SUTTER BASIN PILOT FEASIBILITY FINAL REPORT—FINAL ENVIRONMENTAL IMPACT REPORT / SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

PREPARED BY:

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October 2013

FINAL
PILOT FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT REPORT/ SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
For
Sutter Basin Pilot Feasibility Study
Sutter & Butte Counties, California

This Feasibility Report (FR) includes an integrated Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) with sections required for compliance with the National Environmental Policy Act and California Environmental Quality Act noted by an asterisk (*) in the Table of Contents.

Responsible Agencies: The responsible Federal lead agency is the U.S. Army Corps of Engineers (USACE), Sacramento District. The Sutter Butte Flood Control Agency (SBFCA) is the responsible State lead agency and non-federal cost sharing partner for the study. There are no Cooperating Agencies as defined in 40 Code of Federal Regulation 1508.5 and no agency was requested to be a Cooperating Agency.

Abstract: The purpose of the Sutter Basin Pilot Feasibility Study (SBPFS) is to investigate and determine the extent of Federal interest in plans that reduce flood risk to the Sutter Basin in Sutter and Butte Counties. This report: (1) assesses the risk of flooding; (2) describes a range of alternatives formulated to reduce flood risk; and (3) identifies a Recommended Plan (RP) for implementation. The RP consists of levee improvements to existing levees of the Sacramento River Flood Control Project extending along approximately 41 miles of the Feather River. The RP would provide higher levels of flood risk management to local communities.

Following public and governmental agency review, this final report will be finalized and submitted to Headquarters, USACE, for review and approval, then transmitted to Congress for recommended project authorization. Federal project construction would be dependent upon Congressional appropriation of funding for the Federal share of the project.

Following release of the draft FR/EIR/SEIS for public comment in June 2013, SBFCA initiated construction of the Feather River West Levee Project (FRWLP), which is similar to the recommended plan. The non-federal costs incurred by SBFCA and the State of California in implementing the FRWLP are eligible for credit as non-federal cost share toward potential future USACE construction of recommended plan features.

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Acronyms and Abbreviations

ACE	Annual Chance Exceedance
ACHP	Advisory Council on Historic Preservation
APE	areas of potential effects
ASA(CW)	Office of the Assistant Secretary of the Army for Civil Works
ASTs	aboveground storage tanks
ATR	Agency Technical Review
Basin Plan	Sacramento and San Joaquin River Basins
BCAQMD	Butte County Air Quality Management District
BCR	benefit-to-cost ratios
BFE	base flood elevation
BMPs	Best Management Practices
BRCP	Butte Regional Conservation Plan
BSSCP	bentonite slurry spill contingency plan
CAA	Clean Air Act
CAR	Coordination Act Report
CARB	California Air Resources Board
CDFW	Department of Fish and Wildlife
Central Valley RWQCB	Central Valley Regional Water Quality Control Board
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CNRFC	California Nevada River Forecast Center
CRS	Community Rating System
CVFBP	Central Valley Flood Protection Board
CVFPA	Central Valley Flood Protection Act
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CVHM	Central Valley Hydrologic Model
CVIFMS	Central Valley Integrated Flood Management Study
CWA	Clean Water Act
dbh	diameter at breast height
DPM	diesel-fueled engines
DQC	District Quality Control
DWR	California Department of Water Resources
EFH	Essential Fish Habitat

EIP	Early Implementation Program
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EM	2004 Engineering Manual 1110-1-400
EO	Executive Order
ER	Ecosystem Restoration
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
Flood Board	California Flood Protection Board
FMMP	Farmland Mapping and Monitoring Program
FPPA	Farmland Protection Policy Act
fps	feet per second
FR	Federal Register
FRAQMD	Feather River Air Quality Management District
FRM	flood risk management
FRWA	Feather River Wildlife Area
FRWL	Feather River West Levee
FRWLP	Feather River West Levee Project
FSM	Feasibility Scoping Meeting
GGS	giant garter snake
GIS	geographic information system
HCP	habitat conservation plan
HPTRM	High Performance Turf Reinforced Mat
HTRW	hazardous toxic radioactive wastes
ICF	ICF International
IEPR	Independent External Peer Review
LD	Levee Districts
LERRDs	lands, easements, right of ways, relocations, and disposal areas
LPP	Locally Preferred Plan
LST	Levee Screening Tool
MAs	Maintenance Areas
MBTA	Migratory Bird Treaty Act
MCACES	Micro Computer-Aided Cost Engineering System
MLD	most likely descendant
MMP	mitigation and monitoring plan
MOU	memorandum of understanding
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NCCP	natural community conservation plan
NED	National Economic Development
NEPA	National Environmental Policy Act

NFIP	National Flood Insurance Program
NGOs	non-governmental organizations
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOD	Notice of Determination
NOI	Notice of Intent
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTUs	Nephelometric turbidity units
NWS	National Weather Service
O&M	operations and maintenance
OMB	Office of Management and Budget
OMRR&R	operation and maintenance, repair, replacement, and rehabilitation
OS	open space
OSE	Other Social Effects
OWA	Oroville Wildlife Area
P&G	Principles and Guidelines
PA	programmatic agreement
PDT	Project Deliver Team
PED	Preconstruction, Engineering & Design
PPA	Project Partnership Agreement
PRC	Public Resources Code
RD	Reclamation District
Reclamation Board	California Central Valley Flood Protection Board
RED	Regional Economic Development
ROD	Record of Decision
ROW	Right-of-Way
RP	Recommended Plan
RWQCB	Central Valley Regional Water Quality Control Board
SB	Senate Bill
SB 5	California Senate Bill 5
SBCA	Star Bend Conservation Area
SBFCA	Sutter Butte Flood Control Agency
SBMC	Sutter Butte Main Canal
SBPFS	Sutter Basin Pilot Feasibility Study
SEIS	Supplemental Environmental Impact Report
SHPO	State Historic Preservation Officer
SMAQMD	Sacramento Metropolitan Air Quality Management District
SPCCP	spill prevention, control, and counter-measure plan
SPFC	State Plan of Flood Control

SRA	Shaded Riverine Aquatic
SRFCP	Sacramento River Flood Control Project
State Water Board	State Water Resources Control Board
SWIF	System Wide Improvement Framework
SWPPP	stormwater pollution prevention plan
TRLIA	Three Rivers Levee Improvement Authority
TSP	tentatively selected plan
TSS	total settleable solids
UAIC	United Auburn Indian Community
UFRR	Urban Flood Risk Reduction
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USTs	underground storage tanks
valley	Sacramento Valley
VE	Value Engineering
Vegetation ETL	Guidelines for Landscape Plantings and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures
VELB	valley elderberry longhorn beetle
VFZ	Vegetation-Free- Zone
WDRs	waste discharge requirements
WRDA	need definition
Yuba-Sutter NCCP/HCP	Yuba-Sutter Natural Community Conservation Plan and Habitat Conservation Plan

This report serves three functions. It assesses the risk of flooding in the Sutter Basin, it describes a range of potential projects (called "alternatives") formulated to reduce flood risk, and it identifies a Recommended Plan (RP) for implementation. This report constitutes both a final Feasibility Report that describes the U.S. Army Corps of Engineers (USACE) "pilot" planning process that was followed to identify the RP, and a final Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) that is required to comply with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Following public and governmental agency review, this final report will be submitted to Headquarters USACE, the Assistant Secretary of the Army for Civil Works (ASA[CW]), and the Office of Management and Budget for review and approval. Following approval, a Chief of Engineers Report will be sent to Congress recommending authorization of the Sutter Basin Flood Risk Management project.

ES.1 Purpose and Need

The primary purpose of the Sutter Basin Project is to reduce overall flood risk to the Sutter Basin study area consistent with the project goals. Recent geotechnical analysis and evaluation of historical performance during past floods indicate the existing project levees within the study area do not meet USACE levee design criteria and are at risk of failure. Approximately 26,783 structures throughout the study area are at risk of flooding in a 1% Annual Chance Exceedance (ACE) flood event (100-year event).

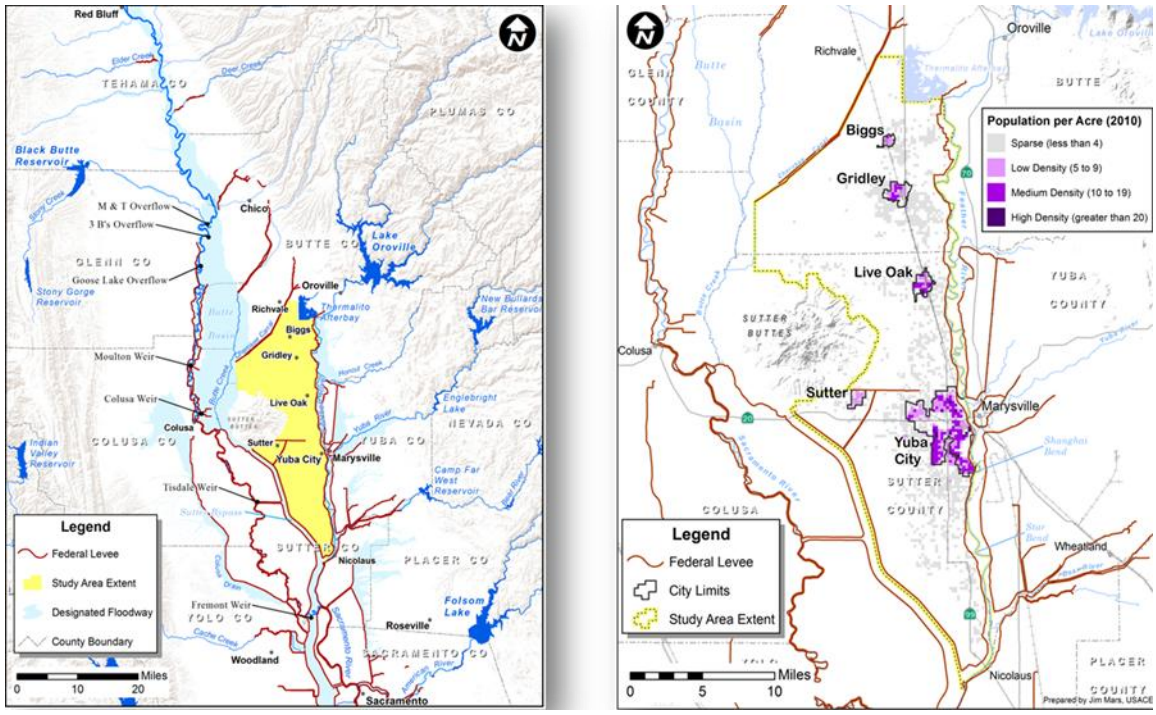
ES.2 Study Area and Need for Action

USACE initiated the Sutter Basin, California, Feasibility Study in 2000 at the request of Sutter County through the California Central Valley Flood Protection Board (formerly the Reclamation Board). The Sutter Butte Flood Control Agency (SBFCA) is a joint powers agency formed in 2007 by the Counties of Butte and Sutter; the Cities of Biggs, Gridley, Live Oak and Yuba City; and Levee Districts 1 and 9. SBFCA became a joint non-federal sponsor with the Central Valley Flood Protection Board (CVFBP) of the Feasibility Study in 2007, and the study area was redefined from the political boundaries of Sutter County to the hydraulic boundaries of Sutter Basin, which includes portions of both Sutter and Butte Counties.

The Sutter Basin is a 326-square-mile area located in northern California on the west bank of the Feather River, as shown on Figure ES-1. The study area is mostly encircled by project levees of the Sacramento River Flood Control Project (SRFCP), which was initially authorized by the Flood Control Act of 1917.

The Gold Rush of 1849 greatly accelerated European settlement in California's Central Valley, including the Sutter Basin. The population surge induced agricultural development and the establishment of the new communities of Marysville on the east bank of the Feather River and Yuba City, Biggs, Gridley, and Live Oak on the west bank. Initial local levee construction was based upon historic high water levels; however, competing levees on either side of the river constrained the flood carrying capacity of the river, as did upstream hydraulic mining that washed large amounts of sediment into the rivers and raised their natural beds. As a result, levees were overtopped, failed, and then rebuilt to a higher elevation. This cycle continued through the late 1800s, when the "Sawyer Decision" by the Ninth Circuit Court in San Francisco put an end to hydraulic mining and

the California Debris Commission proposed a comprehensive plan consisting of levees, weirs, and bypasses to reduce the risk of flooding in the Sacramento Valley. The plan was formally adopted by the State of California in 1911 and the California Reclamation Board was empowered to approve plans for the construction of levees along the Sacramento River, its tributaries, and within any of the overflow basins. By the time the SRFCP was authorized by Congress in the Flood Control Act of 1917, more than 400 miles of river levees had already been constructed. USACE, the State, and local communities continued to extend the system's levees and improve the existing levees to required grade and section. In 1938, USACE rebuilt the Feather River west bank levee from Shanghai Bend to Yuba City in accordance with the established design criteria.



(See the *Figures* folder on the CD for full-sized images.)

Figure ES-1. Sutter Basin Study Area (left) and Sutter Basin Urbanized Areas (right)

The construction of large reservoirs on the Sacramento, Feather, and Yuba Rivers offered additional flood risk reduction by regulating flood discharge flows. However, the Sutter Basin is still at serious risk of flood, not from levee overtopping, but from geotechnical failure as a result of under-seepage. Since 1950 extensive flood fighting has occurred in the study area during 19 events. The flood of 1955 (see Figures ES-2 and ES-3) resulted in 38 deaths. Catastrophic and deadly failures occurred in 1997 on the Feather River East Levee and the Sutter Bypass West Levee. Both of these incidents, which reduced the Feather River water surface elevation, relieved pressure on the Sutter Basin levees and likely prevented further flooding and loss of life within the study area.

The Sutter Basin topography provides for broad and shallow floodplains with a northeast to a southwest flow toward the deeper southern basin (See Figure ES-4). Floodplain modeling of existing conditions clearly shows that the leveed study area, excluding the highlands of the Sutter Buttes, has a high level of flood risk and significant public and life safety risk (See Figure ES-4). Potential levee breaches on the eastern side of the Basin along the Feather River north of Yuba City would flood

most of the northern basin, including the communities of Live Oak, Gridley, and Biggs, and would impact the southern portion of the Basin as floodwaters flowed to the lower elevations.

Before After

Figure ES-2. Yuba City Flooding (1955) and Present Conditions

Figure ES-3. Yuba City Flooding (1955)

The residents, businesses, and local governments of Sutter Basin are keenly aware of the flood risk, which led them to create SBFCA, assess taxes specifically for reducing the flood risk, and formally seek partnership, in the form of a continuing feasibility study, with CVFPB and the Federal Government to address the flood risk. When USACE's National Pilot Program for planning modernization was initiated in 2011 to develop a new risk-informed planning process paradigm, both SBFCA and CVFPB readily supported and signed on to be part of the fast-moving pilot program.

A further example of local sponsor focus on expediting flood risk–reduction efforts is SBFCA's progress on the Feather River West Levee Project (FRWLP). SBFCA has requested and received approval under 33 United States Code Section 408 for certain levee improvement work in the study area. SBFCA's stated intent is to begin construction of the FRWLP to address the most critical sections of the existing levee and, in so doing, advance construction of the Federal project expected to result from this Sutter Basin Pilot Feasibility Study (SBPFS). SBFCA intends to seek in-kind credit for completing portions of the FRWLP that are determined to be integral to the Federal project. As described in Section ES.4, the environmental impact analysis contained in this final integrated pilot feasibility report and EIR/SEIS supplements the Final EIS prepared by USACE for the FRWLP and focuses on the additional impacts of the SBPFS.

The SBPFS and associated environmental documentation present a multi-objective pilot plan formulation process that has resulted in a RP that best addresses the study objectives of reducing flood risk and associated damages, and reducing the public and life safety risk in the Sutter Basin.

The local project sponsors contend that numerous unique flood-related problems, listed below, warrant a continued Federal investment in Sutter Basin public safety.

- **Sudden and unpredictable levee failures.** Numerous historic events confirm that Feather River levees most often fail because of under-seepage. This failure mode is characterized by minimal warning time, which renders evacuation plans ineffective and potentially hazardous.
- **Limited evacuation routes.** The unique geography, small number of transportation corridors, and population distribution necessitate the protection and augmentation of limited evacuation options. During past flood events, such as in 1955 and 1997, evacuation routes and available safe zones proved to be ineffective or hazardous.
- **Vulnerability to winter storms.** Flooding historically has occurred during the months of December through February with air temperatures of 38 to 55°F and water temperatures of 45 to 55°F. These temperatures significantly increase risk of death by exposure.
- **Vulnerable senior population.** Both Butte County (15.6%) and Sutter County (13.0%) are above the state average (11.7%) for percentage of persons at least 65 years of age.
- **Economically disadvantaged community.** The median household income for the study area ranges from $36,563 (Gridley) to $48,830 (Yuba City), well below the median in California. Unemployment is also high, with rates of 14.7%, 8.4%, and 9.3% in Biggs, Gridley and Yuba City, respectively (U.S. Census Bureau 2010).
- **Adoption of wise use of floodplain policies.** Local land use planning policies sustain agricultural land use in the southern portion of the basin, which is subject to deep flooding, while allowing limited growth adjacent to the four communities in the shallower northern portions.
- **Overwhelming support for risk-reduction measures.** In 2010, during the depths of the economic recession, Sutter Basin property owners voted to assess themselves $6.65 million per year to study and implement a project to reduce flood risks. This voting margin (72% to 28%) for one of the highest per-home assessment rates in California by an economically disadvantaged community represents a resounding public endorsement for the critical public and life safety aspects of the project.

ES.3 Study Authority

The authority for USACE to study Flood Risk Management (FRM) and related water resources problems in the Sacramento River Basin, including the study area in Sutter and Butte Counties, is provided in the Flood Control Act of 1962, Public Law No. 87-874, Section 209, 76 Stat. 1180, 1196 (1962).

The existing project levees of the Sutter Basin provide FRM as part of the more comprehensive SRFCP, which was authorized by the Flood Control Act of 1917.

ES.4 Scope of NEPA and CEQA Impact Analysis

USACE as the NEPA lead agency and SBFCA as the CEQA lead agency have prepared this integrated document as a joint CEQA and NEPA document, an Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS). In December 2012, USACE and SBFCA released for public comment a Draft EIS/EIR for the FRWLP. Following release of the Draft EIS/EIR, the NEPA and CEQA processes were separated and a stand-alone EIS and a stand-alone EIR were prepared. SBFCA has since certified and adopted its final EIR and filed a Notice of Determination. The Final EIS has been approved by USACE and a Record of Decision (ROD) was signed on July 19, 2013 covering levee work proposed for construction in 2013 and then a second ROD on September 13, 2013 covering the entire remaining project.

Because the FRWLP Final EIS analyzed a project with similar features and environmental impacts to those of the SBPFS, the actions proposed in the FRWLP Final EIS have been supplemented to include work associated with the SBPFS, including an additional reach of levee improvements and impacts on vegetation. Consequently, this final document supplements the analyses and conclusions reached by USACE in the FRWLP Final EIS. Further, this document incorporates by reference the FRWLP Final EIS where applicable.

ES.5 Pilot Study Program

The SBPFS was one of the first studies selected for inclusion in the National Pilot Program in February 2011. The pilot initiative provides an opportunity to test and develop principles of modernizing the USACE Civil Works Planning Program to better address the many water resource challenges facing the nation. The pilot study paradigm envisions a more predictable and efficient planning process that significantly lessens the time and level of information required to complete a feasibility study. This new process required regular involvement and alignment from the South Pacific Division and Headquarters-assigned personal (Vertical Team) throughout the plan formulation process. The pilot process emphasized multi-objective planning, early identification of the Federal interest, use of available information and data, professional judgment, and risk-informed planning and decisions.

ES.6 Existing Conditions of Levees and Flooding Characteristics

Existing conditions are those at the time the study is conducted and form the basis for extrapolation to other conditions. Existing conditions within the study area are discussed below.

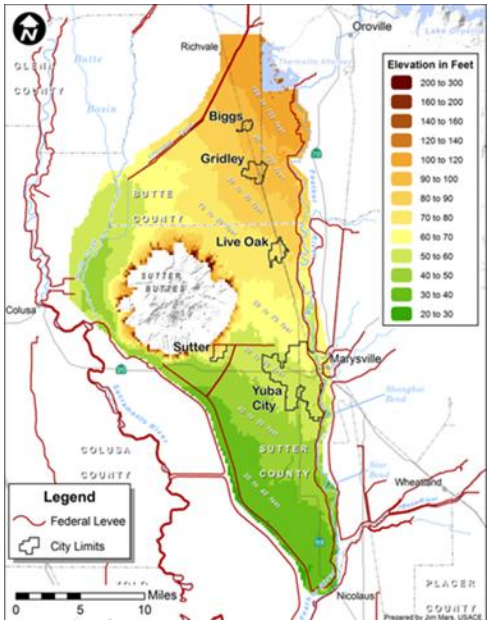
ES.6.1 Topography

As shown in Figure ES-4, the floodplain elevations (excluding the high ground of Sutter Buttes) range from 110 feet in the northeast to 30 feet in the southwest.

ES.6.2 Geotechnical Levee Performance

History, initial information, and modeling during plan formulation indicate that the primary risk of flooding in the Sutter Basin is the result of geotechnical failure of the existing levees, not hydrologic or hydraulic factors that result in levee overtopping. Recent geotechnical analysis and evaluation of historical performance during past floods have resulted in a revision of the criteria used for the evaluation of under-seepage. The risk of levee failure cannot be attributed to design deficiency or

lack of maintenance of the existing levees, but rather to a better understanding of the mechanics of under-seepage. The project levees within the study area do not meet current USACE levee design standards and are at risk of breach failure at stages considerably less than levee crest elevations. This was evidenced by historical boils and heavy seepage at Feather River stages less than authorized design flows. Under-seepage failures are sudden and unpredictable, resulting in minimal warning time and ineffective evacuation plans. The risk of unexpected levee failure coupled with the consequence of flooding presents a continued threat to public and life safety, property, and critical infrastructure. Modeling indicated that a levee could fail for seepage-related reasons even when the water surface is at a 20% level (meaning the event has a 1 in 5 chance of occurring in any year) along the Feather River. During a 10% event (1/10), the probability of failure is 10–20%. For a 1% event (1/100), the probabilities of failure are 30–45%, depending upon the location along the river.



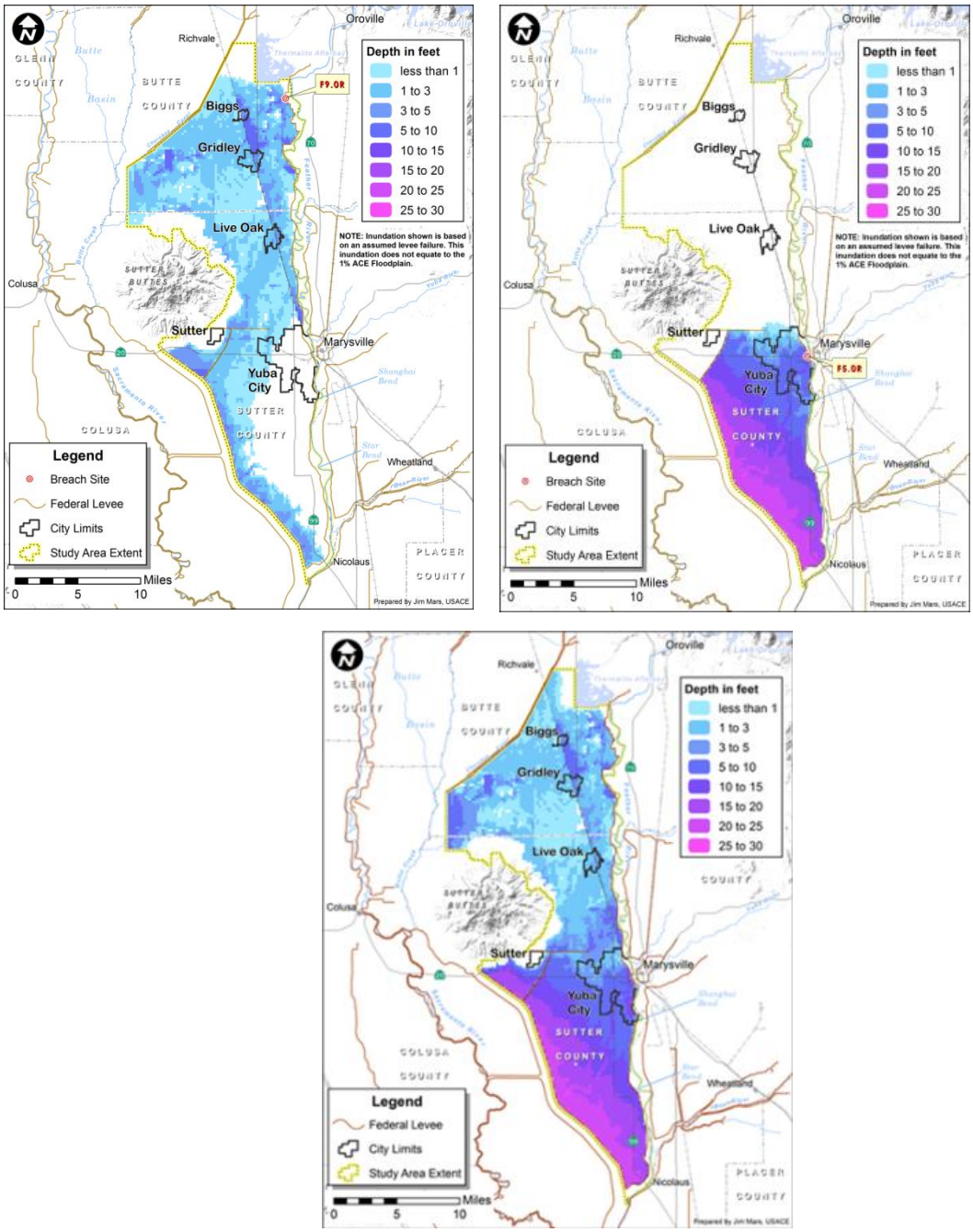
(See the Figures folder on the CD for a full-sized image.)

Figure ES-4. Sutter Basin Topography

ES.6.3 Hydraulics

Multiple levee breach scenarios were modeled along the Feather River and Sutter Bypass to assist in the analysis of the study alternatives. Floodplains resulting from levee breaches differ significantly in nature depending on the location of the breach, as illustrated in Figure ES-5. Simulated breaches along the northern portion of the Feather River flood the northern basin in a shallow (up to 6 feet) northeast to southwest flooding flow. Breaches from the Sutter Bypass and southern most portion of the Feather River only flood the deeper (up to 25 feet) southern basin area and do not impact the northern portion of the basin. The velocity of floodwaters varies depending on the proximity to the breach location. Within 1,000 feet of a breach, the velocity could be great enough to knock structures off of their foundations. This high-risk velocity area would consist mainly of the small portion of Yuba City within 1,000 feet of the river and would see velocities greater than 6 feet per

second (fps). The majority of Yuba City and all of Biggs, Gridley and Live Oak are outside this area and could expect to see flood velocities of 2–3 fps.



(See the *Figures* folder on the CD for full-sized images.)

Figure ES-5. Northern Feather River Levee Breach Scenario, 1% ACE Floodplain (upper left), Yuba City Feather River Breach Scenario, 1% ACE Floodplain (upper right), and Composite 1% ACE Floodplain for Sutter Basin (bottom).

Various without-project levee breach scenarios were developed and evaluated for the study area to determine the inundation area for flood events of various magnitudes. Figure ES-5 shows the 1% ACE floodplain for two breach scenarios, one near Biggs in the northern portion of the basin and the other near Yuba City. Figure ES-5 also shows a summary, or composite, of the 1% (1/100) ACE inundation areas for the entire study area from all evaluated breach locations that have less than a 90% reliability for a given mean annual exceedence event (in this case 1%). While this floodplain is larger than would likely be seen in a single flood/breach event, it is meant to represent the relative residual risk for the area from all remaining breach locations.

ES.7 Plan Formulation

ES.7.1 Pilot Plan Formulation Approach and Multi-Objective Planning

During the feasibility study, the Federal planning process for development of water resource projects was followed to identify a recommended plan for implementation. Following definition of flood-related problems and opportunities, specific planning objectives and planning constraints were identified. A broad array of management measures consisting of FRM, associated ecosystem restoration, and associated recreation opportunities was developed to achieve the planning objectives and avoid the planning constraints. These measures were based on existing reports and studies, local sponsor information, public input, risk assessment, and professional judgment, as discussed in Section 3-1, *Flood Risk–Management Measures*.

A parallel effort of plan formulation was also conducted by SBFCA for the FRWLP. Alternatives considered in detail in the Final EIS for the FRWLP are discussed in this document (Chapter 4, *Affected Environment and Environmental Consequences*) because this integrated document supplements the FRWLP Final EIS, as discussed in Section ES.4, *Scope of NEPA and CEQA Impact Analysis*.

Verification of the geotechnical levee issues and hydraulic modeling scenarios focused the FRM measures and alternatives to two basic approaches: fix the existing Feather River West Levee or construct new setback levees. Setback levees address FRM issues objectives and also provide opportunities at the new waterside areas lands created by the setback of the levee footprint for ecosystem restoration and recreation. These setback waterside lands would be connected to the active floodplain and river, but also to the extensive existing riparian and agricultural lands that provide habitat and recreation connectivity to the river. Fix-in-place measures do not have associated or conjunctive ecosystem or recreational opportunities, because the levee footprint is relatively the same as the existing levee and, therefore, is not creating or providing any new areas for potential ecosystem restoration or recreation connectivity. Thus, any proposed ecosystem restoration and recreation would need to be independent of the FRM fix-in-place place measures. The Feather River levees are already set back hundreds of feet from the river channel, with the connected floodplain area consisting of remnant riparian, fallow, and agriculture areas. These existing remnant riparian and fallow areas provide opportunities for ecosystem restoration and recreation that can be pursued independently from the study.

A combined Value Engineering (VE) Study and Planning Charette (workshop) screened and evaluated the conceptual alternatives developed during the initial management measurement efforts. VE methodology was incorporated into the planning process to compare, refine, and optimize alternatives based on multiple criteria to ensure a robust array of alternatives was evaluated. The VE Study/Charette process also provided an opportunity to validate the array of

conceptual alternatives and to ensure that significant alternatives had not been overlooked. The process resulted in a draft array of eight alternatives as described in Chapter 3, *Plan Formation*.

- Alternative SB-1: No Action
- Alternative SB-2: Minimal Fix-in-Place Feather River Levees: Sunset Weir to Star Bend
- Alternative SB-3: Yuba City Ring Levee
- Alternative SB-4: Little J-levee
- Alternative SB-5: Fix-in-Place Feather River Levees: Thermalito Afterbay to Star Bend
- Alternative SB-6: Fix-in-Place Feather River, Sutter Bypass, and Wadsworth Canal Levees
- Alternative SB-7: Fix-in-Place Feather River Levees: Sunset Weir to Laurel Avenue
- Alternative SB-8: Fix-in-Place Feather River Levees: Thermalito Afterbay to Laurel Avenue

A multi-objective evaluation strategy was used to narrow the draft array of eight alternatives into a final array of three alternatives. The multi-objective evaluation process first screened alternatives using the federal planning criteria that identified efficiency (economics/cost efficiency) and completeness (best meeting study objectives). The next step was screening based on the "planning accounts" of National Economic Development (NED) for efficiency and Other Social Effects (OSE) for completeness.

ES.7.2 Identification of Final Array of Alternatives

Alternative SB-7, which would maximize net benefits, was identified as the NED Plan. This alternative consists of strengthening approximately 27 miles of the existing Feather River West Levee from Sunset Weir to Laurel Avenue. The NED Plan would reduce adverse flooding effects, but benefits would be primarily centered in Yuba City. The NED Plan would not address the significant flooding risks in the communities of Biggs, Gridley, and Live Oak. Therefore, the NED Plan does not fully address the planning objectives.

Using the evaluation metrics and multi-objective analysis, the alternative that best balances the study objectives of reducing flood risk and damages and reducing risk to public and life safety within the entire study area was determined to be Alternative SB-8 (See Table ES-1). Alternative SB-8 is supported by the local sponsors as a locally preferred plan (LPP), and can be considered in a multi-objective planning context to be a more comprehensive and complete Federal plan.

The LPP consists of strengthening approximately 41.4 miles of the existing Feather River West Levee from Thermalito Afterbay to Laurel Avenue. The LPP would reduce adverse flooding effects, including risks to public and life safety, in the northern portion of the basin as well as in Yuba City. See Figure ES-6.

With the confirmation of an LPP, A final array of alternatives was established.

- Alternative SB-1: No Action
- Alternative SB-7: Fix-in-Place Feather River Levees: Sunset Weir to Laurel Avenue (NED Plan)
- Alternative SB-8: Fix-in-Place Feather River Levees: Thermalito Afterbay to Laurel Avenue (LPP)

Table ES-1. Net Benefits (Mean, Standard USACE Practice) – Final Array of Alternatives Using October 2013 Prices (Values in Millions) and 3.5% Discount Rate

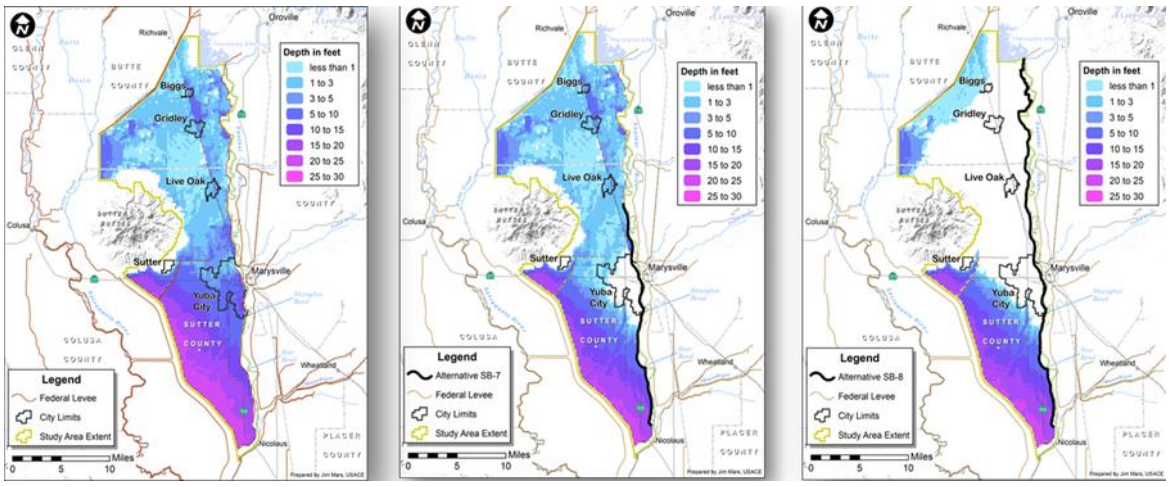
Economic Category	Alternative SB-1: No Action	Alternative SB-7: NED Plan	Alternative SB-8: LPP
Total First Cost [a]	N/A	390	686
IDC	N/A	38	94
OMRR&R	N/A	0.28	0.45
Annual Cost	N/A	18	33
Annual Benefits	N/A	79	87
Annual Net Benefits	N/A	61	54
Benefit to Cost Ratio	N/A	4.4:1	2.6:1

NED = National Economic Development.
IDC = Interest during construction.
OMRR&R = Operations and maintenance, repair, replacement and rehabilitation.
[a] Cultural resources data recovery costs ($1.6 million for SB-7 and $3.0 million for SB-8) are not included in economic costs per Corps policy (ER 1105-2-100, Appendix E, paragraph E-63.f.(5)),

ES.7.3 Management of Residual Risk

The LPP (Alternative SB-8) is the multi-objective/criteria alternative that is both cost effective and best reduces flooding and residual risk to public and life safety in the Sutter Basin. Alternative SB-8 includes Alternative SB-7 and would fix-in-place the northern Feather River levees from Sunset Weir up to Thermalito Afterbay. The total first cost, which is the sum of all initial expenditures to construct a project, of the LPP is estimated at $688,930,000. The LPP would provide annual net benefits of $54 million.

SB-1 (No Action) SB-7 (NED) SB-8 (LPP)



(See the *Figures* folder on the CD for full-sized images.)

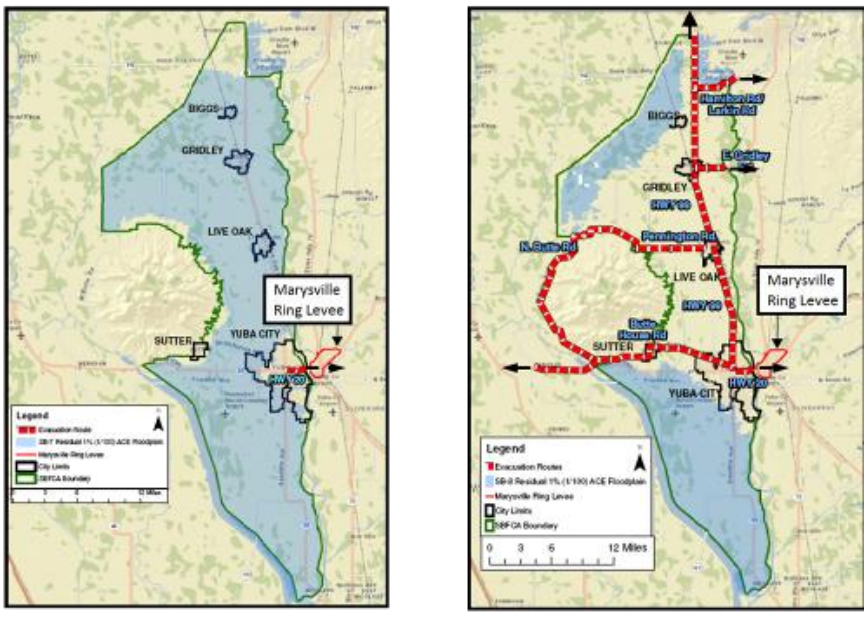
Figure ES-6. Final Array of Alternatives Comparison (Residual 1% ACE Floodplains)

The additional investment of $297,090,000 in project cost (Alternative SB-8 first cost minus the NED Plan cost) would buy down the residual risk of the NED Plan, provide additional annual benefits ($8 million), and provide significant nonmonetized benefits in the reduction of public and life safety risk reduction. The population at risk of flooding from a 1% ACE flood event would decrease from 38,200 under the NED Plan to 6,600 under the LPP. In addition, critical infrastructure at risk would be reduced from 11 facilities under the NED Plan to one under the LPP. Significantly, the number of evacuation routes for the entire Sutter Basin would increase from one under NED Plan to five under the LPP (See Table ES-1, Table ES-2, and Figure ES-7).

Table ES-2. Final Array: Summary of Life Safety Metrics for Residual Risk

Evaluation Metric		Alternative		
		SB-1: No Action	SB-7: NED Plan	SB-8: LPP
Population at Risk	People	94,600	38,200	6,600
Critical Infrastructure	Facilities	28	11	1
Evacuation Routes	Number of Routes	0	1	5
Potentially Developable Floodplains	Acres	71,800	88,200	100,200

In significantly reducing the residual risk of the NED Plan to public and life safety and still providing additional annual benefits and a positive total benefit to cost ratio, Alternative SB-8 is supported by the local sponsors as the LPP, and can be considered in a multi-objective planning context to be a more comprehensive and complete Federal plan. Alternative SB-8 is recommended as the RP.



(See the *Figures* folder on the CD for full-sized images.)

Figure ES-7. Evacuation Routes Comparison of NED Plan and LPP

Strengthening the existing levees from Thermalito Afterbay to Laurel Avenue would reduce the risk of sudden geotechnical levee failure. The remaining flood risk would be from infrequent large flood

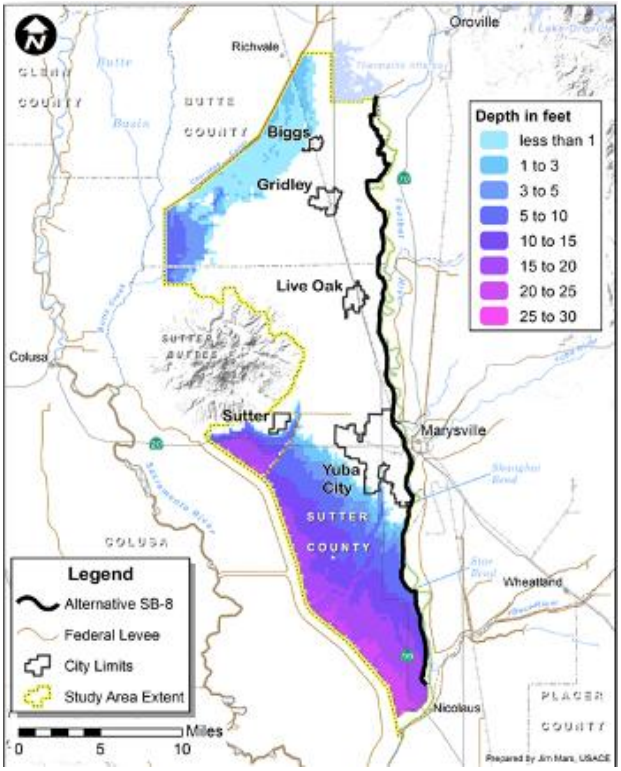
flows that would result in levee overtopping. However, as discussed in Section 4.2.2.5.2., flood events of this magnitude would be preceded by a flood warning issued 5 days in advance. A more accurate warning of potential levee overtopping would likely be made 24 to 36 hours in advance.

ES.8 Recommended Plan

The multi-objective comparison and assessment between the NED Plan and the LPP showed both the NED Plan and LPP provide significant benefits that exceed their costs. While the NED Plan is more efficient than the LPP (greater net benefits), both plans are efficient (annual benefits exceed annual costs).

