. The geotechnical team member presents the Levee Screening Tool (LST) briefing presentation as an introduction to site conditions.
3. The team landscape architect presents information on the trees left in the vegetation free zone as well as the proposed plantings.
4. The team hydraulics engineer presents results of the scour analysis based on a toppled tree.
5. The risk assessment team brainstorms potential failure modes (PFMs) that involve existing or proposed vegetation, and develop short descriptions of each PFM.
6. Non-credible PFMs are eliminated, and the team prepares a short paragraph supporting the non-credible designation.
7. Edited and complete descriptions are prepared for credible PFMs, and the team discusses and develops lists of factors that increase or decrease the likelihood of each PFM.
8. Each team member develops conditional probability estimates for each credible failure mode. Probability estimates are developed for PFMs as a whole, as opposed to developing probability estimates for each node on an event tree. Team members then vote on the likelihood of failure for each PFM. For the first ballot, team members independently evaluate on how to arrive at probability estimates. However, team members typically combine probabilities for several steps in the PFM description to arrive at an overall probability of failure estimate.
9. Results of the first ballot are tabulated and presented to the team. The results are discussed with particular emphasis on the lowest and highest probability estimates for each PFM.
10. The team votes by secret ballot a second time. The results of the first and second ballots are presented in a table for review.

A risk assessment is required to deviate from design standards. No deviations are allowed if there is an increase to incremental life safety risk.

For this action, USACE will seek a variance or design deviation if it is determined to be necessary to maximize on-site features that will adequately offset any losses from the action. During the site selection process, USACE will include additional data collection to support site- specific risk-based assessments and request a variance or design deviation as appropriate.

1.2.3 Current Erosion Sites

USACE Sacramento District and their non-Federal sponsor, CVFPB, conduct annual field reconnaissance reviews of the Sacramento River Flood Control System. Specific criteria are used to identify erosion sites within the system as described in USACE's Field Reconnaissance Report of Bank Erosion Sites and Site Priority Ranking (Ayres Associates 2007). In most cases, the criteria are based on bank and levee conditions that are threatening the function of the flood control system. An erosion site is defined as:

A site that is at risk of erosion during floods and/or normal flow conditions; the term *critical* is used to indicate erosion sites that are an imminent threat to the integrity of the flood control system and of the highest priority for repair.

A site is typically identified as an erosion site if the erosion has encroached into the projected levee prism. The current inventory of erosion sites requiring repair that may be consulted on based on the framework discussed in this Programmatic BA were identified in a field reconnaissance of the Sacramento River Flood Control System conducted by Ayres Associates (2008), which identified 154 erosion sites. Additional erosion sites have been identified in subsequent inventories and, as of 2015, a total of 35 sites were identified within the seven EJBs. Many of these sites are not classified as critical, but they do pose a substantial risk of erosion and threat to the flood control system. As described in Section 1.1.3, the number and extent of documented sites can change from year to year because of various factors. Since streambank erosion is episodic and new erosion sites can appear each year, the analysis is programmatic in nature, focusing on 30,000 LF within the EJBs.

Additional project-level environmental documentation, tiering from this programmatic analysis, will be conducted to address specific sites identified in the future that have been selected for construction through USACE's revised site selection process (Appendix B). As previously described under Section 1.5, "Future Consultation Approach, USACE will prepare site-specific evaluations as described in this framework following the Site Selection Process and adhering to conservation measures and environmental commitments made in their BA.

1.2.4 Bank Protection Measures

The suite of SRBPP PACR site-specific BPMs is described below with figures to support each measure. A BPM is a site-specific design solution to control an existing erosion site while minimizing and/or mitigating environmental impacts.

The following criteria have been developed for bank protection design, consistent with the project purpose and need:

- Restoring the flood damage risk-reduction capability of the originally-constructed levee through the use of structurally reliable erosion-control elements;
- To the extent practicable, maintaining fish and wildlife habitat and scenic and recreational values, and replacing habitat losses through the use of on-site mitigation elements overlying or integrated with erosion-control elements;
- If it is not possible to fully mitigate for fish and wildlife habitat losses on-site, full mitigation of residual habitat losses will occur off-site to the extent justified; and
- Minimizing costs of construction and maintaining both erosion-control and on-site habitat-mitigation elements.

The following measures are intended to meet these criteria while also meeting USACE policy for vegetation management as prescribed in *EP 1110-2-18* (USACE 2019). However, USACE *Implementation Guidance for Section 3013 of WRRDA 2014, Vegetation Management Policy* (USACE 2017) indicates that, until the USACE policy review is completed, trees are not to be removed solely because they are in the vegetation free zone (VFZ) as defined by *EP 1110-2-18*. A risk assessment is required to deviate from design standards. No deviations are allowed if there is an increase to incremental life safety risk (paragraph 4.e). According to the BA (USACE 2017), the VFZ is as defined in *EP 1110-2-18* and thus encompasses the area 15 feet outward of each levee toe that would be restricted to native grass. These measures are conceptual and will be modified to the degree necessary to be suitable for conditions at any given erosion site. As a result, dimensions in the following figures are typical and will vary based on site-specific conditions and designs. The BPMs are described below.

Bank Protection Measure 1—Setback Levee

This measure entails constructing a new levee some distance landward of the existing levee and would avoid or minimize construction in waterside riparian areas (figure 3). The land between the setback and existing levee would act as a floodplain. Land use in the new floodplain would be determined on a site-by-site basis. The old levee could be breached in several locations and/or degraded to allow high flows to inundate the new floodplain. Vegetation on the new setback levee including 15 feet beyond each toe would be restricted to grass, and managed as a VFZ, while vegetation could remain on the existing levee. New vegetation planted in the setback area could serve as mitigation to offset project losses. Additionally, vegetation on the existing levee could become newly available to aquatic species and contribute to a net increase in floodplain vegetation.

Measure 1 would be most applicable in areas where substantial habitat values exist along the channel and land uses in the setback area are not restrictive. Setback levees are recognized for offering opportunities to restore riverine processes and for mitigation of riparian and fish habitat loss at other bank protection sites. Setback levees may also provide other flood control benefits such as addressing seepage issues that other BPMs would not address. Setback levees can be very effective options, but real estate acquisition, existing land use, and technical issues limit opportunities for setback levees in the program area. Due to the typical size of SRBPP proposed actions, often less than 500 linear feet, setback designs may present some hydraulic or other engineering challenges. For their environmental and hydraulic benefits, setback designs remain a preferred option, and are always considered during the Site Selection Process.

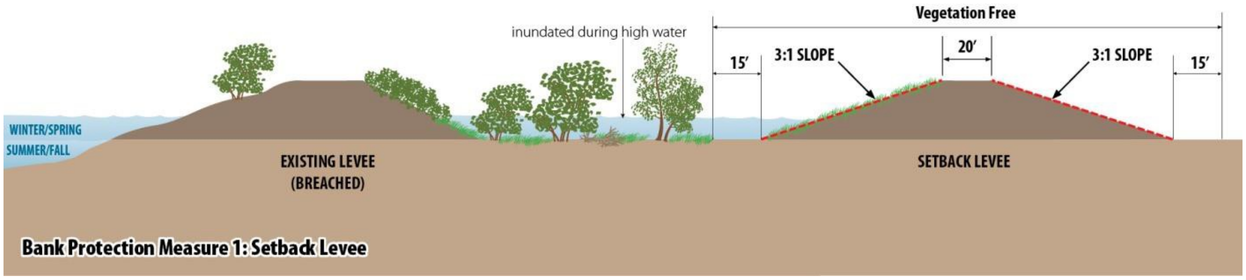

Figure 3. Bank Protection Measure 1: Setback Levee

Bank Protection Measure 2—Bank Fill Stone Protection with No On-Site Woody Vegetation

This measure entails filling the eroded portion of the bank and installing soil-filled revetment along the levee slope (figure 4), and usage will be determined by site-specific analysis. The rock/soil ratio will vary by location and will be determined during site-specific design. Vegetation would be limited to native grass, and existing vegetation would be removed only within the footprint of features to be constructed (e.g., placement of rock or soil). Vegetation within the VFZ but outside of the construction footprint will be left in place. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with revetment. Measure 2 would be most applicable in areas where there is inadequate space or substantial constraints (e.g., critical infrastructure, homes, roadways, pump facilities, real estate issues, etc.) either landside or waterside, where hydraulic concerns would make it difficult to implement the other measures, or where existing habitat values are very limited.

SRBPP has not implemented this measure since 2005; it was used only rarely prior to that time, but it is included as a low maintenance alternative or in situations with no flexibility of design features. Implementation under the proposed framework will rarely result in selection of this measure for repair of an erosion site.

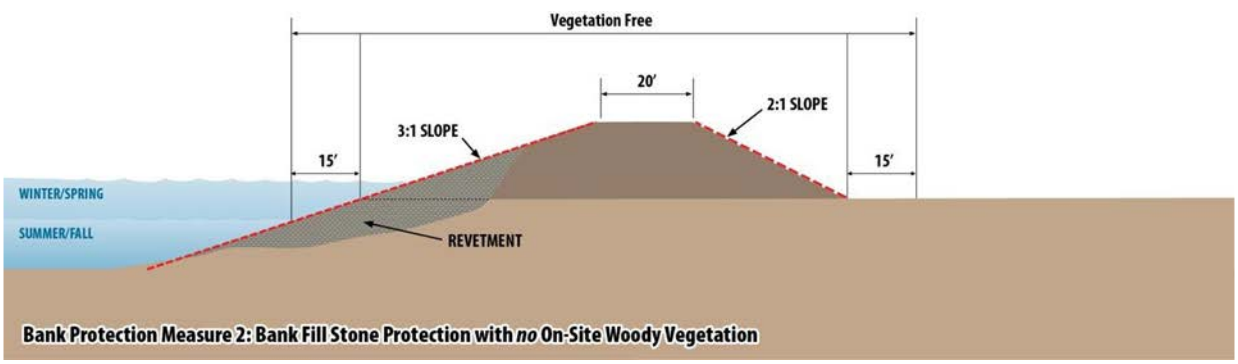

Figure 4. Bank Protection Measure 2: Bank Fill Stone Protection with No On-Site Vegetation.

Bank Protection Measure 3—Adjacent Levee

This measure involves the construction of a new levee embankment adjacent to and landward of the existing levee. The adjacent levee would be constructed to USACE design standards, which require adjacent levees to be constructed with 3:1 slopes on both the waterside and landside (USACE 2000c). The landward portion of the existing levee would be an integral, structural part of the new levee (figure 5). The waterside portion of the existing levee would remain. Vegetation and instream woody material (IWM) could be placed on the old levee if that portion is outside of the VFZ. However, a variance under the *EP 1110-2-18* may be required if the existing levee is considered to be a waterside planting berm based on its dimensions and proximity to the new levee. The levee may also be degraded to riparian and/or wetland benches that comply with Implementation Guidance for Section 3013 of WRRDA 2014, Vegetation Management Policy (USACE 2017). Vegetation on the landward side of the existing levee and within the footprint of the new adjacent levee would be removed as a part of construction.

Measure 3 would be appropriate at many sites where waterside berms are narrow or non-existent but landside uses would limit the use of setback levees.

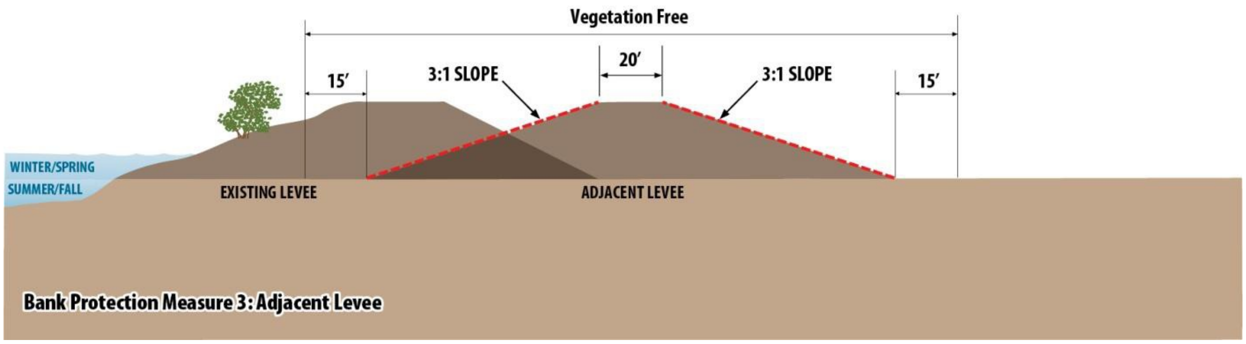

Figure 5. Bank Protection Measure 3: Adjacent Levee.

Bank Protection Measure 4—Riparian and Wetland Benches with Revegetation

Measure 4 consists of three design variations presented as Measures 4a, 4b, and 4c. In general, this measure involves the placement of clean quarry stone from the toe of the bank up to the summer/fall waterline, and placing quarry stone and soil-filled quarry stone on the levee slope above the summer/fall waterline. The rock/soil ratio will vary by location and will be determined during site-specific design. The repairs would involve initial site preparation and construction of levee embankment. Measures 4a, 4b, and 4c would comply with *EP 1110-2-18*, requiring all woody vegetation within the VFZ to be removed.

Measures 4a, 4b, and 4c vary from one another with regard to the placement and extent of environmental features that are intended to increase habitat quality (bank construction, vegetation, and IWM). These variations are driven by a number of factors, most importantly the types of existing resources and the types of species likely to use those resources. For example, if the existing site is downstream of RM 30 and likely to be used by Delta smelt, the new design would not include IWM below the summer/fall waterline, because IWM is not considered optimal habitat for Delta smelt. New IWM would only be installed downstream of RM 30 to replace existing IWM removed during repair of the bank (at a 1:1 ratio). Upstream of RM 30, new IWM is usually incorporated into the design, as Delta smelt are not likely to be present.

In general, plantings consistent with the *EP 1110-2-18* and outside of the VFZ and/or included in the design deviation at each site could include: box elder (*Acer negundo*), white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), western sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), Goodding's black willow (*Salix gooddingii*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), California wild rose (*Rosa californica*), and narrowleaf willow (*Salix exigua*).

These measures are appropriate where the channel is wide enough to accommodate the installation of the stone and soil structure without substantially affecting the hydraulic capacity of the channel.

Bank Protection Measure 4a—Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline

The low riparian bench with revegetation and IWM above the summer/fall waterline measure entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. This design provides near-bank, shallow-water habitat and components of shaded riverine aquatic (SRA) habitat for fish and is typically applicable to sites upstream of Sacramento RM 30. This measure includes a riparian bench (figure 6). The bench will be treated with soil-filled quarry stone.

In this design, the riparian bench is intended to be inundated at river stages corresponding to high tide (where tidally influenced) during average winter/spring flows. The riparian bench will be revegetated in a manner similar to recent SRBPP projects with riparian bench designs. Species planted would comply with the *EP 1110-2-18*. Planting plans would describe species to be planted within a specific elevation zone and would detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers.

The riparian bench would be constructed at a slope (between 6:1 and 10:1) and the revetment portion above and below the bench would typically be 3:1 (distance width to distance height, or dW:dH). The width of the bench would be approximately 10 to 30 feet, depending on site conditions. Anchored IWM would be embedded on top of the riparian bench above the summer/fall waterline. The IWM would be available as accessible habitat along the banks only during winter/spring flows when the bench is inundated. Individual pieces of IWM would be placed to fit the project site's hydraulic conditions and other applicable guidance. The SAM assumes 60% shoreline coverage and a high level of complexity. Exact shoreline coverage amounts and complexity components will be determined during site-specific design.

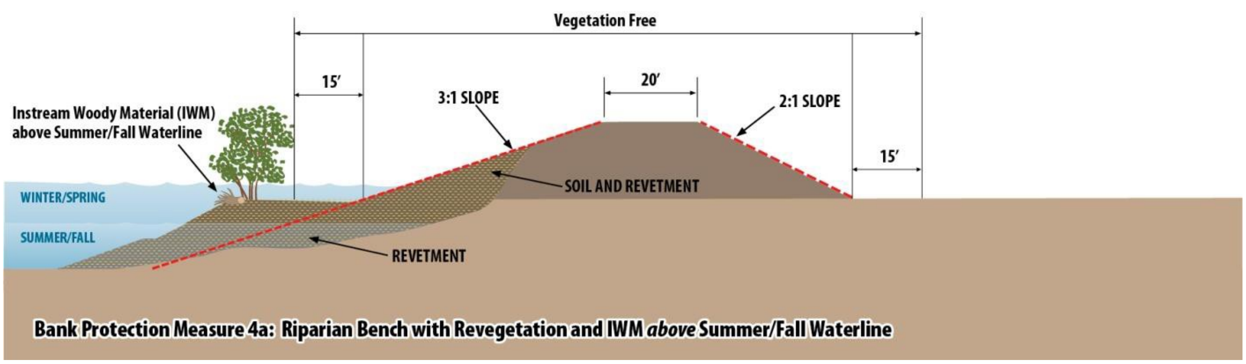

Figure 6. Bank Protection Measure 4a: Riparian Bench with Revegetation and Instream Woody Material above Summer/Fall Waterline.

Bank Protection Measure 4b—Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline

The low riparian bench with revegetation and IWM above and below the summer/fall waterline measure entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench (as described for Measure 4a) to support riparian vegetation and provide a place to anchor IWM. In addition to the placement of IWM above the summer/fall waterline as described for Measure 4a, IWM also would be placed beyond the bench below the summer/fall waterline (figure 7), thereby increasing the types and extent of mitigation for shallow-water fish habitat, providing year-round instream habitat for targeted fish species. This design is typically applicable to sites upstream of Sacramento River RM 30. Installation of soil-filled quarry stone and riparian bench would be similar to Measure 4a.

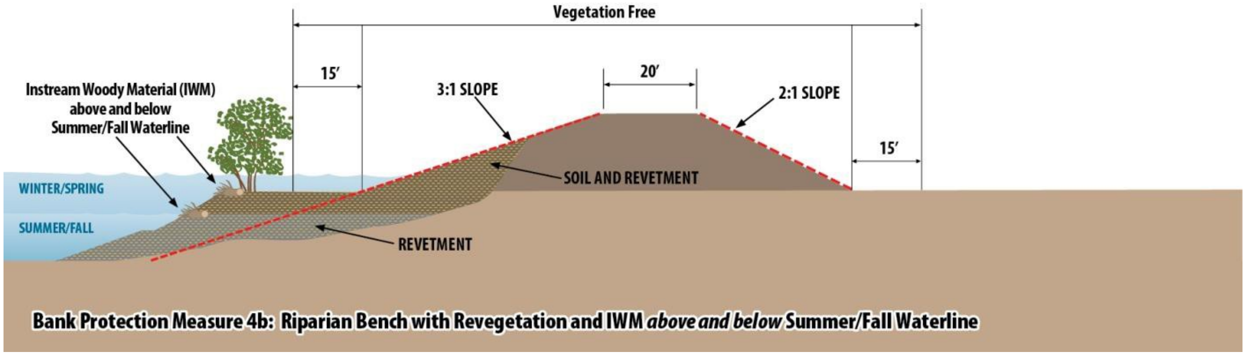

Figure 7. Bank Protection Measure 4b: Riparian Bench with Revegetation and Instream Woody Material above and below Summer/Fall Waterline.

Bank Protection Measure 4c—Riparian and Wetland Benches with Revegetation

Measure 4c (figure 8) entails installing revetment along the waterside levee slope and/or bank as well as a rock/soil bench to support riparian vegetation and provide a place to anchor IWM. Bench slopes would be the same as those described for Measure 4a. The design also includes a wetland bench below the summer/fall waterline to further increase habitat quality. This design is intended for sites downstream of Sacramento RM 30 and targets mitigation of impacts on Delta smelt habitat. Existing vegetation would be removed only within the footprint of features to be constructed (e.g., placement of rock or soil). Grass would be allowed in this area. Vegetation

within the VFZ, but outside of the construction footprint will be left in place. Because IWM might increase habitat suitability of ambush predators, new IWM would only be installed to replace existing IWM removed during project repair (at a 1:1 ratio).

The riparian and wetland benches are intended to flood at river stages corresponding to winter/spring (high) flows and summer/fall (low) flows, respectively. Both benches would be revegetated in compliance with the *EP 1110-2-18* and in accordance with appropriate planting plans. The wetland bench would typically be planted with hardstem bulrush (*Scirpus acutus*), California bulrush (*S. californicus*), and/or giant bur-reed (*Sparganium eurycarpum* ssp. *eurycarpum*).

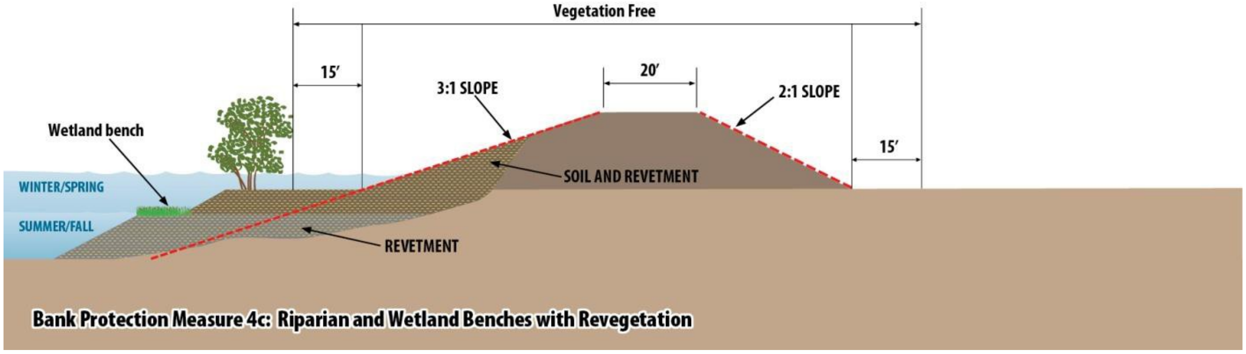

Figure 8. Bank Protection Measure 4c: Riparian and Wetland Benches with Revegetation.

Bank Protection Measure 5—Bank Fill Stone Protection with On-Site Vegetation

Measure 5 (figure 9) entails filling the eroded portion of the bank and installing revetment along the waterside levee slope and streambank from the streambed to a height determined by site-specific analysis. The revetment would be placed at a slope of 3:1. All IWM would be removed from the bank; following construction, it would not be replaced on the bank fill stone protection.

Existing vegetation would be removed only within the footprint of features to be constructed (e.g., placement of rock or soil). Vegetation within the VFZ but outside of the construction footprint would be left in place. The actual amount of retained vegetation could vary substantially from site to site during implementation. New vegetation would be limited to native grasses within the VFZ, while woody vegetation could be replaced by planting outside of the VFZ, and within the project footprint, as allowed by the design deviation and site-specific conditions. The long-term goal of vegetation planting is to provide riparian and SRA cover habitat as defined by USFWS. Planting plans would describe species to be planted within a specific elevation zone and would detail the number, area and spacing of plants to be installed, and whether the plants are from cuttings or containers. Six inches of soil cover would be placed on the revetment to support on-site vegetation. If there is a natural bank distinct from the levee that requires erosion protection, it would be treated with revetment.

Similar to Measure 2, Measure 5 would be most applicable in areas where there is inadequate space or substantial constraints that would limit the applicability of the other measures. However, some amount of space is necessary to allow for the planting of vegetation.

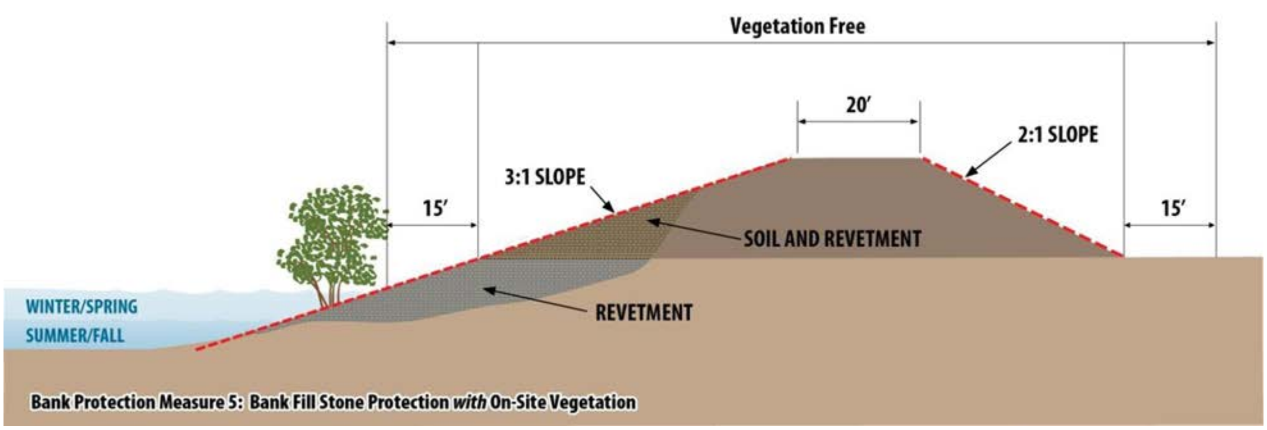

Figure 9. Bank Protection Measure 5: Bank Fill Stone Protection with On-Site Vegetation.

Additional Measures

Additional measures may be considered and found to be appropriate during the implementation of site-specific repairs. Design and analysis of any additional measures would be carried out during the site-specific planning and design phase. Examples of additional measures include, but are not limited to, toe protection, flow modification (e.g., impermeable groins) and alternative materials in place of riprap. These measures are not included in the proposed action identified in Section 2.4. These and other measures, which may be developed in the future, would be included in the tiered site-specific consultations, if proposed.

Recently Completed Repair Sites Representing Likely Future Condition

To illustrate the outcome of this Site Selection Process for implementation, USACE has compiled information from 25 sites within the EJBs that were constructed under the SRBPP Phase II Authorization since 2005 (Table 2-3). For these previously constructed sites, a similar process was used for determining the best design for construction. The best design was determined using engineering, economics and environmental considerations. During implementation of this authorization, the Site Selection Process will be followed, which is used to develop the actual designs selected for construction. This will be done in a manner similar to the process used to determine the designs of this suite of previously constructed sites. Since these sites have extensive available data and demonstrate implementation similar to this proposed action, this approach provides the best opportunity to visualize implementation of this authorization using this programmatic framework process. This is presented as part of the effects analysis in Chapter 5 of the (USACE, 2019).

As previously stated, SRBPP has not implemented this measure as of 2005; it was used only rarely prior to that time, but it is included as a low maintenance alternative or in situations with no flexibility of design features, and is a component of USACE's analysis of potential repairs, although implementation under the proposed framework is unlikely to result in selection of this measure for repair of an erosion site. It should be noted that there was no implementation of Measure 2 on the 25 historic repair sites analyzed between 2005 and 2018.

Table 2. List of Erosion Repair Sites within EJBs Constructed Since 2005.

	System	Location (River Mile)	Bank	SRBPP SAM Region	Design Type	Site Length (LF)
1	Sacramento R.	47	L	1B	BPM 4B	1156
2		49.6	L	1B	BPM 5	298
3		49.7	L	1B	BPM 4A	280
4		49.9	L	1B	BPM 5	268
5		50.2	L	1B	BPM 5	1473
6		50.4	L	1B	BPM 5	288
7		50.8	L	1B	BPM 5	894
8		51.5	L	1B	BPM 5	888
9		52.3	L	1B	BPM 4C	1320
10		52.4	L	1B	BPM 5	166
11		53.1	L	1B	BPM 5	120
12		53.5	R	1B	BPM 4A	430
13		56.7	L	1B	BPM 4D WT	1600
14		57.2	R	1B	SETBACK	1200
15		62.5	R	1B	BPM 4B	255
16		68.9	L	1B	BPM 4B	786
17		73.5	L	1B	BPM 4A	1050
18		77.2	L	1B	BPM 4A	600
19		78	L	1B	BPM 4B	1058
20	Feather R.	5.5	L	2	BPM 4A	832
21		7	L	2	BPM 4A	520
22	American R.	0.3	L	1B	BPM 4A	520
23		2.8	L	1B	BPM 4A	470
24		10	L	1B	BPM 4A	740
25		10.6	L	1B	BPM 4A	670
					Total linear feet	17882

	# Sites	Total LF
Sacramento R.	19	14130
Feather R.	2	1352
American R.	4	2400

1.2.5 Operations and Maintenance

Once repairs are complete, a project site may require limited maintenance to ensure establishment of on-site mitigative features. During the initial establishment period, maintenance activities are anticipated to be required for three to five years; these activities may include removing invasive vegetation detrimental to project success, pruning and watering planted vegetation to promote optimal growth, replacing plantings, monitoring navigational hazards, and placing fill and rock revetment if the site is damaged during high flow events or by vandalism.

Once established, the riparian vegetation should be self-maintaining. Maintenance activities conducted during the initial establishment period are not to be confused with long-term O&M activities, which are the responsibility of the local maintaining agency. Following site turn-over, responsibility for long-term O&M activities rests with the local maintaining agency. USACE will provide the CVFPB with an updated O&M manual detailing any changes made to the levee as the result of the repair and any additional long-term maintenance requirements, including annual maintenance limits to placement of no more than 600 cubic yards of material, which corresponds to a disturbance length of less than 300 feet; should more material be required in any year, the operating and maintaining agency (i.e., CVFPB) will obtain the necessary permits from the regulatory agencies. USACE will be responsible for ensuring that conservation measures and environmental standards stipulated in permits and all required documentation are maintained. If outside alterations of a project site are proposed by other agencies or private entities, USACE will work with USFWS and NMFS to ensure that environmental features at the project sites are maintained or that off-site compensation is implemented to make up for any deficits.

Any needed in-water maintenance work will be conducted during periods that minimize adverse effects on listed fish species. Unless approved otherwise by NMFS, in-water maintenance will be conducted between July 1 and November 30 of each year for sites above RM 60, and between August 1 and November 30 for sites below RM 60.

1.2.6 Proposed Compensation Strategy

Off-Site Compensation for Chinook salmon, Steelhead, and Green Sturgeon

If bank repair actions are not fully self-mitigating, off-site compensation measures will be implemented after either project completion or concurrent with site construction using conservation measures/banks. Whether constructed as part of a suite of bank protection sites or established independent of a project site in coordination with California Department of Water Resources (DWR), USFWS, and NMFS, off-site compensation will focus on replacing and enhancing habitat values for the listed species addressed in this BO. The SAM model, which was specifically created to assist with determining and quantifying effects and compensation amounts, will be utilized to the extent practicable.

However, other evaluation tools recognized by the resource agencies and acceptable to USACE may also be utilized. Possible off-site compensation could include the use of one or more of the following elements:

- Setback levees to reestablish natural bank conditions along the channel, provide a seasonally inundated floodplain, and increase overhead riparian cover with structural diversity (Figure 2-6). Under these conditions, active channel migration could resume and would be subject to the natural cycles of habitat disturbance and renewal.

- Construction of in-channel and off-channel wetland benches or less steeply sloping banks to provide juvenile rearing habitat.
- Planting riparian trees for bank shading and long-term production of IWM for aquatic habitat.
- Installation of IWM for the creation of instream cover and feeding areas.
- Removal of rock revetment, which would allow the river to reclaim its natural geomorphic processes and move freely throughout the floodplain.

Similar compensation values may also be obtained through the purchase of third party mitigation bank credits.

The 2007 Programmatic BA prepared for the SRBPP (Stillwater Sciences 2007) estimated necessary off-site compensation lengths of setback levees, instream benches, and IWM to offset SAM deficits related to construction of 24,000 LF of BPMs. The study demonstrated that these types of off-site compensation measures are capable of addressing deficits that, in this case, were determined through the SAM. However, actual lengths and locations of off-site compensation for future repair sites would be calculated on a site-specific basis.

Off-Site Compensation Process

Sections 7(a)(1) and 7(a)(2) of the ESA, 16 U.S.C. Sections 1636(a)(1) and (2), require all Federal agencies to utilize their authorities to support and implement programs for the conservation of listed species, and to ensure that designated critical habitat will not be destroyed or adversely modified. Impacts to listed species are minimized by including conservation measures in the Federal agency's project description. These conservation measures may include off-site enhancement of listed species habitat as an individual project action. The general off-site compensation process is outlined below.

1. Off-site compensation requirements for one or more individual project sites will be determined using the SAM or other assessment tools recognized by the resource agencies. A combination of pre-construction survey data, SRA habitat modeling, or post- construction survey data will be used to verify assumptions used in the SAM model or other assessment tools.
2. Proposed compensation sites will be surveyed for SRA and other attributes using established methods and recommended compensation measures will be submitted for approval by the resource agencies. If a significant setback levee action (or other significant restorative action) is designed and developed with the intent of offsetting future SRBPP PACR bank protection impacts, the action will be subject to the appropriate advance mitigation guidance, including the requirements of 33 CFR Part 332, Compensatory Mitigation for Losses of Aquatic Resources, the USACE

Implementation Guidance for WRDA 2007 – Section 2036(c) Wetlands Mitigation, and Appendix C of *ER 1105-2-100*.

3. The functional equivalence of the project and compensation sites will be determined by site locations (e.g., compensation sites located where they can be colonized by the affected life stages of the focus fish species), site attributes (e.g., potential exchanges between one or more SRA attributes such as IWM, substrate, shade, etc.), relative sizes of the sites, and compensation timing using the SAM or other assessment tools.
4. Timing of project site construction, compensation site construction, and SRA habitat evolution will be evaluated using the SAM or other assessment tools; the goal is to achieve net positive SAM results for the project and compensation sites at all times. This will require a balance between compensation sites and construction sites at any given time.
5. Compensation requirements are to be met within the SAM-recommended timelines and will be on a bank length basis of 1:1 (project site length to compensation site length) or area basis of 1:1 (project area to compensation site area) using the SAM or other approved methodology. Compensation requirements that remain unmet for periods longer than recommended will be subject to additional accumulated habitat compensation requirements under the framework established by the SAM or other approved methodology.

Location of Compensation

There is a history of policy positions favoring local or on-site mitigation over more distant compensation. Prior policy positions of NMFS have stated that the use of distant sites (>50 miles) is unacceptable because it does not ensure "in-kind" compensation, or that local populations which have been affected by the project benefit from the habitat enhancement (NMFS 2001). 33 CFR Part 332 establishes compensatory mitigation standards and criteria for projects permitted by USACE pursuant to Section 404 of the Clean Water Act, 33 U.S.C. Section 1344. In general, 33 CFR Part 332.3(b)(1) states that compensation sites should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions and services. Watershed scale features such as aquatic habitat diversity, habitat connectivity, relationships to hydrologic sources, trends in land use, ecological benefits, and compatibility with adjacent land uses are to be taken into account.

For the purposes of the proposed action, compensation requirements will generally be determined within each of the four EJB regions (Figure 1) with the intent of completing the proposed conservation measures at sites selected as close as practicable to the bank protection project sites. Whether two potential project and compensation sites are ecologically interchangeable can primarily be assessed by determining whether fish species or specific life stages could inhabit the two sites at the same time of year. In select situations, compensation

sites may be acceptable if fish species utilize the two sites at various times or during different life stages.
Two potential compensation sites have been identified at the time of this Programmatic BA: the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project in Region 1a, and rock removal at Kopta Slough in Region 3. Additional compensation sites within these regions and in Regions 1b and 2, will address the needs of the proposed action. Final compensation site locations may be constrained by: (1) limited potential for habitat benefits to listed species from planned acquisition or enhancement; (2) location of the property relative to site(s) requiring off-site compensation; (3) compatibility of nearby land uses with the proposed land use at the compensation site; (4) available funding; and (5) the willingness of landowners to sell their properties. Due to the unique qualities of some mitigation opportunities or sites (e.g., rock removal at Kopta Slough), it may be appropriate to mitigate for impacts in one region with compensation in another.

Compensation Timing

Compensation timing refers to the time between the initiation of bank repairs at a particular site and the attainment of the habitat benefits to protected species from designated compensation sites. In general, compensation time is the time required for on-site plantings to provide significant amounts of shade or structural complexity from IWM recruitment. Significant long-term benefits have often been considered as appropriate to offset small short-term losses in habitat for listed species in the past, as long as the overall action contributes to recovery of the listed species. The authority to compensate prior to or concurrent with project construction is given under the WRDA of 1986 (33 U.S.C. Sections 2201–2330); however, long-term compensation to offset short-term losses is generally not an option for the loss of critical habitats under the ESA (USFWS 1998).

Guidelines for Off-Site Compensation

Protection of listed species habitat through habitat enhancement actions at sites constructed by USACE or CVFPB may be considered as one means to satisfy off-site compensation requirements once all available on-site mitigation alternatives have been exhausted. For compensation sites constructed to cover compensation needs of multiple proposed bank repair sites, the compensation action may be completed prior to some of the erosion repairs covered, and medium-term to long-term habitat benefits will potentially accumulate for use in offsetting habitat impacts. Within the SRBPP context, the goal of combining compensation actions would be to optimize offsetting adverse impacts to the Federally listed fish species addressed in this Programmatic BO. Combining or “pooling” these compensation actions can reduce costs and provide more productive benefits for listed species. The purchase of mitigation credits from third-party mitigation banks may also be considered as a strategy for off- site habitat compensation.

The use of advance mitigation strategies for the SRBPP PACR might be considered, and would be accomplished through the Section 7 consultation process, with advance mitigation agreements that would be consistent with established criteria and guidelines of the involved agencies. As described in Section 2.6.4.3, *Location of Compensation Sites*, 33 CFR Part 332 establishes compensatory mitigation standards and criteria for projects permitted by USACE. In addition, USACE's *Implementation Guidance for WRDA 2007 – Section 2036(c) Wetlands Mitigation* and *ER 1105-2-100*, Appendix C, will be followed for SRBPP PACR compensatory mitigation actions to the extent practicable, and will be consistent with USFWS and NMFS fulfilling their statutory obligations under Section 7 of the ESA. As advance mitigation is similar in concept to mitigation banking, USFWS will also be directed by its *Guidance for the Establishment, Use, and Operation of Conservation Banks*, as finalized in May 2003 (USFWS 2003b), and NMFS will also be directed by its West Coast Region Conservation Banking Guidance, as finalized in August 2015 (NMFS 2015). Additional guidance for State agencies may be found in *Official Policy on Conservation Banks*, issued in April 1995 (Wheeler and Strock 1995).

Although these relevant Federal and State guidance documents for conservation and mitigation banking provide the fundamental precepts under which advance mitigation for the SRBPP PACR will be undertaken, advance mitigation actions and proposals will be unique and variable. Therefore, some of the more important additional guidelines that would also apply to advance mitigation relative to the SRBPP PACR are as follows:

- A setback levee (or other significant restorative action) for compensation that is part of a suite of discrete bank protection sites analyzed and evaluated together as one SRBPP PACR project, may not need the coverage of a formal advance mitigation agreement, provided USACE and the State of California have addressed the relevant advance mitigation issues in their environmental documentation for the overall programmatic action;
- The IWG will support an independent re-analysis of the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project in Solano County, California to determine how many excess conservation credits may be applied to future SRBPP compensation needs. Application and use of such credits will be subject to appropriate conservation and advance mitigation agreements;
- On-site compensation efforts that create substantially more compensation than necessary to fully offset on-site impacts may have the excess compensation credited, accounted for, and used through appropriate consultation processes, or under appropriate conservation and advance mitigation agreements;
- The project service area for each advance mitigation site may vary and will be defined at the time each site is established;
- Advance mitigation credits may either be withdrawn directly by USACE and the State of California (in the case of advance mitigation sites the State may choose to operate), or conservation bank credits may be purchased from an intermediate, private seller/bank operator. However, all accounting, regardless of credits originating from a government project or private bank, will be based on the SAM (USACE 2012) or other methodology approved by the resource agencies;

- Each IWG agency will be given an opportunity to participate in the development of, and to become a party to any advance mitigation or conservation bank agreements which are developed;
- USACE and the State of California, in coordination with the IWG agencies, will first consider the purchase of credits in a mitigation or conservation bank. In this instance, the mitigation bank sponsor will be responsible for: (1) preparing and seeking approval of mitigation and/or conservation bank agreements, and (2) conducting operations, maintenance, monitoring, and accounting for mitigation bank sites and/or conservation banks; and
- USACE and the State of California may also develop advance mitigation sites in accordance with applicable Federal and State laws, regulations, and policies. The protections and management of advance mitigation sites will be established in perpetuity. Management measures will be implemented to ensure adequate control of undesirable activities (e.g., trash dumping, tree cutting, off-road vehicle use, and invasion by exotic vegetation). Management elements that maintain the habitat for the various listed species will also be included, as necessary. However, for the management and maintenance of all advance mitigation sites, the guiding principle would be to achieve to the extent feasible, a largely unmanaged operation based on natural river functions and processes.

1.2.7 Conservation Measures

Conservation measures have been developed to help identify, avoid, minimize and compensate for potential adverse effects to listed fish species. These measures implemented USACE will include the following mitigation monitoring, site evaluation, and construction-related measures.

Mitigation Monitoring and Site Evaluation

USACE will submit a detailed monitoring plan for on- and off-site habitat mitigation for each individual site as part of the consistency determination with the Programmatic BO. All mitigation sites will be monitored for a period of at least five years to ensure the successful establishment of planted vegetation. Plantings will be monitored to ensure they have a minimum of 70% canopy cover after three years, and 80% planted acreage survival and 75% canopy cover at the end of five years. Remediation will occur if these survival and cover goals are not met. As stated above in Section 1.4 "Proposed Federal Action," an annual monitoring report for each site that evaluates how the site meets the mitigation success criteria will be submitted to the resource agencies by December of each year. Multiple sites may be bundled into one report. NMFS will not review additional bank repair sites under the SRBPP PACR until USACE is up to date on their purchasing of off-site mitigation credits if applicable, and yearly monitoring reporting for all sites under the SRBPP PACR program.

Validation of SAM Model Performance

USACE will evaluate whether sites meet the compensation criteria of the SAM model (USACE 2012). Post-construction vegetation and habitat monitoring will be used to validate previous SAM model outputs, which were used to determine the extent of physical habitat mitigation.

This information may be used to improve the SAM model in the future, and to more accurately mitigate for future loss of riparian physical habitat associated with flood control projects. The monitoring of physical habitat attributes will use passive measurement techniques that are not expected to adversely affect listed fish or critical habitat, and do not require further consultation.

Fisheries and Aquatic Habitat Monitoring

USACE will develop a biological monitoring plan describing the goals and methods of fisheries monitoring under the SRBPP PACR program. This plan will be submitted and approved by NMFS prior to the implementation of any biological monitoring. Any biological monitoring that requires the take of listed salmonids or green sturgeon will require consultation with NMFS. The specific types of fishery monitoring techniques are to be developed by USACE, with consultation and coordination of the Engineer Research and Development Center (ERDC).

Fishery monitoring is expected to include techniques involving sampling at selected program locations in the action area throughout juvenile migration period using electrofishing or other similar methods. If turbidity is low, passive techniques, such as underwater observation may also be used. Passive techniques may also include sonar imaging cameras (e.g., ARIS or DIDSON) or other sonar technology to detect fish use at different reference sites. Monitoring sites within the action area may be used to determine fish presence under different conditions, including during periods of no bench inundation, partial bench inundation, and full bench inundation. Monitoring may include physical characteristics, and benthic biological communities.