ES.8.1 Description

The RP would strengthen about 41.4 miles of existing project levees along the west bank of the Feather River from the vicinity of Laurel Avenue, just south of Yuba City, to Thermalito Afterbay at the northern end of the Sutter Basin. The RP is the LPP; however, Federal cost sharing would be capped at 65% of the cost of the NED Plan. Under the RP, existing levees would be strengthened to reduce the risk of geotechnical failure modes associated with under-seepage. The existing levees would not be raised. The RP would provide FRM benefits to the northern communities of Biggs, Gridley, and Live Oak, as well as to Yuba City, at an estimated cost of $688,930,000 (see Figure ES-8). The RP is justified and has a benefit to cost ratio of 2.6 to 1. In a multi-objective context that emphasizes flood risk management and residual risk to life safety objectives across all accounts and criteria, the LPP (Alternative SB-8) is a more comprehensive FRM solution at a NED level of Federal cost share participation. A policy exception waiver from the ASA(CW) has been approved to allow the Federal government to recommend the LPP over the NED Plan.



(See the *Figures* folder on the CD for a full-sized image.)

Figure ES-8. Recommended Plan (Residual 1% ACE Floodplain)

The RP is a fix-in-place design to strengthen the existing levee along the west bank of the Feather River from a point 2,250 feet south of Laurel Avenue (Station 180+00) to Thermalito Afterbay (Station 2368+00). The proposed design features for the RP include primarily soil-bentonite levee cutoff walls of various depths. The RP also includes erosion control at two sections where initial overtopping will most likely occur for less frequent extreme flood events. A total of about 1.5 miles of erosion protection would be provided to increase the resiliency of the initial overtopping sections, which would increase the flood warning and evacuation time prior to overtopping failure.

The RP assumes all vegetation, except grasses, will be removed from the levee and within 15 feet of the levee toe in compliance with Engineering Technical Letter (ETL) 1110-2-571, *Guidelines for Landscape Plantings and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures* (Vegetation ETL). This assumption discloses the maximum potential impacts of the RP resulting from vegetation removal. During the design phase of the project, other options with lesser impacts, including a formal Vegetation ETL variance application to allow woody vegetation on the waterside of the levee, might be available and will be considered.

Nonstructural measures to be implemented in conjunction with the RP are preparation of an emergency evacuation plan, preparation of flood fight pre-staging areas, updates to the floodplain management plan, and flood risk–awareness communication.

ES.8.2 RP Economics and Cost Sharing

The project first cost, estimated on the basis of October 2013 price levels, is $688,930,000. Estimated average annual costs are $33 million based on a 3.5% interest rate, a period of analysis of

50 years, and construction ending in 2023. The total average annual flood damage reduction benefits would be $87 million for a benefit-cost ratio of 2.6 to 1.

The ASA(CW) has approved an exception to the policy that requires USACE to recommend the NED Plan. The LPP costs $297,090,000 more than the NED Plan. The non-federal sponsors would be responsible for the entire extra cost, which would increase the non-federal cost share from $136,570,000 for the NED Plan to $433,660,000 for the LPP. The Federal cost share of $255,270,000 is the same for both the NED Plan and the LPP. A summary of cost sharing responsibilities is presented in Table ES-3.

The non-federal sponsors, SBFCA and CVFPB, fully support the RP and have agreed to fund the determined cost of the RP.

Table ES-3. Summary of Cost Sharing Responsibilities for the Recommended Plan ($1,000) [a b]

MCACES Account [c]	Account	Federal	Non-Federal	Total
	NED Plan			
1	Land and Damages	$0	$42,390	$42,390
2	Relocations [d]	$0	$28,542	$28,542
6	Fish and Wildlife	$4,797	$1,241	$6,038
11	Levees and Floodwalls	$190,596	$49,326	$239,922
18	Cultural Resources	$493	$127	$620
30	Preconstruction, Engineering, and Design	$41,086	$8,633	$51,719
31	Construction Management	$16,664	$4,312	$20,976
	Add Data Recovery	$1,633	$0	$1,633
	Percentage	65%	35%	100%
	Total First Cost (NED)	$255,270	$136,570	$391,840
	LPP Increment from NED Plan to LPP			
1	Land and Damages	$0	$11,156	$11,156
2	Relocations [d]	$0	$58,917	$58,917
6	Fish and Wildlife	$0	$1557	$1,557
11	Levees and Floodwalls	$0	$172,933	$172,933
18	Cultural Resources / Data Recovery	$0	$1,853	$1,853
30	Preconstruction, Engineering, and Design	$0	$35,831	$35,831
31	Construction Management	$0	$14,843	$14,843
	Total Incremental Increase	$0	$297,090	$297,090
	Total First Cost (LPP)	**$255,270**	**$433,660**	**$688,930**

Notes:

[a] Based on October 2013 price levels.

[b] Planning, Engineering, and Design costs incurred after completion of the Feasibility Report will be cost shared between the Federal Government and the project sponsors in accordance with a Design Agreement. Upon initiation of project construction, all costs incurred under the Design Agreement will be included as part of the total project costs and subject to the project cost sharing requirements in accordance with the Project Partnership Agreement, which will be executed prior to award of the first construction contract.

[c] Micro Computer-Aided Cost Engineering System (MCACES) is the software program and assorted format used by USACE in developing cost estimates. Costs are divided into various categories identified as "accounts." Detailed costs estimates are presented in Appendix C, part 4, Cost Engineering.

[d] Relocations estimate includes construction cost, design cost, and construction management cost associated with required relocations.

ES.8.3 Operations and Maintenance, Repair, Replacement and Rehabilitation

Local non-federal interests are responsible for the existing project levees and have continuing operations and maintenance, repair, replacement, and rehabilitation (OMRR&R) obligations in accordance with established operations and maintenance manuals and agreements. The local sponsors have coordinated with the responsible OMRR&R districts and agencies of the RP levees. Annual OMRR&R cost of the levees after implementation of the RP is estimated to be $454,000, an increase of $22,000 from existing OMRR&R commitments. Amended manuals and new agreements would be prepared upon construction completion.

ES.8.4 Potential Developable Floodplain Effects of the RP

Executive Order (EO) 11988 (May 24, 1977) requires a Federal agency, when taking an action, to avoid short- and long-term adverse effects associated with the occupancy and the modification of a floodplain.

The wise use of floodplains concept, as described in EO 11988, was incorporated as a life safety evaluation metric for this study. The metric, termed "potentially developable floodplain" was used in the pilot study multi-objective planning process for evaluation, screening, and comparison. Potentially developable floodplain is developable land within the 1% ACE floodplain that would flood to a depth of less than 3 feet. This metric approach was based on pilot study objectives of applying qualitative rather than quantitative analysis, use of existing data/inventory, and professional team judgment.

Maps were prepared and acreages were calculated for the No Action, NED Plan, and RP with the baseline 0.2% ACE floodplain. These maps do not forecast future growth. Rather, they measure potentially developable acreage using high-level screening criteria of the metric (See Figure ES-9).

(See the *Figures* folder on the CD for full-sized images.)

Figure ES-9. Potentially Developable Floodplain of the No Action Alternative (left), NED Plan (center) and RP (right)

- The NED Plan would result in an additional 16,000 acres of potentially developable floodplain consisting of 5,000 acres in the Yuba City urban area and 11,000 acres in the Sutter County rural area surrounding Yuba City.
- The additional increment to implement SB-8 (RP) would result in an additional 12,000 acres of potentially developable floodplain consisting of 500 acres in the urban areas of Yuba City, Biggs, Gridley, and Live Oak; 2,700 acres in the Sutter County rural area; and 8,800 acres in the Butte County rural area. This would be in addition to the 16,000 acres under the NED Plan.

The eight-step EO 11988 process was completed for the RP, which was demonstrated to be in compliance with the intent of the EO (see Section 7.1.9 for detailed analysis). Local and state programs and laws also are in place to limit development in Sutter Basin floodplains. SBFCA's position is that Sutter Basin is a model of wise use of the floodplain for the following reasons.

- The agricultural-based economy of Sutter Basin sustains low hazard land uses.
- The agricultural-based economy (and resultant wise use of the floodplain) depends on economically sustainable small communities in the north.
- Existing communities have low growth rates.
- The northern basin communities were developed on the shallower portion of the floodplain.
- No urbanization is planned for the deeper southern basin.

ES.8.5 Areas of Controversy and Issues to be Resolved

Based on the comments received during the scoping period and the public comments received on the FRWLP EIS/EIR, the projected areas of controversy associated with the study are those listed here.

- Construction-related effects.
- Property acquisition.
- Levee encroachments and vegetation.
- Climate change and sea-level rise.
- River access for recreation.

The most controversial concern is the USACE policy contained in the Vegetation ETL that restricts woody vegetation on Federal project levees. Implementation of the policy has stirred public and scientific controversy. The SBPFS is subject to this guidance. With implementation of the proposed project, approximately 20 acres of riparian vegetation may require removal to comply with the policy, resulting in effects on fish and wildlife habitat and social values like recreation and aesthetics. This issue is discussed below and further described in Chapter 3, *Plan Formulation*, and under the effects discussions for vegetation, fish, wildlife, visual resources, and recreation in Chapter 4, *Affected Environment and Environmental Consequences*. The other potential areas of concerns are addressed also in Chapter 4.

ES.8.6 Environmental Impact Conclusions

Presented below is an overview of the impact analysis conclusions of this integrated feasibility report and EIR/SEIS. Table ES-5 presents the impact significance findings for Alternatives SB-8 and

SB-7 before and after consideration of mitigation measures. Due to its length, Table ES-5 is located at the end of the executive summary. As identified in Table ES-5, even though SB-7 would have less overall environmental impact than SB-8, both alternatives would have significant impacts on air quality, noise, vegetation, visual resources, and cultural resources.

The SBPFS RP (Alternative SB-8) is similar to the FRWLP's preferred alternative (Alternative 3) in that both propose fix-in-place levee design measures to the same levees. The SBPFS RP extends 2,250 linear feet farther south, has minor variations in staging and rights-of-way land requirements, and includes additional encroachment removal, including vegetation removal, to satisfy the USACE Levee Safety Vegetation Policy described in the Vegetation ETL. The permanent beneficial effects and adverse impacts of Alternatives SB-8 and SB-7 relative to the FRWLP preferred alternative are summarized in Table ES-4.

The SBPFS RP would provide a similar level of flood risk reduction as the FRWLP would provide, occupy roughly the same footprint, and have similar temporary impacts on air quality, noise, and recreation during construction. However, the RP would result in a greater impact on terrestrial habitats and wildlife resources than the FRWLP preferred alternative due to approximately 20 acres of additional vegetation removal to comply with the Vegetation ETL. USACE guidance (Federal Register, February 17, 2012) requires, "New federally authorized cost shared levee projects shall be designed to meet the current vegetation management standards."

The Vegetation ETL makes allowance for the issuance of variances in certain instances to further enhance environmental values or to meet state of Federal laws and/or regulations, provided that (a) safety, structural integrity, and functionality are retained, and (b) accessibility for maintenance, inspection, monitoring, and flood fighting are retained. During final project design, the existing levee system will be evaluated using current criteria for a possible variance to retain vegetation on the lower 2/3 of the waterside slope of the levee and within 15 feet of the waterside toe; all other woody vegetation would still be removed. It is possible that additional options for Vegetation ETL compliance, or variance consideration, may be established in the future. During the design phase, all available options and means for achieving Vegetation ETL compliance will be considered.

Project effects on fish and wildlife resources have been coordinated with the U.S. Fish and Wildlife Service (USFWS) under the Fish and Wildlife Coordination Act. In consultation with the USFWS and the California Department of Fish and Wildlife (CDFW), a fish and wildlife mitigation and monitoring plan (Appendix D) has been developed to compensate for impacts on fish and wildlife resources. It is anticipated that implementation of the proposed mitigation and monitoring plan and compliance with requirements of the Federal Endangered Species Act and California Endangered Species Act would avoid long-term significant impacts on fish and wildlife resources.

Table ES-4. Summary Comparison of the SBPFS Alternatives and the FRWLP Preferred Alternative Based on Key Characteristics and Environmental Effects

Environmental Effect or Project Characteristic	FRWLP Preferred Alternative	Alternative SB-8	Alternative SB-7	No Action Alternative
Proposed Levee Improvements	Approximately 41 miles, primarily cutoff wall construction. Includes 1.9 miles of seepage berms and 1.8 miles of canal dredging.	Approximately 41 miles, primarily cutoff wall construction. Includes 2.5 miles of seepage berms, 2.2 miles of levee relocation, 1.5 miles of landside levee slope erosion protection, and 0.29 miles of canal relocation.	Approximately 24 miles, primarily cutoff wall construction. Includes 1.3 miles of seepage berms and 1.1 miles of landside levee slope erosion protection. No canal or levee relocation.	Not applicable
Structures in Residual 1% (1/100) ACE Floodplain	1,670 structures	1,670 structures	7,569 structures	26,783 structures
Potentially Developable Floodplain	Removes flood risk as an obstacle to growth in 28,400 acres within the study area.	Same as FRWLP	Removes flood risk as an obstacle to growth in 12,000 acres within the study area.	Flood risk is not removed as an obstacle to growth
Water Quality and Soils				
Ground Disturbance (Footprint)	975 acres	1,031 acres	678 acres	Not Applicable
Soil Borrow Quantity	1.93 million cubic yards	1.62 million cubic yards	1.0 million cubic yards	Not Applicable
Air Quality				
Air Quality Effects of Construction Emissions	Significant effect: Exceeds local air quality management district daily emission thresholds after mitigation. Alternative demonstrates conformity.	Significant effect: Exceeds local air quality management district daily emission thresholds after mitigation. Alternative demonstrates conformity.	Significant effect: Exceeds local air quality management district daily emission thresholds after mitigation. Alternative demonstrates conformity.	Emergency response and clean up actions in the event of levee failures would result in increased emission; however, too speculative to assess magnitude and make a determination of significance.

Environmental Effect or Project Characteristic	FRWLP Preferred Alternative	Alternative SB-8	Alternative SB-7	No Action Alternative
Vegetation and Wetlands				
Wetlands and Other Jurisdictional Waters	0.43 acres of permanent impact 7.61 acres of temporary impact	5.79 acres of permanent impact 3.12 acres of temporary impact	1.76 acres of permanent impact 0.91 acre of temporary impact	Emergency response and clean up actions in the event of levee failures could result in fill or disturbance; however, too speculative to quantify.
Loss of Terrestrial Habitats (Riparian Forest, etc.)	Riparian Forest: 20.63 acres Riparian Scrub-Shrub: 3.09 acres Oak Woodland: 0.22 acres	Riparian Forest: 42.00 acres (without Vegetation ETL variance) to 32.28 acres (with Vegetation ETL variance). Riparian Scrub-Shrub: 0.50 acres (without Vegetation ETL variance) to 0.10 acres (with Vegetation ETL variance). Oak Woodland: 1.30 acres (without or with Vegetation ETL variance)	Riparian Forest: 24.40 acres (without Vegetation ETL variance) to 22.12 acres (with Vegetation ETL variance). Riparian Scrub-Shrub: 0.02 acres (without or with Vegetation ETL variance) Oak Woodland: 1.00 acre (without or with Vegetation ETL variance)	To comply with Federal and state levee operations and maintenance requirements, some removal of vegetation may occur as result of local levee maintenance actions. Emergency response and clean up actions in the event of levee failures could adversely affect habitats; however, too speculative to quantify.
Special Status Wildlife				
Effects on Valley Elderberry Longhorn Beetle and Giant Garter Snake	91 elderberry shrubs 0.004 acre of permanent impact on giant garter snake aquatic habitat	162 elderberry shrubs 3.54 acres of permanent impact on giant garter snake upland habitat	79 elderberry Shrubs 3.54 acres of permanent impact on giant garter snake upland habitat	Emergency response and clean up actions in the event of levee failures could adversely affect special status species habitats; however, too speculative to quantify.
Fisheries				
Effects on Special Status Fish Species	No significant effects. No in-river construction and no vegetation impacts would occur in critical habitat.	No significant effects. No in-river construction and no vegetation impacts would occur in critical habitat.	No significant effects. No in-river construction and no vegetation impacts would occur in critical habitat.	Potential for release of hazardous materials into the waterway in the event of levee breach but too speculative to assess.
Agriculture				
Permanent Conversion of Farmland	219.20 acres	49.4 acres	30.78 acres	No effect

ES.8.6.1 Significant and Unavoidable Effects of Alternatives SB-7 (NED Plan) and SB-8 (RP)

A significant and unavoidable effect or impact (the terms *environmental effect* and *environmental impact* are considered synonymous in this analysis) is one that would result in a significant or potentially significant adverse effect on the environment that could not be reduced to a less-than-significant level even with implementation of applicable feasible mitigation.

The following impacts of the NED Plan (Alternative SB-7) and the RP (Alternative SB-8) were found to be significant and unavoidable. Most of these impacts would be temporary and related to construction activities. Where feasible mitigation exists, it has been included to reduce these impacts; however, the mitigation would not be sufficient to reduce the impacts to a less-than-significant level. The following impacts are presented in the order they appear in Chapter 4, *Affected Environment and Environmental Consequences*.

- Effect AQ-2: Exceedance of Applicable Thresholds for Construction Emissions
- Effect NOI-1: Exposure of Sensitive Receptors to Temporary Construction-Related Noise
- Effect NOI-2: Exposure of Sensitive Receptors to Temporary Construction-Related Vibration
- Effect VEG-1: Disturbance or Removal of Riparian Trees
- Effect VEG-4: Potential Loss of Special-Status Plant Populations Caused by Habitat Loss Resulting from Project Construction
- Effect VIS-1: Result in Temporary Visual Effects from Construction
- Effect VIS-2: Adversely Affect a Scenic Vista
- Effect VIS-3: Substantially Degrade the Existing Visual Character or Quality of the Site and its Surroundings
- Effect CR-1: Effects on Identified Archaeological Sites Resulting from Construction of Levee Improvements and Ancillary Features
- Effect CR-2: Potential to Disturb Unidentified Archaeological Sites
- Effect CR-3: Potential to Disturb Human Remains
- Effect CR-4: Direct and Indirect Effects on Identified Historic Architectural/Built Environmental Resources Resulting from Construction Activities.

ES.8.6.2 Flood Risk Management and Geomorphology

Relative to existing and future without-project conditions, significant beneficial effects would result from the study alternatives due to reduced risk of flooding from levee failure. Proposed levee improvements would provide a levee that is more resistant to under-seepage, and erosion, and less susceptible to catastrophic breaches. The alternatives would not significantly alter the location, height, or alignment of the existing Feather River West Levee and, therefore, would not provide any increased or decreased flood storage or conveyance capacity. No significant adverse impacts on flood control and geomorphology are anticipated. Existing interior drainage patterns could be altered by levee improvements. This impact would be mitigated to a less-than-significant level by

coordinating with owners and operators, preparing drainage studies, and remediating effects through project design.

ES.8.6.3 Water Quality and Groundwater Resources

Construction activities would disturb existing vegetation cover and soils, would expose large areas of disturbed ground that then could be subject to rainfall and erosion, and could cause temporary discharges of sediment and other contaminants in stormwater runoff to drainage channels and the Feather River. Environmental commitments are included in the project to reduce potential temporary effects on surface water quality from construction-related turbidity to a less-than-significant level. Effects on groundwater were studied and cutoff walls were determined to have a negligible effect on groundwater levels. Results indicated that there would be a 3-foot increase in groundwater levels in the southern study area, and a negligible change in the northern study area along the Feather River. A 3-foot change in the groundwater levels in the southern area was determined unlikely to have any significant effect because the depth to groundwater in the southern area is 10 to 30 feet below the ground surface.

ES.8.6.4 Geology, Seismicity, Soils, and Mineral Resources

No significant adverse effects on geology, seismicity, soils, and mineral resources are anticipated from the project. Relative to existing conditions, the project would have a beneficial effect on levee stability. The ground-disturbing activities and vegetation clearing along levee slopes and 15 feet out from the waterside and landside levee toes could potentially cause soil erosion and sedimentation of local drainages and waterways. Alternative SB-8 would disturb the largest area because its construction footprint is substantially larger than Alternative SB-7's footprint. However, significant large-scale erosion and generation of runoff is unlikely because construction would be reduced or would not occur during the winter months, and the levees are generally located distant from the river. Site-specific measures to control erosion would be described in more detail in the required Stormwater Pollution Prevention Plan (SWPPP). With implementation of the SWPPP, erosion and sediment-related effects would be less than significant.

ES.8.7 Traffic, Transportation, and Navigation

Effects on traffic levels would result primarily from hauling of borrow material from borrow sites to the project area along highways and local roads, and from worker trips to and from the project site. Temporary increases in construction-related traffic, temporary road closures, emergency response times, and other traffic and transportation effects from project implementation were determined to be less than significant for both alternatives. Alternative SB-7 would have substantially less impact than SB-8 due to SB-7's smaller construction footprint. The action alternatives would have no effect on navigation.

ES.8.7.1 Air Quality

Emissions resulting from construction activities associated with study alternatives would have short-term impacts on local air quality and would have negligible impacts on regional air quality. Temporary construction-related emissions would be partially mitigated by reducing vehicle and equipment emissions and implementing a fugitive dust plan. Regardless of the mitigation measures, the temporary construction emissions produced would be significant and unavoidable.

ES.8.7.2 Agriculture, Land Use, Socioeconomics

The No Action Alternative would have significant adverse effects on land use if levee failures resulted in catastrophic flooding. Losses of property and agricultural production, and annual cost of insurance to offset the losses present a significant financial burden, especially to low income households. Under Alternatives SB-7 and SB-8, farmland in the direct footprint of the project would be permanently converted to nonagricultural use; however, the conversion of agricultural land would occur only in a narrow corridor adjacent to the existing levee. Overall, the project is intended to preserve existing land use and socioeconomic conditions, especially for agriculture. Construction activities would temporarily increase employment and personal income in the local area. Neither Alternative SB-7 nor Alternative SB-8 is anticipated to result in significant adverse impacts on agriculture, land use, or socioeconomics.

ES.8.7.3 Population, Housing, and Environmental Justice

Both Alternatives SB-8 and SB-7 would require displacement of existing housing units. Alternative SB-8 would affect more housing units than SB-7 because improvements would extend over a longer reach of levee. Permanent acquisition, relocation, and compensation services would be conducted in compliance with Federal and state relocation laws. In cases where project construction is temporarily disruptive to nearby residents, assistance and compensation would be provided for residents to relocate temporarily during construction activities. The alternatives being considered would not result in disproportionately high and adverse effects on minority populations and low-income populations from acquisition of homes because plenty of vacant homes exist within the study area to serve as replacement housing.

ES.8.7.4 Vegetation and Wetlands

Project implementation would result in permanent loss of vegetation and wetlands. Under Alternatives SB-8 and SB-7, as much as 42.00 acres and 24.40 acres of riparian woodland, respectively, could be removed to conform to the Vegetation ETL. The project would include a mitigation and monitoring plan to provide in-kind, offsite compensation for losses of vegetation and jurisdictional waters and wetlands with the goal of no net loss.

ES.8.7.5 Wildlife

Construction activities would result in the injury, mortality, or disturbance of special-status and common species, which could affect local populations. Implementation of mitigation measures and a mitigation and monitoring compensation plan to avoid a long-term loss of riparian habitat would minimize or avoid these impacts and reduce the effects to a less-than-significant level.

ES.8.7.6 Fish and Aquatic Resources

The project would have no effect on shaded riverine aquatic cover and critical habitat; however, due to loss of floodplain riparian vegetation, there may be effects on fish species protected under the Endangered Species Act. Vegetation loss would be minimized and all activities would occur above the ordinary high water mark on the waterside levee slopes and toe. Thus, the project is not expected to have significant effects on fish and aquatic resources.

ES.8.7.7 Visual Resources

Alternatives SB-8 and SB-7 could potentially result in significant visual effects in reaches with sensitive viewers. The effect mechanism is primarily vegetation removal. In Reaches 12–17 near Yuba City, about 220 trees would be removed to meet Vegetation ETL levee vegetation-free zone requirements. Temporary significant unmitigable impacts on visual conditions would also result from construction activities.

ES.8.7.8 Recreation

Access to recreational facilities along the Feather River would be restricted in areas where construction is occurring. However, limitations on the use of recreation facilities would be short-term and temporary. Vegetation removal may reduce visual values immediately along the levee, but the effect on recreation would be less than significant. A substantial permanent change or reduction in the availability of recreational opportunities would not occur as a result of either Alternative SB-7 or Alternative SB-8. Proposed habitat improvements at the Star Bend Conservation Area may enhance recreation opportunities in the local area. The alternatives would not have any significant permanent effects on recreation in the project area.

ES.8.7.9 Utilities and Public Services

Construction may damage drainage and irrigation systems and public utility infrastructure, resulting in temporary disruptions to service. Coordination with drainage and irrigation systems users, consultation with service providers, and implementation of appropriate protection measures would minimize the possibility of any significant effects.

ES.8.7.10 Public Health and Environmental Hazards

Project implementation has the potential to slightly increase risks to the public during construction through use of equipment and fuels, but the increased risk would be temporary. These risks would be minimized by implementation of a SWPPP and the best management practices it contains to control accelerated erosion, sedimentation, and other pollutants during and after project construction.

ES.8.7.11 Cultural Resources

Cultural resources are known to exist throughout the project area, including a number of resources that appear eligible for inclusion in the National Register of Historic Places. These resources eligible for listing or listed in the National Register of Historic Places are called historic properties. Cultural resources, including historic properties, would be disturbed and destroyed under Alternatives SB-8 and SB-7. While mitigation measures have been identified, the mitigation may not reduce the effects to less-than-significant levels.

ES.9 Public and Agency Review

The Draft Integrated Feasibility Report and EIR/SEIS was distributed for public and agency review and comment, in accordance with NEPA and CEQA requirements. The review period began on June 14, 2013 and closed on July 29, 2013. A public meeting was held during the review period in Yuba City on July 22, 2013 to present information and to accept comments. In addition, written comments

from the public, reviewing agencies, and stakeholders were accepted throughout the public comment period. These comments, along with the written responses to those comments, are contained in Appendix F, *Responses to Comments on the Draft Document*, of this Final Integrated Feasibility Report and EIR/SEIS. Corrections, revisions, additions, and/or deletions to the text are not shown in the final document as changes; the final document contains a clean reprint of the document.

This Final Integrated Feasibility Report and EIR/SEIS will be distributed for public and agency review and comment, in accordance with NEPA and CEQA requirements for a 30-day public review. After the CEQA review period, SBFCA will consider certifying the EIR if it is determined to be in compliance with CEQA. After the NEPA review period, USACE will issue a Record of Decision that will identify USACE's decision in recommending an alternative to Congress for authorization.

ES.10 Recommended Plan Recommendation

The Assistant Secretary of the Army for Civil Works has approved, by memorandum dated May 7, 2013, an exception to National Economic Development policy for the Federal government to recommend an LPP over the NED Plan, allowing recommendation of the LPP as the RP at the NED level of Federal cost share participation. The RP is supported by the local sponsors and can be considered, in a multi-objective planning context, a comprehensive and complete Federal plan for addressing flood risk and for the protection of public and life safety.

The recommendation of the District Engineer of Sacramento District, U.S. Army Corps of Engineers, is that the RP (Alternative SB-8) plan be authorized for implementation as a Federal project. The estimated first cost of the RP is $688,930,000 in October 2013 dollars. The estimated Federal cost is $255,2670,000 and the estimated non-federal cost is $433,660,000. Federal cost participation is limited to the Federal cost of the NED Plan (SB-7). OMRR&R cost is estimated to be $454,000, an increase of $22,000 over costs from existing OMRR&R commitments of the existing levees. The estimated fully funded first cost, based on projected inflations specified by USACE budget guidance, is $788,989,000, excluding cultural resources data recovery cost of $2,981,000.

The non-federal sponsors' portion of the estimated first cost is $433,660,000. The non-federal sponsors shall agree to provide all lands, easements, rights-of-way, relocations, and suitable borrow and disposal areas. The non-federal sponsors shall also assume continued responsibility for OMRR&R. The non-federal sponsors shall publicize floodplain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain.

Table ES-5. Summary of Effects and Mitigation Measures

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Flood Risk Management and Geomorphic Conditions				
Effect FC-1: Change in Water Surface Elevations and Flood Safety Attributable to Project Design	SB-8 and SB-7	No effect	None required	No effect
Effect FC-2: Increase in Channel Bed Incision and Bank Erosion Attributable to Project Design	SB-8 and SB-7	No effect	None required	No effect
Effect FC-3: Decrease in Under-seepage	SB-8 and SB-7	Beneficial	None required	Beneficial
Effect FC-4: Decrease in Risk of Levee Failure as a Result of Erosion or Seepage	SB-8 and SB-7	Beneficial	None required	Beneficial
Effect FC-5: Change in Stream Energy and Modification of Floodplain Scour/Deposition	SB-8 and SB-7	No effect	None required	No effect
Effect FC-6: Alteration of the Existing Drainage Pattern of the Site or Area	SB-8 and SB-7	Significant	FC-MM-1: Coordinate with Owners and Operators, Prepare Drainage Studies as Needed, and Remediate Effects through Project Design	Less than significant
Effect FC-7: Increase in Levee Slope Stability	SB-8 and SB-7	Beneficial	None Required	Beneficial
Water Quality and Groundwater Resources				
WQ-1: Effects on Surface Water Quality from Excessive Turbidity or Total Suspended Solids	SB-8 and SB-7	Less than significant	None required	Less than significant
WQ-2: Release of Contaminants into Adjacent Surface Water Bodies from Construction-Related Hazardous Materials	SB-8 and SB-7	Less than significant	None required	Less than Significant
WQ-3: Effects on Groundwater or Surface Water Quality Resulting from Contact with the Water Table	SB-8 and SB-7	Significant	WQ-MM-1: Implement Provisions for Dewatering WQ-MM-2: Complete Phase I and Phase II (if Necessary) Environmental Site Assessment Investigations and Implement Required Measures	Less than significant
WQ-4: Effects on Groundwater Wells Due to Project Encroachment	SB-8 and SB-7	Less than significant	None Required	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Geology, Seismicity, Soils and Mineral Resources				
Effect GEO-1: Beneficial Change in Levee Stability	SB-8 and SB-7	Beneficial	None required	Beneficial
Effect GEO-2: Increase Exposure of People or Structures to Hazards Related to Construction Vibrations	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect GEO-3: Cause Accelerated Erosion and Sedimentation Resulting from Construction-Related Ground Disturbance	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect GEO-4: Cause Structural Damage and Injury Resulting from Development on Expansive Soils	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect GEO-5: Cause Accelerated Erosion and Sedimentation Resulting from Use of Imported Borrow	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect GEO-6: Loss, Injury, or Death from Slope Failure at Borrow Sites	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect GEO-7: Cause the Loss of a Known Mineral Resource of Regional or Local Importance as a Result of Construction of Proposed Project	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect GEO-8: Cause the Loss of a Known Mineral Resource of Regional or Local Importance as a Result of Placement of Proposed Project	SB-8 and SB-7	Less than significant	None required	Less than significant
Traffic, Transportation, And Navigation (Findings for Preferred Alternative in FRWLP Final EIS Applicable to Study Alternatives)				
Effect TRA-1: Temporary Increase in Traffic Volumes from Construction-Generated Traffic	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect TRA-2: Temporary Road Closures	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect TRA-3: Increase in Safety Hazards Attributable to Construction-Generated Traffic	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect TRA-4: Increase in Emergency Response Times	SB-8 and SB-7	Less than significant	None required	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Effect TRA-5: Inadequate Parking Supply to Meet Parking Demand for Construction Equipment and Construction Workers	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect TRA-6: Disruption of Alternative Transportation Modes as a Result of Temporary Road Closures	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect TRA-7: Temporary Changes to Navigation	SB-8 and SB-7	No Effect	None required	No Effect
Effect TRA-8: Damage to Roadway Surfaces during Construction of Facilities	SB-8 and SB-7	Less than significant	None required	Less than significant
Air Quality and Climate Change				
Effect AQ-1: Obstruction of an Applicable Air Quality Plan	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AQ-2: Exceedance of Applicable Thresholds for Construction Emissions	SB-8 and SB-7	Significant	AQ-MM-1: Provide Advance Notification of Construction Schedule and 24-Hour Hotline to Residents AQ-MM-2: Implement Fugitive Dust Control Plan If Unmitigated Emissions Exceed PM_{10} or $PM_{2.5}$ Thresholds AQ-MM-3: Implement General Measures to Reduce Emissions AQ-MM-4: Implement Fleet-Wide Emission Reductions for Large Off-Road Equipment AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0)	Significant and unavoidable
Effect AQ-3: Exceedance of the Federal General Conformity Thresholds during Construction	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AQ-4: Long-Term Operations and Maintenance Emissions of ROG, NO_X, and PM_{10}	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AQ-5: Exposure of Sensitive Receptors to Toxic Air Emissions	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AQ-6: Exposure to Objectionable Odors from Diesel Exhaust	SB-8 and SB-7	Less than significant	None required	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Effect CC-1: Increase in GHG Emissions during Construction Exceeding Threshold	SB-8 and SB-7	Less than significant	CC-MM-1: Implement Measures to Minimize GHG Emissions during Construction	Less than significant
Effect CC-2: Conflict with an Applicable Plan, Policy, or Regulation Adopted for the Purpose of Reducing the Emissions of GHGs	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect CC-3: Failure to Address Changes in Flood Frequency and Floodwater Elevation Caused by Global Climate Change	SB-8 and SB-7	Less than significant	None required	Less than significant
Noise(Findings for Preferred Alternative in FRWLP Final EIS Applicable to Study Alternatives)				
NOI-1: Exposure of Sensitive Receptors to Temporary Construction-Related Noise	SB-8 and SB-7	Significant	NOI-MM-1: Employ Noise-Reducing Construction Practices	Significant and unavoidable
NOI-2: Exposure of Sensitive Receptors to Temporary Construction-Related Vibration	SB-8 and SB-7	Significant	NOI-MM-2: Employ Vibration-Reducing Construction Practices	Significant and unavoidable
Vegetation and Wetlands				
Effect VEG-1: Disturbance or Removal of Riparian Habitat as a Result of Project Construction	SB-8 and SB-7	Significant	VEG-MM-1: Compensate for the Loss of Woody Riparian Trees VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor	Significant and unavoidable (Short-term) Less than significant (Long-term after establishment of compensatory mitigation)
Effect VEG-2: Loss of Wetlands and Other Waters of the United States as a Result of Project Construction	SB-8 and SB-7	Significant	VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor VEG-MM-5: Compensate for the Loss of Wetlands and Other Waters	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Effect VEG-3: Disturbance or Removal of Protected Trees as a Result of Project Construction	SB-8 and SB-7	Significant	VEG-MM-1: Compensate for the Loss of Woody Riparian Trees VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor	Less than significant
Effect VEG-4: Potential Loss of Special-Status Plant Populations Caused by Habitat Loss Resulting from Project Construction	SB-8 and SB-7	Significant	VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor VEG-MM-6: Retain Qualified Botanists to Conduct Floristic Surveys for Special-Status Plants during Appropriate Identification Periods VEG-MM-7: Avoid or Compensate for Substantial Effects on Special-Status Plants	Significant and unavoidable
Effect VEG-5: Introduction or Spread of Invasive Plants as a Result of Project Construction	SB-8 and SB-7	Less than significant	None required	Less than Significant
Effect VEG-6: Conflict with Provisions of an Adopted HCP/NCCP or Other Approved Local, Regional, or State Habitat Conservation Plan	SB-8 and SB-7	No effect	None required	No effect
Wildlife				
Effect WILD-1: Potential Mortality of or Loss of Habitat for Antioch Dunes Anthicid, Sacramento Anthicid, and Sacramento Valley Tiger Beetles	SB-8 and SB-7	Significant	WILD-MM-1: Fence and avoid habitat of Antioch Dunes Anthicid, Sacramento Anthicid, and Sacramento Valley Tiger Beetles and Implement Protective Measures	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Effect WILD-2: Potential Mortality or Disturbance of VELB and its Habitat (Elderberry Shrubs)	SB-8 and SB-7	Significant	WILD-MM-2: Conduct VELB Surveys Prior to Elderberry Shrub Transplantation WILD-MM-3: Implement Measures to Protect VELB and its Habitat WILD-MM-4: Compensate for Effects on VELB and its Habitat	Less than significant
Effect WILD-3: Potential Mortality or Disturbance of Western Pond Turtle	SB-8 and SB-7	Significant	WILD-MM-5: Conduct Preconstruction Surveys for Western Pond Turtle and Monitor Construction Activities if Turtles are Observed	Less than significant
Effect WILD-4: Potential Disturbance or Mortality of and Loss of Suitable Habitat for Giant Garter Snake	SB-8 and SB-7	Significant	WILD-MM-6: Avoid and Minimize Construction Effects on Giant Garter Snake WILD-MM-7: Compensate for Permanent Loss of Suitable Giant Garter Snake Habitat	Less than significant
Effect WILD-5: Potential Loss or Disturbance of Nesting Swainson's Hawk and Loss of Nesting and Foraging Habitat	SB-8 and SB-7	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-9: Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction and Implement Protective Measures during Construction	Less than significant
Effect WILD-6: Potential Mortality or Disturbance of Nesting Special-Status and Nonspecial-Status Birds and Removal of Suitable Breeding Habitat	SB-8 and SB-7	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-10: Conduct Nesting Surveys for Special-Status and Nonspecial-Status Birds and Implement Protective Measures during Construction	Less than significant
Effect WILD-7: Potential Loss or Disturbance of Western Burrowing Owl and Loss of Nesting and Foraging Habitat	SB-8 and SB-7	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-11: Conduct Surveys for Western Burrowing Owl prior to Construction and Implement Protective Measures if Found WILD-MM-12: Compensate for the Loss of Occupied Western Burrowing Owl Habitat	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Effect WILD-8: Potential Injury, Mortality or Disturbance of Tree-Roosting Bats and Removal of Roosting Habitat	SB-8 and SB-7	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-13: Identify Suitable Roosting Habitat for Bats and Implement Avoidance and Protective Measures	Less than significant
Effect WILD-9: Potential Injury, Mortality or Disturbance of Ringtail and Removal of Habitat	SB-8 and SB-7	Significant	WILD-MM-14: Identify Suitable Shelter and Denning Habitat for Ringtail and Implement Avoidance and Protective Measures	Less than significant
Effect WILD-10: Disturbance to or Loss of Common Wildlife Species and Their Habitats	SB-8 and SB-7	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-9: Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction and Implement Protective Measures during Construction WILD-MM-10: Conduct Nesting Surveys for Special-Status and Nonspecial-Status Birds and Implement Protective Measures during Construction	Less than Significant
Effect WILD-11: Potential Disruption of Wildlife Movement Corridors	SB-8 and SB-7	Less than significant	None required	Less than significant
Fish and Aquatic Resources				
Effect FISH-1: Loss or Degradation of Riparian and SRA Cover, including Critical Habitat	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect FISH-2: Construction-Related Erosion Resulting in Substantially Increased Sedimentation and Turbidity	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect FISH-3: Adverse Effects on Fish Health and Survival Associated with Potential Discharge of Contaminants during Construction Activities	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect FISH-4: Adverse Effects Caused by Construction Equipment Noise and Vibration	SB-8 and SB-7	Less than Significant	None required	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Agriculture, Land Use, and Socioeconomics				
Effect AG-1: Temporary Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Accommodate Construction Activities	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AG-2: Irretrievable Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AG-3: Conflict with Existing Zoning for Agricultural Use	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AG-4: Conflict with Williamson Act Contract	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect AG-5: Loss of Agricultural Production	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect LU-1: Conflict with Applicable Land Use Plan, Policy, or Regulation	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect SOC-1: Temporary Increase in Study Area Employment during Construction	SB-8 and SB-7	Beneficial	None required	Beneficial
Effect SOC-2: Conflict with Applicable Socioeconomic Plan or Policy	SB-8 and SB-7	Less than significant	None required	Less than significant
Population, Housing, and Environmental Justice (Findings for Preferred Alternative in FRWLP Final EIS Applicable to Study Alternatives)				
Effect POP-1: Displacement of Existing Housing Units	SB-8 and SB-7	Significant	POP-MM-1: Property Acquisition Compensation and Resident Relocation Plan	Less than significant
Effect EJ-1: Result in a Disproportionately High and Adverse Human Health or Environmental Effect on Minority Populations and Low-Income Populations from Construction Activities	SB-8 and SB-7	Less than significant	None required	Less than significant
Visual Resources				
Effect VIS-1: Result in Temporary Visual Effects from Construction	SB-8 and SB-7	Significant	None available	Significant and Unavoidable
Effect VIS-2: Adversely Affect a Scenic Vista	SB-8 and SB-7	Significant	None available	Significant and Unavoidable

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Effect VIS-3: Substantially Degrade the Existing Visual Character or Quality of the Site and Its Surroundings	SB-8 and SB-7	Significant	None available	Significant and Unavoidable
Effect VIS-4: Create a New Source of Substantial Light or Glare That Would Adversely Affect Day and Nighttime Public Views	SB-8 and SB-7	Less than significant	None required	Less than significant
Recreation				
Effect REC-1: Temporary Changes in Recreation Opportunities during Construction	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect REC-2: Long-Term or Permanent Loss of Recreation Opportunities in the Levee Corridor	SB-8 and SB-7	Less than significant	None required	Less than significant
Utilities and Public Services (Findings for Preferred Alternative in FRWLP Final EIS Applicable to Study Alternatives)				
Effect UTL-1: Potential Temporary Disruption of Irrigation/Drainage Facilities and Agricultural and Domestic Water Supply	SB-8 and SB-7	Significant	UTL-MM-1: Coordinate with Water Supply Users before and during All Water Supply Infrastructure Modifications and Implement Measures to Minimize Interruptions of Supply	Less than significant
Effect UTL-2: Damage of Public Utility Infrastructure and Disruption of Service	SB-8 and SB-7	Significant	UTL-MM-2: Verify Utility Locations, Coordinate with Utility Providers, Prepare a Response Plan, and Conduct Worker Training	Less than significant
Effect UTL-3: Increase in Solid Waste Generation	SB-8 and SB-7	Less than significant	None required	Less than significant
Effect UTL-4: Increase in Emergency Response Times	SB-8 and SB-7	Less than significant	None required	Less than significant
Public Health and Environmental Hazards (Findings for Preferred Alternative in FRWLP Final EIS Applicable to Study Alternatives)				
Effect PH-1: Temporary Exposure to or Release of Hazardous Materials during Construction	SB-8 and SB-7	Significant	Environmental Commitment: Stormwater Pollution Protection Plan	Less than significant
Effect PH-2: Exposure of the Environment to Hazardous Materials during Ground-Disturbing Activities	SB-8 and SB-7	Significant	Environmental Commitment: Stormwater Pollution Protection Plan PH-MM-1: Complete Phase I and Phase II (If necessary) Environmental Site Assessment Investigations and Implement Required Measures PH-MM-2: Employment of a Toxic Release Contingency Plan	Less than significant

Effect	Alternative	Significance before Mitigation	Mitigation Measure	Significance after Mitigation
Effect PH-3: Temporary Exposure to Safety Hazards from the Construction Site and Vehicles	SB-8 and SB-7	Significant	PH-MM-3: Implementation of Construction Site Safety Measures PH-MM-4: Implementation of an Emergency Response Plan	Less than significant
Effect PH-4: Exposure of People or Structures to Increased Flood Risk	SB-8 and SB-7	Beneficial	None required	Beneficial
Cultural Resources				
CR-1: Effects on Identified Archaeological Sites Resulting from Construction of Levee Improvements and Ancillary Facilities	SB-8 and SB-7	Significant	CR-MM-1: Perform Field Studies, Evaluate Identified Resources and Determine Effects, and Develop Treatment to Resolve Significant Effects	Significant and unavoidable
CR-2: Potential to Disturb Unidentified Archaeological Sites	SB-8 and SB-7	Significant	CR-MM-2: Implement a Cultural Resources Discovery Plan, Provide Related Training to Construction Workers, and Conduct Construction Monitoring	Significant and unavoidable
CR-3: Potential to Disturb Human Remains	SB-8 and SB-7	Significant	CR-MM-3: Monitor Culturally Sensitive Areas during Construction, Follow State and Federal Law Governing Human Remains if Such Resources are Discovered during Construction	Significant and unavoidable
CR-4: Direct and Indirect Effects on Built Environment Resources Resulting from Construction Activities	SB-8 and SB-7	Significant	CR-MM-4: Conduct Inventory of Built Environment Resources, Evaluate Identified Properties, Assess Effects, and Prepare Treatment to Resolve and Mitigate Significant Effects	Significant and unavoidable

1.1 Purpose of the Study and Need for the Project and Report

A high risk of flooding from levee failure threatens the public safety of approximately 95,000 people, as well as property and critical infrastructure throughout the Sutter Basin study area. Past flooding events have caused loss of life and extensive economic damages. Recent geotechnical analysis and evaluation of past levee performance indicate the existing project levees, which are part of the authorized Sacramento River Flood Control Project, do not meet current U.S. Army Corps of Engineers (USACE) levee design criteria, and are at risk of breach failure at stages less than overtopping of the levees.