Develop Monitoring Plans Utilizing Appropriate Criteria

In developing the detailed biological and vegetation monitoring plans described above, USACE will use the "SMART" criteria, which refers to an acronym used to set project objectives. SMART objectives are Specific, Measurable, Achievable, Realistic, and Timely. Monitoring would be designed with the following goals in mind:

a. *Rationale* - The rationale, or underlying reason for implementing the monitoring plan is to ensure that compensation and mitigation measures historically and currently implemented are resulting in the intended effect on listed species and critical habitat. In recent years, USACE and NMFS have worked together to carefully design levees that include benefits to listed fish species and designated critical habitat. Some of these features include setback levees, vegetated benches with SRA habitat, installation of IWM, and limiting the amount of rock placement on levees. It would now be timely to test the effectiveness of alternative designs, as opposed to traditionally riprapped levees. The biological portion of this monitoring plan is being implemented to determine the extent of fish use of alternative levee designs. The vegetation portion of this monitoring plan is being implemented to measure the extent of riparian habitat available in alternative levee designs post-construction. As a whole, the monitoring is being implemented in order to guide future implementation of mitigation and conservation measures, and the implementation of alternative levee designs.

b. *Goals* - The goal of the monitoring program is to evaluate fishery and vegetation responses to a range of critical levee repair projects and designs. This includes evaluating how critical levee repair projects and designs are contributing to the recovery of listed fishes in the Central Valley, and to designated critical habitat uplift.

c. *Objectives* - The objective of the monitoring plan is to inform future conservation and mitigation actions related to flood control projects, and to guide the implementation of future levee designs in the Central Valley.

<u>SAM Update</u>

USACE, subject to availability of funds and with the assistance and consultation of the IWG, will develop a strategy to compile recent data and initiate updates or revisions to the SAM model to improve accuracy for project planning. In updating the SAM model, USACE will work with the IWG and ERDC to revisit curves and assumptions used in the model to assure that these accurately reflect potential riparian habitat change inputs, e.g. evaluating impacts to SR winter- run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and their designated critical habitat related to the placement of rock at elevations below the seasonal water surface elevations, and making updates as needed. Any monitoring data from previous SRBPP sites used to validate SAM assumptions would be used as part of this evaluation process. USACE will seek concurrence from NMFS prior to its application in future ESA Section 7 consultations for actions implemented pursuant to the SRBPP PACR.

Additional Green Sturgeon Conservation Measures

The following actions were recommended by NMFS to minimize and mitigate possible impacts to sDPS green sturgeon. USACE proposes to implement these conservation measures for the SRBPP PACR to identify and help reduce impacts to sDPS green sturgeon and their critical habitat.

a. USACE will update the implementation strategy for the sDPS green sturgeon Habitat Mitigation and Monitoring Plan (HMMP), which includes the specific elements that are described below. The goal of developing the HMMP is to ensure that adverse impacts of future SRBPP PACR projects on sDPS green sturgeon are sufficiently mitigated in order to allow for the growth, survival, and recovery of the species in the study area.

b. USACE will then develop an sDPS green sturgeon HMMP in consultation with NMFS and in coordination with the Interagency Ecological Program (IEP) green sturgeon project work team, or another NMFS-approved technical panel of green sturgeon experts. This will happen prior to the construction of any work under the SRBPP PACR within the designated critical habitat of sDPS green sturgeon. The HMMP would focus on filling important data gaps on green sturgeon life history, and micro- and macro-habitat ecology in both the Sacramento River and the Delta within the project action area. This data will look at how bank stabilization measures proposed in the SRBPP PACR affect sturgeon ecology and survival. The goal of this conservation measure is to leverage the resources of the IEP to help develop an HMMP that utilizes and applies the best available scientific expertise and information.

c. USACE will either refine the SAM or develop an alternative sDPS green sturgeon survival and growth response model. The model may be based on using and updating the existing Hydrologic Engineering Center Ecosystem Function Model that reflects sDPS green sturgeon's preference for benthic habitat, or some other model modified for use and approved by NMFS. These new/modified models would account for the physical loss of habitat from revetment footprints instead of the convention used by the SAM, where the fish response is evaluated at the intersection of seasonal water surface elevations and the levee bank. Any proposed model(s) must be capable of evaluating green sturgeon survival in response to levee repair projects as part of the SRBPP, and the effects on all relevant habitat conditions, not exclusively flow changes. Development of the model will be initiated at the start of the first Preconstruction Engineering and Design (PED) Phase in consultation with NMFS and in coordination with the appropriate sturgeon experts on the IEP, or another independent expert panel with sturgeon expertise. The goal of this measure is to develop a functional assessment methodology, using the best available scientific expertise and information, to predict the effects of future SRBPP actions and to evaluate the performance of mitigative actions relative to the survival and growth of sDPS green sturgeon.

d. The HMMP will also identify measures to restore or compensate for the area and ecological function of soft-bottom benthic substrate for sDPS green sturgeon permanently lost to project construction. Any subsequent actions to restore or compensate for impacts to sDPS green sturgeon will be coordinated with the IWG or a Bank Protection Working Group, and must be implemented within the lower Sacramento River/Delta in order to offset any adverse effects to designated critical habitat. The restored habitat must be capable of providing appropriate types and quantities of benthic prey, freshwater or estuarine areas with adequate flow, depth, water quality, temperature, salinity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. It should also provide safe and unobstructed migratory pathways necessary for timely passage of adult, sub-adult, and juvenile fish within the region's different estuarine habitats and between the upstream riverine habitat and the marine habitats. The restoration/compensation will be initiated prior to commencement of each construction cycle within the designated critical habitat of sDPS green sturgeon for the SRBPP, and the updated model should be used to evaluate performance. The restoration site and plan will be developed in consultation with NMFS and in coordination with the IEP or another designated scientific expert panel. The goal is to ensure that the spatial and temporal ecological impacts from project-related permanent loss of critical habitat for sDPS green sturgeon are fully compensated

e. The sDPS green sturgeon HMMP will be developed with measurable objectives for completely offsetting all identified adverse impacts to all life stages of sDPS green sturgeon (as modeled using refined approaches described in Measure C, and considering design refinements that occur in the PED Phase of project implementation). The goal of this measure is to develop SMART objectives for mitigation: Specific (target a specific area for improvement), Measurable (quantify or suggest an indicator of progress), Attainable (specify who will do the work and if possible how), Realistic (state what results can realistically be achieved, given available resources), and Timely (specify when the results can be achieved) habitat performance objectives for green sturgeon mitigation.

f. Mitigation actions will be initiated prior to the construction activities (within each construction cycle) affecting sDPS green sturgeon and their critical habitat. Specific mitigation plans may be developed during PED to reduce the specific impacts of levee bank construction actions. The goal of this measure is to ensure that mitigation coincides with project implementation and minimizes, to the maximum extent possible, extended temporal effects.

g. The sDPS green sturgeon HMMP will include measurable performance standards at agreed upon intervals, and will be monitored for a period of up to ten years following construction. If additional monitoring is necessary, the monitoring will be included in the project O&M plan, and carried out by the non-Federal sponsor. The HMMP will include adaptive management strategies for correcting any mitigation measures that do not meet performance standards. The goal of this measure it to provide a reasonable amount of time to measure performance standards after mitigation occurs to ensure that it meets the objectives of the HMMP.

Construction-Related Conservation Measures

USACE will implement additional measures, consistent with earlier BOs (USFWS 2001, 2004, 2006a, 2007, 2008a, 2008b, 2009a, 2009b, 2010, 2014; NMFS 2001, 2004, 2006a, 2006b, 2008a, 2008b, 2009, 2014, 2016) for the SRBPP, to help conserve and minimize impacts on listed species, including:

- Where feasible, preventative measures to treat failure mechanisms that minimize project size.
- Stockpiling of construction materials such as portable equipment, vehicles, and supplies, including chemicals, at designated construction staging areas and barges, exclusive of any riparian and wetlands areas.
- Erosion control measures (Best Management Practices [BMPs]) that minimize soil or sediment from entering the river. BMPs will be installed, monitored for effectiveness, and maintained throughout construction operations.
- Limiting site access to the smallest area possible in order to minimize disturbance.
- Daily removal of all litter, debris, unused materials, equipment, and supplies from the project area. Such materials or waste will be deposited at an appropriate disposal or storage site.
- Immediate (within 24 hours) cleanup and reporting of any spills of hazardous materials to the resource agencies. Any such spills and the success of the cleanup efforts will also be reported in post-construction compliance reports.
- Designating a USACE-appointed representative as the point-of-contact for any contractor who might incidentally take a living, or find a dead, injured, or entrapped threatened or endangered species. This representative will be identified to the employees and contractors during an all-employee education program conducted by USACE.
- An on-site inspection tour, led by a USACE biologist/environmental manager or contractor, if requested by USFWS or NMFS personnel or other resource agencies, during or upon completion of construction activities.
- Screening any water pump intakes as specified by NMFS and USFWS screening specifications. Water pumps will maintain an approach velocity of 0.2 feet per second or less when working in areas that may support Delta smelt.
- A USACE representative will be assigned to work closely with the contractor(s) through all construction stages, and to ensure that any living riparian vegetation or IWM within vegetation clearing zones is avoided and left undisturbed to the extent feasible.

Furthermore, USACE will seek to avoid and minimize construction effects on listed species and their critical habitat to the extent feasible. A number of avoidance measures will be applied to the entire project or specific actions, and other measures may be appropriate at specific locations within the action area. Avoidance activities to be implemented during the final design and construction are not limited to, but may include:

- Identifying all habitats containing, or with a substantial possibility of containing, listed terrestrial, wetland, and plant species in the potentially affected project areas.
- Minimizing effects by modifying engineering design to avoid potential direct and indirect effects.
- Incorporating sensitive habitat information into project bid specifications.
- Incorporating requirements for contractors to avoid identified sensitive habitats into project bid specifications.
- Minimizing vegetation removal to the extent feasible.
- Minimizing, to the extent possible, grubbing and contouring activities.
- Whenever possible, placing fill materials with no excavation or movement of existing materials on-site.
- A qualified biologist will supervise all construction activities, including clearing, pruning, and trimming of vegetation, to ensure these activities have a minimal effect on natural resources.
- If a cofferdam is needed during construction, constructing it by placing the sheet piles sequentially from the upstream to the downstream limits of the construction area. If substrate, cover, and water depths allow, seining would be conducted within the cofferdam with a small-mesh seine to remove as many fish as possible before the cofferdam is closed; upon completion of seining, exclusionary nets would be placed in the river to prevent fish from re-entering the dammed area. Once the cofferdam is closed the area will be partially dewatered, and a final seining and dip netting effort will be conducted to capture any remaining fish. Only low-flow pumps with screened intakes will be used during dewatering operations. Any captured fish would be released downstream of the construction area

Summary of Conservation Measures

Table 3 presents a general summary of environmental commitments that USACE will adhere to as part of the SRBPP PACR.

Table 3. Summary of Conservation Measures.

Environmental Commitment	Description
Chinook salmon, steelhead, and green sturgeon	One or more of the following measures will be initiated if bank repair actions are not fully self-mitigating for protected fish species: Creation of setback levees Construction of in-channel or off-channel wetland benches or less-steep bank slopes

	Planting of riparian vegetation Placement of IWM Rock removal Purchase of credits from third-party mitigation banks Additional conservation measures will be implemented to reduce programmatic effects to green sturgeon, including: Develop and implement an HMMP • Refine SAM or develop new model to evaluate effects to green sturgeon
Standard Assessment Methodology (SAM) Revisions	Develop strategy to compile recent data and initiate updates or revisions to the SAM model to improve accuracy for project planning.
Monitoring	USACE will conduct the following monitoring: Vegetation establishment at repair sites up to 3-5 years post-construction Aquatic Habitat – Physical structure and biological communities to help validate SAM assumptions and repair site performance Fisheries monitoring utilization by site and project reaches Annual monitoring reports will be prepared and submitted
Construction BMPs	USACE will implement several measures including erosion control, monitoring, limiting vegetation removal, and screening intake pumps to minimize adverse environmental effects during construction.

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR Part 402.02). There are no interdependent or interrelated activities associated with the proposed action.

1.3 Consultation History

- **7 May 2014 –** NMFS received an initial request for formal consultation from the United States Army Corps of Engineers (USACE) for the Sacramento River Bank Protection Project Post Authorization Change Report program (SRBPP PACR), which would install 80,000 LF of bank protection under the Sacramento River Bank Protection Project (SRBPP) Phase II Supplemental Authority. This version is superseded by the most current version of the biological assessment (BA) (revised January 2017).

- **3 November 2014 –** NMFS sent USACE a formal letter requesting additional information on this program.

- **4 December 2014 –** USACE sent NMFS a revised BA. This version is superseded by the most current version of the BA (revised January 2017).

- **22 January 2016 –** In response to comments on the BA provided by the United States Fish and Wildlife Service (USFWS) on 19 March 2015, the USACE provided a revised BA to USFWS *only*. Regarding this, NMFS expressed concerns over potential inconsistencies in the description of the programmatic BA provided to NMFS and USFWS and requested a copy of the BA be provided to NMFS as well. Shortly after this

  request was made, USACE reevaluated the economic feasibility of the program and determined that the scope of the program was to be greatly reduced to 30,000 LF of bank protection, and a new program description would be provided to both agencies.

- **25 January 2016 –** NMFS received supplemental information from USACE including: additional information for the southern Distinct Population Segment (sDPS) of green sturgeon; clarifications of the Standard Assessment Methodology (SAM) results and graphic representations of SAM results generated for Chinook salmon and steelhead; and omission of SAM results for adult Chinook salmon, which NMFS and USACE found to be inconsistent with the reasonably anticipated response to program actions.

- **22 July 2016 –** USACE provided a rough draft of the revised program description section of the BA to NMFS and USFWS via email.

- **9 August 2016 –** NMFS responded with comments to the draft of the revised program description section to USACE via email.

- **10 November 2016 –** NMFS sent a letter to USACE with guidance on potential actions that could mitigate for the impacts of the SRBPP PACR bank stabilization program.

- **27 January 2017 –** NMFS received a revised BA from USACE. The BA was revised in response to comments provided by NMFS and USFWS, including a more limited scope of the program.

- **16 May 2016 –** NMFS requested more information from USACE regarding the critical habitat impacts analysis in the BA

- **16 June 2017 –** USACE provided a response to NMFS regarding the critical habitat impacts analysis.

- **8 June 2017 –** NMFS sent a list of additional questions and comments to USACE concerning the BA via email.

- **21 June 2017 –** NMFS and USACE met in person to discuss these comments.

- **11 July 2017 –** USACE responded to NMFS via email regarding the comments that were generated during the meeting on 21 June 2017. NMFS requested that the USACE provide additional information clarifying the SRBPP PACR repair sites.

- **7 September 2017 –** USACE responded with clarification on the SRBPP PACR repair sites.
- **12 September 2017 –** USACE requested that long-term fisheries monitoring for the SRBPP PACR sites be added to this consultation.
- **16 November 2017 –**NMFS requested more information about some inconsistencies in the BA regarding the rate of construction.
- **5 December 2017 –** USACE provided information on the proposed rate of construction and NMFS initiated consultation.
- **3 May 2019 –** NMFS transmitted a draft BO to USACE for review. The draft BO concluded that the proposed action is likely to jeopardize the continued existence of the Sacramento River winter-run Chinook salmon evolutionarily significant unit (ESU), Central Valley spring-run Chinook salmon ESU, and California Central Valley steelhead DPS, and destroy or adversely modify their designated critical habitat.
- **23 May 2019 –** NMFS and USACE personnel met to discuss USACE comments on the draft BO. The discussions focused on the draft project description and assumptions on repair design, environmental baseline, Reasonable and Prudent Alternative, and Terms and Conditions. USACE provided a draft response letter to NMFS.
- **29 May 2019 –** USACE received comments from NMFS staff regarding the bank protection designs, clarifying how the site selection process would occur, running the SAM analysis for each future site once a design is selected, ensuring the BA is more of a framework programmatic as the USACE had intended, incorporating bioengineered BPMs when possible, and including NMFS on technical teams for the design process.
- **24 June 2019 –** USACE submitted updated BA and initiation package requesting formal consultation.
- **27 June 2019 –** NMFS and USACE met to discuss comments to BA. The USACE indicated their initial BA (and draft BO) did not accurately represent the proportion of expected levee repair designs to be used and discussed intended changes/updates to the BA.
- **7 July 2019** – NMFS requested further information from USACE
- **11 July 2019 –** NMFS received new BA from USACE, and initiated consultation.

2 ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This BO includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR Part 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This BO relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this BO, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.

- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a RPA to the proposed action.

2.1.1 Use of Analytical Surrogates

Standard Assessment Methodology Analysis

SAM is a computational modeling and tracking tool developed by Stillwater Sciences with USACE, DWR, and fishery resource agencies (California Department of Fish and Wildlife [CDFW], NMFS, and USFWS). SAM was designed to address a number of limitations associated with previous habitat assessment approaches and provide a tool to systematically evaluate the impacts and compensation requirements of bank protection projects based on the needs of listed fish species in the Sacramento River. SAM allows agencies to quantitatively assess the potential effects of bank protection and stream restoration projects and inform them of compensation requirements to offset impacts and ensure that these activities do not jeopardize Chinook salmon, steelhead, and green sturgeon or destroy or adversely modify their critical habitat. SAM was applied to previously repaired SRBPP sites to demonstrate the future project impacts while recognizing that more refined SAM analyses would be undertaken to determine project-level effects at individual sites in the future.

SAM evaluates habitat modification impacts and bank protection alternatives by taking into account several key factors affecting listed species relevant to this consultation. A major advantage of the SAM is that it integrates species life history and seasonal flow-related variability in habitat quality and availability to generate species responses to project actions over time. By identifying and quantifying the response of focal species to changing habitat conditions over time, project managers, biologists and design engineers can make changes to project designs to avoid, minimize, or provide on- or off-site compensatory mitigation for impacts to habitat parameters that influence the growth and survival of target fish species by life stage and season (*http://www.stillwatersci.com/tools.php?tid=26*).

The SAM model is used to assess species responses as a result of changes to habitat conditions by direct quantification of bank stabilization design parameters (*e.g.*, bank slope, substrate). Consistent with Fish and Wildlife Mitigation Policy, the USACE proposes to follow as preferred hierarchy for mitigation: avoid, minimize, compensate on-site, and compensate off-site (46 FR 7644, 1981). In the case of most levee projects, most or all of these mitigation strategies are applied due to their large size. Challenges associated with completely avoiding and minimizing impacts, temporal delays in habitat function of on-site compensatory mitigation, and limitations of being able to provide full compensation at project sites, generally warrant the need for some form of off-site compensation.

In general, the SAM quantifies habitat values in terms of bankline weighted or area weighted species responses. These responses are calculated by combining indices of habitat quality (*i.e*., fish response indices) with quantity (bank length or wetted area) for each season, target year, and relevant species/life stage. The SAM conceptual model assesses changes to the quality and extent of the following six near-shore and floodplain habitat variables (*i.e*., fish response indices), taking into account habitat utilization and impacts to the growth and survival by life stage and season (USACE 2012):

1. **Bank slope —** average bank slope of each average seasonal water surface elevation;
2. **Floodplain availability —** ratio of wetted channel and floodplain area during the 2-year flood to the wetted channel area during average winter and spring flows;
3. **Bank substrate size —** the median particle diameter on the bank (i.e., D50) along each average seasonal water surface elevation;
4. **Instream structure —** percent of shoreline coverage of IWM along each average seasonal water surface elevation;
5. **Aquatic vegetation —** percent of shoreline coverage of aquatic or riparian vegetation along each average seasonal water surface elevation; and
6. **Overhanging shade —** percent of the shoreline coverage of shade.

The SAM does not directly model changes in the above variables. Instead, habitat changes are estimated separately by the user and entered into an input data file to an Electronic Calculation Template (ECT) developed within a Microsoft Access database to track species responses to program actions over time. Changes in habitat variables may be fixed in time, such as installation of revetment at a particular slope and substrate size. In other circumstances, habitat evolution over time may be represented by more gradual changes in variables such as changes in floodplain inundation due to meander migration or changes in shade due to growth of planted vegetation. Typically, habitat evolution modeling is restricted to shade estimates from riparian growth models, but the SAM accommodates any number of other habitat modeling approaches such as meander migration modeling or IWM recruitment modeling.

Once a particular time series of habitat variable estimates is developed and entered into an ECT input file, fish responses are calculated using previously developed relationships between habitat variables and species/life stage responses (USACE 2012). The response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (e.g., with-program or without-program) the ECT uses these relationships to determine the responses of individual species and life stages to the measured or predicted values of each variable, for each season and target year; the ECT then multiplies these values together to generate an overall species response index. This index is then multiplied by the linear distance or area of bank to which it applies; the product is then integrated through time, generating a weighted species response index (expressed as feet or square feet) in each year of the analysis. The weighted species response index provides a

common metric that can be used to quantify habitat values over time and evaluate the effectiveness of on-site and off-site habitat compensation actions.

Following the procedures outlined in the SAM User's Manual (USACE 2012), the electronic calculation template (ECT version 4.0) was used to quantify the responses of the focus fish species and life stages to with-program conditions over 50 years. The SAM model utilizes water years (WY) rather than traditional calendar years; SAM WY also differ from traditional hydrologic water years. SAM WY are as follows: fall (September – November), winter (December – February), spring (March – May), summer (June – August). The current application of the SAM has been simplified by assuming two key water surface elevations for habitat analysis: summer/fall and winter/spring. The ECT was used to calculate a time series of the relative response indices for each pre-program and with-program scenario developed below. Biological responses of each focus fish species life stage were predicted within each habitat unit and for each time step, based on habitat variable values and fish residency determined from region-specific timing tables (USACE 2012). In general, as calculated using the ECT, positive differences between the existing and with-program responses are assessed as a net benefit for the focus fish species (i.e., the bank repair action produced superior conditions than pre-program conditions). Negative differences indicate the bank repair actions produced inferior conditions that will require additional habitat compensation.

The SAM evaluates the response of focus fish species and their critical life-stages to BPMs over a 50-year period of analysis. Results are output as either bankline or wetted area Weighted Response Indices (WRI). The maximum negative wetted area WRI for a juvenile life stage are identified and can be used as a proxy for offsetting program effects. Although the SAM results can be presented as bankline weighted and wetted area weighted WRIs, this analysis will focus on bankline weighted because sufficient information was not available to calculate wetted area weighted WRIs.

The SAM incorporates the value of on-site mitigative features; therefore, the maximum negative wetted area WRI can be interpreted as the remaining potential effect that must be mitigated through additional on-site or off-site features, or through the purchase of off-site mitigative credits. Identifying the maximum negative WRI over the 50-year period of analysis ensures that potential temporal losses are sufficiently considered. The site-specific timing by water year and season of installed bank protection features, including rock placement, soil and IWM installation, and vegetation plantings, were considered in this analysis for the with-program conditions. Descriptions of the habitat variables used in the analysis are discussed below.

The following describes how input values for each of the habitat attributes were derived for existing conditions in the SRBPP PACR SAM assessment.

1. **Bank Slope:** Existing bank slopes (run-over-rise ratio) were developed in GIS using seasonal water surface elevation and bathymetric and topographic survey data.
2. **Floodplain Availability:** The SAM attribute of floodplain inundation ratio, which represents floodplain availability, was assumed to have a value of 1, reflecting the absence of significant floodplain habitat above the winter-spring shoreline under existing conditions. These attributes were developed in GIS using seasonal water surface elevation and bathymetric and topographic survey data.
3. **Bank Substrate Size:** The median substrate sizes along the summer-fall and winter-spring shorelines of the program reaches were determined in the field by following the data collection protocol from the USACE riprap database (USFWS 2002) (USACE 2007)

4. **Instream Structure:** The shoreline coverage of IWM along the average summer-fall and winter-spring shorelines of the program reach were determined using field data collected by USACE.
5. **Overhanging Shade:** The extent of overhanging shade along the summer-fall and winter-spring shorelines was determined through from GIS analysis using digitized canopy overlaying seasonal shoreline positions.

Biological responses of each focal species life stage will be modeled within each habitat unit for each season. In general, as calculated, positive differences between the existing and with-program responses are considered to result in improved growth and survival for the focus fish species, and negative values indicate the bank repair actions produced inferior conditions when compared to pre-program conditions and reduced growth and survival; over a 30-day exposure period.

Analytical Surrogates for Green Sturgeon

Critical habitat for green sturgeon in the action is designated in the Sacramento River. Impacts to the southern DPS of North American green sturgeon are also estimated using an analytical surrogate; however, there is a lack of suitable data available to determine precise program impacts on green sturgeon. Although the SAM model does have a green sturgeon component, the model may not have the precision to accurately index green sturgeon responses to changes in modeled habitat attributes and a more rigorous modeling approach needs development. USACE and NMFS have been in close discussion regarding previous requirements to develop a green sturgeon HMMP, with specific elements described in several previously issued BOs (see *Section 1.8.7* above). The HMMP directive included in past BOs also required USACE to either refine the SAM, or develop an alternative green sturgeon survival and growth response model.

No benthic surveys were conducted due to high water levels in the winter of 2016/2017. However, USACE has purchased a standard Ponar sampler and other equipment to proceed with a benthic community sampling study to determine forage organisms that may inhabit the project areas and relate physical habitat characteristics that may determine forage opportunities. Following initial testing of sampling gear, USACE will develop a stratified sampling plan using bathymetry and hydraulic model outputs to identify and select appropriate sampling sites with similar flow and depth characteristics. This will allow them to determine whether there are key habitat features, which may provide suitable production or presence of prey organisms and understand how SRBPP PACR project actions may be affecting forage opportunities for green sturgeon. As of April 4, 2019, USACE plans to conduct pilot sampling to inform plan development as soon as water elevations drop enough to safely commence. Once flows subside USACE plans to sample throughout the year.

For this BO, NMFS has determined that the spatial extent of critical habitat below the ordinary high water mark (OHWM) which will be covered by bare rock revetment (*i.e.*, where there is not soil mixed in and the surface is not planted) would serve as the best analytical surrogate for impacts to all life stages of green sturgeon.

2.2 Rangewide Status of the Species and Critical Habitat

This BO examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR Part 402.02. The BO also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

Table 4. Description of species, current ESA listing classification and summary of species status.

Species	Listing Classification and Federal Register Notice	Status Summary
Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*)	Endangered 6/28/2005 70 FR 37160	According to the NMFS 2016, 5-year species status review, the overall status of Sacramento River winter-run Chinook salmon has declined since the 2010 status review, with the single spawning population on the mainstem Sacramento River no longer at a low risk of extinction. New information indicates an increased extinction risk to winter-run Chinook salmon. The larger influence of the hatchery broodstock in addition to the rate of decline in abundance over the past decade has placed the population at a moderate risk of extinction and because there is only one remaining population, the extinction risk for the ESU has increased from moderate risk to high risk of extinction.
Central Valley spring-run Chinook salmon (*O. tshawytscha*)	Threatened 9/2/2005 70 FR 52488	According to the NMFS 2016, 5-year species status review, the status of the CV spring-run Chinook salmon ESU, until 2015, has improved since the 2010 5-year species status review. The improved status is due to extensive restoration, and increases in spatial structure with historically extirpated populations (Battle, Clear creeks) trending in the positive direction. Recent declines of many of the dependent populations, high pre-spawn and egg mortality during the 2012 to 2015 drought, uncertain juvenile survival during the drought are likely increasing the ESU's extinction risk.
California Central Valley Steelhead (*O. mykiss*)	Threatened 9/2/2005 70 FR 52488	According to the NMFS 2016, 5-year species status review, the status of CCV steelhead appears to have changed little since the 2011 status review that concluded that the DPS was in danger of extinction. Most wild CCV populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.
Green sturgeon (*Acipenser medirostris*)	Threatened 8/9/2009 74 FR 52300	According to the NMFS 2015, 5-year species status review, some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barrier, but the species viability continues to be constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The species continues to face a moderate risk of extinction.

Table 5. Description of critical habitat, designation details and status summary.

Species	Designation Date and Federal Register Notice	Status Summary
Sacramento River Winter-run Chinook ESU	6/16/1993 58 FR 33212	Designated critical habitat includes the Sacramento River from Keswick Dam (river mile (RM) 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta); all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. The designation includes the river water, river bottom and adjacent riparian zones used by fry and juveniles for rearing. Physical and biological features considered essential to the conservation of the species include: Access from the Pacific Ocean to spawning areas; availability of clean gravel for spawning substrate; adequate river flows for successful spawning, Incubation of eggs, fry development and emergence, and downstream transport of juveniles; water temperatures at 5.8–14.1°C (42.5–57.5°F) for successful spawning, egg incubation, and fry development; riparian and floodplain habitat that provides for successful juvenile development and survival; and access to downstream areas so that juveniles can migrate from spawning grounds to the San Francisco Bay and the Pacific Ocean.
Central Valley Spring-run Chinook salmon ESU	9/2/2005 70 FR 52488	Critical habitat for CV spring-run Chinook salmon includes stream reaches of the Feather, Yuba, and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, as well as portions of the northern Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Physical and biological features considered essential to the conservation of the species include: spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas.
California Central Valley Steelhead	9/2/2005 70 FR 52488	Critical habitat for CCV steelhead includes stream reaches of the Feather, Yuba, and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, as well as portions of the northern Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Physical and biological features considered essential to the conservation of the species include spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas.

Species	Designation Date and Federal Register Notice	Status Summary
Southern Distinct Population Segment (sDPS) of North American Green Sturgeon	8/9/2009, 74 FR 52300	Critical habitat includes the stream channels and waterways in the Delta to the ordinary high water line. Critical habitat also includes the main stem Sacramento River upstream from the I Street Bridge to Keswick Dam, the Feather River upstream to the fish barrier dam adjacent to the Feather River Fish Hatchery, and the Yuba River upstream to Daguerre Dam. Coastal marine areas include waters out to a depth of 60 fathoms, from Monterey Bay in California, to the Strait of Juan de Fuca in Washington. Coastal estuaries designated as critical habitat include San Francisco Bay, Suisun Bay, San Pablo Bay, and the lower Columbia River estuary. Certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) are also included as critical habitat for sDPS green sturgeon. Physical and biological features considered essential to the conservation of the species for freshwater and estuarine habitats include food resources, substrate type or size, water flow, water quality, migration corridor; water depth, sediment quality.

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Part 402.02). The action area is not the same as the program boundary area because the action area must delineate all areas where federally listed populations of salmon, steelhead, and green sturgeon may be affected by the implementation of the proposed action.

The action area includes all the waterbodies where work will occur (listed in Table 6 and Table **7**), as well as all additional areas that may be affected by the action. These include mitigation banks, where credits may be purchased, and areas downstream of the repairs that may experience increased turbidity during the repairs. The action area includes perennial waters of the Sacramento River, American River, Feather River and certain tributaries, extending 200 feet perpendicular from the average summer-fall shoreline and up to 400 feet downstream from proposed in-water construction areas. This estimation is based on previous turbidity monitoring efforts at other SRBPP PACR sites, which found that the level of turbidity 300 feet downstream from construction resembled baseline conditions (USACE 2015).

Table 6. Approximate Location of SRBPP PACR, by River Mile.

Sacramento River	Right	51-63
	Left	45-80, 138-176
Feather River	Left	0-12
American River	Right	0-2
	Left	0-12

Table 7. Range Where Repairs May Occur Each Basin and Each Waterbody.

Econ. Justified Basin	Related Waterbodies	Downstream	Upstream
Butte Basin	Butte Creek	2mi SE of Seven Mile Rd and Goodspeed Rd	1mi SE of Midway Rd
Butte Basin	Butte Slough	~ Sac River Mile (RM) 138	1mi East on Marty Rd
Butte Basin	Cherokee Canal	1mi SW Colusa Hwy	>2mi NE Colusa Hwy
Butte Basin	Colusa Bypass	Sac RM 146 L*	Sac RM 146 L*
Butte Basin	Moulton Weir	Sac RM 158 L*	Sac RM 159 L*
Butte Basin	Mud Creek	River Road	Nord Avenue
Butte Basin	Sacramento River	Sac RM 138 L*	Sac RM 176 L*
Natomas Basin	Lower American River	American RM 0 R*	American RM 2 R*
Natomas Basin	Natomas Cross Canal	Sac RM 79 L	Pacific Ave
Natomas Basin	Natomas East Main Drainage Canal (NEMDC)	Northgate Blvd	Sankey Rd
Natomas Basin	Pleasant Grove Canal	Sankey Rd	Howsley Rd
Natomas Basin	Sacramento River	Sac RM 60 L*	Sac RM 79 L*
Rio Oso	Bear River	Bear RM 0	Bear RM 3
Rio Oso	Coon Creek Intercept	Pacific Ave	Coon Creek
Rio Oso	Feather River	Feather RM 0 L*	Feather RM 12 L*
Rio Oso	Natomas Cross Canal	Sac RM 79 L*	Pacific Ave
Rio Oso	Sacramento River	Sac RM 79 L*	Sac RM 80 L*
Rio Oso	Yankee Slough	Hwy 70	Jackson Rd
Sacramento	Sacramento River	Sac RM 45 L*	Sac RM 60 L*
Sacramento	Lower American River	American RM 0 L*	American RM 12 L*
Southport	Sacramento River	Sac RM 51 R*	Sac RM 58 R*
Southport	Sac River Deep Water Ship Channel (DWSC)	Fisher Ave	Solomon Island Rd
West Sacramento	Yolo Bypass	Sac River DWSC	County Rd 127
West Sacramento	Sacramento River	Sac RM 57 R*	Sac RM 63 R*
Yolo	Cache Creek	Yolo Bypass	County Rd 96B
Yolo	Knights Landing Ridge Cut	Yolo Bypass	Knights Landing
Yolo	Yolo Bypass	Cache Creek	Knights Landing Ridge Cut

**"L" refers to the levee on the left side of the river when looking downstream.*
**"R" refers to the levee on the right side of the river when looking downstream.*

Since the USACE may also purchase mitigation credits from one or more conservation bank over the course of the program, the action area also includes the three mitigation banks that have service areas within the potential program area. These include the Fremont Landing Conservation Bank, which is a 100-acre floodplain site along the Sacramento River (Sacramento RM 80); Bullock Bend Mitigation Bank, a 119.65-acre floodplain site along the Sacramento

River at the confluence of the Feather River (Sacramento RM 106); and Liberty Island Conservation Bank within the north Delta.

2.4 Environmental Baseline

The “environmental baseline” includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR Part 402.02).

Most impacts on listed species occurred prior to the SRBPP PACR and are the result of development of the basin-wide flood control system, the SRFCP, and other human developments. The current system evolved from private efforts begun in 1850 into the joint Federal-State SRFCP, which was essentially completed in 1960. Because the SRFCP removed large acreages of riparian floodplain and overflow basins from the river system, it had major effect on regeneration of riparian woodland communities, recruitment of large woody debris to the river system, spawning and rearing of fish in floodplain and floodplain functions, and allochthonous inputs of nutrients and food to the aquatic system. It eliminated the possibility of natural channel migration and habitat renewal over a considerable portion of the river system. Reaches throughout the action area historically provided both shallow and deeper water habitat. However, channel confining levees and upstream reservoirs that maintain year-round outflow have eliminated much of the adjacent shallow water floodplain habitat. Many native fish species are adapted to rear in flooded, shallow water areas that provide abundant cover from prey. As a consequence of habitat alterations, and introduction of non-native species and pollutants, some native fish species are now extinct while most others are reduced in numbers (Moyle 2002).

The SRBPP PACR is occurring in the Sacramento River, American River, Feather River, and other tributaries, bypasses and sloughs in the Sacramento River watershed, most of which serve as rearing habitat and migratory corridors for listed Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. As mentioned above, much of the Sacramento River watershed has been substantially altered from human activities, and this has dramatically reduced the habitat value of the watershed for listed fish species. However, despite the impaired status of the Sacramento River watershed in the proposed action area, the value of the area for listed fish species is high, as it provides some of the last remaining critical habitat for listed fish. The lower Sacramento River is an important migratory corridor for SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon, and contains habitat elements that support the rearing and growth of juveniles and the successful upstream migration of adults. The same high value can be attributed to the lower American River for CV spring-run, CCV steelhead, and sDPS green sturgeon.

The Sacramento River watershed receives winter/early spring precipitation in the form of rain and snow (at higher elevations). Prior to the construction and operation of any reservoirs, winter rainfall events caused extensive flooding and spring snowmelt resulted in high flows during spring and early summer. Summer and fall flows were historically low. Currently, much of the total runoff is captured and stored in reservoirs for gradual release during the summer and fall months. High river flows occur during the winter and spring, but these are usually lower than during pre-European settlement times; summer and fall low flows are sustained by releases from upstream reservoirs.

Anticipated climate change may affect spatial and temporal precipitation patterns along with the intensity and duration of precipitation with the Sacramento and American River watersheds. The effect of climate change is anticipated to be more winter and less spring and summer run-off within the watershed. In addition, expected run-off is anticipated to be warmer, possibly affecting the ability to meet downstream water temperature objectives to protect salmon, steelhead, and green sturgeon. This, combined with more precipitation as rain, will affect future operations of all reservoirs within the California Central Valley. A change in the run-off pattern within the Sacramento and American River watersheds will likely affect reservoir storage and downstream river flows due to more frequent spillway releases.

The Sacramento River Flood Protection Project impacts the natural meander and ecosystem of the Sacramento and American Rivers, included in the SRBPP PACR action area. Downstream from the American River confluence, the Sacramento River is moderately sinuous, with the channel confined on both sides by man-made levees enhanced and repaired over the decades. The channel in this reach is uniform width, is not able to migrate, and is typically narrower and deeper relative to the upstream reach due to scour caused by the concentration of shear forces acting against the channel bed (Brice 1977). Channel migration is similarly limited along the lower American River because of man-made levees and regulated flows from Folsom and Nimbus Dams.

USACE proposes to use the Interagency Working Group (IWG) to support an independent re-analysis of the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project in Solano County, California to determine how many excess conservation credits may be applied to future SRBPP PACR compensation needs. The Cache Slough, built in 1992, provides in-kind mitigation for adverse impacts to Delta smelt habitat. The site is comprises 176 acres, with 12,000 LF of exterior bank line and 138 acres of wetted area. It is located within designated Delta smelt critical habitat on Cache Slough in the northern Sacramento-San Joaquin Delta, west of the Sacramento River, approximately eight miles north of Rio Vista. The site is owned and maintained by DWR, with the purpose of supplying advanced mitigation credits to address off-site mitigation requirements for SRBPP actions where compensation for habitat loss cannot be completed on-site. However, there exists no formal agreement between NMFS, USACE and DWR regarding the disposition of “credits” for NMFS-listed species and this analysis considers the beneficial effects of the 1992 SRBPP Cache Slough/Yolo Bypass Cross-Levee Project to reside in the Environmental Baseline. As such, the NMFS will not support or engage in an effort to analyze the applicability of credits toward future SRBPP PACR actions.

2.4.1 Land Cover

The Sacramento River watershed historically supported an extensive range of riparian habitat and marshes. Today, the Sacramento River Basin includes several distinct ecosystems, including wetlands, riparian habitats, irrigated agriculture, annual grasslands, and valley oak woodland.

Eight land cover types were identified in the SRBPP PACR program area: riparian forest (35%), riparian scrub-shrub (7%), riparian herbaceous (18%), emergent marsh (5%), bare ground (2%), agricultural (31%), ruderal vegetation (0%), and urban (3%).

Riparian forest typically has a dominant overstory of cottonwood, California sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*). Species found in the scrub-shrub will make up the sub canopy and could also include white alder and box elder. Layers of climbing vegetation make up part of the subcanopy, with wild grape being a major component, but wild cucumber and clematis are also found in riparian communities.

Early riparian habitat may be called scrub-shrub. Scrub-shrub generally refers to areas where woody riparian canopy is composed of trees or shrubs approximately 20 feet high. Species that are typically found in these habitats include young cottonwood (*Populus trichocarpa*), willow (*Salix spp.*), elderberry (*Sambucus spp.*), buttonbush (*Cephalanthus occidentalis*), Himalaya blackberry (*Rubus armeniacus*), wild grape (*Vitis vinifera*), and poison oak (*Toxicodendron spp.*).

Riparian herbaceous cover includes herbland cover and gravel and sand bar community types. Areas are designated as riparian herbaceous cover if they are enclosed by riparian vegetation or the stream channel. Gravel and sand bar community types were included in this grouping by the USACE, because these areas support annual and short-lived perennial species, including herbs, grasses and subshrubs that cover less than 50% of the area (Nelson 2000). Species that are typically found in these habitats include European annual and native perennial grasses; native perennials such as Douglas' sagewort (*Artemisia douglasiana*), Santa Barbara sedge (*Carex barbarae*), smooth horsetail (*Equisetum laevigatum*), California pea (*Lathyrus jepsonii* var. *californicus*) and cudweed (*Gnaphalium* sp.); non-natives forbs and grasses such as garden asparagus and Bermuda grass (*Cynodon dactylon*); and invasive plants such as yellow star-thistle (*Centaurea solstitialis*). Monospecific stands of the invasive exotic giant reed (*Arundo donax*) are also included in this vegetation type category.

Emergent marsh includes valley freshwater marsh and common reed plant community types. Common species found in emergent marsh habitat include cattails (*Typha* spp.) and tule (*Scirpus* spp.) with some sedge or associated broad-leaved aquatic species (such as *Verbena hastata*), and common reed (*Phragmites australis*), which can grow in inundated areas along the channel edge.

Other cover types found in the SRBPP PACR action area include bare ground (areas devoid of vegetation), agricultural, ruderal vegetation (areas with sparse to moderate herbaceous plant cover dominated by weedy upland species), and urban (including structures, roads and parks, but are usually located on the landward side of the levee).

Riparian recruitment and establishment models (Mahoney 1998); (Bradley 1986) and empirical field studies (Scott 1997); (Scott 1999) emphasize that hydrologic and fluvial processes play a central role in controlling the elevational and lateral extent of riparian plant species. These processes are especially important for pioneer species that establish in elevations close to the active channel, such as cottonwood and willows (*Salix* spp.). Failure of cottonwood recruitment and establishment is attributed to flow alterations by upstream dams (Roberts 2001) and to isolation of the historic floodplain from the river channel. In addition, many of these formerly wide riparian corridors are now narrow and interrupted by levees and weirs. Finally, draining of wetlands, conversion of floodplains to agricultural fields, and intentional and unplanned introduction of exotic plant species have altered the composition and associated habitat functions of many of the riparian communities that are able to survive under current conditions.

2.4.2 Previous SRBPP Flood Management Actions

The environmental baseline also includes past and present flood management actions within the SRBPP action area.

The SRBPP was originally authorized by the Flood Control Act of 1960, in order to protect levees and flood control facilities of the SRFCP from erosion damage. The SRBPP has been thus far described in two phases: SRBPP Phase I and Phase II. Each phase includes flood risk management actions consisting mainly of bank protection and levee repairs to correct erosion problems and protect low-lying areas of the Sacramento Valley and Sacramento-San Joaquin Delta from damaging floods. Phase I was constructed from 1962 to 1975. Phase II was originally authorized in 1974 and consists of 405,000 LF of bank protection. Construction for Phase II started in 1976 and is on-going. An additional 80,000 LF was added to Phase II by the Water Resources Development Act (WRDA) of 2007, and is the authorization for the proposed action that is the subject of this consultation. A third phase may continue bank protection after the completion of Phase II, but currently, the scope of Phase III is being determined by USACE and the CVFPB.