The purpose of the Sutter Basin Pilot Feasibility Study (SBPFS) is to investigate and determine the extent of Federal interest in plans that reduce flood risk to the Sutter Basin in Sutter and Butte Counties. This report: (1) assesses the risk of flooding; (2) describes a range of alternatives formulated to reduce flood risk; and (3) identifies a Recommended Plan (RP) for implementation. This report constitutes both a Feasibility Report that describes a USACE "pilot" planning process followed to identify the RP, and an Environmental Impact Report/Supplemental Environmental Impact Statement (EIR/SEIS) required to comply with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Following public and governmental agency review, this report will be finalized and submitted to Headquarters, USACE, for review and approval, then transmitted to Congress for recommended project authorization. Project construction is dependent upon Congressional appropriation of funding for the Federal share of the project.

1.1.1 NEPA and CEQA Purpose and Need Statement

NEPA and CEQA specifically require a discussion of the purpose, need, and objectives of the proposed project to facilitate an analysis of reasonable alternatives. NEPA implementing regulations provide that an EIS must include a statement that briefly specifies NEPA guidance states that the purpose and need "shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives, including the proposed action" (40 Code of Federal Regulations [CFR] Section 1502.13). CEQA and the State CEQA Guidelines require a clearly written statement of objectives to guide the lead agency in developing a reasonable range of alternatives and aid decision-makers in preparing findings or a statement of overriding considerations.

The primary purpose of the Sutter Basin Project is to reduce overall flood risk to the Sutter Basin study area. A high risk of flooding from levee failure threatens the public safety of approximately 95,000 people, as well as property and critical infrastructure throughout the Sutter Basin study area. Past flooding events have caused loss of life and extensive economic damages. Approximately 26,783 structures throughout the study area are at risk of flooding in a 100-year event (1% annual chance of flooding). Recent geotechnical analysis and evaluation of past levee performance indicate the existing project levees, which are part of the authorized Sacramento River Flood Control Project, do not meet current USACE levee design criteria, and are at risk of breach failure at stages less than overtopping of the levees. Recent geotechnical analysis and evaluation of historical performance during past floods indicate the existing project levees within the study area do not meet USACE levee design criteria and are at risk of breach failure. Approximately 26,783 structures throughout

the study area are at risk of flooding in a 1% Annual Chance Exceedance flood event (100-year event).

1.2 Study Authority

The authority for USACE to study flood risk management (FRM) and related water resources problems in the Sacramento River Basin, including the study area in Sutter and Butte Counties, is provided in the Flood Control Act of 1962, Public Law No. 87-874, Section 209, 76 Stat. 1180, 1196 (1962). A portion of the authorization reads as follows:

> The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes…to be made under the direction of the Chief of Engineers, in drainage areas of the United States…, which include the following named localities: Sacramento River Basin and streams in northern California, draining into the Pacific Ocean for the purpose of developing, where feasible, multi-purpose water resource projects, particularly those which would be eligible under the provision of title III of Public Law 85-500.

1.3 Study Area

The 326-square-mile Sutter Basin is the study area. It is located in Northern California in Sutter and Butte Counties. A substantial portion of the study area lies within the geographically named Sutter Basin, which is a historic flood basin located between the Sacramento and Feather Rivers. The study area is within the 14,000-square-mile Sacramento River watershed, as shown on Plate 1-1. The study area, which is approximately 50 miles north of Sacramento, is bounded by the Feather River on the east, the high ground of the Sutter Buttes on the west, the Sutter Bypass on the southwest, and Cherokee Canal and the Butte Basin on the northwest and is shown on Plate 1-2. Existing levees along the Feather River, Sutter Bypass, Cherokee Canal, and Wadsworth Canal, as well as the Butte Basin, are features of the Sacramento River Flood Control Project (SRFCP). Authorized by the Flood Control Act of 1917, the SRFCP incorporates features such as levees, weirs, and pumping facilities into a system of leveed river channels and flood bypass channels to provide FRM benefits to the Sacramento Valley.

The climate and geography of the Sacramento Valley combine to produce an area where regular flooding is a natural occurrence. The Sacramento Valley is a semi-arid region with an annual rainfall of approximately 18 inches. There are two distinct annual seasons, a hot dry summer and a cool wet winter. Approximately 80% of the annual rainfall occurs from October to March. Just to the east of the region lies the Sierra Nevada mountain range. Some areas in these mountains receive 100 inches of precipitation annually. The snowpack in some regions can reach 300 inches, with resulting runoff causing flooding problems in the Central Valley. Floodwaters potentially threatening the Sutter Basin originate in the Feather River watershed or the upper Sacramento River watershed, above Colusa Weir. These waterways have drainage areas of 5,920 and 12,090 square miles, respectively. The study area is primarily rural, with extensive agricultural areas and low population density. The total population within the study area is approximately 95,000. Yuba City, located on the west bank of the Feather River, is the largest community in the study area with a population of approximately 67,000. The northern basin Cities of Biggs, Gridley, and Live Oak are situated roughly along the north-south railroad and State Route 99 corridors.

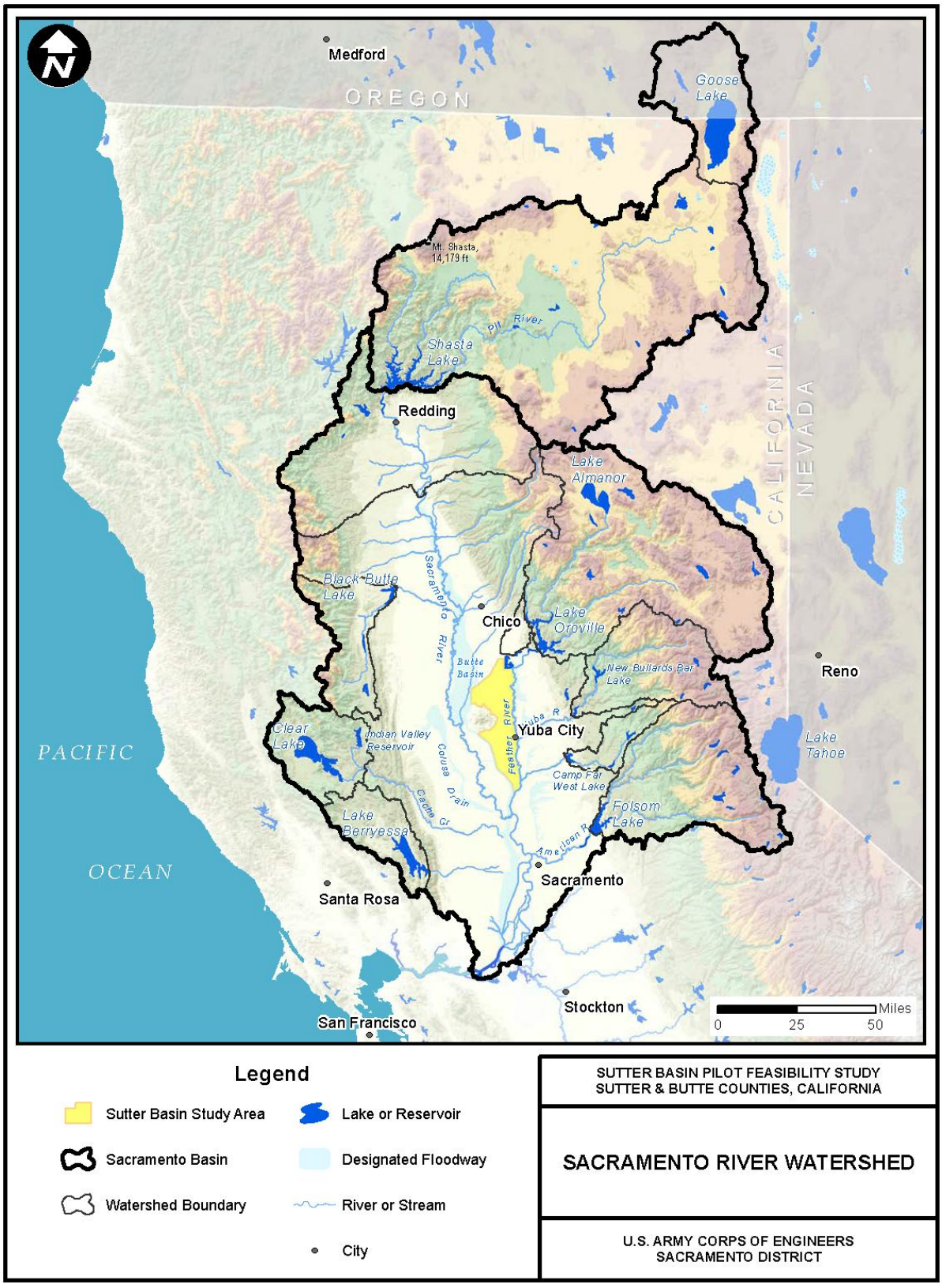


Plate 1-1. Sacramento River Watershed

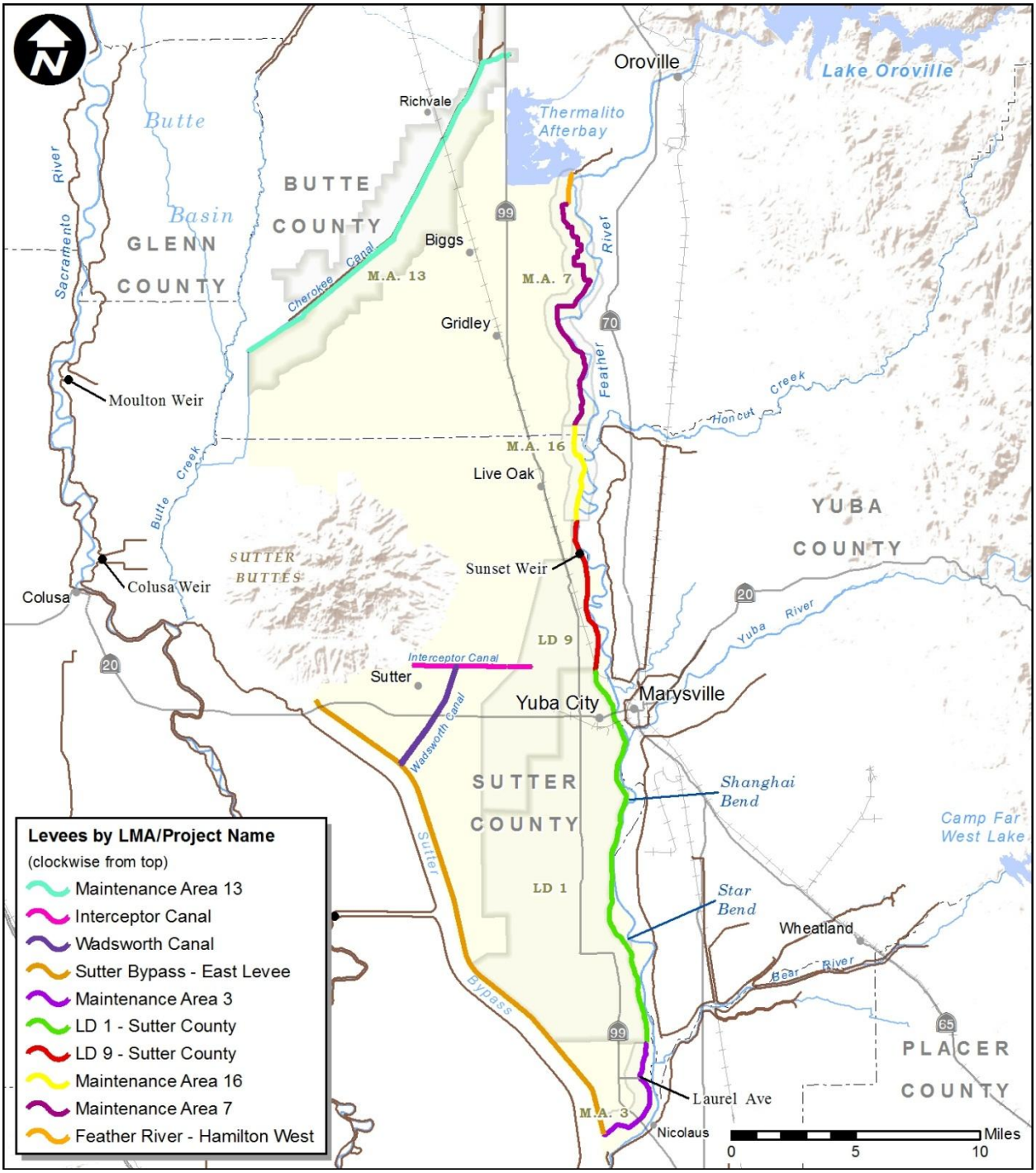


Plate 1-2. Study Area

The existing levees along the Feather River are set back some distance from the river channel, allowing for a wide band of riparian vegetation of up to 1 mile wide. Within this area, south of Yuba City, are the California Department of Fish and Wildlife's Feather River Wildlife Management Area, consisting of about 2,000 acres, and the Audubon Society's 300-acre Bobelaine Sanctuary. The Sutter National Wildlife Refuge operated by the U.S. Fish and Wildlife Service is located within and along the Sutter Bypass and consists of about 3,000 acres along about 20 miles of riparian channels on both sides of the interior of the bypass. The 11,869-acre Oroville Wildlife Area is primarily riparian woodland habitat along the Feather River and grasslands around the Thermalito Afterbay. The California Department of Fish and Wildlife operates Oroville Wildlife Area.

1.4 Study Sponsor and Participants

The non-federal project sponsors are the State of California Central Valley Flood Protection Board (CVFPB), formerly the State Reclamation Board, and the Sutter Butte Flood Control Agency (SBFCA). SBFCA is a joint powers agency formed in September 2007 by Sutter and Butte Counties, the Cities of Biggs, Yuba City, Gridley, and Live Oak, and Levee Districts 1 and 9 of Sutter County to finance and construct regional levee improvement projects. USACE originally executed a Feasibility Cost Sharing Agreement on March 20, 2000, with the Reclamation Board. The agreement was amended on July 10, 2010, to include both the CVFPB and SBFCA as non-federal sponsors.

1.5 History of Sutter Basin Investigations

The floods of 1986 and 1997 resulted in numerous levee failures within the Central Valley, including those of the SRFCP, and raised concerns about the adequacy of the existing levee system. In response, the State of California enacted the Central Valley Flood Protection Act in 2008 which, in part, provided for the evaluation of existing levees and the development of a strategic plan, known as the Central Valley Flood Protection Plan (CVFPP), to achieve new state standards for flood risk reduction throughout the Central Valley. Recognizing the urgent need to improve the existing flood protection system, the Act allows local urban flood improvement projects to be funded with state bond funds in advance of the CVFPP.

The devastating floods of 1986 and 1997 also prompted Sutter County and the CVFPB to request assistance from USACE to investigate alternatives to reduce future flood risks within Sutter County. The Sutter Basin Feasibility Study was initiated in 2000 with the CVFPB as the non-federal sponsor and Sutter County as the local sponsor. Initially, the study area was delineated by the political boundary of Sutter County. A Feasibility Scoping Meeting (FSM) was held in January 2005, but following the FSM, the study essentially became inactive due to local funding limitations and local efforts to clarify the area of immediate concern.

Federal Emergency Management Agency (FEMA) flood insurance rate remapping and California Senate Bill (SB) 5, which mandated the CVFPP (described in Section 1.7.3.1), sparked renewed local interest to address flood risk–reduction measures within the Sutter Basin. SBFCA was formed in 2007 as a joint powers agency by the Counties of Butte and Sutter, the Cities of Biggs, Gridley, Live Oak and Yuba City, and Levee Districts 1 and 9, with the authority to finance and construct regional levee improvements. In 2010, Sutter Basin voters passed a $6.65 million per year assessment to study and implement a project to reduce flood risks to the basin; the assessment rates are among the highest in the state. This action was a strong public endorsement of the need for immediate action to address the flood threat, particularly because the Sutter Basin is an economically disadvantaged community under California guidelines and has higher than average unemployment.

The initial Feasibility Cost Sharing Agreement for the Sutter Basin Feasibility Study was amended in July 2010 to add SBFCA as a non-federal sponsor and the study area was changed from the county boundary to an area that corresponds to the SBFCA boundary. In addition, SBFCA began to aggressively pursue a program to strengthen the existing levees to provide increased flood risk reduction to the Sutter Basin. SBFCA, in coordination with the CVFPB, is preparing design documents for construction of improvements to strengthen the existing levees. SBFCA intends to seek financial support from the California Department of Water Resources' (DWR's) Early Implementation Program (EIP). SBFCA plans to initiate construction in 2013 to advance completion of the Federal project that may be recommended and authorized as a result of the Sutter Basin Feasibility Study. SBFCA is also planning to request credit for any construction they complete prior to implementation of the Federal project under the provisions of Section 221 of the Flood Control Act of 1970, Public Law No. 91-611, Section 221, 84 Stat. 1831(1970) (hereinafter Section 221), as amended.

1.6 Pilot Study

The Sutter Basin Feasibility Study was one of the first studies selected for inclusion in the National Pilot Program in February 2011. The pilot initiative provides an opportunity to test principles that were developed by a workgroup of planning and policy experts from USACE and the Office of the Assistant Secretary of the Army for Civil Works (ASA[CW]), referred to as the 17+1 Team, for the purpose of modernizing the Civil Works Planning Program to better address the many water resource challenges facing the nation. The goal of the revised study paradigm is a more predictable and efficient process that significantly lessens the time required to complete a feasibility study.

The study process relies on sound professional engineering, economics, and environmental judgment and analyses, and focuses the amount and type of data collected and analysis on the risk and consequences of the decisions being made. Costs and benefit estimates used for the initial steps of the planning process are based on an appropriate level of detail for screening of draft alternatives to a final array of alternatives. For the SBPFS, the appropriate level of detail was selected considering that comparative cost estimates are more accurate than absolute cost estimates. The range of confidence in cost and benefit estimates is presented in the comparison of alternatives; however, only mean estimates are presented in the study. More detailed total cost estimates were prepared for the evaluation of the final array of alternatives leading to the identification of the RP.

The new study paradigm recognizes that no single factor, including net national economic development benefit, should provide the basis for the USACE decision for a recommendation for Federal investment. Alternative comparison and selection recognizes that there is no single "best" plan, and there are a variety of approaches (quantitative and qualitative) to multi-criteria decision making.

1.7 Related Projects and Studies

1.7.1 Sacramento River Flood Control Project

The history of the SRFCP dates back to the mid 1800's with the initial construction of levees along the Sacramento, Feather, Yuba, and American Rivers. The early history of the system was characterized by trial and error, with initial construction followed by a levee failure, followed by improvements (strengthening and/or raising), followed by another levee failure, etc. This continued until 1910, when the California Debris Commission produced a comprehensive plan for controlling

the floodwaters of the Sacramento River and its tributaries, known as the "Jackson Report." This comprehensive project was first authorized by the California Legislature in the Flood Control Act of 1911, which also established the California Reclamation Board. The California Reclamation Board was empowered to approve plans for the construction of levees along the Sacramento River or its tributaries or within any of the overflow basins. The comprehensive plan of improvement was authorized by the U.S. Congress in the Flood Control Act of 1917, Public Law No. 64-367, Section 2, 39 Stat. 948, 949-950 (1917), which authorized Federal participation with the State of California in construction of the flood control system.

Federal participation in the SRFCP began shortly after authorization in 1917 and continued for approximately 40 years. The completed flood control system was documented in 1957 in a design memorandum, referred to as the 1957 Profile, which included design water surface profiles based upon the flow characteristics of the flood events of 1907 and 1909. To this day, these are the profiles which govern the operations and maintenance requirements of the levee system. Table 1-1 provides the estimated mean annual chance of exceedance (ACE) for the design flows specified in each reach. The design flow changes at tributary inflows.

Table 1-1. SRFCP Authorized Design Flow Estimated Annual Chance of Exceedance

Stream & Reach	Authorized Design Flow (cfs)	Annual Chance of Exceedance
Feather River		
Oroville to Honcut Creek	210,000	0.4% (1/250)
Honcut Creek to Yuba River	210,000	0.4% (1/250)
Yuba River to Bear River	300,000	0.8% (1/125)
Bear River to Sutter Bypass	320,000	2% (1/50)
Sutter Bypass		
Meridian to Wadsworth Canal	150,000	2% (1/50)
Wadsworth Canal to Tisdale Weir	155,000	2% (1/50)
Tisdale Weir to Feather River	180,000	3% (1/70)
Feather River to Sacramento River	380,000	5% (1/25)
Wadsworth Canal		
Tributary Specific Storm Centering	1,500	30% (1/3)
Cherokee Canal		
Western Canal to Afton Road	11,500	5% (1/25)

cfs = cubic feet per second.

The SRFCP is designed to keep flows from frequent flood events within the river and convey and divert larger flows floods into the Yolo and Sutter bypass system. The Sutter Bypass, part of the SRFCP borders the study area on the southwest, receives flood flows from the Sacramento River, Feather River, and Butte Basin.

CVFPB is responsible for operations and maintenance of the SRFCP levees. Under the oversight of the CVFPB, the SRFCP levees within the Sutter Basin study area are maintained by three different local maintenance agencies: DWR, Sutter maintenance yard; Levee District 1; and Levee District 9. The levees are maintained in accordance with a Standard Operations and Maintenance Manual for the SRFCP prepared by USACE.

1.7.2 Upstream Reservoirs

The Oroville Dam and Reservoir, built in 1967 and operated by the State of California, is a unit of the Feather River Project, which is a part of the State Water Project. Oroville Dam is located on Feather River, a tributary of Sacramento River, in the Feather River Canyon, about 6 miles upstream from the town of Oroville. The dam was built for multi-purpose functions: water supply, flood control, power generation, recreation, and conservation. The reservoir provides water supply to the areas adjacent to the Feather River as well as additional water for diversions from Sacramento-San Joaquin Delta to areas in the San Joaquin Valley, San Francisco Bay Area, and Southern California. The 750,000 acre-feet flood control storage space in Oroville Reservoir provides flood protection to the cities of Marysville, Yuba City, Oroville, and many smaller communities located in the floodplain.

New Bullards Bar, built in 1969 and operated by the Yuba County Water Agency, is located on the Yuba River. It provides 170,000 acre-feet of flood control space. Operations at New Bullards Bar are coordinated with operations at Oroville to control flood flows on the Feather River. For both Oroville and New Bullards Bar, the flood control space was purchased under Section 7 of the Flood Control Act of 1944 (58 Stat. 890) by the Federal government. Any encroachment into the flood control space must be released during the flood season, as defined by the water control operations manual.

Flood control operations for the Feather River (as defined in the Oroville and New Bullards Bar Water Control Manuals) require Feather River flows to not exceed 150,000 cubic feet per second (cfs) at Oroville, 180,000 cfs above Yuba River, and 300,000 cfs below Yuba River. Insofar as possible, the Feather River below Bear River must be limited to 320,000 cfs. During very large floods, releases greater than 150,000 cfs at Oroville may be required, as indicated by the emergency operations, in order to minimize uncontrolled spillway discharges.

Given the unregulated local flows in the Feather River and Yuba River drainage areas as well as the uncertainties associated with regulating for downstream controls, the State, in cooperation with Yuba County Water Agency and USACE, has invested heavily in coordinating operations, including developing models, establishing off-site data servers, and holding annual mock operations scenarios.

1.7.3 Advance Work by Local Interests in Study Area

Non-federal interests have completed construction of a local project, and are actively pursuing a second, to strengthen the existing SRFCP levees in advance of construction of a Federally authorized project. These non-federal interests are seeking credit for the local work to be applied toward the local cost share of the Federal project. The two non-federal projects are discussed below.

As required by Section 14 of the Rivers and Harbors Act of 1899, 33 United States Code (U.S.C.) Section 408 (hereinafter Section 408) temporary or permanent alteration, occupation, or use of any public works, including levees, for any purpose is allowable only with the permission of the Secretary of the Army. Under the terms of Section 408, any proposed modification to an authorized Federal levee project, such as the existing levees in the study area that are part of the SRFCP, requires a determination by the Secretary that the proposed alteration, permanent occupation, or use of a Federal project will not be 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 Section 408 has been delegated to the Chief of Engineers, USACE.

Section 104 of the Water Resources Development Act (WRDA) of 1986, Public Law No. 104-303, Section104, 110 Stat. 3658 (1996) (hereinafter Section 104) and Section 221 provide authorization for non-federal sponsors to apply the cost of local advanced work to the required local contribution for the Federal project. Section 104 authorizes credit for local work accomplished prior to authorization of the Federal project, provided that the ASA(CW) has approved the proposed work prior to initiation of construction, and that the locally constructed work is compatible with the Federal project. Section 221 authorizes in-kind credit for local work accomplished after execution of an agreement with the ASA(CW). If the non-federal sponsors propose to undertake construction prior to execution of the Project Partnership Agreement (PPA), an in-kind memorandum of understanding (MOU) must be eluted; however, any work undertaken by a non-federal sponsor pursuant to an in-kind MOU is at its own risk and responsibility. Credit will be applied only in accordance with the PPA and only for local work that is determined to be integral to the authorized Federal project.

1.7.3.1 Star Bend Setback Levee Project

Levee District 1 has completed construction of 3,400 feet of setback levee along the Feather River in the vicinity of Star Bend, approximately 7 miles south of Yuba City, under DWR's EIP. EIPs are for the construction of projects that rehabilitate, reconstruct, replace, improve, or add to the facilities of the State Plan of Flood Control (SPFC). DWR provides bond funds to cost share for early implementation of State-Federal system modifications for FRM. The Star Bend Setback Levee Project replaced a critical section of the right bank of the Feather River levee system to address critical under-seepage and flow constriction issues, and returned about 50 acres of land to the floodplain. Construction was completed in 2010 at an estimated cost of $20,776,000. Levee District 1 received Section 408 approval for the project in June 2009. Section 104 credit consideration for the local project was approved by the ASA(CW) in June 2010, prior to initiation of construction.

In addition to providing for potential credit, Section 104 also has a significant effect on the study process and on the establishment of study parameters. The legislation and USACE implementation guidance (ER 1165-2-29) provide that the benefits and costs of potentially creditable local work must be considered in the economic evaluation of the potential Federal project. Thus, the identification and evaluation of project alternatives is to proceed without the consideration of the work performed by local interests; that is, the local work approved by the ASA(CW) for potential credit would be considered as a potential measure/alternative and would not be considered as part of the without-project condition.

1.7.3.2 Feather River West Levee Project

SBFCA is constructing levee improvements along the Feather River West Levee under DWR's EIP and has requested in-kind credit to be applied toward the non-Federal cost share of the Sutter Basin construction project in accordance with the provisions of Section 221 of WRDA 1998. The local Feather River West Levee Project (FRWLP) involves the construction of slurry walls, stability berms, and seepage berms to remediate the identified geotechnical problems, including under-seepage and embankment instability, for about 41 miles of the existing Feather River project levees from Thermalito Afterbay south to a point approximately 4 miles north of the Feather River-Sutter Bypass confluence. The FRWLP is a distinct project formulated independently and separate from the Federal Sutter Basin pilot project. The FRWLP is intended to advance the implementation of local flood risk–reduction measures in conjunction with implementation of a Federal project. Section 408

approval was granted for the first construction contract on July 19, 2013. In accordance with the requirements of ER 1165-2-208, an In-Kind MOU was executed on June 14, 2013, after identification of the RP (release of Draft Feasibility Report for public review) and prior to initiation of the local construction effort. The FRWLP has not been assumed as part of the without-project condition, but rather will be evaluated for potential in-kind credit.

1.7.4 Systemwide Studies

1.7.4.1 Central Valley Flood Protection Plan

California SB 5, the Central Valley Flood Protection Act (Act), required that DWR and the California Flood Protection Board (Flood Board) address flooding problems in the Central Valley and report to the Legislature in 2012 with updates every 5 years. This landmark legislation obligated the State and local governments to approach flood management in a much more holistic way. Importantly, the Act required that urban communities (communities with a population with 10,000 people or communities expected to have 10,000 people within 10 years) achieve a 200-year level of protection by 2016 or no new discretionary development entitlements may be granted. In the event that this performance objective cannot be achieved by 2016, the communities must certify they have made (and annually are making) adequate progress in implementation and will achieve the State's 200-year standard by 2025. The Act also required that DWR prepare maps showing areas subject to inundation in a 200-year event, and provide annual notices to all homes protected by levees to ensure homeowners understand their flood risk. Significantly, the Act also required that DWR prepare, and the CVFPB adopt, a CVFPP by July of 2012. This plan was to provide the framework for modification of and future investment decisions in the Central Valley's flood protection system. On June 29, 2012, the CVFPB did adopt the CVFPP which included a strategy for reducing the flood risk of the citizens of the Central Valley. The plan focuses on (i) urban areas obtaining at least 200-year protection through structural improvements, (ii) significant upgrades to system-wide facilities (such as bypasses) to add additional robustness and redundancies to the system, (iii) investment in small community systems (structural improvements or nonstructural improvements, such as home elevation) to achieve at least 100-year protection, (iv) spot repairs and operation and maintenance improvements for the rural areas of the Valley, and (v) investment to update emergency response and recovery plans.

One outgrowth of the CVFPP was the creation of six regional flood management planning areas in the Central Valley. The formal creation of these regions by DWR built upon existing regional collaboration and cooperation among local agencies to consider the many issues that connect the various protected basins, such as reservoir operations, bypass expansion, system modifications, habitat banks, and habitat conservation plans. The six regional planning areas (mid and upper Sacramento, lower Sacramento / Delta North, Feather River, lower San Joaquin / Delta South, mid San Joaquin, and upper San Joaquin) have received State grants in excess of $8 million to promote bottom-up regional flood management planning. While these plans will identify and prioritize potential structural and nonstructural improvements in the region, they also will make recommendations for operation and maintenance practices, operation and maintenance budgets, improved emergency response capabilities, and potential flood management organization consolidation to promote efficiencies. Importantly, these regional plans will reach beyond just the flood management agencies in each region, also including cities, counties, fire departments, police, environmental non-governmental organizations (NGOs), and other important stakeholders. Each of these planning efforts is to be completed in 2014, and the information from these efforts is to feed

into basin-wide feasibility studies and the 2017 update of the CVFPP, both of which are being prepared by DWR.

The CVFPP also includes a conservation framework. This framework is intended to integrate ecosystem mitigation, restoration, and enhancement, into multi-objective projects that will be constructed as part of the CVFPP. The strategy sets forth a series of measurable goals, and in order to help achieve those goals, DWR has begun offering grants to implement conservation projects. The first set of grants, totaling nearly $25 million, will allow for the creation of mitigation credits to be used for future flood damage reduction projects in the Valley. DWR has announced projects to be funded by these grants and the projects are spread throughout the Valley, offering opportunities to dovetail with existing and planned flood risk reduction projects.

Even before adoption of the CVFPP, DWR, the CVFPB, and local agencies understood the importance of specific structural improvements to protect high risk urban areas. As a result, DWR created the EIP Program, a State of California grant program which, when leveraged with local dollars, will result in nearly $1 billion worth of urban levee improvements in the Central Valley. Some of the more well-known projects under this program include the Natomas Levee Improvement Project, the West Sacramento Improvement Project, design of SBFCA's FRWLP and construction of urgently needed reaches, the Three Rivers Levee Improvement Program, and the Reclamation District (RD) 2103 / City of Wheatland Bear River Levee Improvement Project. Each of these projects is intended to promote structural improvements to levees to protect existing urban areas, and most acted as advanced construction for existing urban protection studies underway by USACE. While the EIP Program has sunsetted with the adoption of the CVFPP, DWR has recently announced the Urban Flood Risk Reduction (UFRR) Program, which is designed to continue to fund levee improvements to meet the State's 200-year flood protection requirements for urban areas. In addition, the California Legislature also enacted new laws giving the CVFPB new authorities for managing and enforcing encroachment standards on Federally-authorized levees, and is currently considering legislation that would further streamline that process.

1.7.4.2 Central Valley Integrated Flood Management Study

The Central Valley Integrated Flood Management Study (CVIFMS) is a continuation of the *Sacramento-San Joaquin River Basins, California Comprehensive Study*. The CVIFMS is intended to determine Federal interest and provide the Federal support for the CVFPP vision of improved FRM in the Central Valley. The study will provide parallel technical and policy support to the CVFPP study, basin-wide feasibility studies, and pertinent regional planning efforts where applicable. As part of the Planning Modernization Initiative, the study was re-scoped to reduce the focus to the Sacramento River Basin and the system-based improvement components proposed in the state systemwide investment approach.

1.8 Scope of the NEPA/CEQA Effect Analysis

As noted in Section 1.1, this report integrates into a single document both plan formulation and NEPA/CEQA effect assessment. As described in Section 1.7.2.2, the FRWLP is separate from but related to the SBPFS. The FRWLP is a local and State led project that is proposed by SBFCA to remediate the highest flood risk deficiencies for the urban portions of the Sutter Basin in advance of a potential Congressional authorization and appropriation of a Federal project. SBFCA is striving to initiate construction of the FRWLP in 2013.

In December 2012, USACE released for public review a Draft EIS/EIR for the FRWLP, State Clearinghouse No. 2011052062. The Draft EIS/EIR addressed SBFCA's proposal to construct the FRWLP. Following release of the Draft EIS/EIR, the NEPA and CEQA processes were separated and a stand-alone EIS and a stand-alone EIR were prepared. SBFCA has certified and adopted its Final EIR and filed a Notice of Determination. The Final EIS was circulated by USACE for 30-day public comment and a Record of Decision (ROD) was signed on July 19, 2013 which covered about 2 miles of work (Reach 13 of Contract C) proposed by SBFCA for construction in 2013. A second ROD was signed by USACE on September 13, 2013 covering the remaining portion of the project.

SBFCA is requesting permission from USACE pursuant to Section 408 for alteration of Federal project levees. SBFCA is also seeking a permit under Clean Water Act Section 404 for placement of fill in jurisdictional waters of the United States; and Section 10 of the Rivers and Harbors Act for work performed in, over, or under navigable waters of the United States. The FRWLP Final EIS addressed alternatives that are similar to those evaluated in this integrated report. For purposes of identifying the project proposed for Federal authorization, and because the FRWLP Final EIS analyzed a project whose reach and environmental impacts are similar to those of the SBPFS, the actions proposed in the FRWLP Final EIS have been supplemented to include work associated with the SBPFS, including an additional reach of levee improvements and impacts on vegetation. Consequently, this document supplements the analyses and conclusions reached by USACE in the FRWLP Final EIS.

Therefore, the scope of the NEPA/CEQA effect analysis in this document focuses on the additional effects that would result from Federal construction. Accordingly, this document is intended to supplement the analysis in the FRWLP Final EIS, incorporating by reference, where appropriate, information, analyses, and conclusions contained in the FRWLP Final EIS. This integrated EIR/SEIS will refer to the FRWLP Final EIS, as appropriate, to avoid unnecessary duplication.

Incorporation by reference is encouraged by both NEPA (40 CFR Section 1502.21) and CEQA (14 California Code of Regulations Section 15150) to eliminate repetitive discussions of the same issues. Council on Environmental Quality regulation 40 CFR Section 1502.21 states:

> Agencies shall incorporate material into an environmental impact statement by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material shall be cited in the statement and its content briefly described. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment.

Both NEPA and CEQA require citation to and a brief summary of the referenced material, as well as information about the public availability of the incorporated material. CEQA also requires citation of the state identification number of the EIRs cited.

The FRWLP Final EIS, where specifically noted, is summarized throughout this integrated EIR/SEIS. The FRWLP Final EIS is available on USACE's Web site at http://www.spk.usae.army.mil and SBFCA's Website at http://www.sutterbutteflood.org.

1.9 Planning Process and Report Organization

The planning process, which this Pilot Study followed, consists of six major steps: (1) specification of water and related land resources problems and opportunities; (2) inventory, forecast, and analysis of water and related land resources conditions within the study area; (3) formulation of alternative

plans; (4) evaluation of the effects of the alternative plans; (5) comparison of the alternative plans; and (6) selection of the RP based upon the comparison of the alternative plans.

This report is an integrated Pilot Feasibility Report, and EIR/SEIS. As such, it documents the six-step water resources planning process and meets the requirements of NEPA and CEQA to analyze and disclose potential environmental impacts and mitigation and to inform planning and decision-making. Table 1-2 documents how the USACE's planning process and the NEPA/CEQA process are coordinated. Those chapters or sections required by NEPA and CEQA are indicated by an asterisk in the Table of Contents. The chapter headings and order in this report generally follow the outline of an EIR/SEIS. The report chapters relate to the six steps of the planning process as follows:

- Chapter 2, *Need for and Objectives of Action*, covers the first step in the planning process (specification of water and related land resources problems and opportunities). It also covers the second step of the planning process (inventory and forecast) to the extent necessary to establish the future "without-project condition" prior to development of the alternatives.
- Chapter 3, *Plan Formulation*, is the heart of the report and is, therefore, placed before the more detailed discussions of resources and effects. It covers the third step in the planning process (formulation of alternative plans), the fifth step (comparison of alternative plans), and the sixth step (selection of the recommended plan based upon the comparison of the alternative plans).
- Chapter 4, *Affected Environment and Environmental Consequences*, covers the second step of the planning process (inventory, forecast and analysis of water and related land resources) in greater detail than what was provided in Chapter 2. Chapter 4 also covers the fourth step of the planning process (evaluation of the effects of the alternative plans).
- The remaining chapters discuss public involvement, review, and consultation (Chapter 5); describe compliance with applicable laws, policies, and plans (Chapter 6); present a description of the recommended plan (Chapter 7); present the study recommendation (Chapter 8); list the report preparers (Chapter 9); list the recipients of the draft feasibility report (Chapter 10); and list of references (Chapter 12). A list of acronyms and abbreviations and a glossary of terms precede Chapter 1. An index is found in Chapter 11.

Table 1-2. Comparison and Coordination of USACE Planning, Pilot Study Process, and NEPA/CEQA Processes

USACE Planning Process	Sutter Basin Pilot Study Milestones	NEPA/CEQA Process
Step 1. Identify Problems and Opportunities	Scoping Phase Decision Point 1: Federal Interest Decision	Publish Notice of Intent (NOI)/Notice of Preparation (NOP)[a]
Step 2. Inventory and Forecast		Conduct scoping process[b]
		Prepare Statement of Purpose and Need/Project Objectives Describe existing and future without-project conditions
Step 3. Formulate Alternatives	Analysis Phase Decision Point 2: Tentatively Selected Plan	Identify reasonable alternatives
Step 4. Evaluate Alternatives		
Step 5. Compare Alternatives		Evaluate impacts Develop mitigation
		Compare alternatives
Step 6. Select Alternative	Review Phase Decision Point 3: Civil Works Review Board	Draft EIR/SEIS: public notice and 45-day public review
	Confirmation Phase Decision Point 4: USACE Chief's Report ASA(CW) Transmits Chief's Report to OMB ASA(CW) Transmits Chief's Report to Congress Congressional Authorization	Final EIR/SEIS: respond to public comments
		Final EIR/SEIS: public notice and 30-day public review
		Record of Decision (ROD)/Notice of Determination (NOD)

Notes:

[a] On May 20, 2011, USACE published a NOI in the *Federal Register* (Vol. 76, No. 98) and SBFCA published a NOP with the State Clearinghouse.

[b] Public Scoping Meetings were held jointly by USACE and SBFCA for the SBFPS and FRWLP on June 27, 2011 and June 28, 2011.

ASA(CW) = Assistant Secretary of the Army (Civil Works).

OMB = Office of Management and Budget.

The USACE planning process follows the six-steps defined in *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implemental Studies*, also known as the Principles and Guidelines. The Principles and Guidelines were issued by the Water Resources Council on March 10, 1983 (ER 1105-2-100). This chapter describes the results of the first step of the planning process—the identification of problems and opportunities to be addressed by the Sutter Basin Pilot Feasibility Study (SBPFS). Planning objectives and constraints are also presented.

2.1 Problems and Opportunities

This section discusses the key problems and opportunities identified by the study team and concerned stakeholders.

2.1.1 Flooding Problems

Problem: A high risk of flooding from levee failure threatens the public health and safety of approximately 95,000 people residing within the study area.

The entire Sutter Basin study area receives flood risk management (FRM) benefits from the authorized Sacramento River Flood Control Project (SRFCP) and upstream reservoirs on the Sacramento, Feather, and Yuba Rivers. However, the study area remains at a high risk of flooding. From 1950 to 2011, 19 flood events required extensive flood fighting in the study area. The flood of 1955 resulted from a levee failure on the right bank of the Feather River just below Yuba City. Additional levee failures occurred during the floods of 1986 and 1997 on the Yuba, Feather, and Bear Rivers, which are adjacent to the Sutter Basin and have levees similar in construction to those surrounding the Sutter Basin. A discussion of historical flood events is in Section 4.2.2.4, *Historical Floods*.

The primary risk of flooding in the Sutter Basin has been determined to be geotechnical failure of the existing project levees and not hydrologic or hydraulic factors that result in levee overtopping. Recent geotechnical analysis and evaluation of historical levee performance during past flood events have resulted in a greater understanding of under-seepage and led to a revision of levee design criteria. Geomorphologic and geotechnical studies have identified subsurface features, such as former river channels, meanders, and oxbows. These features are likely to contain coarse-grained pervious soils (i.e., sands and gravels). The potential for seepage problems to occur along the existing levees in the project area is created by discontinuous layers of coarse-grained pervious soils. These soils are found in the study area at varying depths of up to 80 feet. During high-water events, water from the river can enter the pervious soil layers and then move laterally through these layers and under the levee. Excessive seepage can erode soil within the levee and lead to a rapid collapse and subsequent breach. Historically, foundation conditions were evaluated assuming homogeneous materials, but the floods of 1986 and 1997 and the resulting levee failures throughout the Central Valley resulted in a revision of the criteria for the evaluation of under-seepage. The risk of levee failure is not due to design deficiency or to lack of O&M of the existing levees, but to a better understanding of the mechanics of under-seepage in the Central Valley.

The project levees within the study area do not meet current USACE levee design criteria and are at risk of breach failure at stages considerably less than levee crest elevations. This is evidenced by historical levee boils and heavy seepage at river stages less than design flows. Table 2-1 summarizes

the estimated performance of the existing levees with and without geotechnical fragility (the risk of poor geotechnical performance of the levee at a given water surface elevation or flood frequency) to show the significance of the geotechnical condition of the levees in overall levee performance.

Table 2-1. Performance of Existing Levees

Median Flood Frequency	Assurance[a] with Fragility	Assurance[a] without Fragility
Upper Feather River (Index Point FR8.0R)		
10% (1/10)	0.82	0.99
1% (1/100)	0.58	0.99
0.5% (1/200)	0.48	0.86
Lower Feather River and Sutter Bypass (Index Point FR3.0R)		
10% (1/10)	0.94	0.99
1% (1/100)	0.84	0.99
0.5% (1/200)	0.68	0.80

[a] Assurance is the probability that a given flood event will not result in levee failure.

Various without-project levee breach scenarios were developed and evaluated to determine the inundation area for flood events of different magnitudes within the study area. Plate 2-1 is a summary, or composite, of the 10% (1/10) Annual Chance Exceedance (ACE) inundation areas for the entire study area from all evaluated breach locations that have less than a 90% reliability for a given mean annual exceedence event (in this case 10%). While this floodplain is larger than would likely be seen in a single flood/breach event, it is meant to represent the relative residual risk for the area from all remaining breach locations. Plate 2-1 shows that the Sutter Basin is subject to a high risk of flooding. Major urban centers of Yuba City, Biggs, Gridley, and Live Oak are subject to being inundated during a 10% (1/10) ACE event and are considered at high flood risk, as are most of the identified evacuation routes in the study area.

Geotechnical issues, such as under-seepage breach failures, result in large volume flood flows at high velocities that are sudden and unpredictable. These failures allow for minimal warning time and minimal time for effective implementation of evacuation and emergency plans. Study area flood events generally occur during the winter months when cold air and water temperatures significantly increase the risk of death by exposure. The risk probability of unexpected levee failure coupled with the consequence of basin-wide flooding presents a continued threat to public safety, property, and critical infrastructure in the Sutter Basin.

Problem: Urban and rural areas within the Sutter Basin are subject to damages from flooding.

As shown in Figure 2-1, the topographic surface elevations (excluding the high ground of Sutter Buttes) range from 110 feet North American Vertical Datum of 1988 (NAVD88) in the northeast to 30 feet NAVD88 in the southwest, creating deep floodplain pooling in the southern basin.

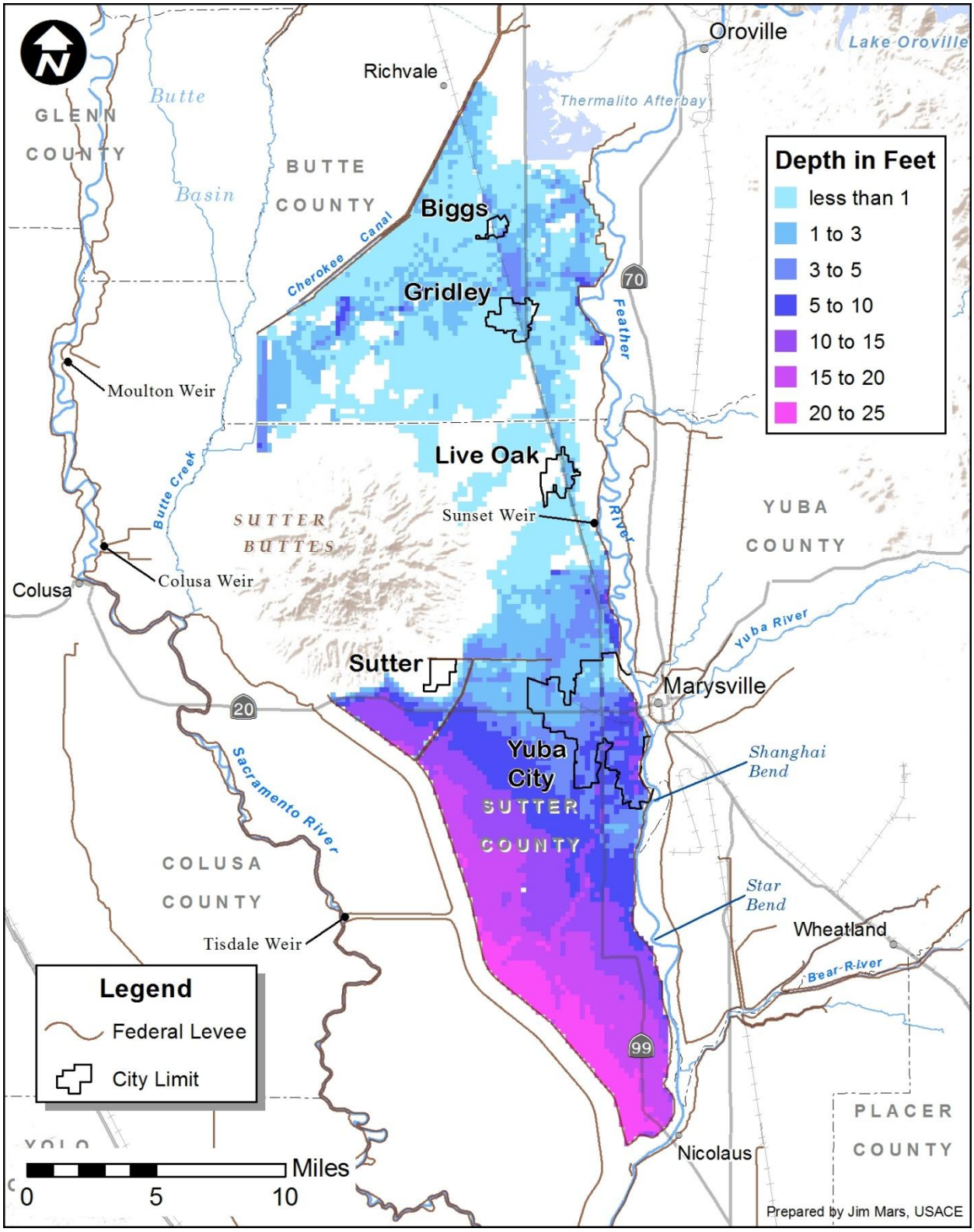
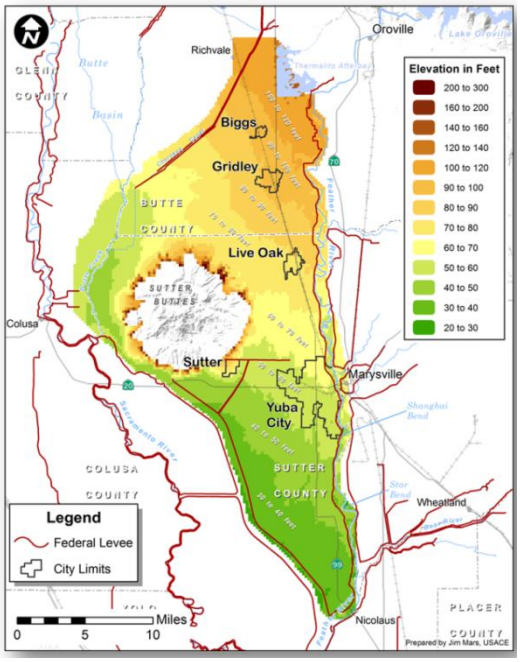


Plate 2-1. 10% (1/10) ACE Composite Floodplain



(See the *Figures* folder on the CD for a full-sized image.)

Figure 2-1. Sutter Basin Topography

As discussed previously, multiple levee breach scenarios were modeled along the Feather River and Sutter Bypass to assist in the analysis of the study problems. Floodplains resulting from levee breaches differ significantly in nature depending on the location of the breach (Figure 2-2). Simulated breaches along the northern portion of the Feather River flood the northern basin in a shallow northeast to southwest flooding flow. Breaches from the Sutter Bypass and southern most portion of the Feather River only flood the deeper southern basin and do not affect the northern half of the basin. Figure 2-3 shows the composite 1% ACE floodplain for the Sutter Basin.

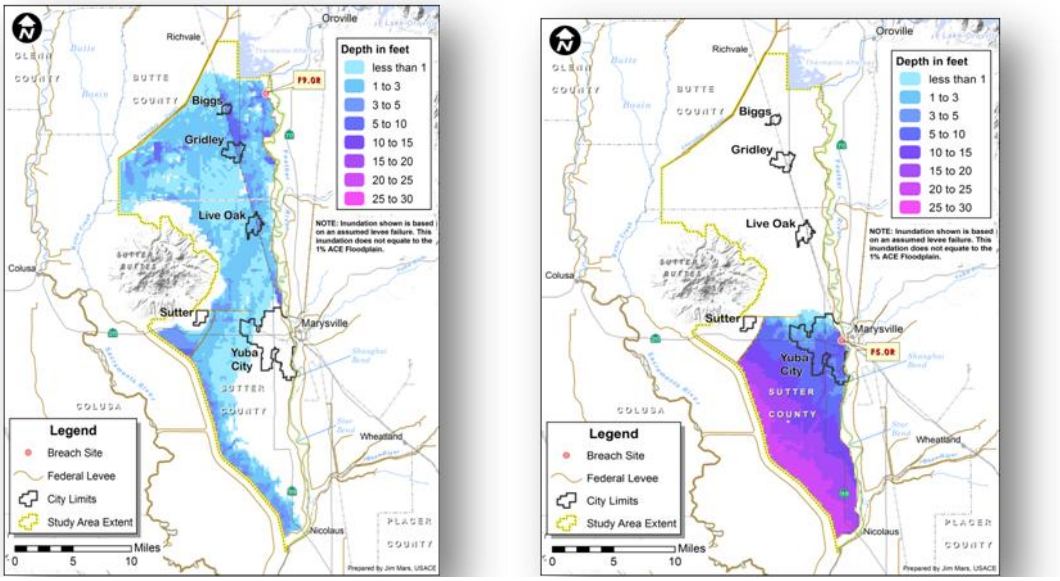


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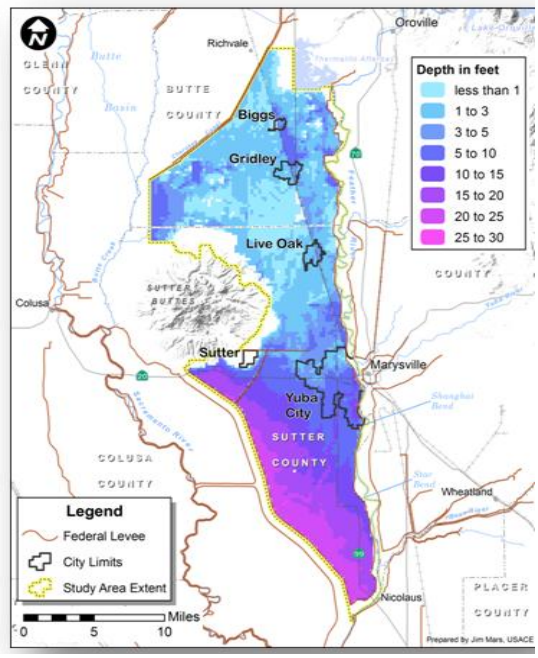
Figure 2-2. Simulated Levee Breach Scenarios, 1% ACE event



(See the *Figures* folder on the CD for a full-sized image.)

Figure 2-3. 1% ACE Without-Project Floodplain

Based on the 2010 Census, the population of the Sutter Basin is estimated to be 95,360 and distributed as shown in Table 2-2.

Table 2-2. Population within Study Area

Economic Impact Area	Population
Town of Sutter	250
Yuba City Urban	67,370
Biggs Urban	1,760
Gridley Urban	6,380
Live Oak Urban	8,360
Sutter County Rural	6,340
Butte County Rural	4,900
TOTAL	**95,360**

An economic inventory was assembled following standard USACE methods. For the study area, a base geographic information system (GIS) inventory with parcel attribute data was provided by the local sponsor for both Sutter and Butte Counties. Field visits were conducted to collect and validate the base inventory data. Parcels with structures were categorized by land use and grouped into residential, commercial, industrial or public categories. The value of damageable structures was estimated based on depreciated replacement values. The total value of the existing damageable property (structures and contents) within the Sutter Basin study area is estimated at $7.0 billion (October 2013 prices) as shown in Table 2-3. Table 2-4 displays the structural inventory by land use category. Total study area without-project expected annual damages are approximately $137 million.

Table 2-3. Value of Damageable Property (Values in $1,000's)

Economic Impact Area	Structures and Contents within 0.2% (1/500) ACE Floodplain				
	Commercial	Industrial	Public	Residential	TOTAL
Biggs	6,700	2,400	0	75,700	84,800
Gridley	73,200	52,6000	3,600	290,900	420,300
Live Oak	26,000	3,800	42,600	324,500	396,900
Yuba City	1,070,000	423,800	339,200	3,645,300	5,478,300
Rural Butte County	4,000	46,400	0	203,200	253,600
Rural Sutter County	9,100	40,200	18,800	279,000	347,100
TOTAL	**1,189,000**	**569,200**	**404,200**	**4,818,600**	**6,981,000**

Table 2-4. Structural Inventory–Existing Conditions

Economic Impact Area	Number of Structures within 0.2% (1/500) ACE Floodplain				
	Commercial	Industrial	Public	Residential	TOTAL
Biggs	18	1	0	586	605
Gridley	81	7	4	1,931	2,023
Live Oak	51	5	23	2,088	2,167
Yuba City	872	210	122	18,760	19,964
Town of Sutter	0	0	0	0	0
Rural Butte County	10	16	0	1,242	1,268
Rural Sutter County	10	29	8	1,162	1,209
TOTAL	**1,042**	**268**	**157**	**25,769**	**27,236**

The December 1955 flood was the most damaging flood recorded to date in the basin, based on loss of lives and damages. Simultaneous peaks occurred on the Feather and Yuba Rivers, with the peak flow on the Feather River at Oroville gage estimated at 230,180,000 cubic feet per second (cfs), and a peak flow of about 155,000 cfs measured at the Marysville gage on the Yuba River. There was no upstream dedicated flood storage at Oroville Dam and Reservoir on the Feather River or at New Bullards Bar Dam and Reservoir on the Yuba River at the time of the event because those facilities had not been constructed yet. At midnight December 24, the right bank Feather River levee at Yuba City had a geotechnical failure about 2 miles downstream of the mouth of the Yuba River at Shanghai Bend (Figure 2-4). This event is illustrative of the limited warning time preceding geotechnical levee failures. The levee failure was preceded by the Governor of the State of California issuing a "State of Emergency" on December 22 due to the abnormal and heavy rainfall. However, the general evacuation order was given approximately 1 hour after the levee break. The left bank levee of the Feather River also broke near Nicolaus. Marysville's levees were threatened. The resulting flooding inundated about 100,000 acres of land, including 95% of Yuba City. Thirty-eight people were killed in the Yuba City area, and two were killed in the Nicolaus area. About 3,300 homes were flooded; 6,000 cattle were killed; and more than 30,000 people were evacuated and rescued. Flood damage was estimated at $50.5 million (1955 dollars). The flooded communities and lives of thousands of residents were disrupted for several months as the basin recovered from the flood.

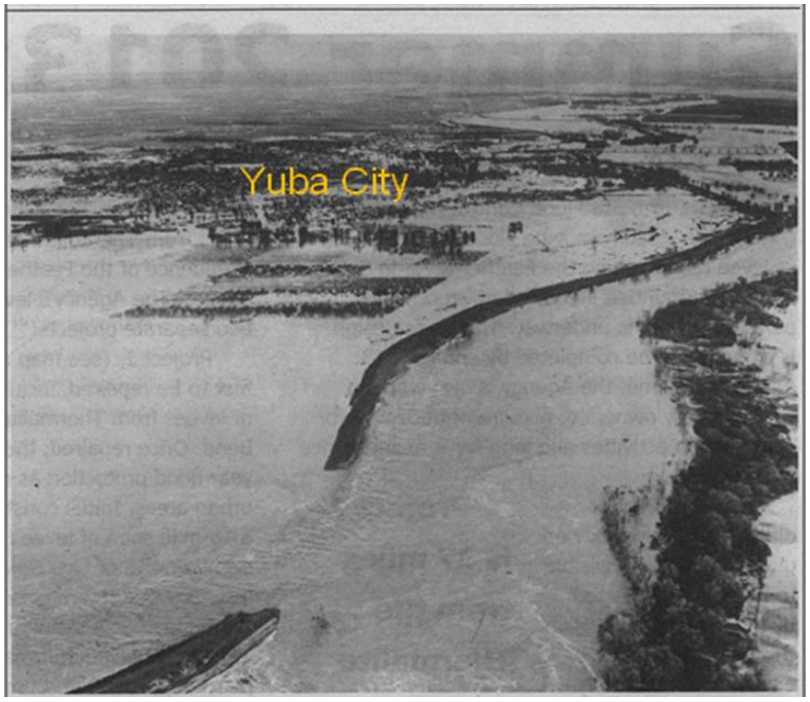


Figure 2-4. 1955 Levee Failure at Shanghai Bend

The 1986 event consisted of a closely spaced series of large storms. On February 20, while the Feather and Yuba Rivers were receding, a section of levee near the community of Linda had a geotechnical failure. About 24,000 people were evacuated. One person died; 32 people were injured; 855 homes and 150 businesses were destroyed; and 3,000 homes and 150 businesses were damaged. Flood damages were estimated at $95 million in 1986 dollars.

The January 1997 flood was the largest in northern California since measured records began in 1906. The flood was notable in the sustained intensity of rainfall, volume of floodwater, and areal extent—from the Oregon border to the southern end of the Sierra Nevada. Over the 3-day period around New Year's Day, warm moist winds from the southwest blowing over the Sierra Nevada poured more than 30 inches of rain onto watersheds that were already saturated by one of the wettest Decembers on record. Levees throughout the SRFCP sustained moderate to heavy damage. A geotechnical-related break in the left bank Feather River levee near the community of Arboga occurred on January 2, 1997, prompting the evacuation of about 15,000 people from Linda and Olivehurst. Nearly 50,000 inhabitants of Yuba City, Marysville, and surrounding areas were evacuated because of fears over possible additional levee failures. Two additional breaks did occur on the right bank of the Bear River near the State Route 70 bridge outside the study area.

2.1.2 Opportunities

Opportunity: Reduce the risk of flooding and flood damages through the least environmentally damaging structural or non-structural method.

There is an opportunity to reduce the risk to public safety and damages caused by flooding from the Feather River and the Sutter Bypass.

Opportunity: Reduce the residual risk to public health and safety by structural or non-structural methods.

There is an opportunity to reduce the risk to public health and safety through the protection of critical health and safety infrastructure.

Opportunity: Sustain and improve aquatic, riparian, and adjacent terrestrial habitats in conjunction with FRM features.

There is an opportunity to sustain and improve floodplain habitats along existing water courses in conjunction with FRM features.

Opportunity: Provide public access and use, and improved outdoor recreational experiences in conjunction with FRM features.

There is an opportunity to provide increased public access to additional habitat areas established in conjunction with FRM features.

2.2 Objectives and Constraints

2.2.1 Federal Objectives

The policy of the United States, as set forth in Section 2031 of the Water Resources Development Act (WRDA) of 2007, Public Law No. 110-114, §2031, 121 Stat. 1041 (2007), is that all Federal water resources investments shall reflect national priorities, encourage economic development, and protect the environment by:

1. seeking to maximize sustainable economic development;
2. seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and
3. protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

In consideration of the many competing demands for limited Federal resources, it is intended that Federal investments in water resources as a whole should strive to maximize public benefits, with appropriate consideration of costs. Public benefits encompass environmental, economic, and social goals, include monetary and nonmonetary effects, and allow for the consideration of both quantified and unquantified measures.

The Federal objective is not specific enough for the development of a water resource project. The formulation of alternative plans requires the identification of study-specific planning objectives.

2.2.2 Non-Federal Objectives

The State of California, recognizing the continuing risk of flooding within the Central Valley, has enacted the Central Valley Flood Protection Act (CVFPA) and related legislation that establishes in California law the objective of providing 200-year (1/200 or 0.5% annual exceedance probability) protection to urban and urbanizing areas. Additionally, the CVFPA requires an immediate analysis of

the condition of the system levees, an action plan for achieving the desired level of protection, and associated actions to reduce residual risks to development within the protected area.

In addition to complying with the state requirement, the non-federal sponsors seek to reduce residual risk to the rural south portion of the Sutter Basin for sustainable high-value agricultural operations.

2.2.3 Planning Objectives

Planning objectives for the SBPFS are more specific than the Federal and non-federal objectives and reflect the problems and opportunities in the study area; an objective is developed to address each of the identified problems and opportunities. Planning objectives represent desired positive changes to the future without-project conditions. All of the objectives focus on activity within the study area and within the 50-year period of analysis.

The planning objectives are:

- Reduce the risk to life, health, public safety and critical infrastructure due to flooding.
- Reduce the risk of property damage due to flooding.
- In conjunction with FRM, improve ecosystem functions and values including restoration of conductivity of historic floodplains.
- In conjunction with FRM, and associated with improving ecosystem functions and associated habitat, improve the public's access to and use of outdoor recreational opportunities.

2.2.4 Planning Constraints

A planning constraint is a restriction that limits the extent of the planning process. It is a statement of things the alternative plans must avoid. Constraints are designed to avoid undesirable changes between future without- and with-project conditions.

The planning constraints are:

- Minimize adverse hydraulic effects where they could result in economic damage to other areas.
- Minimize significant adverse effects on the human environment.
- Comply with all applicable Federal laws, regulations, and policies, including Executive Oder 11988.
- Section 308 of WRDA of 1990 prohibits the inclusion of damages to structures built in the Federal Emergency Management Agency (FEMA) regulated floodplain after 01 July 1991 in the economic analysis.

2.3 Critical Assumptions Affecting Development of Future Without-Project Conditions

The future without-project condition (NEPA/CEQA No Action) is the most likely condition expected to exist in the future in the absence of a proposed water resource project. The future without-project condition defines the benchmark against which the alternative plans are evaluated. These forecasts of future conditions are from the base year (year when a project is expected to be operational) to the end of the period of analysis (50 years). Future without-project conditions for this study are

projected assuming a base year of 2023 and a 50-year period of analysis out to 2073. If no action is taken, the geotechnical condition of the levees within the study area will slowly deteriorate in the future. Every major flood event causes internal erosion of foundation soils, which weakens the levee foundation if it is not remediated after the flood. Drainage and utility lines crossing the levee will corrode, eventually resulting in failure if the lines are not replaced or rehabilitated. This slow deterioration is not quantifiable under existing guidance for the production of geotechnical levee fragility curves, so the existing geotechnical levee conditions, as given by the existing condition levee fragility curves, is assumed to continue into the future. While most of the documentation of the inventory and forecast of affected resources is in Chapter 4, *Affected Environment and Environmental Consequences*, some critical assumptions that affect the plan formulation are discussed below.

- If no action is taken, the existing performance characteristics of the project levees were assumed to remain the same over the period of analysis.
- Ongoing levee maintenance will result in no change to geotechnical conditions and levee performance curves.
- Oroville and New Bullards Bar Reservoirs on the Feather and Yuba River systems, respectively, will continue to be operated using the existing rule curves.
- Vegetation and topographic conditions within the channel are expected to remain the same as existing conditions.
- Fish and wildlife areas in the study area are not anticipated to substantially change in acreage or natural floodplain values over the period of analysis.
- Economic analysis assumes the future without-project condition is equal to existing conditions (NEPA/CEQA baseline) because any future development would take place above the 1% ACE floodplain boundary.
- The 2012 Central Valley Flood Protection Plan (CVFPP) includes only general recommendations for systemwide improvements, not specific project recommendations. Therefore, the 2012 CVFPP recommendations have not been included in the future without-project condition.

The plan formulation process, encompassing the six-step planning process, develops and evaluates alternative plans to address specific planning objectives. These planning objectives and the determining of the Federal interest, which are consistent with the Federal Water Resources Council's Principles and Guidelines and the Planning Guidance Notebook (ER-1105-2-100), guide the planning process to a recommendation of a tentatively selected plan (TSP). The plan formulation process for the Sutter Basin Pilot Feasibility Study (SBPFS) followed a multi-criteria method based on risk-informed decision making, existing data and available information, and coordinated professional judgment.

3.1 Flood Risk–Management Measures

3.1.1 Management Measures Strategy and Development

After the identification of the problems and objectives, a broad array of management measures consisting of flood risk management (FRM), associated ecosystem restoration, and associated recreation opportunities was developed. These measures were based on existing reports and studies, local sponsor information, public input, risk assessment, and professional judgment. The Sutter Basin is protected by project levees that are part of the Sacramento River Flood Control Project (SRFCP). The SBPFS limits its focus to those project levees that provide FRM to the study area, acknowledging that statewide FRM programs such as the Central Valley Flood Protection Plan (CVFPP) are studying system approaches. Initial measures considered a wide range of both nonstructural improvements (e.g., ring-levees around structures, elevations of buildings, relocation) and structural actions (e.g., levee improvements, bypass improvements, reservoir operations) for FRM solutions. The following list provides a summary and general categorization of management measures that were considered.

- Structural FRM Measures
    - Biggs Ring Levee
    - Gridley Ring Levee
    - Live Oak Ring Levee
    - Yuba City Ring Levee
    - Fix-in-Place Feather River West Levee from Thermalito to Shanghai Bend
    - Southern Portion of J-levee
    - Fix-in-Place Feather River West Levee from Shanghai Bend to Sutter Bypass; plus Wadsworth Canal East Levee; plus Sutter Bypass East Levee
    - Butte Bypass
    - Nelson Slough Sediment Removal at Sutter Bypass and Feather River Confluence
    - Southern Relief Structure
    - Modify Fremont Weir

- Reoperation of Oroville Dam and Reservoir (Feather River)
- Increased Flood Storage in Shasta and Black Butte Reservoirs Upstream of Sutter Bypass
- Authorized Marysville Reservoir (South Yuba River)
- Feather River Dredging
- Modify Pumps along Sutter Bypass
- Cherokee Canal Sediment Removal
- Sunset Weir Modification
- Gilsizer Cross Levee with Flap Gates
- Wadsworth Canal Tributary Drainage
- Managed Overtopping (Levee Superiority) on Feather River and Sutter Bypass
- Sutter Bypass Sediment Removal

- Structural FRM Measure with Associated Ecosystem Restoration
  - Sutter Bypass Setback Levee
  - Northern Feather River Setback Levee
  - Sutter Bypass and Feather River Confluence Setback Levee
  - Star Bend Setback Levee
  - Oroville Wildlife Area – Degrade Land Surface and Restore Wetlands
  - Improve Upstream Fish Passage in Sutter Bypass (Remove Fish Passage Barriers)
  - Vegetation Management in Lower Feather River
  - Vegetation Management in Upper Feather River
  - Vegetation Management in Sutter Bypass
- Nonstructural Measures (some overlap with other measures)
  - Relocate Structures and Critical Infrastructure in Floodplain
  - Floodproof Isolated Locations
  - Elevate Structures and Transportation Infrastructure
  - Establish Flood-Resistant Housing
  - Secure Large Floatable Objects
  - Flood Warning System
  - Evacuation Plan
  - Construct Ring Levees at Isolated Locations
  - Flood Fight Pre-Staging Equipment and Supply Area
- Recreational Measures (associated with ecosystem restoration and FRM measures)
  - Multi-Use Trails

- Bicycle Trails
- Equestrian Trails
- Day Use Area
- River Access
- Scenic Overlook
- Recreational Parkway

3.1.2 Management Measures Screening

These management measures were initially screened as part of a critical thinking Charette (workshop). The Charette Team consisted of the Project Delivery Team (PDT), non-federal sponsors, the Vertical Team (composed of representatives of the USACE local, district, division, and headquarters levels of review and approval authority), and the National Pilot Program 17+1 Team (the original pilot study program development team). The Charette Team reviewed each measure, identified additional measures, and then evaluated the measures based on study objectives, study constraints, and Water Resources Council Principles and Guidelines criteria. The Charette Team screened whether each measure should be retained or dropped from further consideration. Of the initial 46 measures that were evaluated, 32 were retained to assist in the development of conceptual alternatives (Table 3-1).

Initial geotechnical and hydraulic analysis, along with analysis of historical records of flood events, indicated that geotechnical failure of existing levees is the most significant FRM issue in the Sutter Basin. Under-seepage can cause existing levees to breach. Because several levee breach scenarios demonstrated the extent of impacts on associated residual floodplains, management measures were mostly screened to focus on fixing existing levees or constructing new levees, especially along the Feather River West Levee sections.

The formulation strategy for screening and analysis of measures developed four management themes (strategies) aligned to the study objectives to focus the plan formulation and the development of conceptual alternatives.

- Theme 1: Consequence management focused on public safety
- Theme 2: Urban FRM focus
- Theme 3: Maximize existing system with FRM focus
- Theme 4: Ecosystem emphasis

These themes were used to assist in formulating an array of conceptual alternatives by grouping measures according to their primary focus of theme. Table 3-2 shows how the measures were grouped and screened into themes and conceptual alternatives.

The majority of these screened conceptual alternatives were composed of new levees or strengthening (fix-in-place) existing levees. To further refine and screen these conceptual alternatives, parametric quantities, costs, and economic benefits were developed.

Table 3-1. Summary of Management Measures and Screening

Measure	Measure Description	Retained	Dropped	Primary Reason(s) for Dropping Measure
Biggs Ring Levee	Construct ring levee around highly developed area of Biggs.	X		
Gridley Ring Levee	Construct ring levee around highly developed area of Gridley.	X		
Live Oak Ring Levee	Construct ring levee around highly developed area of Live Oak.	X		
Yuba City Ring Levee	Construct ring levee around highly developed area of Yuba City.	X		
Fix-in-Place Feather River West Levee from Thermalito to Shanghai Bend	Fix-in-place Feather River West Levee from Thermalito to Shanghai Bend.	X		
Southern Portion of J-Levee	Construct southern portion of J-Levee. This measure would prevent potential levee failures on Sutter Bypass or Feather River downstream of Shanghai Bend from backing up into Yuba City. However, if a failure occurred upstream of Shanghai Bend, the measure would increase flood depths in Yuba City by ponding floodwater behind the J-levee.	X		
Fix-in-Place Feather River West Levee from Shanghai Bend to Sutter Bypass; plus Wadsworth Canal East Levee; plus Sutter Bypass East Levee	Fix-in-place existing Feather River West Levee from Shanghai Bend to Sutter Bypass, Sutter Bypass East Levee, and Wadsworth Canal Levee.	X		
Butte Bypass	Construct a 1,400-foot-wide bypass from Feather River to Butte Basin.		X	This measure would need to be combined with an increase in capacity of the Sutter Bypass and additional easements, which is a system approach being studied under the CVFPP. This measure would also require a fix-in-place levee. Additional engineering improvements along Feather River and Sutter Bypass and/or a ring levee would be needed before this measure would be effective.

Measure	Measure Description	Retained	Dropped	Primary Reason(s) for Dropping Measure
Sutter Bypass Setback Levee	Construct a 500-foot long setback levee along Sutter Bypass.	X		
Northern Feather River Setback Levee	Construct a 5.3-mile-long setback levee.	X		
Sutter Bypass and Feather River Confluence Setback Levee	Construct a 2.1-mile-long setback levee near the Feather River and Sutter Bypass confluence.	X		
Star Bend Setback Levee	Construct a 0.8-mile-long setback levee at Star Bend.	X		
Oroville Wildlife Area – Degrade Land Surface and Restore Wetlands	Degrade the land surface and restore wetlands.	X		
Nelson Slough Sediment Removal at Sutter Bypass and Feather River Confluence	Remove sediment upstream from Nelson Slough rock weir.		X	This measure would provide only a minor hydraulic benefit. The benefit would be temporary because this area would continue to have sediment deposition. This measure would result in high operations and maintenance costs, along with potential increased costs related to hazardous, toxic and radioactive waste concerns.
Southern Relief Structure	Construct a relief structure in the levee at the south end of Sutter Basin. If a levee were to fail upstream this downstream gate or fuse plug type feature would be used to convey floodwaters back into the Feather River and Sutter Bypass channel. In a levee breach scenario this may reduce peak flood stages in the southern basin, resulting in fewer structures being flooded in the Yuba City area.	X		
Modify Fremont Weir	Modify Fremont Weir to reduce flood stages in the study area.		X	This measure would not reduce the water surface elevations enough to reduce the under-seepage problem occurring with the existing levee.
Reoperation of Oroville Dam and Reservoir (Feather River)	Offset approximately 100,000 acre-feet of water supply for flood control storage space in Oroville Reservoir.		X	This measure was dropped because fixes to the existing levee would still be required. This measure provides limited benefits downstream. Other listed measures would provide more efficient means to achieve comparable performance.

Measure	Measure Description	Retained	Dropped	Primary Reason(s) for Dropping Measure
Increased Flood Storage in Shasta and Black Butte Reservoirs Upstream of Sutter Bypass	Offset approximately 1,460,000 acre-feet of water supply in Shasta Reservoir and 674,000 acre-feet in Black Butte Reservoir for flood control storage space.		X	Based on the Sacramento-San Joaquin Comprehensive Study results, this measure was found to have almost no impact on flood stages in the study area.
Authorized Marysville Reservoir (South Yuba River)	Marysville Reservoir is a USACE authorized project that has not been constructed. Marysville Reservoir would be located on the Yuba River just upstream of the city of Marysville and downstream from New Bullards Bar and Englebright dams.		X	This measure is considered cost-infeasible in terms of costs exceeding any benefits. Further this measure has major environmental impacts due to deep foundation problems and construction challenges.
Feather River Dredging	This measure consists of dredging the Feather River from Oroville to the mouth of Sacramento River.		X	This measure was dropped from further consideration because it does not fix the under-seepage problem occurring within the existing levee. This measure also results in high costs due to ongoing operation and maintenance and land acquisition. In addition, there are environmental concerns with mercury and heavy metals.
Modify Pumps along Sutter Bypass	Reduce or eliminate flooding due to ponding of excess floodwaters in the southwestern portion of the study area.		X	This measure does not fit within the study objectives. The study objectives do not focus on interior drainage.
Cherokee Canal Sediment Removal	Remove sediment that may have accumulated in the Cherokee Canal.		X	Canal maintenance is the responsibility of the California Department of Water Resources. There are other ongoing efforts to address sediment removal in the Cherokee Canal.
Sunset Weir Modification	Modify a hydraulic structure in the Feather River that is used to divert water into an irrigation canal.	X		
Gilsizer Cross Levee with Flap Gates	Construct a new levee across the Sutter Basin from Star Bend on the Feather River to Pumping Plant No. 2 on the Sutter Bypass. The areas to the north and south of the new levee would have different residual flood probability.	X		
Wadsworth Canal Tributary Drainage	Increase the capacity of Wadsworth Canal to accommodate additional runoff.	X		

Measure	Measure Description	Retained	Dropped	Primary Reason(s) for Dropping Measure
Managed Overtopping (Levee Superiority) on Feather River and Sutter Bypass	Increase the resilience of the existing levee system by providing designated overtopping locations similar to spillways.	X		
Improve Upstream Fish Passage in Sutter Bypass (Remove Fish Passage Barriers)	Identify and remove fish passage barriers in the Sutter Bypass.	X		
Sutter Bypass Sediment Removal	Remove sediment that may have accumulated in the Sutter Bypass.		X	This measure is considered maintenance. Maintenance is outside of this study's scope and is the responsibility of the California Department of Water Resources.
Vegetation Management in Sutter Bypass	Manage vegetation that affects flood stages within the Sutter Bypass.		X	This measure is considered maintenance. Maintenance is outside of this study's scope and is the responsibility of the California Department of Water Resources.
Vegetation Management in Lower Feather River	Manage vegetation that affects flood stages within the Lower Feather River.		X	This measure is considered maintenance. Maintenance is outside of this study's scope and is the responsibility of the California Department of Water Resources.
Vegetation Management in Upper Feather River	Manage vegetation that affects flood stages within the Upper Feather River.		X	This measure is considered maintenance. Maintenance is outside of this study's scope and is the responsibility of the California Department of Water Resources.
Relocate Structures and Critical Infrastructure in Floodplain	Move structures and critical infrastructure away from floodplains.	X		
Floodproof Isolated Locations	Residential structures and other buildings would be evaluated for potential damages from floodwater entering the structure. Floodproofing techniques would be selected on a case-by-case basis.	X		
Elevate Structures and Transportation Infrastructure	Elevate structures, railroads, and highways.	X		

Measure	Measure Description	Retained	Dropped	Primary Reason(s) for Dropping Measure
Establish Flood-Resistant Housing	Construct flood-resistant housing.	X		
Secure Large Floatable Objects	Objects that might be mobilized and strike people during a flood event would be removed, relocated, or secured.	X		
Flood Warning System	Develop, establish and implement a system for warning the public about potential flood events.	X		
Evacuation Plan	Coordinate with local entities to establish and implement a plan for evacuation during a flood event.	X		
Construct Ring Levees at Isolated Locations	Construct ring levees around structures that are subject to damage from floodwaters.	X		
Flood Fight Pre-Staging Equipment and Supply Area	Establish designated sites within the study area for pre-staging flood fighting equipment and supplies.	X		
Multi-Use Trails	Establish an interconnected multiuse trail system.	X		
Bicycle Trails	Connect bike trails to a larger trail system, with a focus on Class 1 trails.	X		
Equestrian Trails	Equestrian trails are designed for horses and their riders. They are typically separated from bike and pedestrian trails.	X		
Day Use Area	Day use areas are staging or access points to recreation spaces that have their own specific uses.	X		
River Access	River access facilities allow the public to directly engage the water safely at controlled locations.	X		
Scenic Overlook	Construct wildlife viewing platforms and/or boardwalks on levees or flood risk–management lands for bird watchers and wildlife enthusiasts separate from main trails.	X		
Recreational Parkway	This measure compliments the multi-use trail measure by preserving natural areas and wildlife habitat along the trail system.	X		

Table 3-2. Summary of Themes and Conceptual Alternatives

	Theme or Alternative												
Management Measure	**Theme 1: Consequence Management Focused on Public Safety**	**Conceptual Alternative 1.1: Nonstructural**	**Theme 2: Urban FRM Focus**	**Conceptual Alternative 2.1: Ring Levees**	**Conceptual Alternative 2.2: Big J**	**Conceptual Alternative 2.3: Little J**	**Conceptual Alternative 2.4: Minimal Fix-in-Place**	**Conceptual Alternative 2.5: Fix-in-Place Thermalito to Star Bend**	**Theme 3: Maximize Existing System with FRM Emphasis**	**Conceptual Alternative 3.1: Fix-in-Place without Raising**	**Conceptual Alternative 3.2: Fix-in-Place without Raising, including Modest Setbacks**	**Theme 4: Ecosystem Emphasis**	**Conceptual Alternative 4.1: Setbacks with Ecosystem Restoration**
Biggs Ring Levee			*	X									
Gridley Ring Levee			*	X									
Live Oak Ring Levee			*	X									
Yuba City Ring Levee			*	X									
Fix-in-Place Feather River West Levee from Thermalito to Shanghai Bend			*		X	X	X SBFCA segments 4 and 5 only (Sunset Weir to Shanghai Bend)	X	*	X May include subreaches	X	*	X
Southern Portion of J-Levee			*			X							

Management Measure	Theme or Alternative												
	Theme 1: Consequence Management Focused on Public Safety	**Conceptual Alternative 1.1: Nonstructural**	**Theme 2: Urban FRM Focus**	**Conceptual Alternative 2.1: Ring Levees**	**Conceptual Alternative 2.2: Big J**	**Conceptual Alternative 2.3: Little J**	**Conceptual Alternative 2.4: Minimal Fix-in-Place**	**Conceptual Alternative 2.5: Fix-in-Place Thermalito to Star Bend**	**Theme 3: Maximize Existing System with FRM Emphasis**	**Conceptual Alternative 3.1: Fix-in-Place without Raising**	**Conceptual Alternative 3.2: Fix-in-Place without Raising, including Modest Setbacks**	**Theme 4: Ecosystem Emphasis**	**Conceptual Alternative 4.1: Setbacks with Ecosystem Restoration**
Fix-in-Place Feather River West Levee from Shanghai Bend to Sutter Bypass; plus Wadsworth Canal East Levee; plus Sutter Bypass East Levee			* South to Star Bend only		X Feather River north of Star bend and Shanghai Bend north of Gilsizer Slough		X Shanghai Bend to Star Bend	X Shanghai Bend to Star Bend	*	X May include subreaches	X	* Without Sutter Bypass fix-in-place	X Without Sutter Bypass fix–in-place
Sutter Bypass Setback Levee									*		O	*	X
Northern Feather River Setback Levee			*						*		O	*	X
Sutter Bypass and Feather River Confluence Setback Levee									*		X	*	X
Star Bend Setback Levee			*		X			X	*	X	X	*	X
Oroville Wildlife Area – Degrade Land Surface and Restore Wetlands					O	O				O	O	*	X
Southern Relief Structure	*	O	*						*	O	O	*	X
Sunset Weir Modification			*		O	O	O		*	O	O	*	X
Gilsizer Cross Levee with Flap Gates	*		*		X								

Management Measure	Theme 1: Consequence Management Focused on Public Safety	Conceptual Alternative 1.1: Nonstructural	Theme 2: Urban FRM Focus	Conceptual Alternative 2.1: Ring Levees	Conceptual Alternative 2.2: Big J	Conceptual Alternative 2.3: Little J	Conceptual Alternative 2.4: Minimal Fix-in-Place	Conceptual Alternative 2.5: Fix-in-Place Thermalito to Star Bend	Theme 3: Maximize Existing System with FRM Emphasis	Conceptual Alternative 3.1: Fix-in-Place without Raising	Conceptual Alternative 3.2: Fix-in-Place without Raising, including Modest Setbacks	Theme 4: Ecosystem Emphasis	Conceptual Alternative 4.1: Setbacks with Ecosystem Restoration
	Theme or Alternative												
Wadsworth Canal Tributary Drainage			*		0	0			*	0	0		
Managed Overtopping (Levee Superiority) on Feather River and Sutter Bypass			*		0	0	0		*	0	0		
Improve Upstream Fish Passage in Sutter Bypass (Remove Fish Passage Barriers)												*	X
Relocate Structures and Critical Infrastructure in Floodplain	*	0	*	0	0	0	0	0	*	0	0	*	0
Floodproof Isolated Locations	*	0	*	0	0	0	0	0	*	0	0	*	0
Elevate Structures and Transportation Infrastructure	*	0	*	0	0	0	0	0	*	0	0	*	0
Establish Flood-Resistant Housing	*	0	*	0	0	0	0	0	*	0	0	*	0
Secure Large Floatable Objects	*	0	*	0	0	0	0	0	*	0	0	*	0
Flood Warning System	*	X	*	X	X	X	X	X	*	X	X	*	X
Evacuation Plan	*	X	*	X	X	X	X	X	*	X	X	*	X
Construct Ring Levees at Isolated Locations	*	0	*	0	0	0	0	0	*	0	0	*	0

Management Measure	Theme 1: Consequence Management Focused on Public Safety	Conceptual Alternative 1.1: Nonstructural	Theme 2: Urban FRM Focus	Conceptual Alternative 2.1: Ring Levees	Conceptual Alternative 2.2: Big J	Conceptual Alternative 2.3: Little J	Conceptual Alternative 2.4: Minimal Fix-in-Place	Conceptual Alternative 2.5: Fix-in-Place Thermalito to Star Bend	Theme 3: Maximize Existing System with FRM Emphasis	Conceptual Alternative 3.1: Fix-in-Place without Raising	Conceptual Alternative 3.2: Fix-in-Place without Raising, including Modest Setbacks	Theme 4: Ecosystem Emphasis	Conceptual Alternative 4.1: Setbacks with Ecosystem Restoration
	Theme or Alternative												
Flood Fight Pre-Staging Equipment and Supply Area	*	X	*	X	X	X	X	X	*	X	X	*	X
Multi-Use Trails	*	O	*	O	O	O	O	O	*	O	O	*	O
Bicycle Trails	*	O	*	O	O	O	O	O	*	O	O	*	O
Equestrian Trails	*	O	*	O	O	O	O	O	*	O	O	*	O
Day Use Area	*	O	*	O	O	O	O	O	*	O	O	*	O
River Access	*	O	*	O	O	O	O	O	*	O	O	*	O
Scenic Overlook	*	O	*	O	O	O	O	O	*	O	O	*	O
Recreational Parkway	*	O	*	O	O	O	O	O	*	O	O	*	O

* = Included in theme.