SRBPP Phase I

Construction for the SRBPP Phase I included 11 rivers and waterways: 1) 3-Mile Slough; 2) American River; 3) Bear River; 4) Elder Creek; 5) Feather River; 6) Georgiana Slough; 7) Miner Slough; 8) Sacramento River; 9) South Dry Creek; 10) Steamboat Slough; and 11) Sutter Slough. These are described in greater detail below.

1. **3-Mile Slough –** Repairs at this location took place starting in 1963 and concluded by 1970. The repairs primarily took place at 8 sites on approximately 4,500 non-contiguous LF on the left bank of the waterway. The areas repaired began at approximately RM 1.07 and included locations to RM 1.7. Repairs consisted of quarry stone bank revetment.
2. **American River –** Repairs on the American River took place starting in 1965 and concluding by 1970. The repairs took place at 3 sites on approximately 3,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 4.8 and included locations to RM 5.84. Repairs consisted of quarry stone bank revetment.
3. **Bear River –** Repairs at this location took place starting in 1965 and concluded by 1967. The repairs took place at 9 sites on approximately 8,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 1.76 and included locations to RM 11.6.
4. **Elder Creek –** Repairs on Elder Creek took place starting in 1965 and concluding by 1969. The repairs took place at 13 sites on approximately 14,000 non-

contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 0.2 and included locations to RM 1.85.

5. **Feather River –** Repairs at this location took place starting in 1965 and concluded by 1968. The repairs took place at 13 sites on approximately 14,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 1.9 and included locations to RM 49.6. Repairs consisted of cobble and quarry stone bank revetment.
6. **Georgiana Slough –** Repairs on Georgiana Slough took place starting in 1965 and concluded by 1974. The repairs took place at 12 sites on approximately 7,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 4.0 and included locations to RM 10.1. Repairs consisted of quarry stone bank revetment.
7. **Miner Slough –** Repairs at this location took place starting in 1966 and concluded by 1974. The repairs took place at 12 sites on approximately 10,000 non-contiguous LF on the left bank of the waterway. The areas repaired began at approximately RM 0.6 and included locations to RM 5.2. Repairs consisted of quarry stone bank revetment.
8. **Sacramento River –** Repairs on the Sacramento River took place starting in 1963 and concluded by 1975. The repairs took place at 280 sites on approximately 332,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 12.4 and included locations to RM 165.1. Repairs on sites from RM 77.6L and down consisted of quarry stone riprap whereas repairs on sites from RM 77.6L and up consisted of quarry stone riprap or cobble stone bank revetment.
9. **South Dry Creek –** Repairs at this location took place at 3 sites on approximately 4,000 non-contiguous LF on the left bank of the waterway. The areas repaired began at approximately RM 1.3 and included locations to RM 3.5.
10. **Steamboat Slough –** Repairs on Steamboat Slough took place at 41 sites starting in 1966 and concluded by 1974. The repairs took place on approximately 29,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 15.3 and included locations to RM 25.0. Repairs consisted of quarry stone bank revetment.
11. **Sutter Slough –** Repairs at this location took place at 18 sites starting in 1963 and concluded by 1974. The repairs took place on approximately 10,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 22.0 and included locations to RM 28.1. Repairs consisted of quarry stone bank revetment.

In Phase I of SRBPP, repairs of about 430,000 LF of levee consisted mainly of quarry stone and bank revetment, and no mitigation was provided for fish and wildlife habitat losses from the construction of bank protection.

SRBPP Phase II

In 1974, repair of 405,000 LF was authorized for SRBPP Phase II. Construction began in 1976 and, as of December 2011, through multiple construction and multiple design contracts, 404,367 LF has been repaired, leaving 633 LF remaining out of the authorized 405,000 LF. Table 8 is a summary of linear feet of bank protection constructed annually. The overall SRBPP program, area is the same for Phase I and Phase II. However, Phase II site locations vary from the Phase I site locations because erosion problems occurred at different locations throughout the program area.

Table 8. Linear Feet of Bank Protection Constructed Annually under the SRBPP.

Year	Bank Protection Constructed	Total Bank Protection Constructed	Bank Protection Remaining
1975	0	0	405,000
1976	54,955	54,955	350,045
1977	11,955	66,910	338,090
1978	21,802	88,712	316,288
1979	35,519	124,231	280,769
1980	5,745	129,976	275,024
1981	18,763	148,739	256,261
1982	32,458	181,197	223,803
1983	0	181,197	223,803
1984	3,100	184,297	220,703
1985	43,683	227,980	177,020
1986	0	227,980	177,020
1987	31,222	259,202	145,798
1988	11,161	270,363	134,637
1989	42,431	312,794	92,206
1990	0	312,794	92,206
1991	0	312,794	92,206
1992	529	313,323	91,677
1993	0	313,323	91,677
1994	0	313,323	91,677
1995	6,855	320,178	84,822
1996	0	320,178	84,822
1997	689	320,867	84,133
1998	0	320,867	84,133
1999	11,044	331,911	73,089
2000	0	331,911	73,089
2001	9,800	341,711	63,289
2002	700	342,411	62,589
2003	16,500	358,911	46,089
2004	0	358,911	46,089
2005	0	358,911	46,089
2006	13,664	372,575	32,425

Year	Bank Protection Constructed	Total Bank Protection Constructed	Bank Protection Remaining
2007	11,300	383,875	21,125
2008	5,734	389,609	15,391
2009	8,203	397,812	7,188
2010	1,200	399,012	5,988
2011	2,607	401,619	3,381
2012	0	401,619	3,381
2013	0	401,619	3,381
2014	0	401,619	3,381
2015	1,546	403,165	1,835
2016	687	403,852	1148
2017	515	404,367	633
Total:	404,367		
Authorized:	405,000		

Construction for the SRBPP Phase II included 15 rivers and waterways: 1) American River; 2) Bear River; 3) Cache Creek; 4) Cache Slough; 5) Colusa Basin; 6) Elder Creek; 7) Elk Slough; 8) Feather River; 9) Georgiana Slough; 10) Miner Slough; 11) Murphy's Slough; 12) Sacramento River; 13) Steamboat Slough; 14) Sutter Bypass; and 15) Sutter Slough. These are each described in greater detail below.

1. **Lower American River –** Repairs on the American River took place starting in 1996 and concluded by 2012. The repairs took place at 9 sites on approximately 12,000 non-contiguous LF on the waterway. The sections of the Lower American River repaired were: RM 0.3L, 2.0L, 2.8L, 3.7L, 4.5L, 6.8L, 8.7R, 10.0L, and 10.6L.
2. **Bear River –** Repairs at this location took place in 1976. The repairs took place at 1 site on approximately 650 non-contiguous LF on the left bank of the waterway. The areas repaired began at approximately RM 0.3.
3. **Cache Creek –** Repairs on Cache Creek took place in 2006. The repairs took place at 3 critical emergency erosion sites on approximately 2,720 non-contiguous LF on the left bank of the waterway. Three setback levees were constructed at levee mile (LM) 0.8, LM 1.1 and LM 2.4.
4. **Cache Slough –** Repairs at RM 21.8 were completed in 2008. The site is approximately 1,040 LF on the right bank of the waterway on Hastings Island.
5. **Colusa Basin –** Repairs at this location took place starting in 2001 and concluded by 2003. The repairs took place at 1 site on approximately 26,000 non-contiguous LF on the waterway.
6. **Elder Creek –** Repairs on Elder Creek took place in 1976. The repairs took place at 2 sites on approximately 1,600 non-contiguous LF on the right bank of the waterway. The areas repaired began at approximately RM 2.09 and included locations to RM 3.83.
7. **Elk Slough –** Repairs on Elk Slough took place in 1982. The repair took place at 1 site on approximately 300 LF on the left bank of the waterway near RM 2.1.

8. **Feather River** – Repairs at this location took place starting in 1977 and concluded by 2012. The repairs took place at sites approximately 19,000 non-contiguous LF mostly on the left bank of the waterway. Three sections recently repaired were: RM 5.5L, 7.0L, and 28.5R.
9. **Georgiana Slough** – Repairs on Georgiana Slough took place starting in 1978 and concluded by 1985. The repairs took place at 13 sites on approximately 17,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 1.3 and included locations to RM 12.3. Repairs consisted of quarry stone riprap.
10. **Miner Slough** – Repairs at this location took place starting in 1983 and concluded by 1997. The repairs took place at 11 sites on approximately 7,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 1.0 and included locations to RM 7.6. Repairs consisted of quarry stone riprap.
11. **Murphy's Slough** – Repairs on Murphy's Slough were completed at one location in 1976. The repair area was approximately 300 LF on the left bank of the waterway.
12. **Sacramento River** – Repairs on the Sacramento River took place starting in 1976 and the most recent repairs continuing into 2017. The repairs took place at approximately 300 sites on approximately 260,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 8.5 and included locations to RM 191.6. Repairs consisted of stone riprap covered with soil filled quarry stone and planted with native riparian species. Sites completed as of 2017 include: RM 16.8L,16.9L, 26.9L, 33.0R, 33.3R, 34.5R, 42.7R, 43.7R, 44.7R, 47.0L, 47.9R, 48.2R, 49.6L, 49.7L, 49.9L, 50.2L, 50.4L, 50.8L, 51.5L, 52.3L, 52.4L, 53.1L, 53.5R, 56.7L, 62.5R, 68.9L, 71.3R, 72.2R, 73.5L, 78.0L, 87.0L, 93.7L, 99.3R, 114.5R, 123.5L, 136.7R, 136.9R, 149.0L, and 177.8R.
13. **Steamboat Slough** – Repairs at this location took place starting in 1976 and concluded by 2009. The repairs took place at 41 sites on approximately 33,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 15.7 and included locations to RM 26.0R. Sites recently completed were: 16.6R, 19.0R, 19.4R and 22.7R. Repairs consisted of stone riprap covered with soil filled quarry stone and planted with native riparian species.
14. **Sutter Bypass** – Repairs at RM 0.4.E took place in 2009. The site is approximately 365 LF on the left bank of the waterway.
15. **Sutter Slough** – Repairs at this location took place starting in 1983 and concluded by 1997. The repairs took place at 36 sites on approximately 22,000 non-contiguous LF on the right and left banks of the waterway. The areas repaired began at approximately RM 21.9 and included locations to RM 28. Repairs consisted of quarry stone riprap.

Mitigation for Phase II bank protection is an improvement over Phase I. In order to address impacts to species listed under the ESA and impacts to their designated critical habitat, Phase II bank protection has attempted preservation of riparian and riverine habitat through avoidance and on-site mitigation. Although this approach was applied for several years, the ETL has affected the ability for USACE to preserve onsite vegetation and reduced the amount of on-site mitigation.

Most recently, the 2008 programmatic BO consulted on and authorized BPMs for a list of sites shown below in Table 9. These recently constructed sites will further inform the understanding of the environmental baseline in the program action area. The sites located within the EJB, and thus directly within the program action area, are in bold font.

Table 9. Sites Consulted on under the 2008 Programmatic Biological Opinions.

	RM	Bank	LF	BO (#sites)	Year Constructed	Post Con Report
Sacramento River	16.8	L	650	2008-13 sites	2015	NA
	26.0	L	1546	Solo	2016	NA
	35.4	L	1070	2009-12 sites	Not Started	NA
	42.7	R	198	2008-13 sites	2009-10	2009
	49.7	**L**	**285**	**2008-13 sites**	**2008-9**	**2009**
	52.3	**L**	**1320**	**2008-13 sites**	**2008-9**	**2008**
	53.5	**R**	**322**	**2008-13 sites**	**2008-9**	**2008**
	55.2	**L**	**730**	**2008-13 sites**	**Not Started**	**NA**
	57.2	**R**	**1200**	**Solo**	**2012-2013**	**NA**
	71.3	**L**	**515**	**Solo**	**2017**	**NA**
	73.5	**L**	**1088**	**2009-12 sites**	**2009-10**	**2009**
	77.2	**L**	**607**	**2008-13 sites**	**2011**	**2011**
	87.0	L	750	2009-12 sites	2009-10	2009
	93.7	L	1050	2009-12 sites	2009-10	2009
	114.5	R	1500	2009-12 sites	2009-10	2009
	136.7	R	300	2009-12 sites	2009-10	2009
	136.9	R	900	2009-12 sites	2009-10	2009
	177.8	R	1068	2008-13 sites	2008-9	2008
Feather River	**5.5**	**L**	**833**	**2009-12 sites**	**2009-10**	**2009**
	7.0	**L**	**887**	**2009-12 sites**	**2011**	**2011**
	28.5	R	1219	2008-13 sites	2009-10	2009
American River	**0.3**	**L**	**517**	**2008-13 sites**	**2008-9**	**2008**
	2.8	**L**	**472**	**2008-13 sites**	**2008-9**	**2008**
	10.0	**L**	**502**	**2009-12 sites**	**2011**	**2011**
	10.6	**L**	**611**	**2009-12 sites**	**2011**	**2011**
Steamboat Slough	16.6	R	708	2008-13 sites	2008-9	2008
Cache Slough	21.8	R	1042	2008-13 sites	2008-9	2008
Sutter Bypass	0.4	R	365	2009-12 sites	2009-10	2009
	Total LF		**22255**		**EJB LF**	**9889**

SRBPP Environmental Impacts and Mitigation

Mitigation for environmental impacts of bank protection has improved with SRBPP Phase II, reflecting the developing understanding of the status and survival requirements of listed fish species. However, to date, compensatory mitigation has been directed solely at site-level impacts. The Sacramento River is highly fragmented and disconnected from ecological processes, and much of this is the result from river erosion and meandering being halted by rock riprap bank protection (USFWS 2004). As of 2004, of the lower 194 miles of the Sacramento River, over half of the river's banks have been riprapped (*i.e.*, covered with bare rock), and this is mainly due to four decades of work under the SRBPP (USFWS 2004). Note that this figure was taken from a 2004 report, and more riprap has been installed since then, causing further harm to listed species and impacts to their critical habitat.

Although site-level impacts have been addressed from compensatory mitigation associated with the SRBPP, ecosystem impacts have largely been left unaddressed. Levees constructed as part of the SRBPP have replaced the naturally occurring shallow water habitat that existed along the banks of rivers and sloughs, which historically provided a spectrum of complex habitats. Shallow water habitats had a broad range of depths, water velocities, riparian vegetation, fallen trees and woody materials (*i.e*., IWM), and gave the river the ability to migrate across the floodplain to create additional complexity in the geometry of its cross section. Naturally flowing rivers were able to construct riverside benches and naturally formed levees during flood events. These benches could be up to 20 feet high and extended for considerable distances inland, creating suitable conditions for the establishment and successful development of structurally diverse riparian vegetation communities (The Bay Institute 1998). Large, continuous corridors of riparian forests and vegetation were present along major and minor rivers and streams in the Central Valley. Native fish species, including listed salmonids and green sturgeon, evolved under these environmental conditions.

The construction of levees and the "reclamation" of floodplains eliminated these riparian areas. Only remnant riparian forests exist in the action area today, as many of the levees are extensively riprapped with stone armoring. Only in a few areas where waterside benches exist outside of the levee toe and vegetation is allowed to grow, does naturally established vegetation exist. These stands of riparian vegetation are discontinuous and frequently very narrow in width, providing a fraction of the ecological benefits of their historical predecessors.

In particular, the loss of large wood recruitment and IWM on a large-scale is becoming increasingly concerning, as our understanding of the functionality of IWM for fish and other wildlife resources continues to develop. IWM is very important to fish, playing key roles in physical habitat formation, sediment and organic-matter storage, and in maintaining essential habitat complexity and refugia (USFWS 2004). Loss of IWM reduces habitat quality and carrying capacity (USFWS 2004). The act of riprapping river banks not only removes any existing IWM, but prevents recruitment of IWM along the riprapped banks and reduces the retention of IWM recruited from any upstream, non-armored areas (USFWS 2004). In fact, "the cumulative loss of IWM functioning for the lower Sacramento River is now likely at least 67-90 percent, or more, compared to pre-SRBPP conditions" (USFWS 2004).

Loss of IWM negatively impacts salmonids through multiple phases of their life history. Schaffter, Jones et al. (1983) showed that juvenile Chinook salmon densities along riprapped banks are one third that of natural banks with the presence of fallen trees and their root balls in the water. They concluded that traditional riprap methods of protection will likely cause decreases the salmon numbers in the Sacramento River basin. USFWS (2000) reported that in studies conducted in the Sacramento River near the Butte Basin, the highest number of juvenile Chinook salmon were associated with the nearshore areas with woody material, sloping banks, and moderate velocities. Juvenile Chinook salmon catches (*i.e.*, measured as catch per unit effort) were consistently lowest at riprapped sites and highest at natural bank sites with overhead cover and IWM, and intermediate in areas where experimental mitigation studies with artificially placed IWM. USFWS (2000) reported that additional studies conducted between Chico Landing and Red Bluff on the Sacramento River confirmed the low value of riprapped banks, the high value of natural banks with varying degrees of instream and overhead woody cover, and the intermediate value of mitigated sites.

In large mainstem streams and rivers such as the Sacramento River, the primary benefit of IWM occurs along channel margins. The woody materials act to deflect and break up stream flow, creating small eddies, pools, undercut banks, variability in channel depth, and back water areas conducive to rearing and growth (Murphy & Meehan 1991, Bisson *et al*. 1987). Sediment that is trapped by the woody material and stored along the channel margins contributes to the hydraulic and biologic complexity of the stream reach, particularly where organically rich materials are present (Bisson, Bilby et al. 1987). These storage areas create new habitat complexity by trapping inorganic material that creates bars and holes and organic materials that contribute energy and carbon to the local food web of the stream reach (Murphy & Meehan 1991, Bisson *et al.* 1987). These breaks in the river flow also create ideal holding areas with plentiful food resources and the conditions where salmonids can hold with minimal energy expenditure and feed while rearing. These areas are also beneficial to a wide range of other species native to the system. Such refuges are critically important to the lower river reaches where levee construction and riprapping have disconnected the rivers from the adjoining floodplain where slow water refugia and rearing habitats formerly existed.

Riprapping affects the stability of IWM along the river channel margin. Stable wood retention is important for creating and maintaining good fish habitat (Bisson *et al.* 1987). Whole trees and their root balls are more important for long-term stability than smaller fragments, as they tend to stay in place for long periods of time. These large pieces of wood may remain in place for decades and in the process trap additional IWM, thus adding complexity to the overall bank structure. The longevity of IWM, however, may mask changes in the input of woody materials to the river. Since these large pieces of wood would normally be slow to decay, a decline in the woody material input may be masked. Riprapping of the upper river and Delta waterway banks prevents the normal input of upstream woody materials through erosion. The homogeneity and unvarying hydraulic roughness along the riprapped banks prevents pieces of woody materials from becoming anchored and remaining in place. The woody materials are transported downstream, but the riprapping of the lower river and Delta waterway banks further limit these pieces from becoming lodged on the banks and the woody material is lost to the system. There is a continuing reduction of IWM input from upstream and local waterways, so much so, that the presence of IWM in the Delta is becoming exceedingly rare. Sacramento River winter-run

Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon must all migrate through the Delta in order to survive, and therefore the large-scale removal of IWM upstream affects listed species growth and survival. Existing pieces that are removed or break apart from decay are not being replenished from upstream.

In addition to impacts associated with ecosystem-wide loss of IWM, there are additional ecosystem-wide impacts associated with large-scale riprapping from the SRBPP. Riprapping has been shown to reduce recruitment of spawning gravel for salmonids, which was especially impactful during SRBPP phases upstream under the Sacramento River, Chico Landing to Red Bluff Project (USFWS 2004). Riprapping halts the accretion of point bars and other depositions where new riparian vegetation can colonize (DWR 1994 *cited in* USFWS 2004). Riprapping also halts the meander migration and reworking of floodplains, which eventually reduces habitat renewal, diversity, complexity, and heterogeneity (DWR 1994, Larson 2002, USFWS 2004). This, in turn, has adverse effects on aquatic ecosystems, ranging from carbon cycling to altering salmonid population structures and fish assemblages (Schmetterling 2001, USFWS 2004). Riprapping can also incise the thalweg of the river adjacent to the riprapped area, narrowing the low-flow channel width, resulting in decreased hydrological and biological diversity (DWR 1994, USFWS 2004). Riprapping decreases river sinuosity, which increases the river channel slope, increasing the bedload transport and possible bed degradation and scour near the toe of the riprapped bank (USFWS 2004, Larson 2002). Riprapping alters the future channel planform of the river at the riprapped site as well as downstream from the site, which can cause more erosion of the channel bank downstream than if the riprap revetment were not present (USFWS 2004, Larson 2002). Riprapping creates a relatively smooth surface along the riverbank, which is contrary to the habitat hydrodynamic complexity required for endangered salmonids (Lister 1995, NRC 1996, USFWS 2004). Riprap fills in sloughs, tributary channels, and oxbow lake areas, causing loss of nearby wetland habitat and diversity (USFWS 2004, DWR 1994). Riprap limits the lateral mobility of the river channel, decreasing general habitat complexity in the near-shore aquatic area and reducing complex lateral habitat, including small backwaters and eddies, which removes important refugia for plants, invertebrates, fish, birds, and mammals (Welcomme 1979, USFWS 2004). Riprapping also decreases near-shore roughness, which causes stream velocities to increase more rapidly with increasing discharge, further eliminating critical refugia areas for fish and other aquatic organisms during high flows and causing accelerated erosion downstream, which can in turn result in riprap creating the need for more riprap (Gregory 1991, USFWS 2004). Riprap also halts erosion and reduces habitat complexity, which in turn reduces the ability of near-shore areas to retain sediments and organic materials, and isolates the river from its watershed (Gregory 1991, USFWS 2004). Riprap impedes plant growth, resulting in vegetation being pushed far back from the shoreline, further reducing food resources for aquatic invertebrates that would have been provided from such vegetation (Murphy 1991, USFWS 2004).