X = Included in alternative.

O = Optional to alternative.

3.2 Measures and Alternatives Development

As part of the plan formulation process, the level of detail of design analysis was defined and maintained for the development of measures and alternatives by using available information, professional judgment, and risk-informed assumptions. The following are descriptions for each of the primary disciplines of the level of detail and assumptions used for the screening and development of conceptual alternatives on the way to determining a draft array of alternatives.

3.2.1 Level of Detail and Design Assumptions

The study planning process utilized two increasing levels of detail analysis to describe and determine the level of detail and potential uncertainty in the engineering, design, costs, and assumptions for the development of measures, conceptual alternatives, draft alternatives, and ultimately the final alternatives. The level of detail for the conceptual and draft array of alternatives was performed at a reconnaissance level or Class 4 Analysis with the final array of alternatives completed at the more detailed feasibility level or Class 3 Analysis.

The classes of analysis used are from EM 1110-2-1302, *Civil Works Cost Engineering*, and are based on ASTM E 2516-06, *Standard Classification for Cost Estimate Classification System*. The purpose of this classification system is to improve communication among all the stakeholders involved with preparing, evaluating, and using cost estimates (ASTM 2011). The five class definitions are described below.

- Class 5 is least accurate and is the minimum required for assessing rough order of magnitude. The level of project definition is 0% to 2% of a complete definition. A Class 5 cost estimate may vary from the best (Class 1) estimate by a magnitude of 4 to 20. Class 5 analysis was not used.
- Class 4 is the minimum required for Reconnaissance/905b Reports and alternative analysis in feasibility studies. The level of project definition is 1% to 15% of a complete definition. The expected cost accuracy (+/-) may vary from the accuracy of the best (Class 1) estimate by a magnitude of 3 to 12. Class 4 analysis was used for management measures and alternative development for the draft array of alternatives.
- Class 3 is the minimum required for analyzing the feasibility of the National Economic Development (NED) Plan and the Sponsor Preferred Plan. The level of project definition is 10% to 40% of a complete definition. The expected cost accuracy (+/-) may vary from the accuracy of the best (Class 1) estimate by a magnitude of 2 to 6. Class 3 analysis was used for validating the final array of alternatives.
- Class 2 is the minimum required for Preconstruction, Engineering, and Design up to 90% Plans and Specifications. The level of project definition is 30% to 70% of a complete definition. The expected cost accuracy (+/-) may vary from the accuracy of the best (Class 1) estimate by up to a magnitude of 3. Class 2 analysis was not used.
- Class 1 is the minimum required for Preconstruction, Engineering, and Design 100% Plans and Specifications and the Independent Government Estimate. The level of project definition is 50% to 100% of a complete definition. This is considered the most accurate estimate. It does not imply that all unknowns and risk are eliminated. Class 1 analysis was not used.

The management measures and draft array of alternative development were formulated at the Class 4 (reconnaissance) level of detail and design using construction quantities, costs, real estate

requirements, and economic benefits based on a parametric design approach and assumptions that were derived from professional judgment, standard design templates, and existing comparable cost information. Costs of the final array of alternatives were developed from a feasibility level of 35% design and detail or Class 3 Analysis to determine a TSP. See Section 3.9, *Final Array Economic Analysis*, for additional details.

3.2.1.1 Civil Design

3.2.1.1.1 Levee Heights

The following describes the approach to setting the design levee height for fix-in-place levee measures, ring levee measures, new levee measures, and setback levee measures.

Fix-in-Place Measures

Fix-in-place levee reaches would be reconstructed to the existing top of levee elevation or the 1957 design top of levee elevation, whichever is higher. The 1957 design profile and operations and maintenance manuals for the SRFCP define the currently authorized design flow, design water surface elevation, and minimum design top of levees. In no cases would the reconstructed levee height exceed the existing or 1957 design profiles.

The 1957 design profile top of levee is based on the 1957 design water surface profiles and the minimum freeboard specified in the 1951 operations and maintenance manuals. The SRFCP adopted multiple existing levees of varying height. The operations and maintenance manuals indicate the adopted levee segments met or exceeded the design freeboard. The 1957 design profile and freeboard are described in detail in the *Memorandum for File: Design of Existing Corps Project Features, December 2012*.

An increase or decrease to the currently authorized levee design height was considered but is not proposed because of project economics and possible adverse hydraulic effects that would transfer flood risk to other reaches of the system. One of the primary factors in USACE plan selection is maximizing net flood risk benefits (benefits minus costs). The increased costs of raising a levee relative to the minimal increase in flood damage benefits (no new structures with reduced risk) would have resulted in a decrease in the economic net benefits. Therefore, levee height increases were not pursued because they were judged to decrease net benefits.

Increases or decreases in the levee height would likely result in a transfer of flood risk within the system. For example, increasing the height of the Feather River West Levee without an increase in the East Levee would increase the probability of an overtopping failure of the East Levee. Likewise, a decrease in levee height of the West Levee without decreasing the East Levee would increase the probability of an overtopping failure of the West Levee. The floodwaters from an overtopping breach would not be confined to the area directly adjacent to the lowered levee and result in a transfer of risk.

New Levee Measures

The heights of new levee reaches were determined by reviewing the flood elevations from the hypothetical levee breaches near the levee area. Wind wave run-up analysis was also conducted, and the levee height was increased as necessary to provide similar levee assurance as the Feather River portion of the levee.

Levee Setback Measures

The design heights for all setback levee measures were based on the same height as the fix-in-place measures.

3.2.1.1.2 Levee Design

All existing and new levees under each alternative were assumed to have a design that meets current State of California and USACE standards for slopes (1V:3H waterside, 1V:2H or 1V:3H landside for existing or new slopes, crest width (20 feet), operation and maintenance, repair, replacement, and rehabilitation (OMRR&R), maintenance access (15 feet minimum for existing levees), and seepage and stability. The levees were assumed to perform to the 1957 levee design profile. To achieve this performance, seepage control measures were included in every alternative based on a parametric approach explained below.

- The parametric levee design approach utilized nine levee cross sections that represent typical design configurations applicable to the study area levees. For parametric simplicity, low-impact soil-bentonite cutoff walls were assumed at this level of design, though a seepage berm, relief wells, or some other measure may be required.
- A set of applicable templates was assigned to each reach based on a review of the levee and soil conditions. Each template was then specified as a percentage of overall reach length. For example, a reach might include 20% soil-bentonite slurry wall template and 90% levee crest widening template (note that the totals can be more than 100%, even for seepage control measures). The basic parameters that define each template were then specified based on an assessment of the existing performance of the levee within each reach.
- Parametric templates were specified to meet current USACE geotechnical design requirements. Cutoff walls, instead of seepage berms, were typically specified for levee strengthening. In general, seepage berms and cutoff walls have roughly the same overall cost (considering real estate acquisition, and local contractor capability and expertise) but seepage berms usually have a greater environmental impact.
- Proposed fix-in-place seepage control measures, including type (e.g., berm, cutoff wall), sizing (depth, width), and length (or percentage of length) were based on the existing conditions report, and augmented by professional judgment, specific local knowledge, and geological and soil maps.

New levee alignments were based on a review of aerial photography and topographic features. Geographic placement was based on minimizing impacts on existing structures, environmentally sensitive areas, and features expected to require costly mitigation or relocation. The design objective was to maximize FRM benefits to existing structures while minimizing the length (cost) of a new levee.

3.2.1.2 Geotechnical Design

Geotechnical design template parameters for fix-in-place seepage control measures were based on "expected" or median values. Judgment was used to estimate the minimum and maximum possible values, followed by an assumption of a median value. For instance, a ring levee far from the river was assumed to require a cutoff wall for some portion of the ring, and the lowest possible value that was expected based on engineering judgment was selected (for instance 25%). Next, the highest

possible value was estimated (for instance 75%). The same approach was used for the depth of cutoff walls. Based on engineering experience, the expected value was estimated to lie between these extreme values. The median value was not necessarily a conservative value, nor was it the mean value.

Additional features necessary to meet current USACE standards were tabulated for each levee reach. Examples of additional features include utility penetrations, drainage culverts, and pipelines. Estimates of additional features were based on levee logs recently completed by the California Department of Water Resources (DWR).

3.2.1.3 With-Project Floodplains

With-project residual floodplains were estimated for each alternative. The floodplains for the with-project conditions were estimated using the modeled breaches under existing conditions. For the fix-in-place alternatives, only breaches in the unimproved levee reaches were included. For the ring and J-levee conceptual alternatives, the existing condition breach maps were modified to remove areas on the landside of the ring or J-levee.

3.2.1.4 Cost Estimates

Cost estimates were completed for each conceptual alternative. Construction quantities for levee improvements were developed from the levee design templates and levee logs. Construction quantities for relocations, additional non-levee features, and real estate were developed primarily from assessment of aerial imagery.

A levee improvement and new levees spreadsheet estimated the costs based on a parametric approach. The spreadsheet calculated the cost based on the design cross section templates and typical parameters within the reach (levee top width, height, etc.). The spreadsheet utilized a database of unit price data from public bid results, similar state projects, and other public agencies. Unit prices in the spreadsheet were reviewed and updated to reflect present costs. For each levee reach and selected design template, the design parameters and quantities provided by USACE civil and geotechnical engineers were utilized to generate the cost estimate.

Other major cost items including roads, railroads, and canals crossing new levees, utility relocations, interior drainage, traffic control, erosion control, cultural resources protection and mitigation, and fish and wildlife mitigation, along with corresponding project costs for Preconstruction, Engineering, and Design (PED), and Construction Management, were considered separately. The costs for work relative to obstructions and structures crossing levees (special items) and interior drainage (pump stations) were based on preliminary quantity take-offs, hydrological analysis, existing cost data for similar projects, and historic cost estimates for projects with similar work. A percentage of the construction costs were used to compute costs for the other major cost items.

3.2.1.5 Real Estate Costs

Real estate land costs were estimated using the same cost estimate parametric spreadsheet. The spreadsheet multiplies the estimated footprint area by the percentage of land in four typical categories found within the study area, specifically, agricultural, residential, commercial, and orchard. The percentage of land within each category was based on a review of the linear distribution in recent aerial photography. The approximate land costs of each category were based

on a range of values (high and low) provided by the appraisal section. The costs included in the parametric spreadsheet were based on the average of the high and low values within each category.

Real estate and structure relocation cost estimates were developed for each alternative based on estimated rights-of-way. Acreage was calculated using the levee template parameters within each design reach.

Real estate acquisition costs were assumed to be less for existing levees because they are likely to be within an existing right-of-way. The costs were estimated based on historical USACE projects. Actual values would vary significantly because each parcel is unique.

The total estimated real estate cost for alternatives is the summation of the costs from the parametric spreadsheet output, the costs developed for special items and interior drainage, and the costs of the other major cost items (as a percentage of construction cost).

3.2.1.6 Economics

Economic benefit ranges were estimated for each conceptual alternative. The maximum economic benefit of fixing all levees to their design height was estimated. For each alternative, the benefit was estimated by applying a ratio based on the without- and with-project floodplains. The results were used to screen out those conceptual alternatives that did not appear economically justified even in the most favorable benefit/cost ratio ranges.

3.2.2 Conceptual Alternative Screening and Evaluation

A combined Value Engineering (VE) Study and Planning Charette (workshop) screened and evaluated the conceptual alternatives developed during the initial management measurement efforts. VE methodology was incorporated into the planning process to compare, refine, and optimize alternatives based on multiple criteria to ensure a robust array of alternatives. The VE Study/Charette process also provided an opportunity to validate the array of conceptual alternatives and to ensure that significant alternatives had not been overlooked.

Initial alternative evaluation criteria were reviewed and expanded using VE Study criteria and Charette Team input. Final criteria were used to assess each alternative in conjunction with the conceptual level cost estimates and economics for each alternative. The VE Study/Charette used the following criteria to rate and evaluate the conceptual alternatives and respective measures.

- Life safety – focused on potential loss of life, health impacts, and associated life safety services.
- Flood damage benefits – focused on reduction of flood damages to property.
- Critical infrastructure impacts – focused on impacts on critical public services infrastructure, utilities, transportation, and communication.
- Design capacity exceedance – focused on flood risks after the project is constructed that are above and beyond those risks being addressed by the project.
- Wise use of floodplain (minimize growth inducement in the floodplain) – focused on characteristics that could encourage or facilitate growth in the floodplain in an unwise manner.
- Sustainability – emphasizing the extent to which future funds and effort will be required to sustain the project measures once built.

- Ecosystem functionality – focus was on the project's ability to maintain or enhance the natural environment to support a functioning ecosystem.
- Environmental impacts – focused on the project's temporary and permanent impacts on the environment.

As part of this evaluation and VE analysis, the construction of setback levees to reduce flood risk was determined to be not as cost effective or as efficient, in terms of higher construction, environmental, and real estate costs, for addressing the existing levee geotechnical issues as compared to the fix-in-place measures. The study objectives state that ecosystem restoration and recreation opportunities and measures needed to be in conjunction to FRM measures (setback or fix-in-place measures). Setback levees address FRM issues and also provide opportunities at the newly created waterside areas for ecosystem restoration and recreation. Fix-in-place measures do not have associated or conjunctive ecosystem or recreation opportunities. Any ecosystem restoration and recreation will need to be independent of the FRM fix-in-place measures.

The Feather River levees differ from other California levees such as the Sacramento River in that in the majority of reaches the levees are already setback hundreds of feet from the river channel with this connected floodplain area consisting of remnant riparian, fallow, and agriculture areas. During the analysis, it was determined that these existing remnant riparian and fallow areas provide better and less costly opportunities for ecosystem restoration and recreation that can be pursued independently from the study.

With setback levees screened out, and better independent opportunities identified for both ecosystem restoration and recreation in the existing waterside areas, the ecosystem restoration and recreation objectives were not further considered.

An independent nonstructural alternative was determined not cost efficient compared to use of structural measures, and not practical for the established communities of the study area. Certain nonstructural measures were carried forward for each of the draft alternatives such as developing a flood warning system and implementing emergency evacuation planning.

Based on these screening criteria discussions and decisions during the VE Study/Charette, conceptual alternatives with very similar functions were combined and consolidated to a preliminary draft array as shown in Table 3-3.

The VE Study/Charette evaluation and further formulation resulted in a final refinement of this preliminary array of alternatives and their associated common measures. Two additional alternatives (SB-7 and SB-8) were identified during this formulation step to provide additional flood risk reduction by including an additional fix-in-place levee section from Star Bend to Laurel Avenue. The resulting alternatives and their respective measures defined and completed a draft array of eight alternatives (Table 3-4).

Table 3-3. Preliminary Array of Alternatives

Management Measure	Preliminary Alternative				
	Primarily Nonstructural Measures with Minimal Levee Improvement Reaches	**Yuba City Ring Levee**	**Little J-Levee**	**Fix–in-Place Feather River Levees Thermalito to Star Bend**	**Fix-in-Place Feather River[a], Sutter Bypass[b], and Wadsworth Canal[c] Levees**
Yuba City Ring Levee		X			
Fix-in-Place Feather River West Levee from Thermalito to Shanghai Bend	X SBFCA segments 4 and 5 only (Sunset Weir to Shanghai Bend)		X	X	X
Southern Portion of J-Levee			X		
Fix-in-Place Feather River West Levee from Shanghai Bend to Sutter Bypass; plus Wadsworth Canal East Levee; plus Sutter Bypass East Levee				X Shanghai Bend to Star Bend	X
Sutter Bypass Setback Levee					0
Northern Feather River Setback Levee			0	0	0
Sutter Bypass and Feather River Confluence Setback Levee					0
Star Bend Setback Levee	0	0	0	0	0
Oroville Wildlife Area – Degrade Land Surface and Restore Wetlands	0	0	0	0	0
Southern Relief Structure	0	0	0	0	0
Sunset Weir Modification	0		0		0
Managed Overtopping (Levee Superiority) on Feather River and Sutter Bypass	0		0	0	0
Improve Upstream Fish Passage in Sutter Bypass (Remove Fish Passage Barriers)					0
Sutter Bypass Sediment Removal			0	0	0
Relocate Structures and Critical Infrastructure in Floodplain	0	0	0	0	0
Floodproof Isolated Locations	0	0	0	0	0

Management Measure	Preliminary Alternative				
	Primarily Nonstructural Measures with Minimal Levee Improvement Reaches	**Yuba City Ring Levee**	**Little J-Levee**	**Fix–in-Place Feather River Levees Thermalito to Star Bend**	**Fix-in-Place Feather River[a], Sutter Bypass[b], and Wadsworth Canal[c] Levees**
Elevate Structures and Transportation Infrastructure	O	O	O	O	O
Establish Flood-Resistant Housing	O	O	O	O	O
Secure Large Floatable Objects	O	O	O	O	O
Flood Warning System	X	X	X	X	X
Evacuation Plan	X	X	X	X	X
Construct Ring Levees at Isolated Locations	O	O	O	O	O
Flood Fight Pre-Staging Equipment and Supply Area	X	X	X	X	X
Multi-Use Trails	O	O	O	O	O
Bicycle Trails	O	O	O	O	O
Equestrian Trails	O	O	O	O	O
Day Use Area	O	O	O	O	O
River Access	O	O	O	O	O
Scenic Overlook	O	O	O	O	O
Recreational Parkway	O	O	O	O	O

X = Included in alternative.

O = Optional / Not Further Pursued in an alternative.

[a] Feather River West Levee from Thermalito to Sutter Bypass.

[b] Sutter Bypass East Levee, Wadsworth Canal to Feather River.

[c] Wadsworth Canal East Levee, East Interceptor to Sutter Bypass.

Table 3-4. Draft Array of Alternatives and Associated Management Measures

	Alternative							
Management Measure	**Alternative SB-1: No Action**	**Alternative SB-2: Minimal Fix-in-Place Feather River Levees: Sunset Weir to Star Bend**	**Alternative SB-3: Yuba City Ring Levee**	**Alternative SB-4: Little J-Levee**	**Alternative SB-5: Fix-in-Place Feather River Levees: Thermalito Afterbay to Star Bend**	**Alternative SB-6: Fix-in-Place Feather River, Sutter Bypass, and Wadsworth Canal Levees**	**Alternative SB-7: Fix-in-Place Feather River Levees: Sunset Weir to Laurel Avenue**	**Alternative SB-8: Fix-in-Place Feather River Levees: Thermalito Afterbay to Laurel Avenue**
Yuba City Ring Levee			X					
Southern Portion of J-Levee				X				
Fix-in-Place Feather River Levee: Thermalito to Sunset Weir				X	X	X		X
Fix-in-Place Feather River Levee: Sunset Weir to Shanghai Bend		X		X	X	X	X	X
Fix-in-Place Feather River Levee: Shanghai Bend to Star Bend		X			X	X	X	X
Fix-in-Place Feather River Levee: Star Bend to Laurel Avenue						X	X	X
Fix-in-Place Feather River Levee: Laurel Avenue to Sutter Bypass						X		
Fix-in-Place Wadsworth Canal East Levee Plus Sutter Bypass to East Levee						X		
Flood Warning System	X	X	X	X	X	X	X	X
Evacuation Plan	X	X	X	X	X	X	X	X
Flood Fight Pre-Staging Equipment and Supply Area	X	X	X	X	X	X	X	X

3.3 Draft Array of Alternatives

The draft array of alternatives represents eight alternatives ranging from fixing-in-place existing Feather River levees to constructing new ring or J-shaped levees in combination with fixing-in-place other levee sections. The draft array was then further evaluated and screened to identify and determine a final array of alternatives with appropriate level of detail, risk-informed decisions, use of existing data and information, and use of professional judgment. Some general determinations and measures common to all draft alternatives being carried forward, except for Alternative SB-1: No Action, are listed below.

- All alternatives include the nonstructural measures of a flood warning system, emergency evacuation plan, and flood fight pre-staging equipment and supply areas.
- A southern relief structure (a levee section removal) measure for addressing post-basin flood drainage relief is being deferred and recommended as a separate local initiative.
- Fix-in-place levee improvements refer to the seepage control measure of slurry cutoff wall in addition to some other measures at levee infrastructure penetrations (see Table 3-5).
- The Star Bend levee section is assumed to be a fix-in-place measure for all alternatives.
- The structural measures for all the alternatives were focused on fix-in-place features of the existing Feather River levees or construction of new levees.

3.3.1 Engineering Features for Draft Alternatives

A range of engineering features was further developed and confirmed at the Class 4 Analysis level of detail and design (reconnaissance level) for each draft alternative. These engineering features consisted primarily of under-seepage design solutions, specifically, fix-in-place existing levees with design measures of berms or cutoff walls, or constructing new levees. All features were inclusive of real estate needs for easements, relocations, utilities, and encroachments. Table 3-5 presents the general engineering features developed for the draft array of alternatives consisting of fix-in-place or new levees.

Table 3-5. Engineering Features of the Draft Array of Alternatives

	Alternative							
Engineering Feature	**SB-1**	**SB-2**	**SB-3**	**SB-4**	**SB-5**	**SB-6**	**SB-7**	**SB-8**
Gravel Stability Berm (Fix-in-Place)		X	X	X	X	X	X	X
Centerline Soil-Bentonite Slurry Cutoff Wall (Fix-in-Place)		X	X	X	X	X	X	X
New Levee			X	X				
New Levee with Centerline Soil-Bentonite Slurry Cutoff Wall (Fix-in-Place)			X	X				
Levee Crest Widening (Fix-in-Place)		X	X	X	X	X	X	X

3.3.2 Alternative SB-1: No Action

Under the No Action Alternative, or the future without-project condition, the Federal government would take no action toward implementing a specific flood risk–management plan. The economic evaluation necessary to determine if the locals will received Section 104 credit requires the USACE to assume for planning purposes that the local agencies will take no action in improving levees within the study area. Current maintenance practices and OMRR&R manuals would continue to be followed on the existing levees. The entire study area would continue to be at high risk of flooding and would rely on emergency responses and flood fighting to ensure the public and life safety of local communities. Significant damage to property and potential loss of life could occur if existing project levees fail. Subsequent improvements to the existing project levees would be done under

emergency or post-failure conditions. Emergency costs associated with evacuation, flood fighting, fire and police services, and government disruptions would result. Transportation and evacuation routes throughout the area could be severely restricted by a flood event, and critical infrastructure could be rendered nonfunctional for an extended period of time after the flood event. See Figure 3-1.

3.3.3 Alternative SB-2: Minimal Fix-in-Place Feather River Levees: Sunset Weir to Star Bend

This alternative includes the fix-in-place levee structural measures and nonstructural measures. Alternative SB-2 focuses on strengthening the existing Feather River levee in the immediate vicinity of Yuba City and would reduce risk to the Yuba City urban core. See Figure 3-1.

3.3.4 Alternative SB-3: Yuba City Ring Levee

This alternative includes the construction of new levee sections surrounding Yuba City. The eastern section of the ring levee would utilize the existing levee and would be fixed-in-place. Two new pump stations were assumed to be required to address interior drainage caused by the new levees for areas inside the ring levee. This alternative would reduce flood risk and isolate the primary urban boundary of Yuba City. See Figure 3-1.

3.3.5 Alternative SB-4: Little J-Levee

This alternative is a nonstructural/structural hybrid that includes fixing-in-place the Feather River levees north of Yuba City from Shanghai Bend to Thermalito, and the construction of a new levee to the south and west of Yuba City (little J). Fix-in-place levee and new levee structural measures and nonstructural measures are included in this alternative. This alternative assumes two new pump stations to address interior drainage. Reduction of flood risk would be centered in Yuba City and the northeastern part of the Sutter Basin. See Figure 3-1.

3.3.6 Alternative SB-5: Fix-in-Place Feather River Levees: Thermalito Afterbay to Star Bend

This alternative includes Alternative SB-2 but further extends levee fix-in-place improvements north to Thermalito Afterbay. Alternative SB-5 includes fix-in-place levee structural measures and nonstructural measures. Reduction of flood risk would extend from around the Yuba City area into the Sutter Basin's northern area and communities. See Figure 3-2.

3.3.7 Alternative SB-6: Fix-in-Place Feather River, Sutter Bypass, and Wadsworth Canal Levees

This alternative consists of fix-in-place improvements to the Sutter Bypass and Wadsworth Canal levees and the Feather River levees from Thermalito Afterbay to Laurel Avenue. Alternative SB-6 includes fix-in-place levee structural measures and nonstructural measures. Flood risk would be reduced most extensively throughout the entire basin except near the Cherokee Canal area. See Figure 3-2.

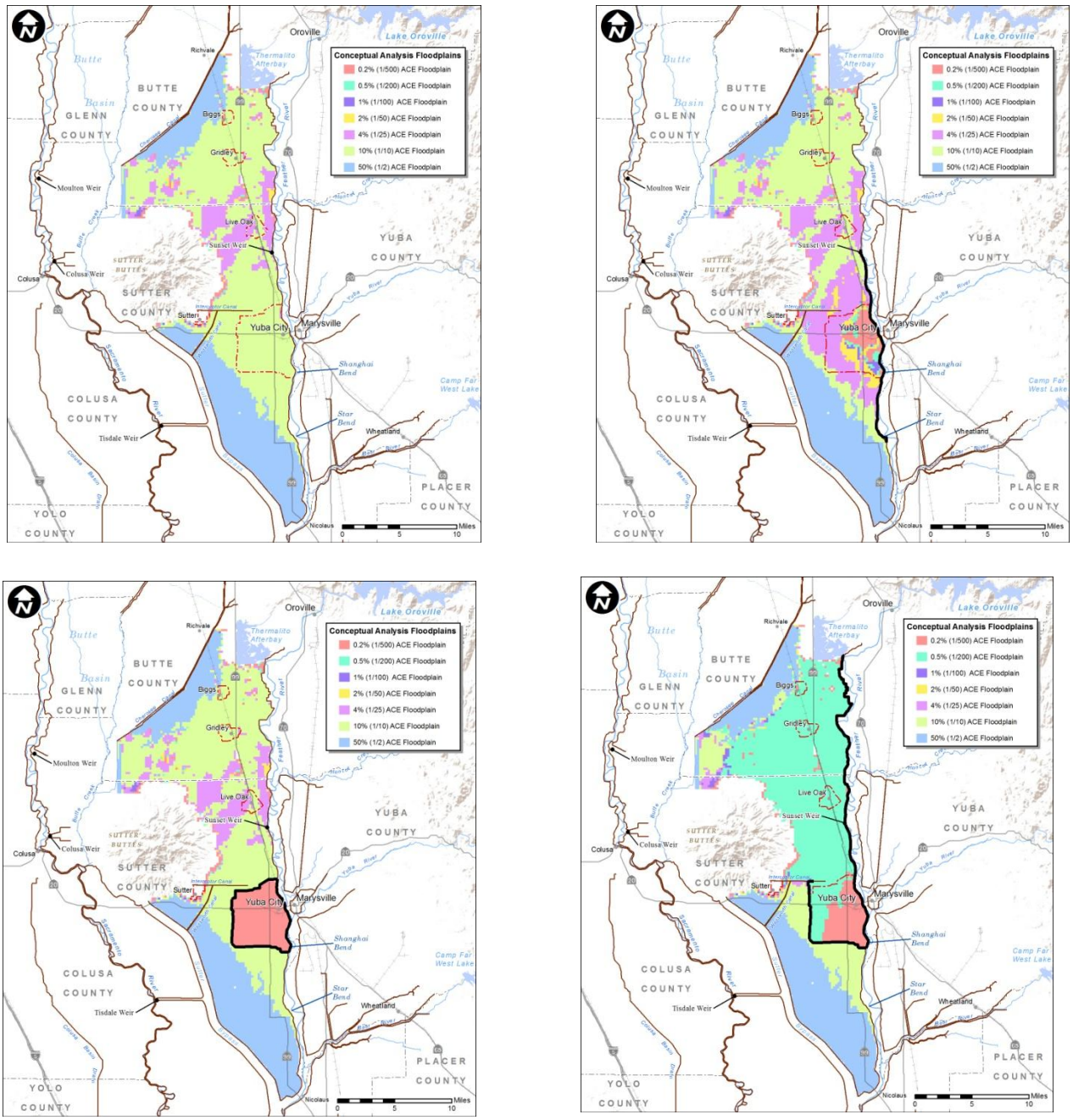


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Figure 3-1. Alternatives SB-1, SB-2, SB-3, and SB-4

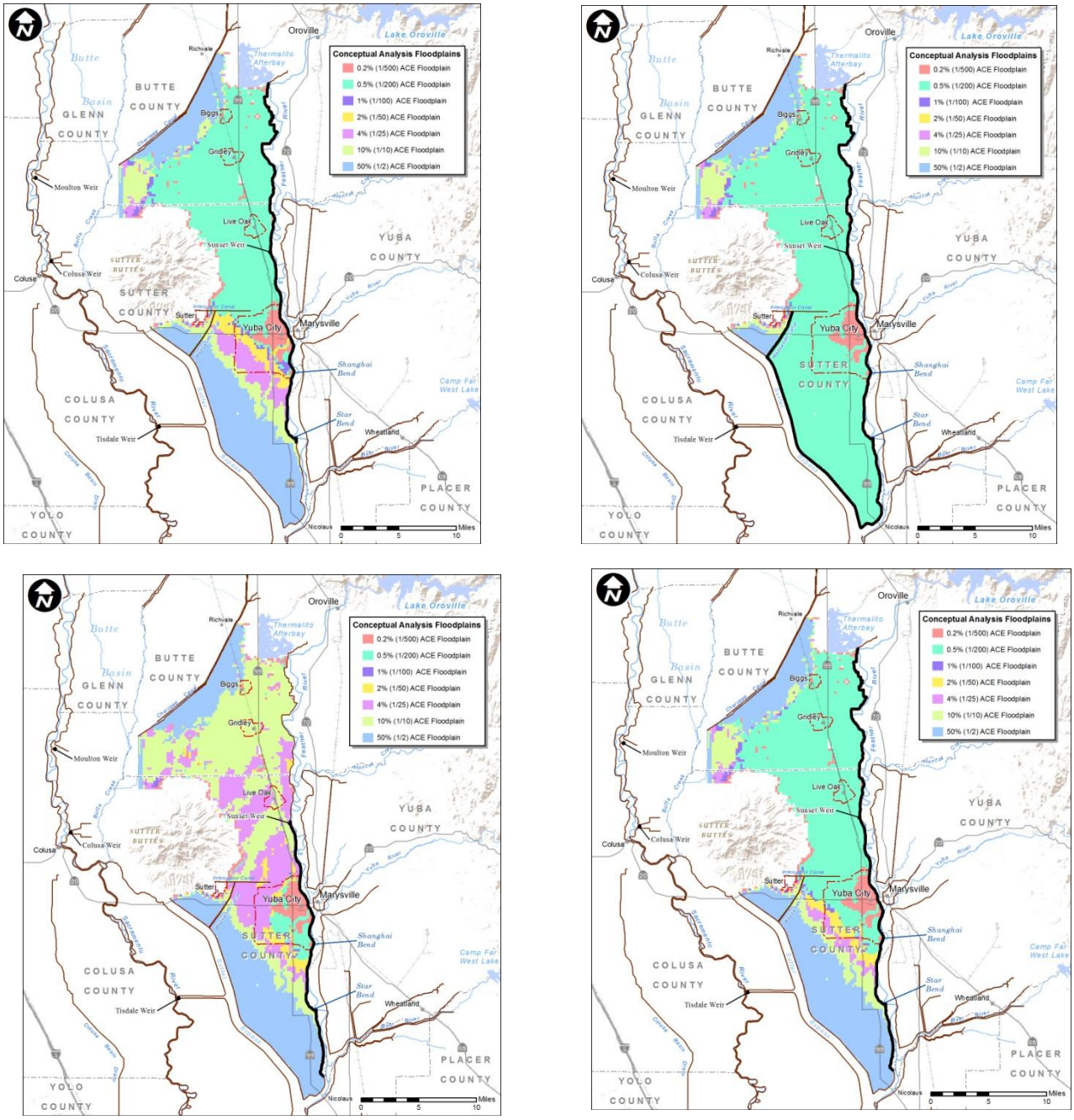

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Figure 3-2. Alternatives SB-5, SB-6, SB-7, and SB-8

3.3.8 Alternative SB-7: Fix-in-Place Feather River Levees: Sunset Weir to Laurel Avenue

This alternative includes Alternative SB-2 but extends Feather River fix-in-place levee improvements south of Yuba City to a point 2,250 linear feet downstream of Laurel Avenue. Alternative SB-7 includes fix-in-place levee structural measures and nonstructural measures. The additional increment of levee improvements includes the flood risk–reduction benefits of Alternative SB-2 and provides additional flood risk–reduction benefits in the most southern areas of Yuba City. See Figure 3-2.

3.3.9 Alternative SB-8: Fix-in-Place Feather River Levees: Thermalito Afterbay to Laurel Avenue

This alternative includes Alternative SB-7 but extends Feather River levee improvements north to Thermalito Afterbay. Alternative SB-8 includes fix-in-place levee structural measures and nonstructural measures. Alternative SB-8 includes all the flood risk benefits of all of Alternative SB-7. However, Alternative SB-8 would also provide extensive flood risk reduction in the northern areas, including the communities of Live Oak, Gridley, and Biggs. See Figure 3-2.

3.4 Evaluation Strategy of Draft Alternatives

The plan formulation evaluation strategy for the draft alternatives was based upon existing policy and guidance (ER 1105-2-100) to determine a final array of alternatives and a Recommended Plan (RP).

3.4.1 Federal Planning Criteria

Federal planning criteria were used as the screening structure for the first level screening of the draft array of alternatives.

3.4.1.1 Acceptability

The local sponsors (Sutter Butte Flood Control Agency [SBFCA] and Central Valley Flood Protection Board [CVFPB]) and the public are highly aware of the Basin's flood risk. The sponsors and community continue their support and acceptance of the FRM efforts. All alternatives for the Sutter Basin with a strategy to reduce flood risk and life safety risk have sponsor support and acceptance. Further, all alternatives are acceptable because they are compatible with existing laws, regulations, and public policies. No further evaluation and screening were necessary for this criterion.

3.4.1.2 Effectiveness

Within identified constraints of the study, each alternative in the draft array addresses all of the planning objectives regarding FRM and life safety to varying degrees. No further evaluation and screening was necessary for this criterion.

3.4.1.3 Efficiency

This criterion is defined in terms of cost efficiency of economic residual annual damages and FRM analysis for annual net benefits. As part of the analysis for cost efficiency, the NED Plan is identified as the alternative that reasonably maximizes annual net benefits. The draft array of alternatives will be screened for cost efficiency using economic criteria.

3.4.1.4 Completeness

The definition of "completeness" from the Planning Guidance Notebook is, "the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-federal entities." The study further defines a complete and effective alternative as one that best meets the study objectives of reducing flood risk and damages and minimizes the resulting residual flood risk to public and life safety. Completeness is evaluated using metrics for public and life safety developed during the study.

3.4.2 Evaluation Metrics for Completeness

The evaluation metrics, as part of the multi-objective planning process to support the study objectives, were developed as a screening analysis tool to assist in organizing and evaluating alternatives across the system of planning accounts. These planning accounts are USACE tools used to categorize benefits of a project. The four accounts used are listed below.

- National Economic Development (NED).
- Environmental Quality (EQ).
- Regional Economic Development (RED).
- Other Social Effects (OSE) – public and life safety.

The evaluation metrics were partly aligned with the VE Study evaluation criteria. The metrics were developed to permit evaluation of the project beyond the traditional single account of NED. The metrics permitted the evaluation of the project by the other accounts of EQ, RED, and OSE with an emphasis on the study objective of public and life safety.

The pilot formulation process anticipated that evaluation and comparison of the alternatives in the draft array would be based on multiple criteria, including the following: monetary and nonmonetary effects; qualitative and quantitative data; and economic, public safety, environmental, and regional criteria. The evaluation metric criteria identified in Table 3-6 were based upon both existing USACE policy, including the Water Resources Council Principles and Guidelines criteria, and the Planning Guidance Notebook.

Table 3-6. Evaluation Metric Criteria and Study Objectives

Study Objectives	Evaluation Metric
(a) Reduce the risk to life, health, and public safety due to flooding	Population at Risk Critical Infrastructure-Life Safety Evacuation Routes
(b) Reduce the risk of property damage due to flooding	NED Costs NED Benefits
(c) Reduce the risk of damage to critical infrastructure due to flooding	Critical Infrastructure-Life Safety
(d) Encourage the wise use of the floodplain	Potentially Developable Floodplain (Acres)

For the EQ account, the study objectives state that ecosystem restoration and recreation opportunities and measures needed to be in conjunction to FRM measures. Viable measures to meet this objective were limited in this study to new setback levees that potentially reduced flood risk and created additional waterside areas for potential restoration and recreation.

The Feather River levees in the majority of the reaches of the study area are setback hundreds of feet from the main channel and river bank. These existing setback areas contain agricultural and remnant riparian areas still connected to the natural floodplain that provide better and more cost efficient independent opportunities for restoration and recreation in the study area. During plan formulation, setback measures were determined not an effective or cost efficient FRM measure compared to fix-in-place levee measures. Dropping setback measures from further consideration during the plan formulation process also eliminated ecosystem restoration and recreational opportunities from this study. Definitions of the study-specific evaluation metrics, aligned with VE/Charette evaluation criteria and strategy, are shown in Table 3-7.

Table 3-7. Description of Evaluation Metrics

Evaluation Metric	Description
Population at Risk (People)	Number of people within the 1% ACE floodplain[a] based on the 2010 census blocks.
Critical Life Safety Infrastructure (Facilities)	Number of fire stations, police stations, hospitals, senior living facilities, jails, etc. that are of life safety significance.
Evacuation Routes (Number of Routes)	The vulnerability of populations with regard to the number of escape routes available during flood events.
Potentially Developable Floodplain (Acres)	Potentially developable land within the 1% ACE floodplain with flood depths less than 3 feet. General determination of potential acres (supply).

[a] 1% ACE floodplains and residual 1% ACE floodplains are used to provide a standard comparison graphic. The 1% ACE is not a safety metric or study objective. A range and composite of flood events with ACE of 50%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% were used in the study analysis and evaluation. Larger events beyond the 1% ACE are possible and continued floodplain management actions will be needed to reduce residual flood risk.

3.4.2.1 Evaluation of Residual Risk of Draft Array of Alternatives

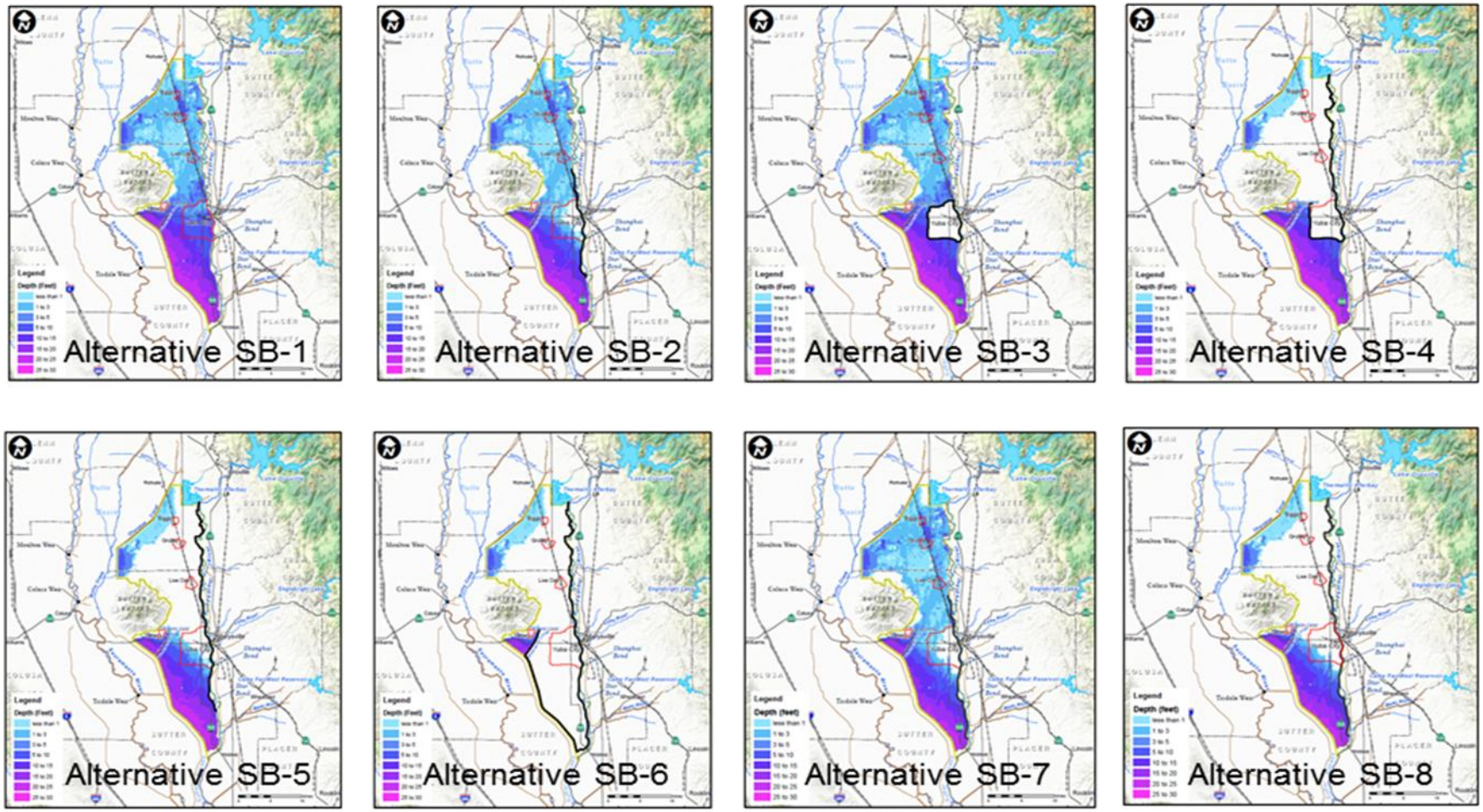
In order to conduct completeness criteria screening, a general qualitative ranking of the alternatives in the draft array was performed for residual risk focused on OSE planning to account for public and life safety. Evaluation metrics for public and life safety and the residual 1% ACE floodplain maps under the alternatives were used to evaluate alternatives at the appropriate level of detail and to provide an initial ranking and grouping of the draft alternatives. Public and life safety evaluation metrics factored in residual floodplains and the existing communities and population centers of Yuba City, Live Oak, Gridley, and Biggs (See Table 3-8 and Figure 3-3). Alternatives that removed communities and population from the residual floodplain were determined generally to have a lower residual risk ranking. The potentially developable floodplain metric was ranked according to the alternative's minimization of developable floodplain, which would reduce public safety risk in the future.

Table 3-8. Draft Array of Alternatives: Comparison of Residual 1% ACE Floodplain Risk

	Alternative							
Evaluation Metric	**SB-1**	**SB-2**	**SB-3**	**SB-4**	**SB-5**	**SB-6**	**SB-7**	**SB-8**
Population at Risk	5	3	3	2	2	1	3	2
Critical Infrastructure	5	4	4	2	2	1	4	2
Evacuation Routes Choices	5	4	4	2	2	1	4	2
Loss of Life	5	3	3	2	2	1	3	2
Minimizing Potentially Developable Floodplain	1	2	2	3	3	5[a]	2	3

Note: Qualitative rankings range from 5 (High Residual Risk) to 1 (Low Residual Risk).

[a] Only alternative with entire lower Basin in potentially developable floodplain.



(See the *Figures* folder on the CD for full-sized images.)

Figure 3-3. Residual Risk of Draft Array of Alternatives Using Residual 1% ACE Floodplains

Residual risk rankings were developed for each evaluation metric. The rankings provide a relative ranking of alternatives. Residual risk was defined for three areas: Yuba City area, northern communities area, and southern area, and ranked as follows:

- A 5 ranking is for maximum residual risk to public and life safety for urban areas and rural areas in the Basin.
- A 4 ranking is for reducing some residual risk to public and life safety in most of Yuba City and no reduction in risk in the northern community and rural areas.
- A 3 ranking is for reducing residual risk to public and life safety for most of Yuba City, and minimal northern urban areas and rural areas.
- A 2 ranking is for minimizing residual risk to public and life safety for the majority of urban areas (Yuba City, Live Oaks, Biggs, and Gridley), and for most of the northern rural areas.
- A 1 ranking is for minimizing residual risk to public and life safety for the entire Basin's urban and rural areas.

The residual risk comparison distributed the alternatives into two main groupings of high residual risk (Alternatives SB-1, SB-2, SB-3, and SB-7) and lower residual risk (Alternatives SB-4, SB-5, SB-6, and SB-8).The residual risk comparison presented a grouping of alternatives (SB-4, SB-5, SB-6, and SB-8) that had a generally low residual risk ranking compared with all draft alternatives. Alternative SB-6 had the lowest residual risk ranking, but with significant risk concerns related to potentially developable floodplain in the southern deeper floodplain end of the Basin.

3.4.3 Cost Efficiency

Cost efficiency was determined through economic analysis for the draft array of alternatives, and results were presented as residual annual damages and annual net benefits using the conceptual parametric costs at the Class 3 Analysis level of detail. The cost effectiveness determination also identified the NED Plan from the draft array.

3.4.3.1 Annual Net Benefits

Economic analysis provided annual net benefits and benefit-to-cost ratios (BCR) ranges that were evaluated for the draft array of alternatives in Table 3-9. Note that price levels and interest rates from this 2011 draft array screening analysis were not updated to current price levels and discount rates as it would not impact screening level decisions.

- The low annual benefit column represents the 75% confidence level that benefits will exceed the indicated value, the mid annual benefit represents the 50% confidence level, and the high annual benefit represents the 25% confidence level.
- The low annual cost represents the 20% confidence level that costs will be less than the indicated value, the mid annual cost represents the 50% confidence level, and the high annual cost represents the 80% confidence level that costs will be less than indicated.
- Net benefit and BCR mean values and ranges were calculated using Monte Carlo methodology Monte Carlo methods (or Monte Carlo experiments) are a broad class of computational algorithms that rely on repeated random sampling to obtain numerical results; i.e., by running simulations many times over in order to calculate those same probabilities heuristically just like

actually playing and recording your results in a real casino situation: hence the name. Monte Carlo methods are mainly used in three distinct problems: optimization, numerical integration and generation of samples from a probability distribution. The mean net benefit and BCR represent the mean result from this Monte Carlo method. The low to high range represent the 90% confidence range, with the mean value providing the best estimate. In an asymmetrical distribution, confidence is highest that net benefits and BCR will exceed the low values, and confidence of numbers reduces toward the high values. The mean values of this total range provide the best estimate.

3.4.3.2 Identifying the NED Plan

USACE criteria require the identification of a NED Plan. The economic analysis indicates that the NED alternative is Alternative SB-7 because it most reasonably maximizes annual net benefits compared with the other alternatives. Alternative SB-7 consists of fixing-in-place the existing Feather River West Levee from Sunset Weir down river to 2,250 linear feet beyond Laurel Avenue. The total first cost, which is the sum of all initial expenditures to construct a project, is estimated at $423 million with annual net benefits of $37 million. Figure 3-5 shows the Alternative SB-7 NED Plan and the resulting residual 1% ACE floodplain.

To validate and confirm the NED Plan, an evaluation is required to demonstrate that net benefits are maximized. Alternative SB-2, which has the next highest annual net benefits, was further evaluated in comparison with Alternative SB-7 in terms of other metrics such as life safety of population at risk, critical infrastructure, evacuation routes, and wise use of floodplains. Alternative SB-2 by definition is a minimal fix-in-place of Feather River levee sections consisting of fixing-in-place the Feather River levees from Sunset Weir up to and including Star Bend. The total first cost estimate is $319 million with annual net benefits of $29 million. Benefits are concentrated in the Yuba City center of the study area.

Alternative SB-7 consists of the Alternative SB-2 levee fixes (Sunset Weir to Star Bend) plus an additional 13.4 miles of levee fixes. This addition would reduce flood risk and associated life safety risk to additional areas of south western Yuba City. The additional investment of $104 million results in an increase in annual net benefits of $8 million. The incremental BCR is 2.6:1. Benefits for this additional reach are centered in Yuba City, but the alternative also addresses significant flood risk to the southern urban edge of Yuba City. Fixing this reach provides flood risk reduction to an additional approximately 18,500 people. See Figure 3-4.

When compared with Alternative SB-2, Alternative SB-7 reasonably maximizes economic benefits (Table 3-10). The comparison and evaluation confirmed Alternative SB-7 as the NED Plan with continued Federal interest and cost effectiveness. See Figure 3-5.

Table 3-9. Net Benefits/Benefit to Cost Ratio Ranges for the Draft Array of Alternatives, Using October 2011 Prices ($ Millions) and 4.0% Discount Rate

	Total First Cost[a]			IDC[b]	Annualized Cost + O&M[c]			Annual Benefits			Annual Net Benefits[d]			Benefits to Cost Ratio[e]		
Alternative	**Low (20%)**	**Mid (50%)**	**High (80%)**	**Mid**	**Low (20%)**	**Mid (50%)**	**High (80%)**	**Low (20%)**	**Mid (50%)**	**High (80%)**	**Low**	**Mean**	**High**	**Low**	**Mean**	**High**
SB-1: No Action	0	**0**	0	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**	0
SB-2: Minimal Fix-in-Place Feather River Levees: Sunset Weir to Star Bend	290	**319**	361	24	14	**16**	18	24	**38**	73	14	**29**	48	1.9:1	**2.9**:1	4.1:1
SB-3: Yuba City Ring Levee	411	**451**	507	53	21	**23**	26	25	**41**	71	8	**23**	40	1.3:1	**2.0**:1	2.7:1
SB-4: Little J-Levee	729	**798**	899	94	37	**40**	45	31	**46**	87	-3	**14**	36	0.9:1	**1.4**:1	1.9:1
SB-5: Fix-in-Place Feather River Levees: Thermalito Afterbay to Star Bend	549	**608**	694	72	28	**31**	35	29	**45**	81	4	**21**	41	1.1:1	**1.7**:1	2.3:1
SB-6: Fix-in-Place Feather River, Sutter Bypass, and Wadsworth Canal Levees	1,018	**1,131**	1,297	183	53	**59**	67	46	**73**	134	-3	**25**	58	0.9:1	**1.4**:1	2.0:1
SB-7: Fix-in-Place Feather River Levees: Sunset Weir to Laurel Avenue	386	**423**	479	41	19	**21**	24	32	**51**	92	18	**37**	60	1.8:1	**2.7**:1	3.8:1
SB-8: Fix-in-Place Feather River Levees: Thermalito Afterbay to Laurel Avenue	645	**713**	812	100	33	**36**	42	36	**58**	101	7	**28**	52	1.2:1	**1.8**:1	2.4:1

Note:

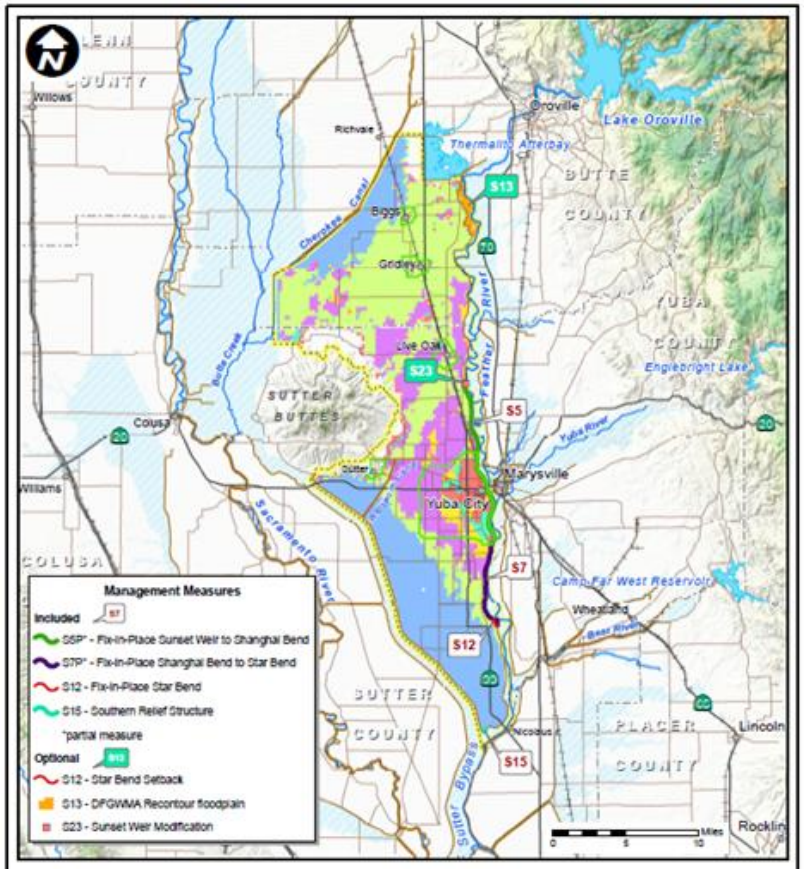
[a] Cost Range: Min = 20% Mid = 50% Max = 80% (confidence costs are less than given value).

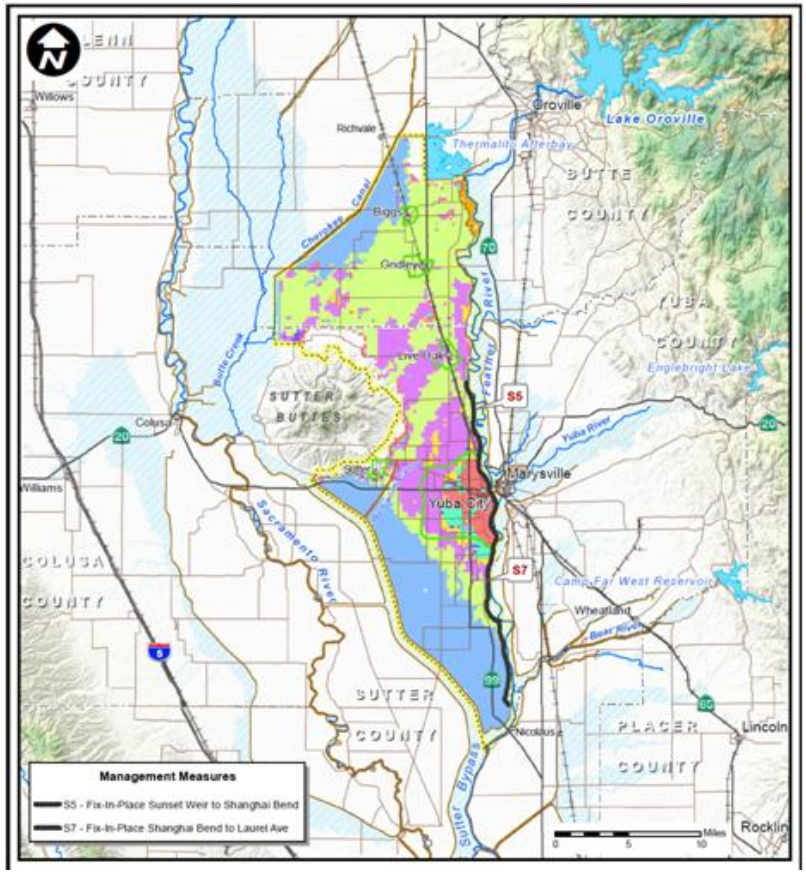
[b] IDC = Interest during construction, which is estimated interest accumulated until the project begins to accrue intended benefits. Here, IDC is based on equal annual spending over the following construction schedules: SB-2 = 3 years, SB-3 = 5 years, SB-4 = 5 years, SB-5 = 5 years, SB-6 = 7 years, SB-7 = 4 years, SB-8 = 6 years.

[c] First Cost plus IDC amortized over 50 years at 4% plus annual O&M. Annual O&M costs: SB-2 = $195k, SB-3 = $270k, SB-4 = $477k, SB-5 = $360k, SB-6 = $661k, SB-7 = $350k, SB-8 = $500k.

[d] Benefit Range: Min = 75% Mid = 50% Max = 25% (confidence benefits are greater than given value).

[e] Benefit to Cost values are a result of Monte Carlo simulations using triangular distributions of annual benefit and annual cost confidence intervals as inputs. Mean=Mean result from simulation.



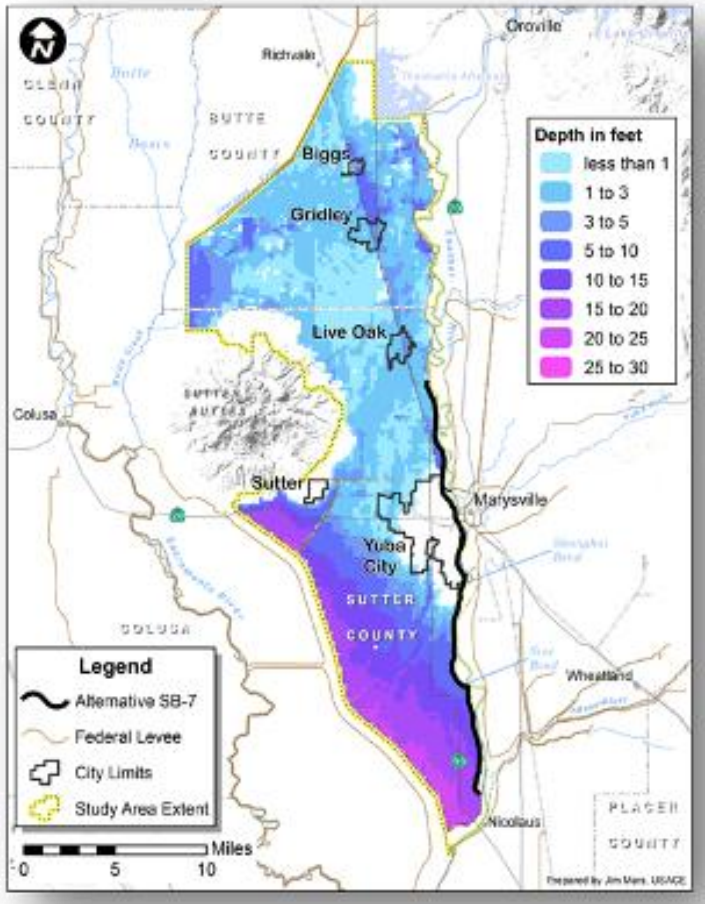


(See the *Figures* folder on the CD for full-sized images.)

Figure 3-4. Floodplains of Alternative SB-2 and SB-7

Table 3-10. Alternatives SB-1, SB-2, and SB-7 Comparison, Using October 2011 Prices ($Millions) and 4.0% Discount Rate

Item (from mean economic range number)	Alternative SB-1: No Action	Alternative SB-2	Alternative SB-7 (NED)
Investment Cost			
First Cost	-	319	423
Interest during Construction	-	24	41
Subtotal	-	343	464
Annual Cost	-		
Interest and Amortization	-	15.8	20.7
Operation, Maintenance, Repair, Replacement and Rehabilitation	-	0.2	0.4
Subtotal	-	16	21
Annual Flood Risk Management Benefits	-	38	51



(See the *Figures* folder on the CD for a full-sized image.)

Figure 3-5. Residual 1% ACE Floodplain of the NED Plan: Alternative SB-7

3.4.3.3 Efficiency Evaluation of Screened Residual Risk Alternatives

Upon the completion of the cost efficiency evaluation and analysis for the NED Plan, the alternatives previously identified and screened for completeness for their low residual life safety risk, Alternatives SB-4, SB-5, SB-6, and SB-8, were also evaluated and screened using cost effectiveness economic information. See Table 3-11. Using the cost efficiency screening criteria of maximized annual net benefits, Alternative SB-8 was identified, after the NED Plan, as the next most cost efficient alternative that also has low residual life safety risk, (i.e., Alternative SB-8 is more complete by study definition).

Table 3-11. Summation of Screened Alternatives for Completeness (Residual Risk) and Efficiency (Cost), Based on October 2011 Prices and 4.0% Discount Rate

Economic Metric ($ millions)	Residual Risk Screened Alternatives				
	SB-4	SB-5	SB-6	SB-8	SB-7 NED
Total First Cost	798	608	1131	713	423
Annual Benefits	46	45	73	58	51
Annual Net Benefits	14	21	25	28	37
Benefit to Cost Ratio	1.4:1	1.7:1	1.4:1	1.8:1	2.7:1

In summary, the completeness criteria screening identified Alternatives SB-4 and SB-8 as having low residual risk. The other two alternatives identified with low residual risk, Alternative SB-5 and SB-6, were both screened out as being less cost efficient. Alternative SB-6 was also screened out as having an unacceptable increase in potentially developable floodplain risk in the deep southern portion of the Basin relative to the other alternatives. Alternative SB-4 was put on hold from further consideration until later in the iterative formulation process due to its high cost ($798 million), low annual net benefits ($14 million), reduced life safety benefits in the southern Yuba City area, complexity, and high environmental impacts associated with new levee construction. The remaining Alternatives SB-7 and SB-8 were further evaluated for the final array.

3.4.4 Alternative Evaluation: NED Plan Residual Risk

The completeness criteria and the cost efficiency criteria screenings identified two alternatives for the final array: Alternative SB-7 as the NED Plan, and Alternative SB-8. Alternative SB-8 is the next most cost efficient alternative with low residual risk and can be considered as a potential Locally Preferred Plan (LPP). A LPP is defined as a plan that deviates from the identified NED Plan and is supported by the local sponsors. Identification of a LPP as the TSP requires ASA(CW) approval. As part of the iterative planning process, the NED Plan and Alternative SB-8 required a more a detailed residual risk screening, comparison, and evaluation using the evaluation metrics for public and life safety to further establish and verify a final array of alternatives.

3.4.4.1 Evaluation of the NED Plan Residual Risk and Mitigation Strategies

A next step in the screening for a final array of alternatives involved validating as part of the planning reiteration process the completeness of the NED Plan. This process required more detailed analysis of the NED Plan's residual risk and mitigation strategies using the evaluation metrics.

Residual risk of the NED Plan was assessed by the life safety metrics, described in Table 3-12. The NED Plan benefits are derived from reduction in adverse flooding effects, but benefits are primarily centered on the Yuba City area. The analysis of the NED Plan's residual 1% ACE floodplain (Figure 3-5) reveals that substantial residual risk to the communities of Biggs, Gridley, Live Oak, and southern areas of Yuba City would remain (Table 3-12) from under-seepage failures of the northern Feather River levees.

Table 3-12. Evaluation Metric Residual Risk Comparison

		Alternative	
Evaluation Metric	**Measurement**	**SB-1: No Action**	**NED Plan**
Population at Risk	People within 1% floodplain	94,600	38,200
Critical Infrastructure	Facilities within 1% floodplain	28	11
Evacuation Routes	Number of routes outside 1% floodplain	0	1
Potentially Developable Floodplain	Acres within 1% floodplain with depths less than 3 feet.	71,800	88,200

3.4.4.1.1 Population at Risk

Even with the implementation of the NED Plan, a population of 38,200 people would remain at risk from a 1% ACE flood event. Of special concern are people at least 65 years old who live within the study area, because those individuals experience a higher risk of life loss in flood events. Both Butte County (15.6%) and Sutter County (13.0%) are above the state average (11.7%) for percentage of persons 65 years of age and older. Flood events most likely would occur during the winter months' cold water and air temperatures.

Risk-Reduction Measures

There are no practical mitigation measures for addressing population at risk, such as relocating entire town populations, structures, and infrastructures. These measures were deemed infeasible to address residual risk in the established population centers of Live Oak, Gridley, and Biggs. Additional nonstructural measures were evaluated in Section 3.4.6.1.6, *Cost Effectiveness of Structural vs. Nonstructural Mitigation Measures*. These measures were considered cost prohibitive due to the numbers of structures involved and multiple urban locations covered, and would be socially and economically unacceptable and disruptive.

3.4.4.1.2 Critical Infrastructure

A significant amount of critical infrastructure is located within the study area floodplain, especially in the more populated northern area outside of Yuba City. Critical infrastructure is a term used by governments to describe assets that are essential for the functioning of a society and economy from a national perspective. Most commonly associated with the term are facilities for fire stations, police stations, hospitals, senior living facilities, and prisons. The benefits of the NED Plan (Alternative SB-7) would be primarily centered on Yuba City, leaving 11 elements of critical infrastructure in the communities of Live Oak, Gridley, and Biggs at risk from a 1% ACE event.

Critical Infrastructure Risk-Reduction Measures

Risk-reduction measures that could reduce loss of life and improve the function of critical infrastructure facilities that remain at risk from a 1% ACE event after implementation of the NED Plan were evaluated and screened.

- Ring levees to floodproof structures were considered to be ineffective for facilities like hospitals, correctional facilities, and assisted living centers, because the functionality of the facilities would be compromised by isolating facilities from the community during an average flood event, which is estimated to last 2–3 weeks (using historical Sutter Basin flood event data).
- Physically elevating smaller facilities such as police stations and fire stations might be economically justified, but their functionality during flood events would be compromised by isolating facilities from the community during a flood event.
- Relocation of critical infrastructure facilities was determined not effective in terms of expense and requirements of relocation structures too far from areas they are servicing due to floodplain footprint.
- Alternatives SB-4 and SB-8 provide structural fix-in-place or new levee measures that would effectively reduce loss of life and improve the function of critical infrastructure facilities left by the NED Plan.

Evacuation Routes

The primary urban centers in the study area are Yuba City, Biggs, Gridley, and Live Oak. These communities are all located on or near State Route 99, which runs north-south through the region. The Sutter County Evacuation and Mass Shelter/Care Plan identifies State Routes 20, 99, and 113 as the primary evacuation routes in the region. Evacuation routes are subject to change because they are event-specific and official evacuation routes are established by the county sheriff's office during an emergency. The Butte County Office of Emergency Management does not have published evacuation routes at this time, but anticipates State Routes 99 and 162 and the Colusa Highway could be used as conditions allow. Interior evacuation routes to the town of Sutter and Sutter Buttes could isolate evacuees within the Sutter Basin with limited support. The best emergency evacuation practices call for evacuating people out of the flooded areas to more secure and accessible locations whenever practical.

During the 1997 event, seven different evacuation zones needed to be established over seven days because of constantly changing conditions and levee breaks.

The main evacuation routes used for the 1997 flood event were State Route 99 north and State Route 113 south. State Route 20 west and State Route 99 south were used intermittently because not all portions of these roads were accessible at all times during the flood.

Evacuation preparation can be made days in advance for predictable flood events within the major river system in the study area. As river water levels rise and are predicted to reach flood stages, warnings would be reiterated and evacuation efforts increased. This would allow time for evacuation of immobile residents and other people with special evacuation needs (hospital patients, rest home residents, jail inmates, elderly individuals, school students) via the established routes. However, none of the historical flooding evacuations in the region has been due to foreseen events. Historical flood evacuations in the region have resulted from levee failures due to under-seepage, which is characterized by its unpredictability and resulting sudden levee failure. The result has been

evacuations after levees have failed and widespread flooding is in progress. The 1955 flood was due to a levee break in late December where no prior evacuation notice was given. In the 1997 flood, Yuba City was evacuated, but a levee on the east side of the Feather River near Olivehurst—which was not evacuated—unexpectedly failed.

The residual 1% ACE (1/100 year event) floodplain resulting from the NED Plan would affect every major urban center and nearly every primary evacuation route in the region. Although flood depths can be considered shallow (1 to 3 feet) in the northern area, the California Department of Transportation guidelines do not consider depths of flooding as a primary consideration for closure; it is the length or distance of roadways being flooded that determine road closures as directed by the California Highway Patrol.

The most critical levee breach scenario used to define the composite floodplain associated with the NED Plan would be a potential levee failure upstream of Sunset Weir resulting in flooding of the northern basin and communities. This breach location would cause flooding first in the northern area and communities, and continue to migrate south through Yuba City and into the deep southern basin area. All routes out of Biggs, Gridley, and Live Oak would be affected by the flood residual inundation. The only evacuation route from Yuba City would be provided by State Route 20 east into Marysville, which is a community surrounded by a ring levee with significant flood risk. Additionally, heading eastbound to Marysville entails driving over a four-lane bridge that may create a traffic bottleneck limiting the evacuation.

Evacuation Residual Risk Mitigation Measures

Specific measures to improve evacuation during a flood event were assessed and screened. Measures considered included modifying the elevations of roads used for evacuation.

- Flooding in the northern portion of the basin would involve extensive sheet flow (northeast to southwest) flood water movement. Elevating roadway embankments can result in even greater flood depths or redirecting the water to another roadway overtopping location. Any embankment modifications to roads and the railroad would need to be raised. Culverts would not be able to convey the flood flow. Therefore, most roadways would require extensive causeway type bridges or series of culverts.
- Raising roadways was considered to be cost and environmentally prohibitive relative to other measures due to the extensive construction, borrow, infrastructure, and real estate requirements.
- Raising the railroad that travels roughly north to south is considered to be more costly and complex than raising a vehicular road due to the larger footprint, more complex construction, extensive drainage infrastructure, and special requirements required by the railroad.
- Other internal evacuation routes from populated areas to the higher ground of Sutter Buttes or the town of Sutter were considered not viable due to the number of connector roads that would need to be raised. Evacuating to essentially an “island” at Sutter Buttes would be high risk and difficult to logistically support in emergencies. Evacuation out of the flooding area is always a best practice where practicable.
- Alternatives SB-4 and SB-8 provide structural fix-in-place or new levee measures that would effectively reduce residual risk by removing critical life safety infrastructure out of the

floodplain, creating critical additional evacuation routes and options for population centers in the northern area.

3.4.4.1.3 Potentially Developable Floodplains (Wise Use of Floodplains)

The NED Plan increases potentially developable floodplains as defined for this study to approximately 88,200 acres in Sutter Basin. The floodplain metric used in this analysis is a simple index based on basic physical parameters. The metric does not forecast future population growth, economic conditions, or government decisions that will constrain future floodplain development. Current measures in place to restrict or mitigate development in the Sutter Basin are listed below.

- Sutter and Butte County General Plans contain restrictive development policies for floodplains.
- Local policies, combined with recent state legislation and Federal regulations, are expected to limit land development.
- Conservation easements and Williamson Act contracts are in place, and the potential exists to expand use of these conservation tools.
- The State of California provides annual flood risk notifications to landowners.

3.4.5 Identification of the Final Array of Alternatives

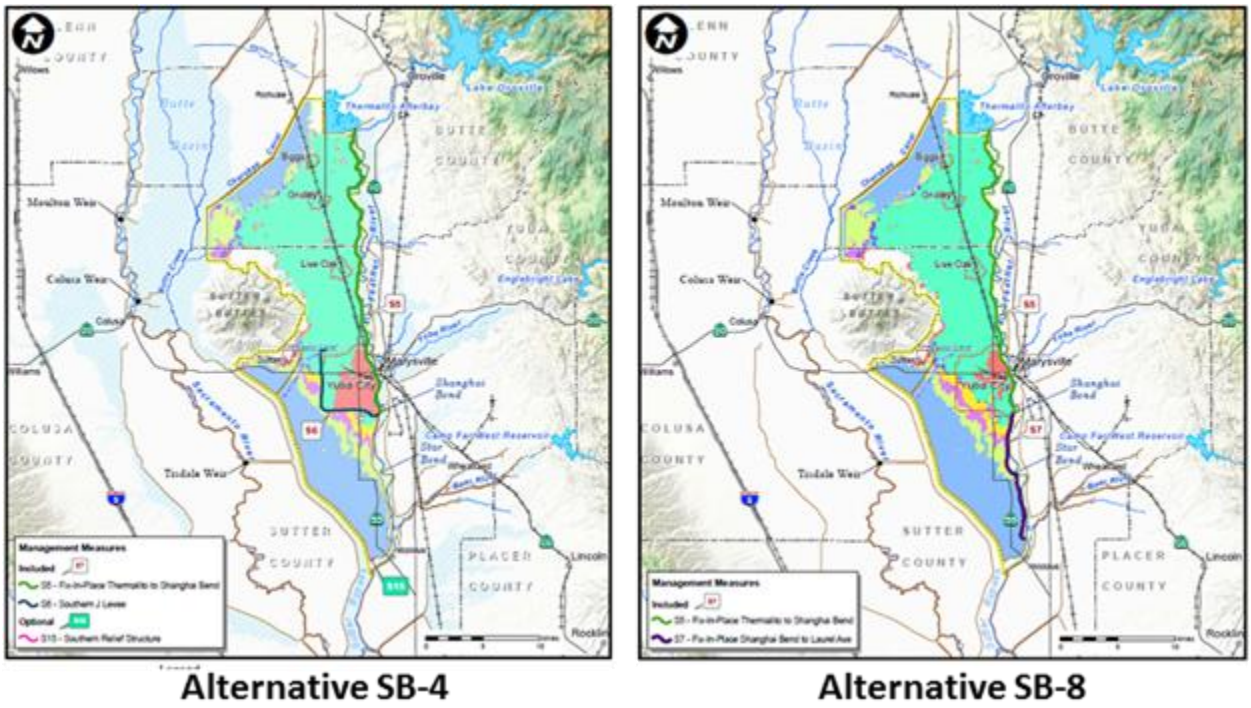
The NED Plan would reduce adverse flooding effects but significant residual risks would remain. Other alternatives and measures were evaluated and screened that would best mitigate the residual risk to life safety of the NED Plan. In summary, the completeness criteria screening identified Alternatives SB-4 and SB-8 as having low residual risk (see Figure 3-6). The other two alternatives identified with low residual risk, Alternatives SB-5 and SB-6, were both screened out as being less cost efficient. Alternative SB-6 was also screened out as having an unacceptable increase in potentially developable floodplain risk in the deep southern portion of the basin relative to the other alternatives.

Alternative SB-4 was dropped from further consideration due to its high cost ($798 million), low annual net benefits ($14 million), reduced life safety benefits in the southern Yuba City area, complexity, and high environmental impacts associated with new levee construction. This left Alternative SB-8 as a potential LPP alternative for the final array of alternatives.

3.4.6 Comparison of the Final Array of Alternatives

The screening process left the potential LPP, Alternative SB-8, as the alternative to be further evaluated and compared with the NED Plan. The levee fix-in-place extents of both the NED Plan (Alternative SB-7) and the potential LPP are shown in Figure 3-7. These two alternatives were evaluated in more detail using MCACES cost estimates, refined economic analysis and current price levels and interest rates.

Alternative SB-8 includes the NED Plan (Alternative SB-7), but contains additional fixes to existing project levees from Sunset Weir north to Thermalito Afterbay. These levee fix additions address the NED Plan's primary residual life safety risk in the northern area population centers of Live Oak, Gridley, and Biggs as shown on Figure 3-8. The geotechnical levee issues prevalent throughout all the levee sections and the hydraulic flow characteristics of the Feather River north of Yuba City necessitates addressing all the levee sections from Sunset Weir to Thermalito Afterbay.



(See the *Figures* folder on the CD for full-sized images.)

Figure 3-6. Floodplain Comparison of Alternatives SB-4 and SB-8

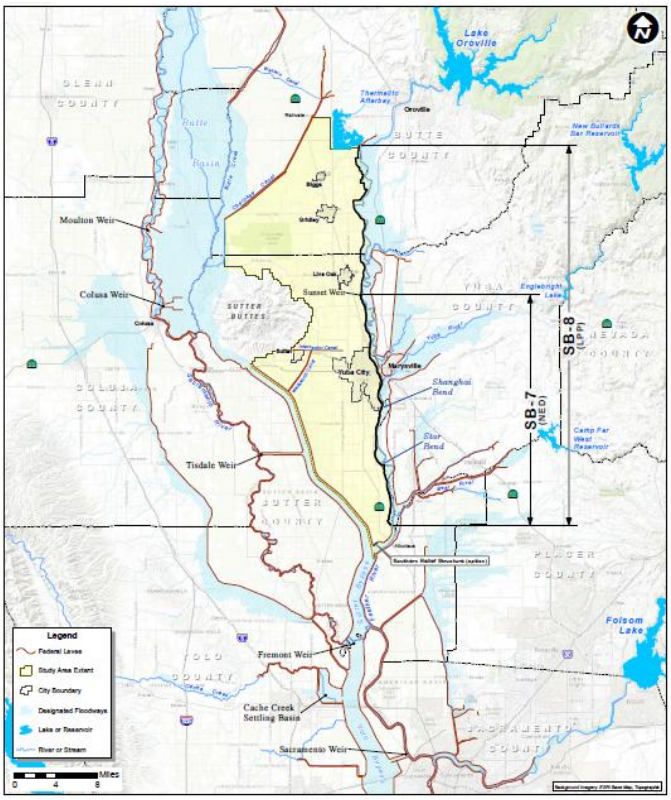


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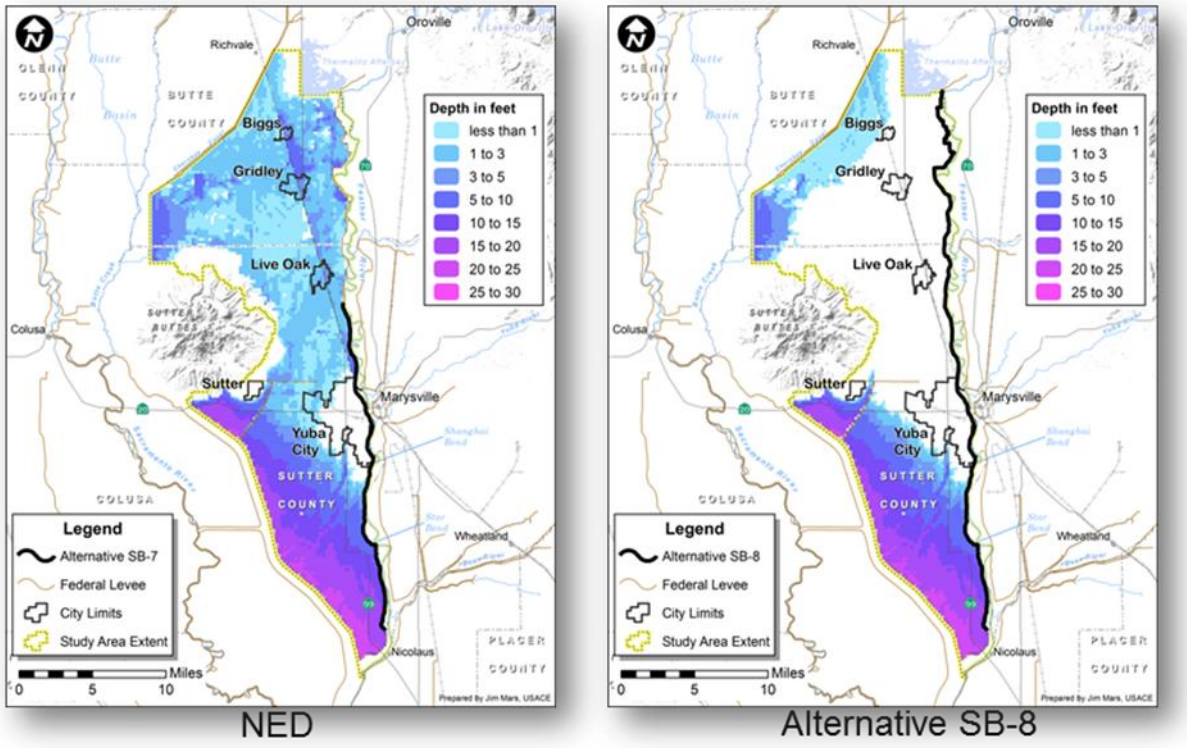
Figure 3-7. Alternative SB-7 (NED Plan) and SB-8 (LPP) Levee Extents



(See the *Figures* folder on the CD for a full-sized image.)