The above effects of riprapping are well documented, but there are additional, complex, and relatively poorly understood and unaddressed effects of large-scale riprapping, which warrant additional study and consideration (USFWS 2004). Studies that seek to provide insights into presently poor understood effects of large-scale riprapping include those related to the effects of bank stabilization of channelization on rivers, and the effects of snagging and clearing operations (USFWS 2004).

Environmental Effects of USACE Vegetation Policy

The continuation of the USACE ETL policy of no vegetation within 15 feet of the levee toe on both the waterside and landside of the levee greatly exacerbates the negative attributes of the currently armored levee habitat in the SRBPP program action area. Removal of the vegetation on the waterside and landside of the levees prevents the input of allochthonous organic materials to adjacent waterways and severely reduces the function of riparian and nearshore habitat along the affected levee reaches. By preventing the input of organic materials that serves as a source of energy and organic carbon, aquatic and terrestrial food webs are negatively impacted and the quantity and quality of nearshore rearing habitat is measurably reduced. Removal of riparian vegetation has reduced the amount of overhead shade along significant stretches of the Sacramento River mainstem and tributaries.

Compliance with the ETL policies prevents the establishment of riparian vegetation communities. The ETL policy does not allow woody vegetation to become established that could eventually be recruited into the adjacent aquatic habitat through erosion or death of the woody plants. Allowance of only grasses, sedges, and small bushes to grow on the waterside banks of the levees will not create the full functionality of a riparian zone, or create the equivalent complexity of habitat that a full riparian vegetation community would possess.

The NMFS Salmonid Recovery Plan identifies loss of juvenile rearing habitat in the form of lost natural river morphology and function, and lost riparian habitat and instream cover as a “very high stressor” affecting the viability of salmon and steelhead in the Central Valley (NMFS 2014). The Recovery Plan also establishes a strategic approach to recovery, which identifies critical recovery actions for the Central Valley, as well as watershed- and site-specific recovery actions. Watershed-specific recovery actions address threats occurring in each of the rivers or creeks that currently support spawning populations of the Sacramento River winter-run Chinook salmon ESU, the Central Valley spring-run Chinook salmon ESU, or the California Central Valley steelhead DPS. Site-specific recovery actions address threats to these species occurring within a migration corridor (*e.g.*, Sacramento River [SAR], San Francisco Bay, or the Delta [Del], Feather River [FER], American River [AMR]). Relevant recovery actions include:

CEV-1.8 (Priority 1): *Develop and implement State and National levee vegetation policies to maintain and restore riparian corridors.*

Del-1.4 (Priority 1): *Conduct landscape-scale restoration of ecological functions throughout the Delta to support native species and increase long-term overall ecosystem health and resilience.*

Del-1.7 (Priority 1): *Restore, improve and maintain salmonid rearing and migratory habitats in the Delta and Yolo Bypass to improve juvenile salmonid survival and promote population diversity.*

SAR-1.2 (Priority 1): *Restore and maintain riparian and floodplain ecosystems along both banks of the Sacramento River to provide a diversity of habitat types including riparian forest, gravel bars and bare cut banks, shade vegetated banks, side channels, and sheltered wetlands,* *such as sloughs and oxbow lakes following the guidance of the Sacramento River Conservation Area Handbook (Resources Agency of the State of California 2003).*

SAR-2.1 (Priority 2): *Ensure that riverbank stabilization projects along the Sacramento River utilize bio-technical techniques that restore riparian habitat, rather than solely using the conventional technique of adding riprap.*

SAR-2.8 (Priority 2): *Implement projects that promote native riparian (e.g., willows) species including eradication projects for non-native species (e.g., Arundo, tamarisk).*

SAR-2.11 (Priority 2): *Improve instream refuge cover in the Sacramento River for salmonids to minimize predatory opportunities for striped bass and other non-native predators.*

FER-1.8 (Priority 1): *Implement the lower Feather River Corridor Management Plan and other projects that promote natural river processes (e.g., floodplain and riparian restoration). Federal, State and local agencies should use their authorities to develop and implement programs and projects that focus on retaining, restoring and creating active floodplain and riparian corridors within their jurisdiction in the Feather River watershed.*

FER-1.9 (Priority 2): *Implement projects to improve near shore refuge cover for salmonids in the Feather River to minimize predatory opportunities for striped bass and other non-native predators.*

FER-2.6 (Priority 2): *Utilize fish friendly designs (e.g., levee setbacks, inclusion of riparian vegetation) for levee construction and maintenance.*

AMR-1.6 (Priority 1): *Implement a long-term wood management program to provide habitat complexity and predator refuge habitat.*

AMR-2.5 (Priority 2): *Develop and implement programs and projects that focus on retaining, restoring and creating river riparian corridors within their jurisdiction in the American River Watershed.*

AMR-2.7 (Priority 2): *Utilize bio-technical techniques that integrate riparian restoration for riverbank stabilization instead of conventional riprap in the American River.*

ETL compliance that reduces or eliminates the potential for establishing riparian communities along the program's levee reaches will significantly impair implementation of these key recovery actions and will make it difficult to recover the ecosystems upon which ESA-listed salmon and steelhead in the Central Valley depend. Furthermore, the ongoing requirement under the ETL to remove vegetation will typically require the application of herbicides to control vegetation on the levee faces. Herbicides and their additives, such as surfactants, can have negative or deleterious effects upon sensitive receptors of fishes, invertebrates, or plants, in the aquatic environment. Spraying of herbicides on "unwanted" vegetation can create situations where the herbicides drift into adjacent waters and contaminate those water bodies, or is contained in runoff from surface flow during rain events.

Future projects should focus on channel margin enhancement to protect and restore key migratory and rearing areas. Degradation of channel margins by retaining riprap and removing riparian and nearshore vegetation should be mitigated on-site first or at least elsewhere on the migratory corridor. Benefits from off-site mitigation should be carefully evaluated, as the species impacted from the program development may not benefit at all from mitigation conducted elsewhere, particularly if the mitigated area is removed from the migratory corridors of the impacted fish populations (*i.e.*, the ESUs and DPSs of listed fish species).

The reduction in the quality and quantity of beneficial habitat through previous actions, and the continued maintenance of these poorly functioning habitats through discretionary actions of vegetation management results in the severely diminished habitat value for ESA-listed fish species.

2.4.3 Status of the Species in the Action Area

The action area, which is described above, encompasses the mainstem and tributaries of the Sacramento River, from RM 0 to RM 184, and the lower reaches of the American River, and all associated floodplains and riparian areas at and adjacent to the proposed construction sites. These sites function as a migratory corridor for CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. The action area is also used for rearing and adult feeding.

Presence of Sacramento River winter-run Chinook salmon in the Action Area

The temporal occurrence of Sacramento River winter-run Chinook salmon smolts and juveniles within the action area are best described by a combination of the salvage records of the CVP and SWP fish collection facilities and the fish monitoring programs conducted in the northern and central Delta. Based on salvage records at the CVP and SWP fish collection facilities, juvenile Sacramento River winter-run Chinook salmon are expected in the action area starting in December. Their presence peaks in March and then rapidly declines from April through June. The majority of winter-run juveniles will enter the action area during February through June. Presence of adult Chinook salmon is interpolated from historical data. Adult winter-run Chinook salmon are expected to enter the action area starting in January, with the majority of adults passing through the action area between February and April.

The action area contains CV winter-run Chinook salmon from the Basalt and Porous Lava Diversity group (*i.e.*, mainstem Sacramento River below Keswick Dam). Within the action area, there are “Core 1” populations of CV winter-run Chinook salmon, as designated for by NMFS Recovery Plan for the species (NMFS 2014). Core 1 watersheds possess the known ability or potential to support a viable population. For a population to be considered viable, it must meet the criteria for low extinction risk for Central Valley salmonids (Lindley *et al*. 2007). The criteria include population size, population decline, catastrophic decline and hatchery influence. Only a few of the Core 1 populations meet the long-term objective of low extinction risk; the remaining Core 1 populations have the potential to do so.

Presence of CV spring-run Chinook salmon in the Action Area

CVP/SWP salvage records and the northern and Central Delta fish monitoring data indicate that juvenile spring-run Chinook salmon first begin to appear in the action area in December and January, but that a significant presence does not occur until March and peaks in April. By May, the salvage of juvenile CV spring-run Chinook salmon declines sharply and essentially ends by the end of June. The data from the northern and central Delta fish monitoring programs indicate that a small proportion of the annual juvenile spring-run emigration occurs in January and is considered to be mainly composed of older yearling spring-run juveniles based on their size at date. Adult spring-run Chinook salmon are expected to start entering the action area in approximately January. Low levels of adult migration are expected through early March. The peak of adult spring-run Chinook salmon movement through the action area is expected to occur between April and June with adults continuing to enter the system through the summer. Currently, all known populations of CV spring-run Chinook salmon inhabit the Sacramento River watershed.

The action area contains CV spring-run Chinook salmon from the Basalt and Porous Lava Diversity group and the Northern Sierra Nevada Diversity group. Within the action area, there are both “Core 1” and “Core 2” populations of CV spring-run Chinook salmon, as designated for by NMFS recovery plan for the species (NMFS 2014). Core 1 populations were described above. Core 2 populations meet, or have the potential to meet, the biological recovery standard for moderate risk of extinction. These watersheds have lower potential to support viable populations, due to lower abundance, or amount and quality of habitat. These populations provide increased life history diversity to the ESU/DPS and are likely to provide a buffering effect against local catastrophic occurrences that could affect other nearby populations, especially in geographic areas where the number of Core 1 populations is lowest.

Presence of CCV steelhead in the Action Area

The CCV steelhead DPS final listing determination was published on January 5, 2006 (71 FR 834) and included all naturally spawned populations of steelhead (and their progeny) downstream of natural and manmade barriers in the Sacramento River and its tributaries. FRFH steelhead are also included in this designation. Depending on the year, there is potential spawning habitat present within the SRBPP PACR action area in the American River. There is also rearing and migration habitat present in the action area. Juveniles use rearing and migration habitat rear year-round in the mainstem Sacramento River and tributaries. Juveniles and smolts are most likely to be present in the action area during their outmigration, which begins in November, peaks in February and March, and ends in June.

Adult CCV steelhead originating in the Sacramento River watershed will have to migrate through the action area in order to reach their spawning grounds and to return to the ocean following spawning. Likewise, all CCV steelhead smolts originating in the Sacramento River watershed will also have to pass through the action area during their emigration to the ocean. The waterways in the action area also are expected to provide some rearing benefit to emigrating steelhead smolts. The CCV steelhead DPS occurs in both the Sacramento River and the surrounding watersheds.

The action area contains CCV steelhead from the Basalt and Porous Lava Diversity group and the Northern Sierra Nevada Diversity group (*i.e.*, American and Feather Rivers). Within the action area, there are both “Core 2” and “Core 3” populations of steelhead, as designated by NMFS Recovery Plan for the species (NMFS 2014). Core 2 populations were described above. Core 3 watersheds have populations that are present on an intermittent basis and require straying from other nearby populations for their existence. These populations likely do not have the potential to meet the abundance criteria for moderate risk of extinction. Core 3 watersheds are important because, like Core 2 watersheds, they support populations that provide increased life history diversity to the ESU/DPS and are likely to buffer against local catastrophic occurrences that could affect other nearby populations. Dispersal connectivity between populations and genetic diversity may be enhanced by working to recover smaller Core 3 populations that serve as stepping stones for dispersal.

Presence of North American Green Sturgeon in the Action Area

The Sacramento River is an important migratory corridor for larval and juvenile sturgeon during their downstream migration to the San Francisco Bay Delta and Estuary. Detailed information regarding historic and current abundance, distribution and seasonal occurrence of North American green sturgeon in the action area is limited due to a general dearth of green sturgeon monitoring. The action area is located on the main migratory route for adults moving upstream to spawn, post spawn adults migrating back to the ocean, juvenile outmigrants, and rearing subadults (NMFS, 2018). Juvenile green sturgeon from the sDPS are routinely collected at the CVP and SWP salvage facilities throughout the year. Based on the salvage records, green sturgeon may be present during any month of the year, and have been particularly prevalent during July and August. Adult green sturgeon begin to enter the Delta in late February and early March during the initiation of their upstream spawning run. The peak of adult entrance into the Delta appears to occur in late February through early April with fish arriving upstream in April and May. Adults continue to enter the Delta until early summer (June-July) as they move upriver to spawn. It is also possible that some adult green sturgeon will be moving back downstream in April and May through the action area, either as early post spawners or as unsuccessful spawners. Some adult green sturgeon have been observed to rapidly move back downstream following spawning, while others linger in the upper river until the following fall. It is possible that any of the adult or sub-adult sturgeon that inhabit the Delta may enter the American River.

2.4.4 Status of Critical Habitat within the Action Area

The SRBPP PACR encompasses areas within the SRBPP program area, which includes over 1,000 miles of levees and weirs. This area extends south-to-north along the Sacramento River, from the Town of Collinsville (RM 0) upstream to Chico at RM 184. The SRBPP also includes Cache Creek, the lower reaches of Elder and Deer Creeks, the lower reaches of the American River (RM 0-23), Feather River (RM 0-61), Yuba River (RM 0-11), and Bear River (RM 0-17), portions of Three mile, Steamboat, Sutter, Miner, Georgiana, and Cache Sloughs, as well as a number of flood bypasses and distributaries. The SRBPP PACR action area occurs within this program area, and includes the mainstem Sacramento River (as far south as Collinsville up to Chico), Yolo and Sacramento Bypasses, the lower American River, and numerous tributaries (for a full visual representation of the program vicinity, see Figures 1, 2, and 3). Designated critical habitat for Sacramento River winter-run Chinook salmon (June 16, 1993, 58 FR 33212), CV spring-run Chinook salmon (September 2, 2005, 70 FR 52488), CCV steelhead (September 2, 2005, 70 FR 52488) and the sDPS of green sturgeon (October 9, 2009, 74 FR 52300) occur in the SRBPP PACR action area.

The PBFs essential to the conservation of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead are physical habitat, water quality and quantity, available forage required to maintain habitat for spawning, larval and juvenile transport, rearing, and adult migration. PBFs for Chinook salmon and steelhead within the action area include freshwater rearing habitat and freshwater migration corridors. The features of the PBFs essential to the conservation of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and the CCV steelhead DPS include the following: sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions necessary for salmonid development and mobility, sufficient water quality, food and nutrients sources, natural cover and shelter, migration routes free from obstructions, no excessive predation, adequate forage, holding areas for juveniles and adults, and shallow water areas and wetlands. Habitat within the action area is primarily utilized for freshwater rearing and migration by steelhead and Chinook salmon juveniles and smolts and for adult freshwater migration. CCV steelhead also utilize the parts of the American River within the action area for spawning habitat.

The PBFs essential to the conservation of green sturgeon are physical habitat for spawning, larval and juvenile transport, rearing, and adult migration. The action area includes the following green sturgeon PBFs: adequate food resources for all life stages; water flows sufficient to allow adults, subadults, and juveniles to orient to flows for migration and normal behavioral responses; water quality sufficient to allow normal physiological and behavioral responses; unobstructed migratory corridors for all life stages; a broad spectrum of water depths to satisfy the needs of the different life stages; and sediment with sufficiently low contaminant burdens to allow for normal physiological and behavioral responses to the environment.

The substantial degradation over time of several of the PBFs in the action area has diminished the function and condition of the freshwater rearing and migration habitats in the area. The action area now only has rudimentary functions compared to its historical status. The channels of the lower Sacramento and American Rivers have been replaced with coarse stone riprap on artificial levee banks and have been stabilized in place to enhance water conveyance through the system. The extensive riprapping and levee construction has precluded natural river channel migrations. The natural floodplains have essentially been eliminated, and the once extensive wetlands and riparian zones have been “reclaimed” and subsequently drained and cleared for agriculture.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its value remains high for the conservation of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. Many of the factors affecting these species throughout their range are discussed in the *Rangewide Status of the Species and Critical Habitat* section of this BO, and are considered the same in the action area. This section describes all factors that have resulted in the current state of critical habitats in the action area, particularly focusing on factors most relevant to the proposed SRBPP PARC program. The SRBPP PACR action area encompasses a large portion of the remaining critical habitat for these species, and it is therefore critical to maintain the habitat functionality of what remains of the riparian corridors in the action area.

The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs affecting listed salmonids in the action area. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round. Current flood control practices require peak flood discharges to be held back and released over a period of weeks to avoid overwhelming the flood control structures downstream of the reservoirs (*i.e.* levees and bypasses). Consequently, managed flows in the mainstem of the river often truncate the peak of the flood hydrograph and extend the reservoir releases over a protracted period. These actions reduce or eliminate the scouring flows necessary to mobilize gravel and clean sediment from the spawning reaches of the river channel.

High water temperatures also limit habitat availability for listed salmonids in the lower Sacramento River. High summer water temperatures in the lower Sacramento River can exceed 72^{o}F (22.2^{o}C), and create a thermal barrier to the migration of adult and juvenile salmonids (Kjelson 1982). In addition, water diversions at the dams (*e.g.*, Friant, Goodwin, La Grange, Folsom, Nimbus, and other dams) for agricultural and municipal purposes have reduced in-river flows below the dams. These reduced flows frequently result in increased temperatures during the critical summer months which potentially limit the survival of holding/spawning adults, incubating eggs, emerging fry, and juvenile salmonids (Reynolds 1993). The elevated water temperatures compel many salmon juveniles to migrate out of the valley floor systems quickly and forgo adequate rearing time before summer heat creates temperatures unsuitable for salmonids. Those fish that remain either succumb to the elevated water temperatures or are crowded into river reaches with suitable environmental conditions.

Levee construction and bank protection have affected salmonid habitat availability and the processes that develop and maintain preferred habitat by reducing floodplain connectivity, changing riverbank substrate size, and decreasing riparian habitat and SRA cover. Individual bank protection sites typically range from a few hundred to a few thousand LF in length. Such bank protection generally results in two levels of impacts to the environment: (1) site-level impacts which affect the basic physical habitat structure at individual bank protection sites; and (2) reach-level impacts which are the cumulative impacts to ecosystem functions and processes that accrue from multiple bank protection sites within a given river reach. Revetted embankments result in loss of sinuosity and braiding and reduce the amount of aquatic habitat. Impacts at the reach level result primarily from halting erosion and eliminating riparian vegetation. Reach-level impacts which cause significant impacts to fishes are reductions in habitat complexity, changes to sediment and organic material storage and transport, reductions of primary food-chain production, and reduction in IWM and SRA habitat.

The use of rock armoring limits recruitment of IWM (*i.e.*, from non-riprapped areas), and greatly reduces, if not eliminates, the retention of IWM once it enters the river channel. Riprapping creates a relatively homogeneous surface, which diminishes the ability of IWM to become securely snagged and anchored by sediment. IWM tends to become only temporarily snagged along riprap, and generally moves downstream with subsequent high flows. Habitat value and ecological functioning aspects are thus greatly reduced, because wood needs to remain in place to generate maximum values for fish and wildlife. Recruitment of IWM is limited to any eventual, long-term tree mortality and whatever abrasion and breakage may occur during high flows. Juvenile salmonids are likely being impacted by reductions, fragmentation, increased predation, and general lack of connectedness of remaining nearshore refuge areas.

Point and non-point sources of pollution resulting from agricultural discharge and urban and industrial development occur upstream of, and within the action area. The effects of these impacts are discussed in detail in the *Rangewide Status of the Species and Critical Habitat* section. Environmental stressors as a result of low water quality can lower reproductive success and may account for low productivity rates in fish (*i.e*.,. green sturgeon, (Klimley 2002)). Organic contaminants from agricultural drain water, urban and agricultural runoff from storm events, and high heavy metals concentrations may deleteriously affect early life-stage survival of fish in the Sacramento River (USFWS 1995). Principle sources of organic contamination in the Sacramento River are rice field discharges from Butte Slough, Reclamation District 108, Colusa Basin Drain, Sacramento Slough, and Jack Slough (USFWS 1995). Other impacts to adult migration present in the action area, such as migration barriers, water conveyance factors, water quality, *etc.*, are discussed in the *Rangewide Status of the Species and Critical Habitat* section.

The transformation of the Sacramento River from a sinuous, meandering waterway lined with a dense riparian corridor, to a highly leveed system under varying degrees of control over riverine erosional processes has resulted in homogenization of the river,. These impacts include the removal of valuable pools and holding habitat for sDPS green sturgeon. In addition, channelization and removal of riparian vegetation and IWM have greatly reduced access to floodplain and off-channel rearing habitat, diminished the quantity and quality of benthic habitat and the abundance of prey items in rearing, foraging and holding habitats. A major factor in the decline of sDPS green sturgeon, and the primary reason for listing this species was the alteration of its adult spawning and larval rearing habitat in California's Sacramento River Basin (71 FR 17757, April 7, 2006).

2.4.5 Mitigation Banks and the Environmental Baseline

There are several conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this BO. These banks occur within critical habitat for Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. These include:

Liberty Island Native Fisheries Conservation Bank**:** Established in 2010, the Liberty Island Conservation Bank (Bank) is a conservation bank that serves the Delta region. It is located in the southern Yolo Bypass in Yolo County, CA. The Bank consists of 186 acres located on the still leveed northernmost tip of Liberty Island. Approved in July 2010 by NMFS, USFWS, and CDFW, the Bank provides compensatory mitigation for permitted projects affecting special-status Delta fish species within the region. The Bank provides habitat for all Delta fish species including: Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, delta smelt, and Central Valley fall- and late fall-run Chinook salmon. Of the 186 total acres, 139.11 acres can be used for salmonid conservation credits. Of the 139.11 acres available for salmonids, approximately 68 acres have been allocated. The habitat includes tidally influenced shallow freshwater habitat, SRA habitat, and tule marsh SRA habitat. The increased ecological value of the enhanced rearing habitat for juvenile salmonids (and potentially sDPS green sturgeon) which have already been purchased are part of the environmental baseline for the Project. All features of this bank are within the designated critical habitats for the species analyzed in this BO.