Figure 3-8. Residual 1% ACE Floodplains of the NED Plan and Alternative SB-8

3.4.6.1 Economic Comparison with the NED Plan

Alternative SB-8 has a roughly $297 million additional first cost (using the 80% confidence costs) and provides $7 million less in annual net benefits compared with the NED Plan. Alternative SB-8 is not incrementally economically justified, with a benefit to incremental cost ratio of approximately 0.5:1. However, Alternative SB-8 does provide additional annual benefits of $8 million and has a total benefit to cost ratio of 2.6 to 1 (see Table 3-13).

3.4.6.1.1 Population at Risk

The NED Plan would remove 60% of the basin population out of the 1% ACE floodplain while the LPP (Alternative SB-8) would remove 93% of the basin population out of the 1% ACE floodplain (see Table 3-14).

Life Safety Evaluation

To evaluate and estimate the potential loss of life and injury in a flood event that follows the planning modernization paradigm of employing sound qualitative analysis guided by professional judgment the Levee Screening Tool (LST) was used.

Table 3-13. Final Array of Alternatives – Incremental Probability Distributions Economic Comparisons (in millions)

Alternative	Total First Cost			IDC	Annualized Cost + O&M			Annual Benefits			Annual Net Benefits			Benefits to Cost Ratio		
	Low (25%)	Mid (50%)	High (75%)	Mid	Low (25%)	Mid (50%)	High (75%)	Low (75%)	Mid (50%)	High (25%)	Low	Mean	High	Low	Mean	High
SB-1: No Action	0	**0**	0	0	0	**0**	0	0	**0**	0	0	**0**	0	0	**0**	0
SB-7: Fix-in-Place Feather River Levees: Sunset Weir to Laurel Avenue	355	**370**	386	36	17	**17**	18	43	**64**	109	33	**54**	79	2.9:1	**4.1:1**	5.5:1
SB-8: Fix-in-Place Feather River Levees: Thermalito Afterbay to Laurel Avenue	632	**659**	688	92	31	**32**	33	46	**72**	120	22	**45**	73	1.7:1	**2.4:1**	3.3:1
SB-8 incremental cost and benefits compared with SB-7	277	**289**	302	56	14	**15**	15	3	**8**	11	-11	**-7**	-5	0.2:1	**0.5:1**	0.7:1

Note: See Section 3.4.3.1, *Annual Net Benefits*, for explanation of economic ranges and calculations.
IDC = interest during construction.

The LST provided a preliminary assessment of the general condition and associated risks of levee segments and systems in support of the USACE Levee Safety Program established in 2006 via the National Flood Risk Management Program. The LST provided an initial relative risk index to assist local, state, and Federal stakeholders in identification and prioritization of funding needs for levees of concern. Routine inspection data was combined with a preliminary engineering assessment to indicate the ability of a levee system to perform as intended and the consequences of potential failure (life loss and economic loss).

Table 3-14. Remaining Population at Risk within the 1% (1/100) ACE Floodplain

Community	NED Population Remaining at Risk	SB-8 Population Remaining at Risk	Reduction of Population at Risk
Yuba City	11,400	3,500	7,900
Biggs	1,500	20	1,480
Gridley	6,400	0	6,400
Live Oak	8,400	0	8,400
Rural Sutter County	5,800	3,100	2,700
Rural Butte County	4,800	20	4,780
Total	**38,200**	**6,600**	**31,600**

The computed fatalities under a breach scenario for the without-project condition (SB-1: No Action) are estimated to be 388 and 489 for day and night times, respectively. Table 3-15 indicates the results of the application of the LST to the estimated population under each alternative scenario. For the approximately 38,300 people at risk under Alternative SB-7, the potential loss of life estimate is 157 (day) and 197 (night). For the approximately 6,640 people at risk under Alternative SB-8, the potential loss of life estimate is 27 (day) and 34 (night).

Table 3-15. Loss of Life Estimate

	Alternative					
	SB-1		SB-7		SB-8	
Community	Day	Night	Day	Night	Day	Night
Biggs	6	8	6	8	0	0
Gridley	26	33	26	33	0	0
Live Oak	34	43	34	43	0	0
Yuba City	276	348	47	59	14	18
Rural Butte County	20	25	20	25	0	0
Rural Sutter County	26	32	24	30	13	16
Total	**388**	**489**	**157**	**197**	**27**	**34**

Note: The numbers generated by the Levee Screening Tool have very high uncertainties, and outputs are in the higher ranges.

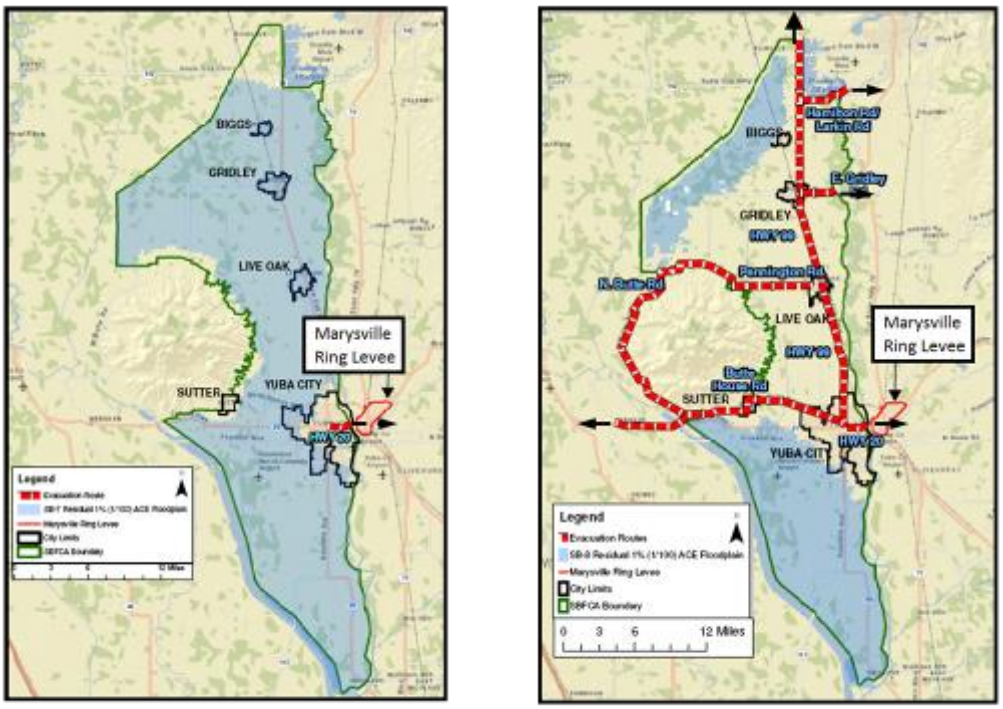
3.4.6.1.2 Evacuation Routes

The availability and access of evacuation route options during sudden, unpredictable flood events is a critical factor for effective and safe evacuations. With the population centers spread throughout the middle and northern sections of the Sutter Basin study area, evacuation route options are critical to evacuation planning and real time evacuation. Adjoining basins to the southwest, west, south, and east either have lower levels of flood protection or are surrounded by water during flood events, making them dangerous locations for evacuees.

The Sutter County Evacuation and Mass Shelter/Care Plan identifies State Routes 20, 99, and 113 as the primary evacuation routes in the region. These routes are subject to change because these routes are event-specific. Official routes are established by the county sheriff's office during an emergency. The Butte County Office of Emergency Management does not have published evacuation routes at this time but anticipates that State Routes 99 and 162 and Colusa Highway could be used as conditions allow. During the 1997 event, seven different evacuation zones were established over seven days in response to constantly changing conditions and levee breaks. The main evacuation routes used for this flood event were State Route 99 north and State Route 113 south. State Route 20 west and State Route 99 south were used intermittently because not all portions of these roads were accessible at all times during the flood.

Evacuation preparation can be made days in advance for predictable rain events. For example, a 0.2% ACE (1/500 year event) rain storm would be identified by meteorologists and residents could be given notice days in advance. As a significant rain event nears, warnings and evacuation efforts would be increased and reiterated. This would allow time for evacuation of immobile residents and other people with special evacuation needs (residents of hospitals, rest homes, and jails, elderly individuals, school students) via the established routes. However, none of the historical flooding evacuations in the region have been due to foreseen weather events. Historical flood evacuations in the region have resulted from levee failures due to under-seepage, which is characterized by its unpredictability and sudden occurrence. The result is evacuations occur after levees have failed and widespread flooding is in progress. The 1955 flood resulted from a levee break in late December when no prior evacuation notice was given. In the 1997 flood, Yuba City was evacuated; however, during the evacuation, a levee on the east side of the Feather River near Olivehurst (which was not evacuated) failed.

Every major population center and nearly every primary evacuation route in the region would remain in the residual 1% ACE floodplain resulting from implementation of the NED Plan (Alternative SB-7). The most critical levee breach scenario used to define the composite floodplain associated with the NED Plan would be a levee failure upstream of Sunset Weir floodplain. All routes out of Biggs, Gridley, and Live Oak would be affected by the residual flood inundation. The only egress from Yuba City would be State Route 20 east into Marysville, a community surrounded by a ring levee. Additionally, heading eastbound entails driving over a four-lane bridge that is not expected to adequately handle the additional traffic flow and is built to only a 1% ACE event (Figure 3-9).



(See the *Figures* folder on the CD for full-sized images.)

Figure 3-9. Comparison of NED Plan and LPP Evacuation Routes (Residual 1% ACE Floodplains)

3.4.6.1.3 Critical Infrastructure

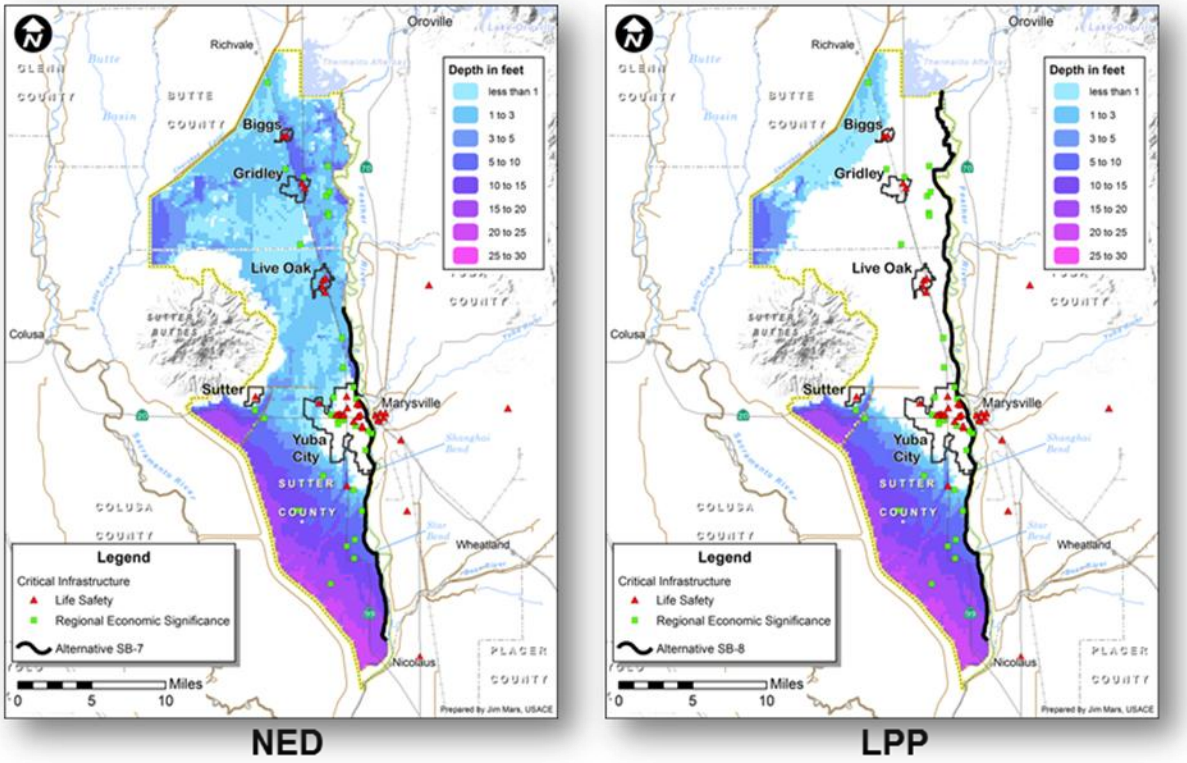
The NED Plan would leave numerous critical infrastructure facilities at risk in the residual 1% ACE floodplain in the cities of Biggs, Gridley, and Live Oak, and southern areas of Yuba City (Figure 3-10). A partial list of facilities at risk is provided here.

- 1 hospital (45 beds)
- 2 police stations
- 5 fire stations
- 1 assisted living center (99 beds)
- 3 city hall buildings
- 1 correctional facility (305 inmate capacity)
- 3 water and sewer treatment facilities
- Multiple telecommunication facilities

Additional comparisons of residential, commercial, and industrial structures were performed as part of the economic analysis to provide perspectives beyond the critical infrastructure of the communities and economic impact areas (see Table 3-16).

Table 3-16. Structures within the Residual 1% (1/100) ACE Floodplain

Number of Structures within the 1% (1/100) ACE Residual Floodplain															
	Commercial			Industrial			Public			Residential			Total		
Economic Impact Analysis	SB-1 Without Project	SB-7 NED Plan	SB-8 LPP	SB-1 Without Project	SB-7 NED Plan	SB-8 LPP	SB-1 Without Project	SB-7 NED Plan	SB-8 LPP	SB-1 Without Project	SB-7 NED Plan	SB-8 LPP	SB-1 Without Project	SB-7 NED Plan	SB-8 LPP
Biggs	17	17	0	1	1	1	0	0	0	478	478	6	**496**	**496**	**7**
Gridley	80	80	0	7	7	0	4	4	0	1,931	1,931	0	**2,022**	**2,022**	**0**
Live Oak	51	51	0	5	5	0	23	23	0	2,088	2,088	0	**2,167**	**2,167**	**0**
Yuba City	871	5	5	210	2	2	122	2	2	18,709	985	985	**19,912**	**994**	**994**
Rural Butte County	10	10	0	16	16	1	0	0	0	1,203	1,203	7	**1,229**	**1,229**	**8**
Rural Sutter County	9	9	9	23	20	20	7	7	7	918	625	625	**957**	**661**	**661**
TOTAL	**1,038**	**172**	**14**	**262**	**51**	**24**	**156**	**36**	**9**	**25,327**	**7,310**	**1,623**	**26,783**	**7,569**	**1,670**



(See the *Figures* folder on the CD for full-sized images.)

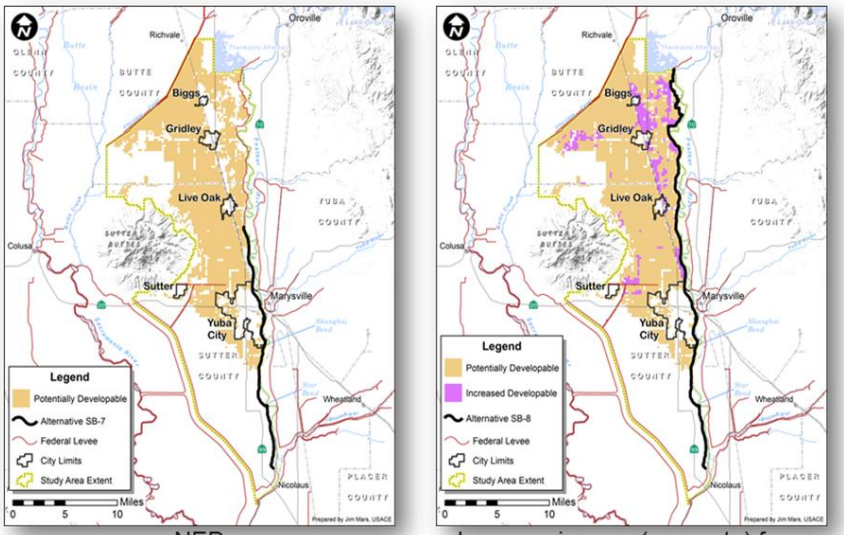
Figure 3-10. Critical Infrastructure and Life Safety Comparison

3.4.6.1.4 Potentially Developable Floodplain

Potentially developable land in the residual 1% ACE floodplain was calculated as an evaluation metric. This assumes that land is developable if the 1% ACE floodplain depths are 3 feet or less (Figure 3-11). The calculation estimates the potential of roughly 12,000 additional acres made available for development under the LPP than under the NED Plan.

Sutter Basin is an agriculturally focused region. The local and state partners have several existing land use commitments and constraints to floodplain development.

- Williamson Act contracts: These rolling 10-year agreements between local government and farmers preserve agricultural lands and open space in rural California by offering landowners tax breaks on the assessed land value.
- Conservation easements: These agreements between landowners and agencies such as the U.S. Fish and Wildlife Service (USFWS) permanently preclude future development.
- Flood risk notifications: State of California sends annual flood risk notifications to all affected property owners.



NED

Increase in area (magenta) from NED to LPP

(See the *Figures* folder on the CD for full-sized images.)

Figure 3-11. Potentially Developable Floodplain Comparison

Other measures for addressing additional potential developable floodplain acres beyond the measures already in place include purchasing additional flood or land use restriction easements.

3.4.6.1.5 Incremental Cost Effectiveness Comparison of Risk-Reduction Measures

With the NED Plan identified, and Alternative SB-8 confirmed as an LPP that best addresses the residual risk of the NED Plan, mitigation measures were considered and evaluated for effectiveness and cost efficiency as part of the iterative planning process to reduce the residual risk left after implementation of the NED Plan. A cost effectiveness comparison analysis was performed and a table of the identified risk-reduction measures was developed (see Tables 3-17 and 3-18).

The metrics used for comparison of risk-reduction measures were estimated costs, annual benefits, population-at-risk, estimated loss of life, critical infrastructure, evacuation routes, flooding characteristics, and potentially developable floodplain. Table 3-17 summarizes the residual risk of the NED Plan (Alternative SB-7) and the LPP (Alternative SB-8). Table 3-18 compares each nonstructural risk-reduction measure with Alternative SB-7 and with Alternative SB-8 for effectiveness by evaluation metric.

This analysis serves to capture the potential range of cost-effective risk-reduction measures to reduce the loss of life and protect critical infrastructure in the Sutter Basin study area. This qualitative analysis was guided by professional judgment, rather than heavily based on the quantitative processes used during alternative selection. The analysis reveals that the only possible measure competitive with Alternative SB-8 (in terms of outputs for the northern basin) is relocations, a measure that has greater costs.

The results of the cost-effectiveness comparison indicate that the most cost-effective measure to address the residual risk of the NED Plan alternative is a more extensive fix-in-place levee alternative (Alternative SB-8).

Table 3-17. Summary of Residual Risk – North Basin Only (Biggs, Gridley, Live Oak, and Rural Butte County)

Alternative	Incremental First Cost [Total Cost] (Millions)	Residual Annual Damages (Millions)	Annual Benefits (Millions)	PAR during 1% ACE Event (Persons)	Estimated Loss of Life during 1% ACE Event (Persons)	Critical Inf. in floodplain (Structures)	Evacuation Routes	1% Event Flooding Characteristics within Reduced Risk Area			Potentially Developable Floodplain (Acres)
								AEP	Depth	Extent	
Final Array of Alternatives – Entire Basin											
SB-1: No Action	0	137	0	94,600	112	28	0	8%	1–15 ft	High	71,800
SB-7	391 [391]	58	79	38,200	45	10	1	0.3%	1–7 ft	Med	88,200
SB-8	297 [689]	50	87	6,600	8	1	5	0.2%	0–1 ft	Low	100,200
NED Plan Residual Risk – Northern Basin Only											
SB-7	n/a	11	0	21,100	26	9	1	8%	1–7 ft	Med	45,570
LPP Plan Residual Risk – Northern Basin Only											
SB-8	n/a	3	8	40	0	0	5	0.2%	0–1 ft	Low	58,265

PAR = population at risk
ACE = annual chance exceedance
Inf. = infrastructure
AEP = annual exceedance probability

Table 3-18. SB-7 NED Plan Residual Risk–Reduction Measures Summary – Northern Basin (Biggs, Gridley, Live Oak, Rural Butte County)

Alternative or Measures	Compare with SB-7 & SB-8	Incremental First Cost [Total Cost]	Annual Damages	Annual Benefits	PAR during 1% ACE event	Estimated Loss of Life	Critical Inf. in Floodplain	Evacuation Routes	1% ACE Event Flood Characteristics within Reduced Risk Area	Potentially Developable Floodplain
(a) Raise Homes	vs. SB-7	+ [+]	-	+	-	-	=	=	=	=
	vs. SB-8	+ [+]	+	-	=	+	+	-	+	-
(b) Flood Proof Critical Infrastructure	vs. SB-7	+ [-]	-	+	=	=	-	=	=	=
	vs. SB-8	- [-]	+	-	+	+	=	-	+	-
(c) Elevated Evacuation Route	vs. SB-7	+ [+]	=	=	=	-	-	+	=	=
	vs. SB-8	+ [+]	+	-	+	+	+	-	+	-
(d) Ring Levees	vs. SB-7	+ [+]	-	+	-	-	-	-	-	+
	vs. SB-8	+ [+]	+	-	+	+	+	-	=	-
(e) Buyouts (Relocations)	vs. SB-7	+ [+]	-	+	-	-	=	=	=	=
	vs. SB-8	+ [+]	-	+	=	=	=	-	+	-
(f) SB-8	vs. SB-7	+ [+]	-	+	-	-	-	+	-	+
	vs. SB-8	= [=]	=	=	=	=	=	=	=	=

Key:

-	Metric is lower		Less effective
=	Metric is equal		Equally effective
+	Metric is higher		More effective

PAR = population at risk
ACE = annual chance exceedance
Inf. = infrastructure
AEP = annual exceedance probability

3.4.6.1.6 Cost Effectiveness of Structural vs. Nonstructural Mitigation Measures

A last general cost comparison of Alternative SB-8 with nonstructural measures was performed, at a very conceptual level of detail, to verify that the structural measures of Alternative SB-8 are the most cost effective in addressing the residual risk and consequences left by the NED Plan. Fix-in-place levees structural measures of Alternative SB-8 are estimated to cost $260 million to $330 million more than the NED Plan. Various structural and nonstructural measures addressing similar residual risk areas were conceptually estimated and found generally to have considerably higher costs and impacts compared with the costs and impacts of Alternative SB-8's structural measures, as identified below.

- Elevate houses: approximately $650 million.
- Provide evacuation route by elevating causeway and retrofitting existing bridges: approximately $650 million.
- Construct ring levees around Live Oak, Gridley, and Biggs: approximately $375 million.
- Buyout at-risk property owners: approximately $1 billion.

The results of the comparison show Alternative SB-8 as best addressing the residual risks of the NED Plan.

3.4.7 Summary of Evaluation Metrics on Public Safety

Alternative SB-8 is the multi-objective alternative that is cost effective and best reduces flooding and residual risk to public and life safety in the Sutter Basin. Alternative SB-8 is composed of Alternative SB-7, plus fixes-in-place the northern Feather River levees from Sunset Weir north to Thermalito Afterbay. The total first cost estimate is $689 million with annual net benefits of $54 million.

The additional investment of $302 million in project cost (Alternative SB-8 first cost minus the Alternative SB-7: NED Plan cost) would buy down the residual risk of the NED Plan, provide additional annual benefits ($8 million), and provide significant non-monetized benefits (See Table 3-19). The population at risk of flooding from a 1% ACE flood event would decrease from 38,200 to 6,600, critical infrastructure facilities at risk would be reduced from 11 to 1, and the number of evacuation routes would increase from 1 to 5.

Table 3-19. Summary of Public Safety Metrics

		Alternative		
Evaluation Metric	**Measurement**	**SB-1: No Action**	**SB-7: NED Plan**	**SB-8: LPP**
Population at Risk	People	94,600	38,200	6,600
Critical Infrastructure	Facilities	28	11	1
Evacuation Routes	Number of Routes	0	1	5
Potentially Developable Floodplains	Acres	71,800	88,200	100,200

Because Alternative SB-8 reduces flood risk and significantly reduces the residual risk of the NED Plan, Alternative SB-8 is supported by the local sponsors as the LPP, and can be considered multi-objectively (reducing flood risk and risk to public and life safety) a more comprehensive and complete Federal plan.

3.4.7.1 Separable Area Consideration

Separable areas or elements are defined hydrologically for the study as the subdivision of a study area's flood risk based on hydrologic and hydraulic characteristics and functions with identifiable and distinct economic benefits. While not specific to "hydrological separableness," "separable element" is defined in 33 United States Code (USC) Section 2213(f) as a portion of the project that "(1) is physically separable from other portions of the project; and (2)(a) achieves hydrologic effects, or (b) produces physical or economic benefits, which are separately identifiable from those produced by other portions of the project." The Sutter Basin study area has three separable hydrologic areas, one north of Yuba City, one centered in Yuba City, and one south of Yuba City.

An evaluation of how the Sutter Basin study area and the TSP meet the 33 USC Section 2213(f) requirements is provided below.

- **(1) is physically separable from other portions of the project**

  Within the Sutter Basin study area, the floodplain has a relatively low gradient and the hydrologically separable areas are not clearly defined by basic topographic features alone, therefore the physical separation is best understood by analyzing the hydrologic characteristics. In general, there are three separable hydrologic areas. The separation is evident in levee breach simulations conducted for the study and the functionality of the alternatives.

- **and (2) (a) achieves hydrologic effects**

  The north of Yuba City separable area can only see a reduction in residual hydrologic floodplain from levee fixes associated with the SB-8 increment. The Yuba City separable area can only see significant reduction in residual hydrologic floodplains from levee fixes associated with the SB-7 increment. The south of Yuba City separable area can only see significant reduction in residual hydrologic floodplains from levee fixes associated with the lower Feather River and the Sutter Bypass, which are not part of the TSP.

- **or (b) produces physical or economic benefits, which are separately identifiable from those produced by other portions of the project.**

  SB-7 has distinctly identifiable economic benefits within the Yuba City separable area of $60 million that cannot be produced by any other portions of the project. The SB-8 increment has distinctly identifiable economic benefits within the north of Yuba City separable area of $8 million that cannot be produced by any other portions of the project.

The breach simulations for a 1% ACE event are shown in the Engineering Appendix, Hydraulic attachment (Appendix C1b, *Hydraulic Design and Analysis*) and are described in the following three sections and Figures 3-12, 3-13, and 3-14.

With respect to evacuation considerations related to life safety, travel routes between the hydrologically separable areas and the flood risk of the final destination was also considered.

The separable area evaluation has determined that the study area has separable areas and the TSP is by itself separable, meeting the 33 USC Section 2213(f) requirement. This conclusion also supports the completeness determination for the TSP.

3.4.7.1.1 Separable Hydrologic Floodplain 1: North of Yuba City

A breach in the area along the Feather River north of Yuba City would permit floodwaters to flow southwest and inundate the towns of Biggs, Gridley, Live Oak, and the western and southern fringes of Yuba City. Due to the topography, the northern areas of the Sutter Basin are not susceptible to flooding from a breach in the southern portion of the study area including the Sutter Bypass. This reach of levee represents the additional increment of Feather River levee fix for SB-8 over and above SB-7, and the physical separability is demonstrated by distinct flooding north of Yuba City.

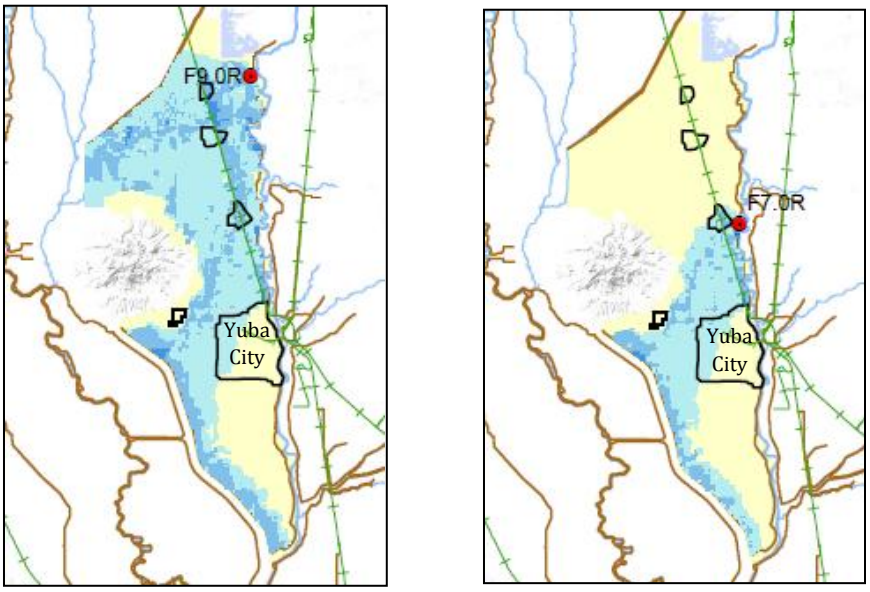


Figure 3-12. Separable Hydrologic Floodplain 1: Levee Breaches North of Yuba City

3.4.7.1.2 Separable Hydrologic Floodplain 2: Yuba City

A breach along the Feather River adjacent to Yuba City would permit floodwaters to flow directly through Yuba City and inundate the southern portion of the Basin. Due to topography, a breach at Yuba City would not inundate the northern portion of the study area. The Yuba City area is not susceptible to flooding from a Sutter Bypass or southern Feather River breach. This reach of levee represents the extent of levee fixes for SB-7, and the physical separability is demonstrated by distinct flooding within Yuba City.

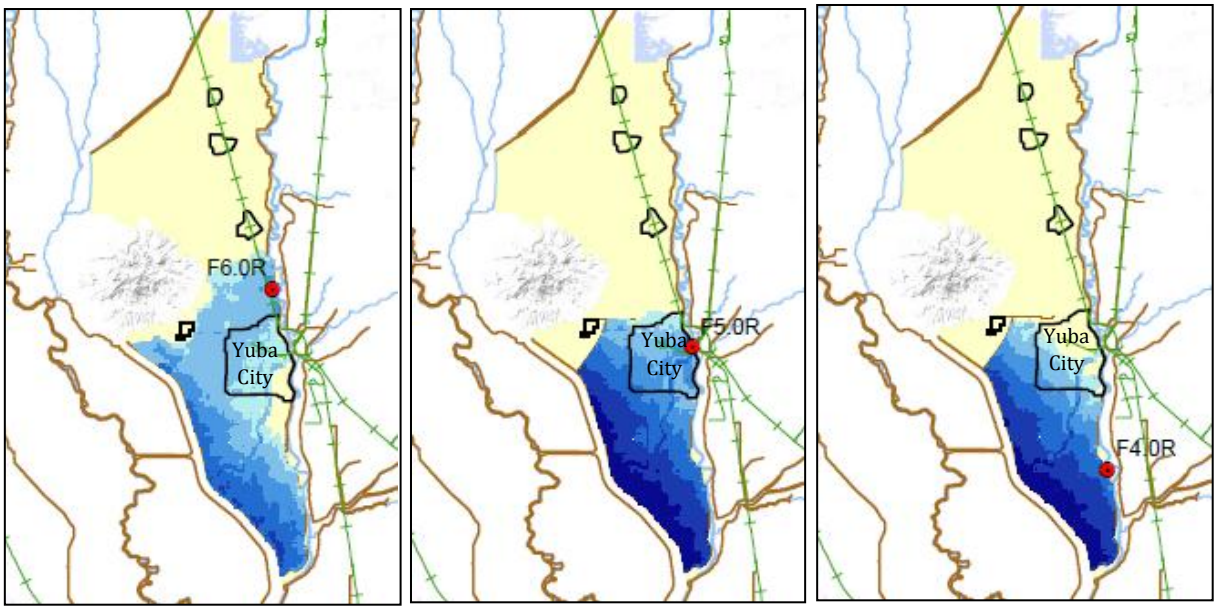


Figure 3-13. Separable Hydrologic Floodplain 2: Levee Breaches Near or In Yuba City

3.4.7.1.3 Separable Hydrologic Floodplain 3: South of Yuba City

A breach on the southern end of the Feather River or Sutter Bypass would inundate this portion of the study area (deepest part of the basin). A breach south of Yuba City would not result in inundation of Yuba City or the areas north of Yuba City. This reach of the Feather River levee represents the extent of levee not proposed for fix by either SB-7 or SB-8, and the physical separability is demonstrated by distinct flooding only in the area south of Yuba City.

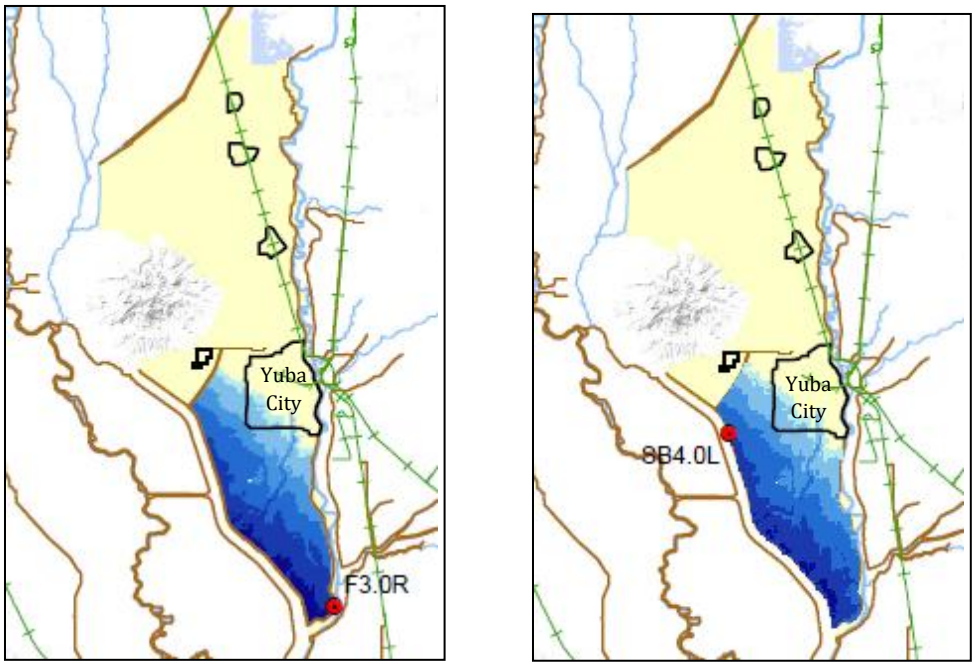


Figure 3-14. Separable Hydrologic Floodplain 3: Sutter Bypass Levee Breach or Feather River Levee Breach South of Yuba City

3.4.8 Final Array of Alternatives

With the identification of the NED Plan and the LPP, a final array of alternatives was determined.

- No Action: Alternative SB-1. This is the no action and future without-project condition alternative and is required to be in the final array.
- NED Plan: Alternative SB-7. This alternative reconfirms the Federal interest and reduces flood risk to most of the Yuba City area, but leaves considerable residual flood risk to public and life safety in the northern communities of the Sutter Basin and parts of Yuba City.
- LPP: Alternative SB-8. This alternative reconfirms the Federal interest the same as the NED Plan does, but significantly reduces residual risk of the NED Plan in the northern communities of Live Oak, Biggs, and Gridley, and in additional areas of Yuba City. Alternative SB-8 has been identified through multi-objective planning using evaluation metrics as a comprehensive Federal plan.

The Alternative SB-1 is included in the final array because NEPA and CEQA require an analysis of the no action alternative for purposes of comparison against the action alternatives. The No Action Alternative or future without-project alternative is described in Section 3.3.2, *Alternative SB-1: No Action*.

The screening process leading to the identification of the final array of alternatives was based on a Class 4 Analysis (reconnaissance level) as described in Section 3.2.1, *Level of Detail and Design Assumptions*. The final array of alternatives (SB-7 and SB-8) is now evaluated in more detail using the Class 3 Analysis (feasibility level and costs). Both of these alternatives includes the nonstructural measures of a flood warning system, emergency evacuation plan, and flood fight pre-staging equipment and supply areas.

For alternatives SB-7 and SB-8, a reach identification system was developed as shown on Plate 3-1. Alternative SB-8 contains 41 reaches (2A north to 41) along the Feather River West Levee (FRWL)) alignment, beginning approximately 1.7 miles north of the State Route 99 bridge over the Feather River (at station 180+00, approximately 2,250 feet south of Laurel Avenue) and extending north approximately 41 miles to the Thermalito Afterbay, downstream of Oroville Dam (at station 2368+00). Alternative SB-7 contains 21 reaches (2A north to 21) along the FRWL alignment, beginning at the same point south of Laurel Avenue and extending approximately 24 miles north to immediately north of Sunset Weir (station 1433+83).

3.5 Levee Design Measures

3.5.1 Selection of Design Measures

Two primary design measures of the alternative were evaluated. In general, the measures were a fully penetrating soil-bentonite cutoff wall and a partially penetrating soil-bentonite cutoff wall combined with a seepage berm or relief wells. Both measures would include a partial levee degrade to obtain the needed working platform width. A full levee degrade is proposed where the levee has a severe burrowing rodent infestation or to prevent having to use the more expensive Deep Soil Mixing method for cutoff wall construction due to depth. A reach-by-reach cost comparison between the two measures showed a fully penetrating soil-bentonite cutoff wall was the lowest cost measure for most reaches. However, site conditions dictated selection of a different measure for some reaches or portions of reaches.

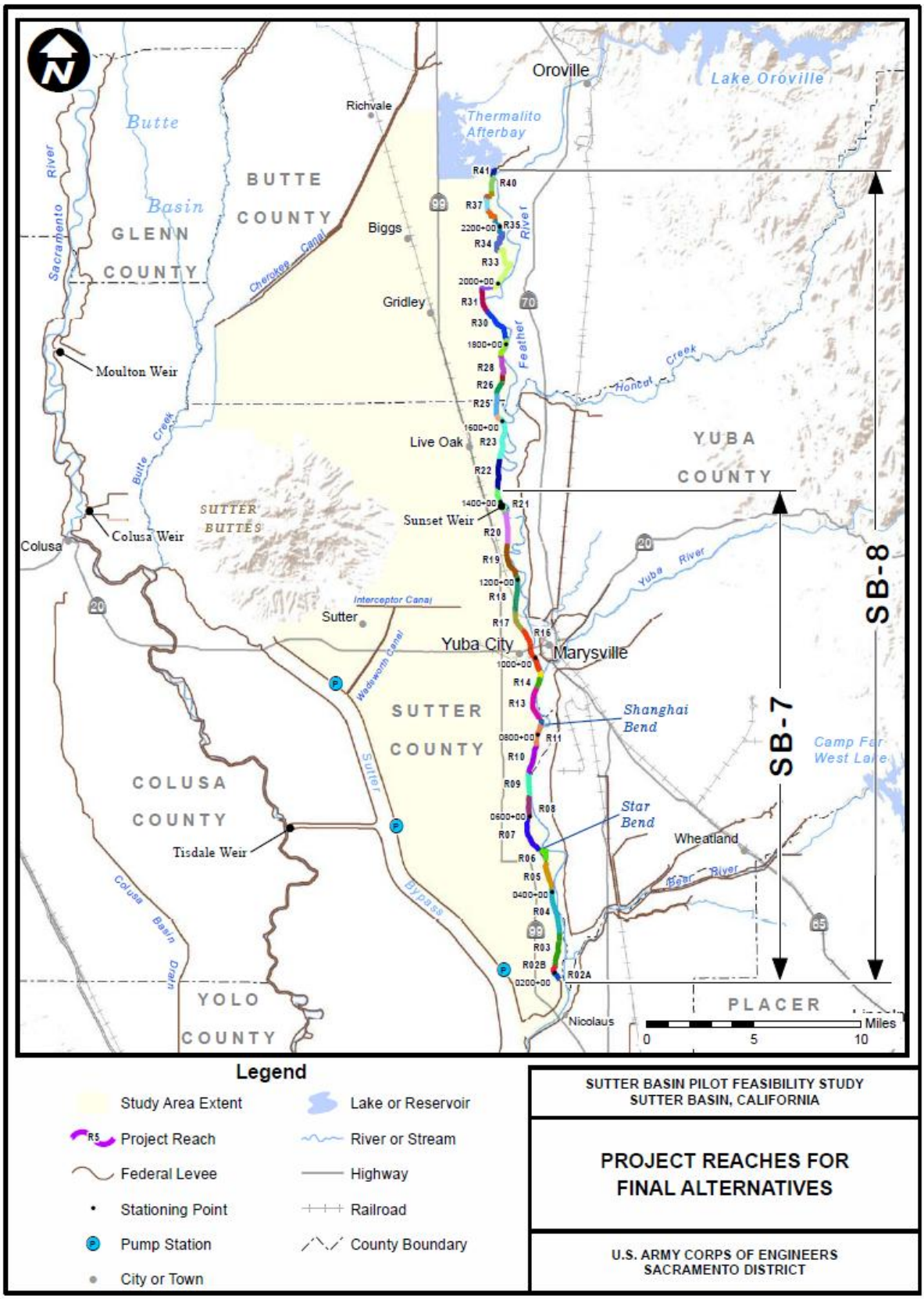


Plate 3-1. Project Reaches for Final Alternatives

Jet grouting cutoff walls are proposed at locations where it is not practical to construct a conventional soil-bentonite cutoff wall (i.e., at bridges, railroad crossings, and the Yuba City water treatment plant). Seepage berms by themselves are proposed for the northernmost end of the FRWL because a conventional soil-bentonite cutoff wall is not constructible through the cobble levee. Partially penetrating cutoff walls combined with seepage berms or relief wells are proposed for the southern end of the FRWL because fully penetrating cutoff walls would need to be too deep to be cost effective. A cutoff wall with levee relocation and a cutoff wall with Sutter Butte Canal relocation are proposed for some levee sections along the FRWL (north of Sunset Weir, where the Sutter Butte Canal is located adjacent to the landside levee toe) to obtain the required operations and maintenance (O&M) corridors.