Fremont Landing Conservation Bank: Established in 2006, the Fremont Landing Conservation Bank is 100-acre floodplain site along the Sacramento River (RM 80) and was approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. There are off-channel shaded aquatic habitat credits, SRA habitat credits, and floodplain credits available. To date, there have been less than 25 percent of the 100 credits sold and the ecological value (*i.e.*, increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are within the designated critical habitats for the species analyzed in this BO.

Bullock Bend Mitigation Bank: Established in 2016, the Bullock Bend Mitigation Bank is a 119.65-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento RM 106) and was approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. There are salmonid floodplain restoration, salmonid floodplain enhancement, and salmonid riparian forest credits available. To date, there have been approximately 10 percent of 119.65 credits sold and the ecological value (*i.e.*, increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are within the designated critical habitats for the species analyzed in this BO.

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR Part 402.02). Indirect effects are those that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur.

To evaluate the effects of the SRBPP PACR programmatic, NMFS examined the proposed BPM designs, the site selection process, and the possible locations. We also reviewed and considered the USACE's proposed conservation measures. This assessment relied heavily on the information from the USACE's BA. As a framework programmatic consultation, without exact sites or designs within the action area, NMFS assumed SAM outputs that were analyzed for previously repaired sites of the Phase I repair program, were a good representation to extrapolate to the total proposed program impact length. A more detailed description of this analysis can be found below in the section entitled *Use of Representative Sites to Estimate Effects*.

The assessment will consider the nature, duration, and extent of the potential actions relative to the migration timing, behavior, and habitat requirements of federally-listed Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS of North American green sturgeon. Specifically, this assessment will consider the potential impacts resulting from the construction and subsequent O&M activites at a framework level. Effects of the SRBPP PACR on aquatic resources include both short- and long-term impacts. Short-term effects, which are related primarily to construction activities, may last several hours to several weeks. Some long-term effects are expected to last years to decades, and generally involve physical alteration of the riverbank and riparian vegetation adjacent to the water's edge, while other long-term effects are expected to continue indefinitely, including the continued blockage to floodplain habitat.

The SAM model has previously been used to quantify impacts to the green sturgeon, but its utility is limited to assessing nearshore habitat. There is currently no model that can evaluate the effects of bank stabilization projects on habitats below seasonal water surface elevations or on the benthic habitat that green sturgeon utilize. As part of the HMMP, USACE will either refine the SAM to evaluate impacts to benthic habitat, or develop a new model that will evaluate the effect of levee repair projects on green sturgeon. Similarly, the effects of bank armoring below seasonal water surface elevations on salmon and steelhead are not well captured by the SAM.

Further bank armoring and levee repairs will contribute to the continued confinement of the riverine system, blocking rearing juveniles from the floodplain, which in turn negatively affects listed fish species and their designated critical habitat.

2.5.1 Program Effects for Salmonids and Green Sturgeon

NMFS expects that juvenile winter-run Chinook salmon, juvenile spring-run Chinook salmon, adult and juvenile CCV steelhead, and adult and juvenile green sturgeon will be present in the action area during construction activities, although in low numbers because the construction window avoids periods of peak abundance. No spawning habitat for winter-run Chinook salmon, spring-run Chinook salmon, or green sturgeon is present in the action area and, therefore no adverse effects to spawning adults or incubating eggs are expected. The action area overlaps with potential spawning habitat for steelhead in the American River from RM 0-12, however, spawning in this area is considered rare and the construction window avoids spawning season.

Direct effects of the proposed action associated with in-river construction work will involve equipment and activities that will produce sound pressure waves, and create underwater noise and vibration, thereby temporarily altering in-river conditions. Hydroacoustic pressure impulses can affect behavior of fish and may result in physical injury such as tissue damage, hearing loss, or death (Popper and Hastings 2009). Any alteration in behavior or physical injury can increase the chance of predation due to disorientation, the ability to feed, or migrate. Only those fish that are holding adjacent to or migrating past the levee repair site will be directly exposed or affected by construction activities. Those fish that are exposed to the effects of construction activities will encounter short-term (i.e., minutes to hours) construction-related noise and physical disturbance. Construction disturbance can cause injury or harm by increasing the susceptibility of some individuals to predation by temporarily disrupting normal sheltering behaviors. These changes can also impair feeding behaviors, which in turn impact their ability to grow and survive. Juvenile fish are the most vulnerable to these changes, since adults are better able to quickly swim away from the construction sites and escape injury. Any fishes that do not avoid the worksite during construction could potentially be crushed or injured by construction equipment or personnel.

Toxic substances used at construction sites, including gasoline, lubricants, and other petroleum-based products could enter the waterway as a result of spills or leakage from machinery and injure listed salmonids and green sturgeon. Petroleum products also tend to form oily films on the water surface that can reduce dissolved oxygen available to aquatic organisms. The exposure to these substances can kill fishes directly in high enough concentrations through acute toxicity or suffocation from lack of oxygen. These chemicals may also kill the prey of listed fish species, reducing their ability to feed and therefore grow and survive. However, due to adherence to proposed project BMPs that dictate the use, containment, and cleanup of contaminants, there is very low risk of toxic substances affecting fishes at the construction site.

Turbidity and sedimentation events are not expected to affect visual feeding success of green sturgeon, as they are not believed to utilize visual cues (Sillman et al. 2005). Green sturgeon, which can occupy waters containing variable levels of suspended sediment and thus turbidity, are not expected to be impacted by the slight increase in the turbidity levels anticipated from the proposed program activities. Increases in turbidity can harm salmonids by temporarily burying submerged aquatic vegetation that supports invertebrates for feeding juvenile fishes, leading to reduced growth and survival. High turbidity can also damage a fish's gills, interfere with cues necessary for orientation in homing and migration, and reduce available spawning habitat (Bash et al. 2001). However, BMPs in place for the SRBPP PACR program are expected to greatly reduce the severity and duration of increased turbidity caused by program activities, such that turbidity levels are expected to have minor effects to listed fish species, primarily resulting in behavioral modifications.

NMFS expects that actual physical damage or harassment may occur to listed fish species, but will be low due to the timing of the construction. Impacts to adults due to construction are expected to be especially minor because their size, preference for deep water, and their crepuscular migratory behavior will enable them to avoid most temporary, nearshore disturbance that occurs during typical daylight construction hours.

Ecological Effects Related to Ecological Changes to Riparian Habitat and Function

Loss of riparian habitat is a key driver to many of the negative short- and long-term impacts of the SRBPP PACR. The existence and continual establishment of vegetation in proximity to streams and rivers is essential to maintain functioning riparian habitats (Boyer *et al*. 2003). Intact riparian habitat performs many functions essential to fish growth and productivity, and is critical in supporting suitable instream conditions necessary for the survival and recovery of imperiled native salmonid stocks. Vegetated riparian areas provide the following ecosystem services:

- Shade channels maintaining cool water temperatures and retaining dissolved oxygen levels.
- Stabilize channel banks and control bank erosion and sedimentation.
- Provide overhead cover and refuge for juvenile salmonids that reduce predation.
- Reduce velocities along channel margins preferred by newly emerged fry and yearling salmonids.

- Contribute small organic matter (*e.g*., leaves, twigs, grasses, and insects) to channels and support primary and secondary production.
- Capture organic matter and wood from upstream sources, increasing surface areas for primary and secondary production.
- Provide trees that fall into channels and influence river geomorphology, creating complex habitats, including pools, riffles, debris collections, backwater, and off-channel habitat that are necessary to fish for cover, holding, spawning, rearing, and protection from predators.
- Filter stormwater runoff, capturing sediments and pollutants from upslope areas and thereby assisting in water quality maintenance.
- Provide low velocity areas that allow deposition of fine sediments during overbank flows.
- Reduce flood flow velocities and create micro-currents that provide fish near-channel holding areas to rest and maintain their position in a stream reach during flooding.

Each of these functions support the ability of a reach to contribute to the salmonid life histories expressed in those reaches. A diverse assemblage of native riparian vegetation can appreciably increase instream habitat conditions, and enhance bank integrity (Shields 1991). Riparian vegetation has a profound effect on the stability of both cohesive and non-cohesive soils. Wynn *et al.* (2004) found that at sites where banks are nearly vertical, woody vegetation may provide better protection against scour of the bank toe. Woody vegetation also provides greater geotechnical reinforcement of stream banks by serving as an effective buffer between the water and the underlying soil. It increases flow resistance, which reduces flow velocity, thereby greatly reducing erosion (Fischenich 2001).

Streamside vegetation is an important source of energy for the maintenance of invertebrates and fish. Instream communities are highly dependent on leaf litter from streamside forests for maintaining metabolism and ecosystem structure. Robust vegetation along the water's edge dramatically increases the input of terrestrial invertebrates into aquatic systems (Fischenich 2001, Florsheim *et al.* 2008). Roots uptake elements from the soil and bedrock, then deliver them to the stream through the process of decay (Fischenich & Copeland 2001). Roots, stems, logs, and organic debris such as leaves provide colonization sites through increased surface area, and velocity refuge for algae and macro invertebrates (Fischenich 2001, Florsheim *et al.* 2008).

Aquatic macroinvertebrate diversity and density are higher in streams with wider riparian areas (Newbold *et al.* 1980, as cited in Florsheim *et al*. 2008). Organic matter delivered from site-level riparian areas, or accumulated within edge habitat from upstream sources, is a food source for macro-invertebrates (Fischenich 2001). In floodplain channels, which frequently have a high fluvial transport potential, floodplain forests are an important source of immobile wood that provide, among other functions, forage species colonization sites. Riparian vegetation is a vital source of energy for invertebrates and fishes (Fischenich 2001).

Standard Assessment Methodology Analysis

The SAM provides a framework to quantitatively assess both short and longer-term impacts of the SRBPP PACR proposed actions. See Section 2.1.1 *Use of Analytical Surrogates* for an in-depth description of SAM analysis. Due to the programmatic nature of the SRBPP PACR, the final type and location of BPMs cannot be determined in advance, which creates a challenge in describing the potential effects. In an effort to evaluate project effects, the results of previous Phase I SRBPP repair sites was provided as a representation of the more recent designs being utilized by the SRBPP (See Appendix A SRBPP PACR 2019 BA). Each site will have a separate SAM analysis performed once a more detailed design is presented, and effects will be consulted on through this programmatic on a site-by-site basis.

2.5.2 Program Effects on Critical Habitat

A majority of the action area overlaps with designated critical habitat for all of the following listed fish species: winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. Therefore, usage of most of the BPMs presented can cause significant effects on PBFs of critical habitat. However, without prior knowledge of what Measures will be selected the full extent of these impacts cannot be determined in advance.

Impacts due to construction are expected to temporarily impact PBFs of critical habitat including rearing and migratory corridor from potential releases of toxic substances, increases in turbidity, and increases in underwater noise. Described above in the Section 2.5.1 *Construction Impact Analysis for Salmonids and Green Sturgeon*, the BMPs utilized by the SRBPP PACR program are expected to prevent these impacts from permanently degrading the PBFs of critical habitat for winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. Further analysis of long-term impacts to critical habitat described below, include the removal of SRA habitat, removal of IWM, and installation of rock revetment.

Critical Habitat for Sacramento River Winter-Run Chinook, CV Spring-Chinook Salmon, and CCV Steelhead

SAM results of the previously repaired sites under this program demonstrate short-term effects to PBFs, with many effects not persisting for greater than 10 years. This analysis of previous sites can only be looked at as a potential outcome for future sites, and still demonstrates significant short-term effects on the following PBFs. For all salmonid species, habitat deficits are greater in the fall and summer than in winter and spring due to greater shade reductions. Habitat deficits for fry/juvenile rearing and juvenile (smolt) migration will occur in all seasons due to reductions of instream, shoreline vegetation, and overhead cover. Habitat deficits for juvenile migration will generally persist beyond project construction in all regions. For winter-run Chinook, habitat deficits for fry/juvenile rearing will generally result in short-term and longer-term habitat deficits in all seasons in Regions 1B and 3. Winter-run Chinook are not expected to occur at any of the representative erosion sites in the analysis within Region 2, so no results were calculated for winter-run Chinook in Region 2. For CV spring-run Chinook and CCV steelhead, habitat deficits for fry/juvenile rearing will generally persist in Regions 1B, 2, and 3.

The proposed SRBPP PACR is expected to significantly impact several of the essential features (PBFs) of critical habitat for winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead, particularly freshwater rearing habitat and migration corridors for juvenile salmon and steelhead. The PBF of freshwater rearing habitat refers to water quantity and floodplain connectivity that supports juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, large wood, and aquatic vegetation, and undercut banks. Similarly, The PBF of migratory corridors refers to rivers and creeks that are free from obstruction and excessive predation with natural cover such as large wood, aquatic vegetation, and undercut banks that support juvenile survival (NMFS 2014).

The SRBPP PACR program as described will remove some portion of riparian habitat and IWM, depending on the site-specific details and designs chosen. With NMFS involvement in the PDT and PED design process, impacts are expected to be minimized to the extent possible, and unavoidable impacts will be mitigated, as described in the mitigation process outlined in the proposed action. Riparian habitat, especially the SRA component, is important for rearing and out-migrating juvenile salmonids because it enhances the aquatic food webs and provides high-value feeding areas. Once in the river channel, stems, trunks, and branches become very important structural habitat components for aquatic life. Many of the aquatic invertebrates that are primary food sources for juvenile salmon and steelhead live on woody debris. In some cases, the reproductive cycles of macroinvertebrates rely on IWM, as their eggs are laid and develop inside fallen logs and are eventually available to be eaten by fishes. The removal of riparian habitat will greatly degrade these habitat attributes, leading to a reduction of food, and thereby a reduction in growth and survival for juvenile salmon and steelhead.

Riparian shade can be critical in preventing diurnal thermal maxima from reaching dangerous levels, thereby extending the usable season for small streams (Maslin, Lennon et al. 1997). Trees and shrubs growing along riverbanks provide microclimates of cooler water temperatures during the hot summer months where many fishes will congregate to feed and seek cover. Therefore, the removal of riparian habitat will degrade the PBFs of freshwater rearing and migratory corridors by increasing temperatures to harmful and potential lethal levels. The SRBPP PACR program will also lead to an increase in predation of juvenile salmonids through both the removal of IWM, which serves as cover from predation, and the installation of rock revetment, the preferred habitat of ambush predators of salmonids. The program will also perpetuate the confinement of rivers within their banks, reducing connectivity with adjacent floodplains that could serve as rearing habitat.

The PBF of migratory corridors for adults is not expected to be impacted, as migrating adult Chinook and steelhead prefer deeper water and are unlikely to use the nearshore habitat that will be affected by this program. Furthermore, the site will not install any features that are expected to block or impede juvenile or adult migration. There is no spawning habitat for winter-run Chinook salmon or spring-run Chinook salmon in the action area. Although steelhead spawning has been documented in a reach of the American River that overlaps with the action area, spawning in this area is considered uncommon, as the potential spawning area is very small and the channel areas immediately adjacent to erosion sites do not support spawning riffles. The work window for the SRBPP PACR program also avoids the peak spawning time for steelhead. Therefore, the program is not expect to degrade the quality of PBFs for Chinook salmon and steelhead spawning adults or incubating eggs.

Critical Habitat for the Southern DPS of the North American Green Sturgeon

Critical habitat for green sturgeon is present within the program area. The PBFs essential to the conservation of green sturgeon include physical habitat, water, river flow, and salinity concentrations required to maintain green sturgeon habitat for spawning, larval and juvenile transport, rearing, and adult migration. Of these, the PBFs that may be adversely affected by the program action include food resources and substrate type or size.

The PBF of food resources, which refers to the availability of prey items for juvenile, sub-adult, and adult life stages, is expected be adversely affected by the installation of up to 30,000 linear feet of rock revetment. In all repairs, the rock revetment is assumed to extend below ordinary high water and cover benthic habitat. The replacement of soft benthic substrate with rocks will impair green sturgeon foraging habitat, thereby reducing the availability of prey. Similarly, the PBF of substrate type and size will also be adversely affected, as part of the natural riverbed will be permanently covered with large rocks and will no longer be available as foraging habitat.

The SRBPP PACR program is not expected to permanently impact the PBFs of water flow or water quality, migration corridors (*i.e.*, pathways necessary for the safe and timely passage of all life stages), or depth (*i.e.*, availability of deep pools for use as holding habitat), since the program will not install any features that are expected to block or impede juvenile or adult migration, alter any deep pools, or permanently alter water quality. In addition, green sturgeon PBFs for egg deposition and development, and larval development are not expected to be affected since no spawning occurs in the action area.

As discussed above, the SAM can provide some information about the impacts to green sturgeon critical habitat, although these are limited to near-shore changes. Because green sturgeon are primarily a benthic rather than nearshore dwelling species, SAM results for green sturgeon should be interpreted within that context. The SAM results will likely indicate habitat deficits for adult residence in all regions in all seasons due to potential reduction in slope, low replacement of instream structure (LWM recruitment), and due to rock revetment and little replacement of habitat features.

Proposed Mitigation and Conservation Measures

Section 1.2.7 of the Proposed Action describes the additional minimization and conservation measures (*i.e.*, mitigation measures) that USACE proposes to offset the unavoidable and residual adverse effects of the proposed levee repair actions. After discussion with NMFS during earlier drafts of this program, USACE developed a much more robust Compensation Strategy to incorporate more alternatives. As each site will be consulted on separately, mitigation and compensation measures will be evaluated on a project-by-project basis in technical assistance with NMFS to determine the best suited compensation plan.

If bank repair actions are not fully self-mitigating, off-site compensation measures will be implemented after project completion or concurrent with site construction using conservation measures/banks. Whether constructed as part of a suite of bank protection sites or established independent of a project site in coordination with DWR, USFWS, and NMFS, off-site compensation will focus on replacing and enhancing habitat values for the listed species addressed in this BO. The SAM model, which was specifically created to assist with determining and quantifying effects and compensation amounts, will be utilized to the extent practicable.

Program Influence on Very Highly Rated Stressors

Implementation of actions under the SRBPP PACR could exacerbate several of the most highly rated stressors affecting Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead identified in the recovery plan (NMFS 2014). These very high stressors were previously described in Section 2.4 *Environmental Baseline*. The tables below identify the Very Highly Ranked Stressors, by species, which could be exacerbated by the proposed action. Table 13 identifies Very Highly Ranked Stressors specific to the green sturgeon in the action area that were identified in the Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (NMFS 2018).

Table 10. Very Highly Ranked Threats to Sacramento River Winter-run Chinook salmon in the Action Area.

Life Stage	Primary Stressor Category	Specific Stressor	Exacerbated by the Proposed Action
Juvenile Rearing and Outmigration	Loss of Natural Morphologic Function	Loss of Natural Morphologic Function in the Delta	Yes
Juvenile Rearing and Outmigration	Loss of Natural Morphologic Function	Loss of Natural Morphologic Function in the lower Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Riparian Habitat and Instream Cover	Loss of Riparian Habitat and Instream Cover in the Delta	Yes
Juvenile Rearing and Outmigration	Loss of Riparian Habitat and Instream Cover	Loss of Riparian Habitat and Instream Cover in the lower Sacramento River	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the Delta	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the lower Sacramento River	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the middle Sacramento River with emphasis on anthropogenically-created predation opportunities at GCID, RBDD and other structures	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the upper Sacramento River with emphasis on anthropogenically-created predation opportunities at ACID and other structures	Yes
Juvenile Rearing and Outmigration	Loss of Natural Morphologic Function	Loss of Natural Morphologic Function in the upper Sacramento River	Yes

Table 11. Very Highly Ranked Threats to Central Valley Spring-run Chinook salmon in the Action Area.

Life Stage	Primary Stressor Category	Specific Stressor	Exacerbated by the Proposed Action
Juvenile Rearing and Outmigration	Loss of Floodplain Habitat	Lower and Middle Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Natural River Morphology	Lower and Middle Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Riparian Habitat and Instream Cover	Lower and Middle Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Floodplain Habitat	Delta	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the Delta	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the middle and lower Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Riparian Habitat and Instream Cover	Delta	Yes
Juvenile Rearing and Outmigration	Loss of Natural River Morphology	Delta	Yes

Table 12. Very Highly Ranked Threats to California Central Valley Steelhead in the Action Area.

Life Stage	Primary Stressor Category	Specific Stressor	Exacerbated by the Proposed Action
Juvenile Rearing and Outmigration	Loss of Floodplain Habitat	Lower and Middle Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Natural River Morphology	Lower and Middle Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Riparian Habitat and Instream Cover	Lower and Middle Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Floodplain Habitat	Delta	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the Delta	Yes
Juvenile Rearing and Outmigration	Predation	Predation in the middle and lower Sacramento River	Yes
Juvenile Rearing and Outmigration	Loss of Riparian Habitat and Instream Cover	Delta	Yes
Juvenile Rearing and Outmigration	Loss of Natural River Morphology	Delta	Yes

Table 13. Very Highly Ranked Threats to the sDPS of North American Green Sturgeon in the Action Area.

Life Stage	Primary Stressor Category	Specific Stressor	Exacerbated by the Proposed Action
Larvae/Juveniles	Altered Prey Base	Non-native species	Yes
Larvae/Juveniles	Altered Prey Base	Global climate change	Yes
Larvae/Juveniles & Adults	Altered Water Temperature	Global climate change	Yes
Eggs	Disease and Predation	Non-native species	Yes

Larvae/Juveniles	Competition for Habitat	Native and non-native species	Yes

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR Part 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.6.1 Agricultural Practices

Agricultural practices in the action area may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow. Grazing activities from cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the associated watersheds. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect listed salmonid and sDPS green sturgeon reproductive success and survival rates (Dubrovsky 1998, Daughton 2002).

2.6.2 Aquaculture and Fish Hatcheries

More than 32-million fall-run Chinook salmon, 2-million spring-run Chinook salmon, 1-million late fall-run Chinook salmon, 0.25-million winter-run Chinook salmon, and 2-million steelhead are released annually from six hatcheries producing anadromous salmonids in the CV. All of these facilities are currently operated to mitigate for natural habits that have already been permanently lost as a result of dam construction. The loss of this available habitat resulted in dramatic reductions in natural population abundance, which is mitigated for through the operation of hatcheries. Salmonid hatcheries can, however, have additional negative effects on ESA-listed salmonid populations. The high level of hatchery production in the CV can result in high harvest-to-escapements ratios for natural stocks. California salmon fishing regulations are set according to the combined abundance of hatchery and natural stocks, which can lead to over-exploitation and reduction in the abundance of wild populations that are indistinguishable and exist in the same system as hatchery populations. Releasing large numbers of hatchery fish can also pose a threat to wild Chinook salmon and steelhead stocks through the spread of disease, genetic impacts, competition for food and other resources between hatchery and wild fishes, predation of hatchery fishes on wild fishes, and increased fishing pressure on wild stocks as a result of hatchery production. Impacts of hatchery fishes can occur in both freshwater and the marine ecosystems. Limited marine carrying capacity has implications for naturally produced fish experiencing competition with hatchery production. Increased salmonid abundance in the marine environment may also decrease growth and size at maturity, and reduce fecundity, egg size, age at maturity, and survival (Bigler, Welch et al. 1996). Ocean events cannot be predicted with a high degree of certainty at this time. Until good predictive models are developed, there will be years when hatchery production may be in excess of the marine carrying capacity, placing depressed natural fish at a disadvantage by directly inhibiting their opportunity to recover (NPCC 2003).

2.6.3 Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those which are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially re-suspending contaminated sediments and degrading areas of submerged vegetation. This in turn will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.6.4 Rock Revetment and Levee Repair Projects

Cumulative effects include non-Federal riprap projects. Depending on the scope of the action, some non-Federal riprap projects carried out by state or local agencies do not require Federal permits. These types of actions and illegal placement of riprap occur throughout the action area. For example, most of the levees have roads on top of the levees which are maintained either by the county, reclamation district, owner, or by the state. Landowners may utilize and modify roads at the top of the levees to access part of their agricultural land. The effects of such actions result in continued fragmentation of existing high-quality habitat, and conversion of complex nearshore aquatic to simplified habitats that affect salmonids in ways similar to the adverse effects associated with this program.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's BO as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminishes the value of designated or proposed critical habitat for the conservation of the species.

2.7.1 Status of the Sacramento River Winter-Run Chinook salmon ESU

Best available information indicates that the Sacramento River winter-run Chinook salmon ESU remains at a high risk of extinction. Key factors upon which this conclusion is based include: (1) the ESU is composed of only one population, which has been blocked from its entire historic spawning habitat; and (2) the ESU has a risk associated with catastrophes, especially considering the remaining population's dependency on the cold-water management of Shasta Reservoir (Lindley *et al.* 2007). The most recent 5-Year Status Review for winter-run Chinook salmon demonstrated that the ESU had further declined, and that continued loss of historical habitat and the degradation of remaining habitat continue to be major threats (NMFS 2016a). NMFS concludes that the Sacramento River winter-run Chinook salmon ESU remains at high risk of extinction.

2.7.2 Status of the CV Spring-Run Chinook salmon ESU

In the 2016 status review, NMFS found, with a few exceptions, CV spring-run Chinook salmon populations have increased through 2014 returns since the last status review (2010/2011), which moved the Mill and Deer creek populations from the high extinction risk category, to moderate, and Butte Creek remaining in the low risk of extinction category. Additionally, the Battle Creek and Clear Creek populations continued to show stable or increasing numbers in that period, putting them at moderate risk of extinction based on abundance. Overall, the Southwest Fisheries Science Center concluded in their viability report that the status of CV spring-run Chinook salmon (through 2014) had probably improved since the 2010/2011 status review and that the ESU's extinction risk may have decreased. However, fish returns in 2015 were extremely low (1,488 adults) (CDFW GrandTab). For the fourth consecutive year, CDFW has documented critically low returns for Butte, Deer, and Mill creeks which hold the only wild, independent populations of CV spring-run Chinook salmon (CDFW GrandTab). The effects of the December 2011 to March 2017 drought have resulted in severe rates of decline and a trend toward extirpation.

2.7.3 Status of the CCV Steelhead DPS

The 2016 status review (NMFS 2016c) concluded that overall, the status of CCV steelhead appears to have changed little since the 2011 status review and should remain as a threatened species. Although there is still a general lack of data on the status of wild populations, there are some encouraging signs, as several hatcheries in the Central Valley have experienced increased returns of steelhead over recent years. There has also been a slight increase in the percentage of wild steelhead in salvage at the south Delta fish facilities, and the percentage of wild fish in those data remains much higher than at Chipps Island. The new video counts at Ward Dam show that Mill Creek likely supports one of the best wild steelhead populations in the Central Valley, though at much reduced levels from the 1950's and 60's. Restoration efforts in Clear Creek continue to benefit CCV steelhead. However, the catch of unmarked (wild) steelhead at Chipps Island is still less than 5 percent of the total smolt catch, which indicates that natural production of steelhead throughout the Central Valley remains at very low levels. Despite the positive trend on Clear Creek and encouraging signs from Mill Creek, all other concerns raised in the current status review remain.

2.7.4 Status of the Green Sturgeon southern DPS

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2015). The recovery potential for this species is likely high, however, if sources of mortality and activities that decrease habitat quality and quantity, particularly in spawning and rearing habitat, are limited (NMFS 2018).

Although the population structure of sDPS green sturgeon is still being refined, it is currently believed that only one population of sDPS green sturgeon exists. Lindley, Schick et al. (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (NMFS 2015).

There is a strong need for additional information about sDPS green sturgeon, especially with regards to a robust abundance estimate, a greater understanding of their biology, and further information about their micro- and macro-habitat ecology.

2.7.5 Status of the Environmental Baseline and Cumulative Effects in the Action Area

Salmon, steelhead and green sturgeon use the action area as an upstream and downstream migration corridor and for rearing. Within the action area, the essential features of freshwater rearing and migration habitats for salmon, steelhead and green sturgeon have been transformed from a meandering waterway lined with a dense riparian vegetation, to a highly leveed system under varying degrees of constraint of riverine erosional processes and flooding. Levees have been constructed near the edge of the river and most floodplains have been completely separated and isolated from the Sacramento River. Severe long-term riparian vegetation losses have occurred in this part of the Sacramento River, and there are large open gaps without the presence of these essential features due to the high amount of riprap. The change in the ecosystem as a result of halting the lateral migration of the river channel, the loss of floodplains, the removal of riparian vegetation and IWM have likely affected the functional ecological processes that are essential for growth and survival of salmon, steelhead and green sturgeon in the action area.

The *Cumulative Effects* section of this BO describe how continuing and future effects such as the discharge of point and non-point source chemical contaminant discharges, aquaculture and hatcheries, increased urbanization, and increased installation of rock revetment affect the species in the action area. These actions typically result in habitat fragmentation, and conversion of complex nearshore aquatic habitat to simplified habitats that incrementally reduces the carrying capacity of the rearing and migratory corridors.

The perpetuation of the current levee system will result in the diminished functioning of the aquatic and riparian ecosystems, which reduces the contributions of these habitats to the survival of rearing and migrating listed species, particularly salmonids. Given the extensive loss of upstream spawning grounds and the extreme modification of habitat in the Sacramento River and its tributaries, careful consideration of the impacts of future levee projects is needed.

2.7.6 Synthesis

Summary of Effects of the Proposed Action to Sacramento River Winter Run Chinook Salmon, CV Spring-run Chinook Salmon, CCV Steelhead, and sDPS Green Sturgeon Individuals

Effects of the levee repair on aquatic resources included both short- and long-term impacts. Short-term impacts include the impacts of construction during the repair. Long-term impacts include the permanent physical alteration of the riverbank and riparian vegetation, as well as continued blockage to the floodplain, which will last for many years.

1. Construction-related Effects

Direct effects associated with in-river construction work will involve equipment and activities that will produce pressure waves, and create underwater noise and vibration, thereby temporarily altering in-river conditions. Any fishes that do not relocate during construction can be crushed or injured by construction equipment or personnel, or may be affected behaviorally or physically from hydroacoustic impacts. However, only fishes that are holding adjacent to or migrating past the levee repair site will be directly exposed to construction activities. These construction type actions will occur during summer and early fall months, when the abundance of individual salmon, steelhead, and green sturgeon is low and is expected to result in correspondingly low levels of injury or death.

Other potential impacts due to construction include the releases of toxic substances and increases in turbidity. However, BMPs utilized in the SRBPP PACR are expected to prevent these impacts from adversely affecting salmonids or green sturgeon.

2. Long-term Effects Related to the Presence of Program Features

The effects of the proposed action could exacerbate many of the Very Highly Ranked Threats to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead, and sDPS green sturgeon. Considering that site-specific actions will occur along primary migratory corridors of the Sacramento River, the Delta, and some of the larger tributary reaches of the Sacramento River, we expect that all Sacramento River Basin populations of these species are likely to be exposed and adversely affected by program actions. We do not expect the proposed action to affect the spatial structure or diversity of any of these species. Program implementation using the Site Selection Process will result in identifying BPMs optimized to include greater plantable areas, which will allow for substantial on-site compensation of the impacts. However, site-specific considerations, such as design configuration and planting densities, will determine the actual amount of on-site compensation that can be provided. As previously stated, and demonstrated by the historic constructed sites evaluation, the USACE future implementation will likely consist of primarily BPM 4 (a, b, or c) or BPM 5 designs, which will include replacement of vegetative features to provide habitat value for fish species. Some of this will be replaced as part of site design and construction, but there will be temporal gaps in function while the site plantings establish and grow. The overall effects are not able to be determined fully with the programmatic approach, but will be further evaluated for each site.

Mitigative Effects of Proposed On-site and Off-site Conservation Measures

Section 1.2.7 of the Proposed Action describes the additional minimization and conservation measures (*i.e.,* mitigation measures) that USACE proposes to offset the unavoidable and residual adverse effects of the proposed levee repair actions. The USACE's Compensation Strategy incorporates alternatives; through site-specific consultations including mitigation and compensation measures, which will be evaluated on a project-by-project basis in technical assistance with NMFS to determine the best suited compensation plan.

If impacts of bank repair actions cannot be fully mitigated on-site, off-site compensation measures will be implemented after project completion or concurrent with site construction using conservation measures/banks. Whether constructed as part of a suite of bank protection sites or established independent of a project site in coordination with DWR, USFWS, and NMFS, off-site compensation will focus on replacing and enhancing habitat values for the listed species addressed in this BO. The SAM model, which was specifically created to assist with determining and quantifying effects and compensation amounts, will be utilized to the extent practicable.

Summary of Long-term Effects to Species ESUs/DPSs as a Whole

Based on the reach-specific analysis of long-term project-related impacts to each analyzed species we determine that there will be appreciable adverse effects to each species in nearly all reaches and water surface elevations. Adverse effects at various water surface elevations, regions, and life stages are expected to last in many cases for several decades, affecting a high proportion and multiple generations of the species analyzed in this BO.

Most of the effects are related to long-term impacts to riparian habitat and IWM, as well as the continued lack of access to floodplain habitat. The perpetuating effects of the ETL and riprap placement are clearly driving these effects. Other effects to all species are not measured by the SAM such as short- and long-term effects to species associated with changes in substrate size and related increases in predation below seasonal water surface elevations. These "unmeasured" effects represent an inherent shortfall of the SAM approach to measuring effects to the focus species and represent a level of uncertainty that is difficult to address in this BO.

Depending on design, the effects of the proposed programmatic action could exacerbate stressors/threats to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon,CCV steelhead, and sDPS green sturgeon. Through conscientious design in coordination with NMFS and the mitigation procedures included in the program, these impacts are expected to be minimized to the maximum extent possible, with unavoidable impacts mitigated. Considering that site-specific actions will occur along primary migratory corridors of the Sacramento River, the Delta, and some of the larger tributary reaches of the Sacramento River, we expect that all Sacramento River Basin populations of these species have the potential to be exposed and adversely affected by program actions. With the nature and potential duration of the effects, we expect the proposed action to temporarily reduce the productivity of a portion of each species during construction exposed to a project site and for the first 5 years as re-vegetation occurs. However, based on the proposed action, unavoidable impacts will be mitigated, such that the program is not expected to reduce appreciably the likelihood of both the survival and recovery of the species.

Summary of Program Effects on Sacramento River Winter-run Chinook Salmon, CV Spring-run Chinook Salmon, CCV Steelhead and sDPS Green Sturgeon Critical Habitat

Within the action area, the general relevant PBFs of the designated critical habitat for listed salmonids are migratory corridors and rearing habitat, and for green sturgeon, the six PBFs include food resources, water flow, water quality, migratory corridor, depth, and sediment quality.

As described in the project description, this consultation analyzed a number of BPMs, which involve vegetation removal, bank fill stone protection installation of rock revetment, and limited replacement of on-site habitat features, resulting in loss of SRA habitat and IWM at the project sites. These actions are expected to temporarily or permanently reduce the quality of habitat for rearing and migrating juvenile salmonids, due to the removal of SRA habitat and IWM. SRA habitat and IWM are important for rearing and out-migrating juvenile salmonids because they enhance the aquatic food webs, provide high-value feeding areas for juvenile salmonids. Removal of SRA habitat and IWM associated with the SRBPP PACR program is expected to temporarily reduce the growth and survival for juvenile salmonids exposed to the project sites. Similarly, SRA habitat and IWM are critical in providing shade and cooling water temperatures for salmonids. Therefore, the removal of SRA habitat and IWM associated with the SRBPP PACR will degrade freshwater rearing and migratory corridors for listed salmonids by temporarily increasing temperatures. The removal of IWM will also increase the risk of predation for juvenile salmonids. The SRBPP PACR further perpetuates the confinement of rivers within their banks, reducing river connectivity with adjacent floodplains, which serve as optimal rearing habitat. The severity of these effects and whether they are temporary or permanent is dependent on the BPM chosen for repairs at each site.

Green sturgeon PBFs of food resources are expected to be adversely affected by the proposed program, as program features will cover the soft benthic substrate where green sturgeon forage for food with riprap, reducing food availability. The lack of scientific information regarding bank protection actions on green sturgeon makes the extent of effects difficult to quantify. Ongoing efforts through the green sturgeon HMMP will develop methodology for quantifying and mitigating these effects. This plan will be in place before the commencement of project construction.

Based on the proposed action, unavoidable impacts will be mitigated, such that the program is not expected to appreciably diminish the value of designated critical habitat.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' BO that the proposed action is not likely to jeopardize the continued existence of the Sacramento River winter-run Chinook salmon ESU, the Central Valley spring-run Chinook salmon ESU, the California Central Valley steelhead DPS, and the Southern DPS of North American green sturgeon, or to destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR Part 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR Part 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

For a framework programmatic action, an incidental take statement is not required at the programmatic level; any incidental take resulting from any action subsequently authorized, funded, or carried out under the program will be addressed in subsequent section 7 consultation, as appropriate [50 CFR Part 402.14(i)(6)].

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR Part 402.02).

1. The USACE should complete a study of potential rock revetment removal sites on the Sacramento River where rock revetment does not serve a flood risk reduction benefit and can be removed for the purpose of enhancing green sturgeon (if applicable) and salmonid

shoreline habitat. The USACE should consider remediating one of these sites as mitigation for subsequent consultations to be completed under the SRBPP PACR programmatic.

2. The USACE should make set-back levees integral components of their authorized bank protection or ecosystem restoration efforts.
3. USACE should engage with NMFS on opportunities for implementing actions under the SRBPP PACR that avoid, minimize and effectively offset impacts to fish species and critical habitat. USACE should collaborate with NMFS to develop a prioritization framework that identifies and implements site-level and system improvements that avoid in-water work to the maximum extent practicable. This should include the following, but not necessarily limited to:
    a. Developing a prioritization framework for the SRBPP PACR with a project design hierarchy that starts with set-back levees and landside levee repairs.
    b. Proactively conducting real-estate investigations for landside work before consultation requests and/or program planning and implementation.
    c. Proactively investigating and identifying riparian corridor enhancement opportunities that could be implemented in the vicinity of future projects that impact fish species and critical habitat.
    d. Proactively investigating and planning rock removal projects to mitigate future placement of revetment in critical habitat. For example, the USACE has legacy rock placement areas along the Upper Sacramento River reach from Red Bluff to Chico Landing near Hamilton City that do not serve any purpose toward protecting human safety and could be removed to facilitate riverine function such as side channel and floodplain inundation.

7. USACE should prioritize and continue to support flood management actions that set levees back from rivers and in places where this is not technically feasible, repair in place actions should pursue landside levee repairs instead of waterside repairs.
8. USACE should develop an institutional mechanism for including NMFS in the review and approval of ETL variances for future projects that require ETL compliance.
9. USACE should use all of their authorities, to the maximum extent feasible to implement high priority actions in the NMFS Central Valley Salmon and Steelhead Recovery Plan (NMFS 2014). High priority actions related to flood management include setting levees back from riverbanks, and increasing the amount and extent of riparian vegetation along reaches of the Sacramento River Flood Control Project.
10. USACE should encourage cost share sponsors and applicants to develop floodplain and riparian corridor enhancement plans as part of their projects.
11. USACE should support and promote aquatic and riparian habitat restoration within the Sacramento River and other watersheds, especially those with listed aquatic species. Practices that avoid or minimize negative impacts to listed species should be encouraged.
12. USACE should continue to work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects.
13. USACE should continue to work with NMFS and other agencies and interests to restore fish passage to support the improved growth, survival and recovery of native fish species in the Yolo Bypass and other bypasses within the Sacramento River Flood Control Project.

14. USACE should work with NMFS to implement bio-technical designs when possible to incorporate both bank protection and fish habitat measures into designs.
15. USACE should avoid designing any sites using BPM 2 unless all other options are deemed infeasible at that location.

NMFS requests notification of the implementation of any conservation recommendations.

2.11 Reinitiation of Consultation

This concludes formal consultation for Sacramento River Bank Protection Project Post Authorization Change Report.

As 50 CFR Part 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this BO, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this BO, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR Part 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the Action Agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the USACE and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans (FMP) developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

EFH designated under the Pacific Coast Salmon FMP may be affected by the proposed action. Species that utilize EFH designated under this FMP within the action area include fall-run/late fall-run Chinook salmon. Habitat Areas of Particular Concern (HAPCs) that may be either directly or indirectly adversely affected include (1) complex channels and floodplain habitats, (2) thermal refugia, and (3) spawning habitat.

3.2 Adverse Effects on Essential Fish Habitat

Consistent with the ESA portion of this document which determined that aspects of the proposed action will result in impacts to Pacific Coast salmon and critical habitat, we conclude that aspects of the proposed action would also adversely affect EFH for these species. Adverse effects to ESA-listed critical habitat and EFH HAPCs are appreciably similar, therefore no additional discussion is included. Listed below are the adverse effects on EFH reasonably certain to occur. Affected HAPCs are indicated by number, corresponding to the list in Section 3.1.

Sedimentation and Turbidity

- Reduced habitat complexity (1)
- Degraded water quality (1, 2, 3)
- Reduction in aquatic macroinvertebrate production (1)

Contaminants and Pollution-related Effects

- Degraded water quality (1, 2)
- Reduction in aquatic macroinvertebrate production (1)

Installation of Revetment

- Permanent loss of natural substrate at levee toe (1, 2, 3)
- Reduced habitat complexity (1, 2)
- Increased bank substrate size (1, 3)
- Increased predator habitat (1)

Removal of Riparian Vegetation

- Reduced shade (1, 2)
- Reduced supply of terrestrial food resources (1)
- Reduced supply of IWM (1, 2)

3.3 Essential Fish Habitat Conservation Recommendations

NMFS recommends the following EFH conservation recommendations:

1. Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures throughout the life of the proposed program to ensure their effectiveness.
2. Measures shall be taken to minimize the impacts of bank protection by implementing integrated on-site and off-site conservation measures that provide beneficial growth and survival conditions for juvenile salmonids, and the sDPS of North American green sturgeon. Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures throughout the life of the proposed program to ensure their effectiveness.
3. Measures shall be taken to ensure that contractors, construction workers, and all other parties involved with this program implement the program as proposed in the biological assessment and this BO.
4. Measures shall be taken to ensure that USACE levee vegetation management policies that influence SRBPP PACR repair design are based on best available science and consider the potential benefits of levee vegetation to levee integrity, public safety, and ESA-listed fish species.
5. Measures shall be taken to minimize the amount and duration of placement of rock revetment below the OHW of the Sacramento River.
6. Measures shall be taken to ensure that future flood risk reduction projects that result from this program minimize, to the maximum extent practicable, any adverse effects on federally listed salmon, steelhead and green sturgeon that are subject to this consultation.
7. Measures shall be taken to ensure that riparian habitat within the study area is preserved and protected to the maximum extent feasible for protection of fish habitat features that are the subject of this BO.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, USACE must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the

Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR Part 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the Action Agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

USACE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR Part 600.920(l)).

4. FISH AND WILDLIFE COORDINATION ACT

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16 USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.

The following recommendations apply to the proposed action:

(1) USACE should recommend that contractors use biodegradable lubricants and hydraulic fluid in construction machinery. The use of petroleum alternatives can greatly reduce the risk of contaminants such as polycyclic aromatic hydrocarbons (PAHs) or heavy metals directly or indirectly entering the aquatic ecosystem.

The action agency must give these recommendations equal consideration with the other aspects of the proposed action so as to meet the purpose of the FWCA.

This concludes the FWCA portion of this consultation.

5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

5.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are USACE. Individual copies of this opinion were provided to USACE. The format and naming adheres to conventional standards for style.

5.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

5.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR Part 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR Part 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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