3.5.2 Proposed Design Measures and Features

The proposed design features and measures are listed below.

- Soil-Bentonite Cutoff Walls
- Jet Grouting Cutoff Walls
- Seepage Berms
- Levee Relocations
- Canal Relocations
- Embankment Reconstruction/Landside Toe Fill
- Erosion Protections
- Closure Structure
- Utility Improvements
- Utility Relocations
- Structural Relocations

Levee Superiority – Hardening of Levee Locations

These features and measures would rehabilitate, replace, or tie in and function in conjunction with the existing system. The existing system includes the following features.

- Embankment
- Cutoff Walls
- Stability Berms
- Relief Wells
- Closure Structures
- Toe Drains

Plate 3-2 shows the location of proposed levee improvements and reaches. As shown in Plate 3-2, Alternatives SB-8 and SB-7 are similar in that the same design measures are proposed where the two alternatives overlap. Refer to the Engineering Appendix (Appendix C).

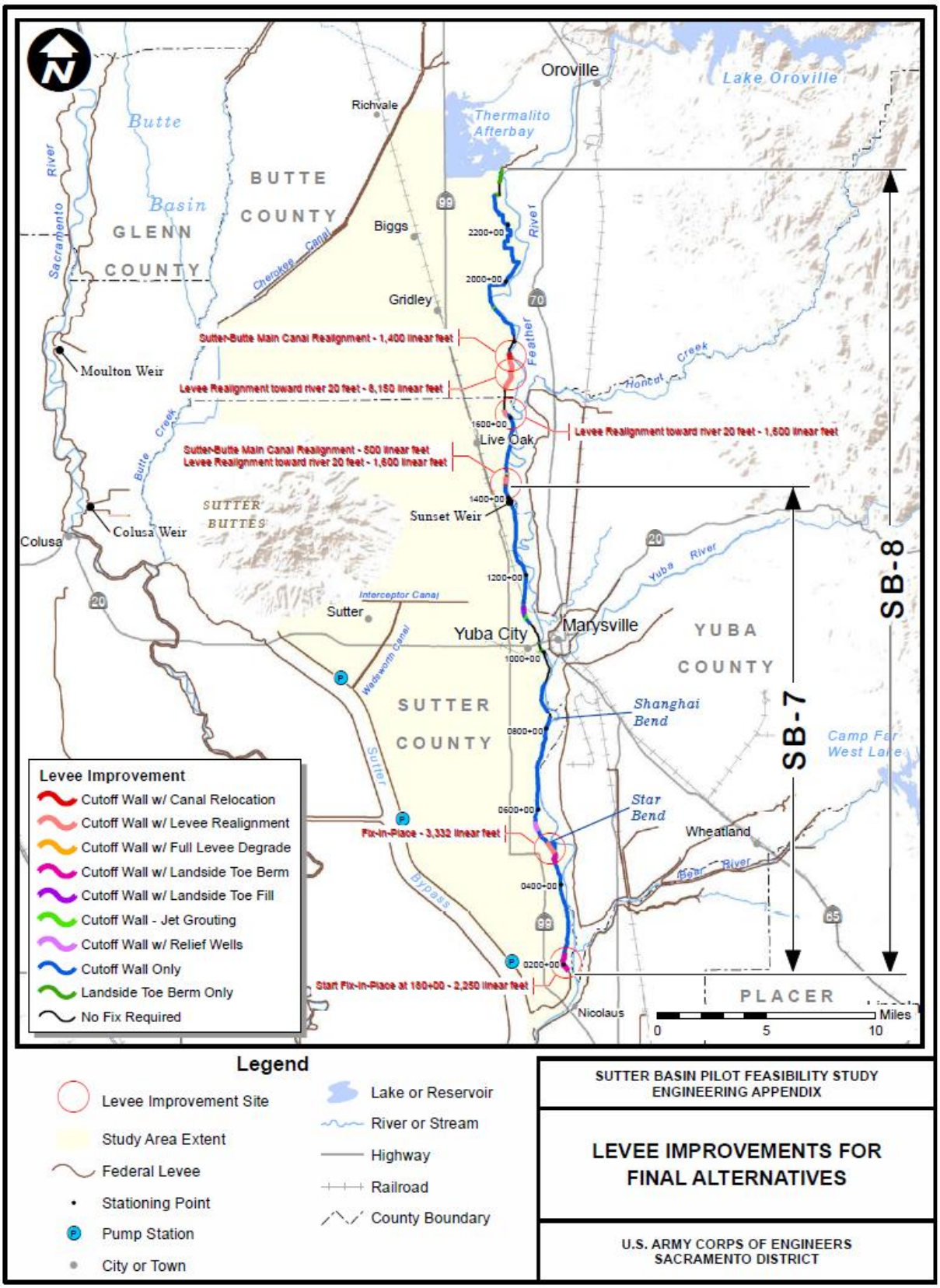


Plate 3-2. Levee Improvements for Final Alternatives

3.6 Locally Preferred Plan: Alternative SB-8

Alternative SB-8 contains 41 reaches (2A to 41) along the FRWL alignment, beginning approximately 1.7 miles north of the State Route 99 bridge over the Feather River (at station 180+00, approximately 2,250 feet south of Laurel Avenue) and extending north approximately 41 miles to the Thermalito Afterbay, downstream of Oroville Dam (at station 2368+00).

Plate 3-2 shows the location of proposed levee improvements and Table 3-20 summarizes the levee improvements by reach.

In addition, there are seven levee sections along the FRWL alignment where fix-in-place work is not required. These sections are between: (1) station 831+50 and 844+50, (2) 923+75 and 1006+24, (3) 1007+70 and 1024+00, (4) 1027+50 and 1078+00, (5) 1625+00 and 1673+00, (6) 1769+40 and 1813+30, and (7) 2303+00 and 2331+00, approximately. See Table 3-20 for more details. Existing cutoff walls (30 to 50 feet in depth) are present within the first four levee sections.

Table 3-20. Alternative SB-7 (Reach 2A North to Reach 21) and SB-8 Proposed Design Measures

Reach	Station	Length (feet)	Primary Design Measures
2A North	180+00 to 202+50	2,250	Cutoff wall with 100-foot-wide undrained seepage berm
2B	202+50 to 218+66	1,616	Cutoff wall with 100-foot-wide undrained seepage berm
3	218+66 to 300+66	8,200	Cutoff wall with 100-foot-wide undrained seepage berm (218+66 to 231+00) Cutoff wall (230+00 to 231+00)
4	300+66 to 410+67	11,001	Cutoff wall
5	410+67 to 478+68	6,801	Cutoff wall (410+67 to 478+65) Cutoff wall with 300-foot-wide undrained seepage berm (453+00 to 478+00)
6 FIP	478+68 to 512+00	3,332	Cutoff wall
6 SB	478+68 to 512+00	3,332	Remove the existing levee and construct a setback levee with 65-foot-deep (from degrade line) cutoff wall
7	512+00 to 596+00	8,563	Cutoff wall (512+00 to 596+00) Cutoff wall with relief wells (545+00 to 570+00) Erosion Protection (High-Performance Turf Reinforced Mat) (547+00 to 596+00)
8	596+00 to 654+75	5,875	Cutoff wall (596+00 to 654+75) Erosion Protection (High-Performance Turf Reinforce Mat) (596+00 to 604+60)
9	654+75 to 706+50	5,175	Cutoff wall
10	706+50 to 774+00	6750	Cutoff wall
11	774+00 to 830+00	5,600	Cutoff wall

Reach	Station	Length (feet)	Primary Design Measures
12	830+00 to 845+00	1,500	No proposed design measure with exceptions below Cutoff wall (transition only, at both ends of this reach) Cutoff wall, transition only (830+00 to 831+50) Cutoff wall, transition only (844+50 to 845+00)
13	845+00 to 927+00	8,200	Cutoff wall Cutoff wall with full levee degrade and re-construction (844+50 to 897+50)
14	927+00 to 954+40	2,740	No proposed rehabilitation measure
15	954+40 to 968+50	1,410	No proposed rehabilitation measure
16	968+50 to 1080+00	11,150	Jet grouting cutoff wall at 5th Street bridge crossing (1006+04 to 1007+90) Toe berm, 23 feet wide, at 10th Street bridge crossing (1023+90 to 1027+50) Cutoff wall and backfill landside toe depression, transition only (1077+85 to 1080+00)
17	1080+00 to 1130+86	5,086	Backfill landside toe depression (1107+00 to 1125+70) Cutoff wall (1080+00 to 1096+00) Jet grouting cutoff wall at Yuba City water treatment plant (1095+80 to 1098+30 Cutoff wall (1098+10 to 1129+50) Jet grouting cutoff wall at railroad north of Yuba City (1129+50 to 1130+67) Cutoff wall (1130+20 to 1130+86) Stop log closure structure or equivalent at 1130+00
18	1130+86 to 1213+85	8,299	Cutoff wall
19	1213+85 to 1297+83	8,398	Cutoff wall
20	1297+83 to 1374+33	7,650	Cutoff wall
21	1374+33 to 1433+83	5,950	Cutoff wall (1374+33 to 1432+50) Cutoff wall with levee relocation (20 feet riverward, transition only), (1432+50 to 1433+83) Sutter Butte Canal relocation (1429+00 to 1433+83)
22	1433+83 to 1503+83	7,000	Cutoff wall with levee relocation (20 feet riverward) (1433+83 to 1450+00) Cutoff wall with levee relocation (20 feet riverward, transition only) (1450+50 to 1451+50) Cutoff wall with full levee degrade and re-construction (1455+00 to 1461+00) Cutoff wall (1461+00 to 1503+83)
23	1503+83 to 1609+37	10,554	Cutoff wall (1503+83 to 1608+75) Cutoff wall with levee relocation (20 feet riverward, transition only)(1608+50 to 1609+37) Erosion Protection: High-Performance Turf Reinforce Mat (1582+00 to 1601+00)
24	1609+37 to 1623+86	1,449	Cutoff wall with levee relocation (20 feet riverward, transition only) (1609+37 to 1612+00) Cutoff wall with levee relocation (20 feet riverward) (1612+00 to 1623+00) Cutoff wall with levee relocation (20 feet riverward, transition only) (1623+00 to 1623+86)

Reach	Station	Length (feet)	Primary Design Measures
25	1623+86 to 1674+37	5,051	Cutoff wall with levee relocation (20 feet riverward, transition only) (1623+86 to 1624+50) Cutoff wall (transition only)(1623+86 to 1625+00) Cutoff wall (transition only)(1673+00 to 1674+37) Cutoff wall with levee relocation (20 feet riverward, transition only) (1673+00 to 1674+37)
26	1674+37 to 1707+11	3,274	Cutoff wall with levee relocation (20 feet riverward, transition only) (1674+37 to 1675+00) Cutoff wall with levee relocation (20 feet riverward) (675+00 to 1707+11)
27	1707+11 to 1721+60	1,449	Cutoff wall with levee relocation (20 feet riverward) (1707+11 to 1721+60)
28	1721+60 to 1769+31	4,771	Cutoff wall with levee relocation (20 feet riverward)(1721+60 to 1753+00) Cutoff wall with levee relocation (20 feet riverward, transition only)(1753+00 to 1754+50) Sutter Butte Canal Relocation (1752+00 to 1766+00) Cutoff wall (1754+50 to 1769+31)
29	1769+31 to 1813+33	4,402	No proposed rehabilitation measure
30	1813+33 to 1902+00	8,867	Cutoff wall (1813+33 to 1900+50) Jet grouting cutoff wall (1900+00 to 1902+00)
31	1902+00 to 1958+00	5,600	Jet grouting cutoff wall (1902+00 to 1904+00) Cutoff wall (1904+50 to 1958+00)
32	1958+00 to 1989+00	3,100	Cutoff wall
33	1989+00 to 2122+00	13,300	Cutoff wall
34	2122+00 to 2182+00	6,000	Cutoff wall
35	2182+00 to 2224+00	4,200	Cutoff wall
36	2224+00 to 2259+00	3,500	Cutoff wall
37	2259+00 to 2290+00	3,100	Cutoff wall
38	2290+00 to 2303+00	1,300	Seepage berm up to 11 feet high tapering to a distance 170 feet from the centerline of the existing levee (2290+00 to 2303+00) Seepage berm with cutoff wall (transition only, extend from reach 37 into reach 38 Cutoff wall (transition only) (2290+00 to 2292+00)
39	2303+00 to 2319+00	1,600	No proposed rehabilitation measure
40	2319+00 to 2359+00	4,000	No design measure: 2319+00 to 2331+00 Seepage berm 120 feet wide (2331+00 to 2335+00) Seepage berm 100 feet wide (2335+00 to 2359+00)
41	2359+00 to 2368+00	900	Seepage berm 100 feet wide with filter drain (2359+00 to 2368+00)

3.7 NED Plan: Alternative SB-7

Alternative SB-7 contains 21 reaches (2A to 21) along the FRWL alignment, beginning at station 180+00 (approximately 2,250 feet south of Laurel Avenue) and extending approximately 24 miles north to station 1433+83 (immediately north of Sunset Weir). The levee reaches are shown on Plate 3-1. Table 3-20 summarizes the design measures.

There are four levee sections along the FRWL alignment where fix-in-place work is not required. These sections are between: (1) 831+50 and 844+50, (2) 923+75 and 1006+24, (3) 1007+70 and 1024+00, and (4) 1027+50 and 1078+00, approximately. See Table 3-20 for more details. Existing cutoff walls (30 to 50 feet in depth) are present within these levee sections.

3.8 Common Elements and Environmental Commitments of Alternatives

The following sections describe the project elements and environmental commitments common to Alternatives SB-7 and SB-8.

3.8.1 Borrow and Disposal Requirements

3.8.1.1 Borrow Requirements

While some of the embankment material removed during levee degrading would be re-used to reconstruct the levee, it is anticipated that borrow materials would be needed to meet the levee fill material specifications. Two primary types of borrow material needed for levee and cutoff wall construction are Type 1 levee fill, primarily used as a clay core for the reconstructed levee above the cutoff wall and for the soil-bentonite mix, and Type 2 levee fill, primarily used for shells for the reconstructed levee above the cutoff wall.

As part of SBFCA's early implementation project for the Feather River West Levee Project (FRWLP), 13 sites were identified as potential borrow areas, 5 of which were eliminated as a result of a preliminary screening process. The screening criteria include contamination level, and relative location to the levee or seepage berm. SBFCA and USACE will sample and test the sites to ensure they meet material requirements. It was estimated that the borrow sites can provide up to 1,349,900 cubic yards of Type 1 fill material, 459,800 cubic yards of Type 2 fill material, and 330,800 cubic yards of Random fill material.

Alternative SB-8 may require up to 629,810 cubic yards of Type 1 fill material, 809,845 cubic yards of Type 2 fill material, and 179,520 cubic yards of Random fill material. All are included in the total project cost.

Alternative SB-7 may require up to 419,760 cubic yards of Type 1 fill material, 579,045 cubic yards of Type 2 fill material, and no Random fill material. All are included in the total project cost.

3.8.1.2 Disposal Requirements

Implementation of Alternatives SB-7 and SB-8 may generate up to 813,000 cubic yards of solid waste that would require disposal. Solid waste related to construction activities would include levee material, structural debris from removal of residences and agricultural structures, and roadway pavements.

The solid waste facilities nearest to the project area are the Ostrom Landfill (located east of the project site, approximately 30 miles south of Reach 2) and the Neal Road Landfill (located 25 miles north of Reach 40).

The 225-acre Class II Ostrom Landfill is permitted to accept the following types of waste: solid waste; wastewater treatment sludge; construction debris; food and green waste; some types of contaminated soils; and nonfriable asbestos. The Neal Road Landfill is permitted to accept the following types of waste: municipal solid waste, inert industrial waste, demolition materials, special wastes containing nonfriable asbestos; and septage.

3.8.2 Right-of-Way (ROW) Requirements, Relocations, and Encroachments

The existing FRWL's ROW corridor includes O&M corridors that vary in width along the alignment and that are discontinuous for a significant distance at some locations. The minimum levee design criteria require the project levee to have an O&M corridor along the levee toes of a minimum of 15 feet on each side of the levee. The O&M corridors are necessary for O&M and flood fighting purposes. Therefore, to implement the SBPFS, additional real estate would be acquired to provide sufficient space for the O&M corridors. Acquiring additional real estate would result in relocation of physical structures (e.g., buildings, canals) along the alignment. Where it is impractical to acquire the additional real estate, the levee would be relocated toward the river.

There would be one exception to the minimum requirement of 15 feet for the O&M corridor. The exception covers the area between station 1904+00 and station 1957+00 where the Sutter Butte Canal encroaches into the proposed 15-foot minimum landside easement. For this area, an existing 10-foot minimum natural berm, on the levee's landside slope, would be utilized for O&M purposes without any further actions.

3.8.2.1 Relocations

To meet the minimum ROW requirements as stated above, acquisition of additional real estate would be necessary and would require relocations of certain physical structures. Any physical structures falling within the proposed ROW would be considered potential relocations under the Relocation Assistance Act, except for the encroachment of the utilities/facilities of the Sutter Butte Canal.

Under Alternative SB-8, 34 physical structures fall within the proposed ROW and, therefore, would be demolished. Twenty-seven of these structures are within Reach 16 (Yuba City). The remaining structures are in Reaches 26 to 31. Approximately 2,196 acres would be acquired and 468 parcels would be affected. However during the preconstruction engineering design phase of project implementation, a more detailed case-by-case evaluation will be made of the ROW requirements and resulting relocations.

Under Alternative SB-7, a total of 27 physical structures fall within the proposed ROW and, therefore, would be demolished. All of these structures are within Reach 16 (Yuba City). Approximately 2,110 acres would be acquired and 292 parcels would be affected.

In the case of the Sutter Butte Canal, which encroaches into the proposed ROW at four locations along the FRWL alignment (between stations 1430+00 and 1957+00), four potential measures were considered for each area to address ROW needs: construction of a retaining wall in the landside

slope; construction of a flood wall; levee relocation; and canal relocation. The proposed measures were also coordinated with the USFWS. The flood wall and retaining wall options were eliminated because these structures were deemed to create substantial barriers to movement of terrestrial wildlife species. Each measure was evaluated based on construction cost and impacts with the conclusion that the levee relocation measure would have the least impacts and costs.

Levee relocation was deemed to have the least overall impact and was selected as the primary measure for addressing the issue. The relocated levee is required to meet the minimum levee design criteria and height requirement. The cutoff wall would be constructed at the centerline of the relocated levee sections.

Canal relocation was selected for a small section along the alignment where the FRWL is too close to the Feather River's main channel to relocate the levee. This measure was also selected for a small section of the Sutter Butte Canal near the Sunset Weir Pump Station, around station 1430+00, because it was deemed to be more cost effective than the levee relocation measure which would require relocation of the pump station' electrical system.

At one of the four locations where the Sutter Butte Canal encroaches into the proposed ROW, specifically between station 1904+00 and station 1957+00, an existing 10-foot minimum natural berm, on the levee's landside slope, would be utilized for O&M purposes without any further actions needed.

3.8.2.2 Encroachments

A comprehensive inventory of all encroachments (utilities, physical structures, and woody vegetations) was completed based on existing data and field investigations. The existing encroachment data came from multiple sources, including the CVFPB encroachment list, the USACE Periodic Inspection Report, and as-built drawings of various projects located along the FRWL alignment. Field investigations were conducted to validate and improve the existing inventories.

Encroachments include a number of utilities running parallel to the alignment (e.g., power poles, irrigation ditches, pipelines), physical structures (public, residential, and commercial buildings), and woody vegetation (mature trees) currently located within the proposed ROW.

The encroachments were divided into 2 groups.

- Utilities and Physical Structures
- Woody Vegetation

The following two sections outline the approach for addressing levee encroachment issues.

3.8.2.2.1 Utilities and Physical Structures

This group was subdivided into two categories: levee prism encroachments and ROW encroachments.

The levee prism encroachments are utility pipelines and conduits running perpendicular to the levee alignment. Most of these pipeline and conduit crossings are either dated and do not comply with the current standard for levee encroachment, or would be disrupted or otherwise affected by levee construction. These pipelines and conduits, therefore, would be removed before the cutoff wall construction began and replaced with proper materials after the cutoff wall construction was

completed. Gravity lines (storm drain) would be replaced in-place. Pressurized lines (e.g., irrigation and drainage discharge lines, gas pipes, water and sewer lines) and conduits (e.g., electrical and communication lines) would be relocated. Pipes that are known to be recent installations would remain. Abandoned pipelines and conduits would be removed.

ROW encroachments are the utilities and physical structures located outside of the levee prism but within the limits of the proposed ROW. These structures would be relocated outside of the proposed ROW prior to levee and seepage berm construction.

Temporary bypass systems would be provided to minimize disruption to irrigation and other utility services during the farming season.

Under Alternatives SB-7 and SB-8, utilities that run parallel to the levee alignment and within the proposed ROW would be relocated outside of the proposed ROW. Utility pipelines and conduits crossing the existing levee embankment would be removed, modified or replaced to meet the USACE standard for levee penetration.

3.8.2.2.2 Woody Vegetation on Levee

The FRWL currently has mature trees on the both the levee slopes and within 15 feet of both the landside and waterside toes, with the majority of the trees being within 15 feet of the toes. Engineering Technical Letter No. 1110-2-571, *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures* (Vegetation ETL) establishes minimum guidelines to assure that landscape and vegetation management provide aesthetic and environmental benefits without compromising the reliability of flood damage–reduction projects. The Vegetation ETL establishes a vegetation-free zone to provide a reliable corridor of access to, and along, levees, floodwalls, embankment dams, and apparent structures to assure adequate access by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood fighting (Figure 3-15). In the case of levees, such as those being evaluated for the Sutter Basin, the vegetation-free zone includes the levee (waterside slope, landside slope, and crown), and 15 feet on both sides of the levee measured from the levee toe.

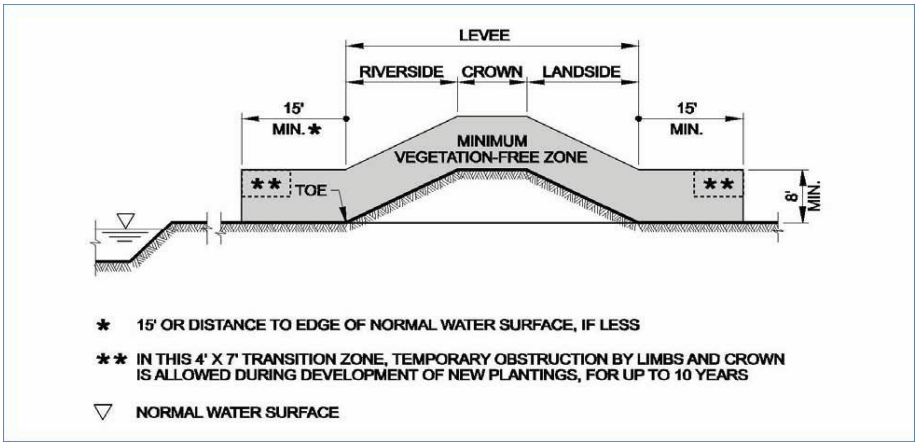


Figure 3-15. Illustration from Chapter 6, Engineering Technical Letter 1110-2-571

In its early implementation project documents for the FRWLP, SBFCA proposed allowing woody vegetation to temporarily remain within the project ROW and adoption of a life cycle adaptive management approach to address noncompliant vegetation removal over time. However, for the

purpose of this feasibility study, the Sacramento District's PDT determined that all alternatives were to be formulated and evaluated under the conservative assumption that each alternative would include necessary work, and costs thereof, for the removal of all vegetation on the levees, with the exception of grasses including 15 feet from the toe of the levee on both the landside and waterside.

On March 28, 2013, the CVFPB submitted a Letter of Intent (LOI) notifying USACE that the local maintaining agencies within the Sutter Basin led by SBFCA intended to develop and implement a System Wide Improvement Framework (SWIF) plan. A SWIF is a plan developed and implemented by levee sponsors to make system-wide improvements to a levee system (or multiple levee systems within a watershed) to address system-wide issues, including correction of unacceptable inspection items (see Section 4.2.2.5.4), in a prioritized way to optimize risk reduction. The SWIF plan would be developed within 2 years and then implemented gradually over time to bring the existing levees into compliance with the existing project O&M manual and is considered part of the without-project condition (SB-1: No Action Alternative). Therefore, while a SWIF is not a component of the LPP, a SWIF is being implemented but by the CVFPB and the local maintaining entities independently from the study.

Based on the LOI to develop a SWIF plan to achieve compliance with the existing O&M requirements, including vegetation removal in accordance with the existing O&M requirements, the SBPFS has assumed that there will be no deferred maintenance; i.e., the without project condition will be fully compliant with existing O&M requirements. During construction, any unacceptable inspection items and deficiencies that have not been addressed in accordance with the SWIF will be included in the Government construction contract as a non-federal expense.

The Vegetation ETL makes allowance for the issuance of variances in certain instances to further enhance environmental values or to meet state or Federal laws and/or regulations, provided that (a) safety, structural integrity, and functionality are retained; and (b) accessibility for maintenance, inspection, monitoring, and flood fighting are retained. During the design phase, all available options and means for achieving Vegetation ETL compliance will be evaluated. The project as designed and constructed would be in compliance with the Vegetation ETL guidelines.

3.8.3 Mitigation and Monitoring Plan

3.8.3.1 Mitigation Plan Requirements

The USACE Planning Guidance Notebook (ER 1105-2-100) describes the mitigation process and procedures and content of mitigation plans to be included in feasibility-level reports. The planning of USACE projects must ensure that project-related adverse environmental impacts (i.e., impacts on fish and wildlife resources) have been avoided or minimized to the extent practicable, and that remaining unavoidable significant adverse impacts are compensated to the extent justified.

Under Section 2036(a)(3)(B) of WRDA 2007, Public Law No. 110-114, Section 2036(a)(3)(B), 121 Stat. 1093 (2007), USACE must fully develop a mitigation plan that includes the following: (1) monitoring until successful, (2) criteria for determining ecological success, (3) a description of available lands for mitigation and the basis for the determination of availability, (4) the development of contingency plans (i.e., adaptive management), (5) identification of the entity responsible for monitoring, and (6) establishing a consultation process with appropriate Federal and state agencies in determining the success of mitigation.

ER 1105-2-100 requires that mitigation plans be analyzed for cost effectiveness and incremental cost and benefits. Analysis of cost effectiveness, in general, compares the relative costs and benefits of alternative mitigation plans. The least expensive plan which meets the restoration objective is usually selected. "Incremental cost analysis" is the technique used by USACE to develop cost-effective mitigation plans. Incremental cost analysis calculates the cost per unit of output gained by each successive feature, allowing the planning team to determine the point of diminishing returns. Appendix D contains the Draft Cost Effectiveness Incremental Cost Analysis Report.

3.8.3.2 Fish and Wildlife Mitigation and Monitoring Plan

A mitigation and monitoring plan (MMP) has been developed to compensate for the loss of vegetation and impacts on listed species. The MMP would be finalized following completion of Endangered Species Act Section 7 consultation with the USFWS and National Marine Fisheries Service and completion of Fish and Wildlife Coordination Act coordination with the USFWS and California Department of Fish and Wildlife (CDFW). The MMP accompanies this report in Appendix D.

The MMP is intended to address the following issues.

- Effects on and mitigation for riparian and non-riparian native trees.
- Effects on special-status species habitat for valley elderberry longhorn beetle (VELB) and giant garter snake (GGS).
- Effects on Section 404 jurisdictional features.

The MMP proposes offsite in-kind compensatory mitigation for riparian forest, non-riparian native trees and VELB. Mitigation for these areas will occur on the Feather River at the Star Bend Conservation Area (SBCA) and the proposed Three Rivers Levee Improvement Authority's (TRLIA) Feather River Floodway Corridor Restoration Project (FRFCRP) site. Mitigation for GGS and features subject to Federal jurisdiction under Section 404 of the Clean Water Act will occur at offsite private banking lands as discussed below.

Onsite habitat replacement is generally the preferred approach to habitat mitigation; however, because much of the affected habitat (specifically, woody vegetation) is not compliant in its location with USACE levee vegetation policy, this option was determined to be infeasible. Further, the highly dispersed nature of the impact locations makes efficient replacement infeasible. Therefore, onsite replacement was not considered further as a viable option for this project and offsite, in-kind habitat replacement was selected as the best option for mitigation. It involves replacement of affected habitat with the same type of habitat at a different location offsite. 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.

The MMP proposes two strategies for offsite, in-kind replacement.

- **Agency-responsible mitigation.** This strategy involves replacement of in-kind habitat on habitat lands. The SBCA on the west levee of the Feather River near river mile 18 is an existing floodplain habitat restoration site that was created as part of the Star Bend setback levee project. The Three Rivers restoration site is located within the TRLIA Early Implementation Project (EIP) Feather River Setback levee expanded floodway. These two sites contain sufficient area to accommodate all of the project's upland compensatory mitigation and will be used for

mitigating impacts on: (1) riparian forest, (2) oak woodland (non-riparian native trees), and (3) VELB.

- **Purchase credits at commercial mitigation banks.** This strategy involves replacement of in-kind habitat through purchase of credits issued for habitat lands operated by a commercial mitigation bank. For the aquatic habitat impacts on GGS, the project proposes to purchase credits at the Sutter Basin Conservation Bank, operated by Westervelt Ecological Services in Sutter County, which is the only bank that presently offers GGS credits approved by both the USFWS and CDFW. The project proposes to purchase jurisdictional water credits at the River Ranch Wetland Mitigation Bank, owned and operated by Wildlands, Inc., and located at the confluence of the Sacramento and Feather Rivers in Yolo County. There are currently no mitigation banks that offer oak woodland (non-riparian native tree) credits.

3.8.3.2.1 Habitat Mitigation and Monitoring at the Star Bend Conservation Area and Feather River Floodway Corridor Restoration Project Sites

The proposed actions to enhance habitat at the SBCA and FRFCRP sites are summarized below; additional details are contained in the MMP in Appendix D. This section only addresses agency-responsible mitigation. As described above, mitigation for USACE Section 404 jurisdictional habitat and GGS will occur offsite at commercial mitigation and conservation banks and is deemed satisfied and complete once credits are purchased.

To compensate for fish and wildlife impacts from construction, approximately 88 acres of riparian forest, oak woodland (non-riparian native), and VELB compensation would occur at the SBCA and FRFCRP sites. The SBCA mitigation site is located on the water side (east) of the new setback levee that was constructed in 2009 on the Feather River, approximately 6 miles south of Yuba City. The SBCA project created approximately 48.5 acres of floodplain habitat, which included habitat enhancement and onsite mitigation for impacted VELB habitat. The FRFCRP site is located on the east side of the Feather River in the levee setback area created by the TRLIA EIP Feather River Setback Levee project. The setback levee actions taken by Levee District 1 and TRLIA have together increased the amount of floodplain potentially exposed to inundating flows by approximately 1,649 acres. The floodplain riparian forest proposed by USACE and SBCA in combination with these actions allow for higher quality floodplain habitat for juvenile salmonids and other native species.

At the 48.5-acre SBCA site, approximately 24 acres has already been used for elderberry transplants and associated native plants. Under the SBPFS, the remaining approximately 24.5 acres would be used for mitigating impacts on elderberry shrubs, riparian forest, and non-riparian native trees. The SBCA site will serve as a transplant site for elderberry shrubs that are unable to be avoided by construction. Elderberry seedlings or cuttings and associated native species will also be planted at the SBCA site. The design characteristics used in the initial mitigation work at SBCA serve as a reference site for the additional mitigation. These characteristics are described in the report *Habitat Enhancement Plan for the Feather River Setback Levee and Habitat Enhancement Project at Star Bend*, prepared by River Partners and Stillwater Sciences in 2009 for Levee District 1 and Wood Rodgers.

The target plant communities and species at the SBCA and the FRFCRP sites will include riparian forest, non-riparian native trees, and elderberry shrubs and associated plants for VELB habitat. It is anticipated that both the SBCA and FRFCRP mitigation sites will sustain rapid growth of restored riparian species given the presence of good soils and potential exposure to frequent flooding. The goal for each mitigation site is to become fully self-sustaining. An "over-planting" approach is

proposed to rapidly establish native riparian species. Over-planting of these sites will minimize or eliminate the need for any additional replanting efforts. The ultimate ecological objective for over-planting is that in time the area will thin out and create a complex of open canopy, dense forest, and dead snags, all of which provide benefits to wildlife (River Partners and Stillwater Sciences 2009). Over time, mortality based on differences of soil textures and water table depths will create areas of complex, open canopy, dense forest, and dead snags, all of which create habitat for wildlife (River Partners and Stillwater Sciences 2009).

USACE will be responsible for the design, installation and maintenance of the plantings for a period of 3 years from the end of project construction and then responsibility for operation and maintenance will be transferred to SBFCA. It is anticipated that at the end of the 3-year establishment period, 80% survivorship of woody species will be attained. The riparian tree and non-riparian native tree restoration areas will be monitored annually during Years 1 through 5 following completion of mitigation project implementation. First year monitoring will not be completed until after one full growing season for vegetation has passed since completion of construction. At the end of the first growing season, the restoration contractor will conduct a complete census of all woody species planted. During Years 2 and 3, woody species plantings will be sampled to determine survivorship, growth, and coverage. Irrigation will be applied with the goal that plants will become self-sufficient by the end of the third growing season at which time the SBFCA will assume O&M responsibility from USACE. SBFCA will submit an annual report at the end of each monitoring year and a final report to USACE and other resource agencies for review and approval. These areas will be monitored annually during May or June. Additional monitoring of the riparian tree and non-riparian native tree restoration areas will be conducted in the 10th, 15th, and 20th years. A minimum survival rate of at least 80% must be maintained throughout the first 2 years of the monitoring period. A minimum survival rate of at least 70% must be maintained at the end of the third year, as must a minimum survival rate of at least 60% at the end of 20 years. Within 1 year of discovery that survival has dropped below the respective percentage for each monitoring year, failed plantings will be replaced to bring survival above this level. The resource agencies in consultation with USACE and SBFCA will make any determination as to replacement responsibilities arising from circumstances beyond the project's control, such as plants damaged or killed as a result of severe flooding or vandalism.

A final monitoring report will be submitted after all performance monitoring at the mitigation sites is complete. The final report will be prepared by a qualified biologist and will evaluate whether the mitigation has achieved the goals and success criteria set forth in the approved MMP. If the final report indicates that the mitigation project has been unsuccessful, in part or in whole, based on the approved success criteria, the causes for not meeting the criteria will be evaluated and a revised or supplemental mitigation plan submitted within 90 days of the end of the monitoring period for the review and approval of resource agencies to compensate for those portions of the original program that did not meet the approved success criteria. The approved remedial measures will be developed based on the qualitative and quantitative monitoring results to determine the most effective remedy. If, after all remedial measures have been implemented, it becomes evident that the permit requirements cannot be satisfied according to the proposed mitigation plan, SBFCA will coordinate with USACE and the resource agencies to develop a contingency plan to be approved by all parties.

A long-term management plan will be prepared to ensure the mitigation site is monitored and maintained in perpetuity. This management plan provides management objectives and tasks to monitor, manage, maintain, and report on the mitigated natural resources. Routine monitoring and

minor maintenance tasks are intended to assure the viability of the mitigation site's functions and values. This long-term management plan will take effect after the completion of the monitoring period, once it has been determined by the appropriate resource agencies that the mitigation project has achieved its objectives and that the outlined performance standards for each habitat type have been reached. The designated resource manager(s) will oversee all long-term management activities.

3.8.4 Operations and Maintenance, Repair, Replacement, and Rehabilitation

The OMRR&R requirements, activities, and costs were identified during the final analysis of Alternatives SB-7 and SB-8. Typical OMRR&R activities both with- and without-project are those listed below.

- Vegetation removal and control in compliance with the Vegetation ETL.
- Rodent control and repair of rodent damage.
- Slope re-grading and reseeding.
- Repair of waterside erosion.
- Maintenance of relief wells and collection ditches.
- Maintenance and repair of flap gates to minimize internal drainage.
- Patrol road and ramp maintenance.
- Inspection/patrolling including participation in Federal and state inspection programs, routine patrolling to identify maintenance needs and to assure flood worthiness, and continuous patrolling during high water conditions.
- Flood fighting.
- Sandbagging of the gap in the levee crown for passage of the railroad during high water conditions to prevent flooding of Yuba City and vicinity.

3.8.5 Environmental Commitments

Environmental commitments are measures incorporated as part of the project description, meaning they are proposed as elements of the proposed project and are to be considered in conducting the environmental analysis and determining effects and findings.

3.8.5.1 Stormwater Pollution Prevention Plan

Because ground disturbance for the project would be greater than 1 acre, a National Pollutant Discharge Elimination System (NPDES) general construction activity stormwater permit would be obtained from the Central Valley Regional Water Quality Control Board (RWQCB). The RWQCB administers the NPDES storm water permit program in Sutter and Butte Counties. Obtaining coverage under the NPDES general construction activity permit generally requires that the project applicant prepare a stormwater pollution prevention plan (SWPPP) that describes the best management practices (BMPs) that would be implemented to control accelerated erosion, sedimentation, and other pollutants during and after project construction. The SWPPP would be prepared prior to commencing earth-moving construction activities.

3.8.5.2 Bentonite Slurry Spill Contingency Plan (Frac-Out Plan)

The construction contractor would be required to prepare and implement a bentonite slurry spill contingency plan (BSSCP) for any excavation activities that use pressurized fluids (other than water). The BSSCP would include measures intended to minimize the potential for a frac-out (short for "fracture-out event") associated with excavation and tunneling activities; provide for the timely detection of frac-outs; and ensure an organized, timely, and *minimum-effect* response in the event of a frac-out and release of excavation fluid (i.e., bentonite).

3.8.5.3 Spill Prevention, Control, and Counter-Measure Plan

A spill prevention, control, and counter-measure plan (SPCCP) is intended to prevent any discharge of oil into navigable water or adjoining shorelines. USACE would require the construction contractor to develop and implement an SPCCP to minimize the potential for and effects from spills of hazardous, toxic, or petroleum substances during construction and operation activities. The SPCCP would be completed before any construction activities begin. Implementation of this measure would comply with state and Federal water quality regulations. The SPCCP would describe spill sources and spill pathways in addition to the actions that would be taken in the event of a spill (e.g., an oil spill from engine refueling would be immediately cleaned up with oil absorbents). USACE inspectors would routinely inspect the construction area to verify that the measures specified in the SPCCP are properly implemented and maintained.

3.8.5.4 Monitoring of Turbidity in Adjacent Water Bodies

Monitoring of turbidity in adjacent water bodies would be required and included in construction plans and specifications to determine whether turbidity is being affected by construction and ensure that construction does not exceed Basin Plan turbidity objectives set by the State Water Resources Control Board (State Water Board). The Basin Plan specifically states that where natural turbidity is between 5 and 50 Nephelometric turbidity units (NTUs), turbidity levels may not be elevated by 20% above ambient conditions. Where ambient conditions are between 50 and 100 NTUs, conditions may not be increased by more than 10 NTUs. If turbidity limits exceed Basin Plan standards, construction-related earth-disturbing activities would slow to a point that results in alleviating the problem.

3.9 Final Array Economic Analysis

For the final array, a Class 3 Analysis (feasibility level) was conducted using the approach required for engineering design, real estate and technical detail efforts (35%), costs, real estate, and economics to assist in determining the Recommended Plan (RP). The updated economic numbers using the pilot process varying confidence intervals methodology are shown in Table 3-21.

Table 3-21. Net Benefits[a,] (Varying Confidence Intervals) of the Final Array of Alternatives Using October 2013 Prices (Values in Millions) and 3.5% Discount Rate

	Alternative						
		NED Plan, SB-7			LPP, SB-8		
Category	SB-1	Low	Mid	High	Low	Mid	High
Total First Costs		355	370	386	632	659	688
Interest during Construction		34	36	37	88	92	96
OMRR&R			0.28			0.45	
Annual Cost		17	17	18	31	32	33
Annual Benefits		43	64	109	46	72	120
Net Benefits[b]		34	54	79	23	47	74
Benefit to Cost Ratio[b]		2.8:1	3.9:1	5.3:1	1.6:1	2.3:1	3.1:1

[a] Refer to Section 3.4.3.1, *Annual Net Benefits*, for economic range explanation.

[b] Net Benefits and Benefit to Cost Ratios are a result of Monte Carlo simulations using triangular distributions of annual benefit and annual cost confidence intervals as inputs in accordance with ER-1105-2-101.

The Class 4 Analysis cost estimate was conducted as required to refine the economic numbers to a feasibility level of confidence. These more refined costs confirmed that the conceptual parametric cost estimate, ranges, and assumptions were valid and accurate. Table 3-22 presents net benefits in standard mean USACE format for the feasibility level cost estimates.

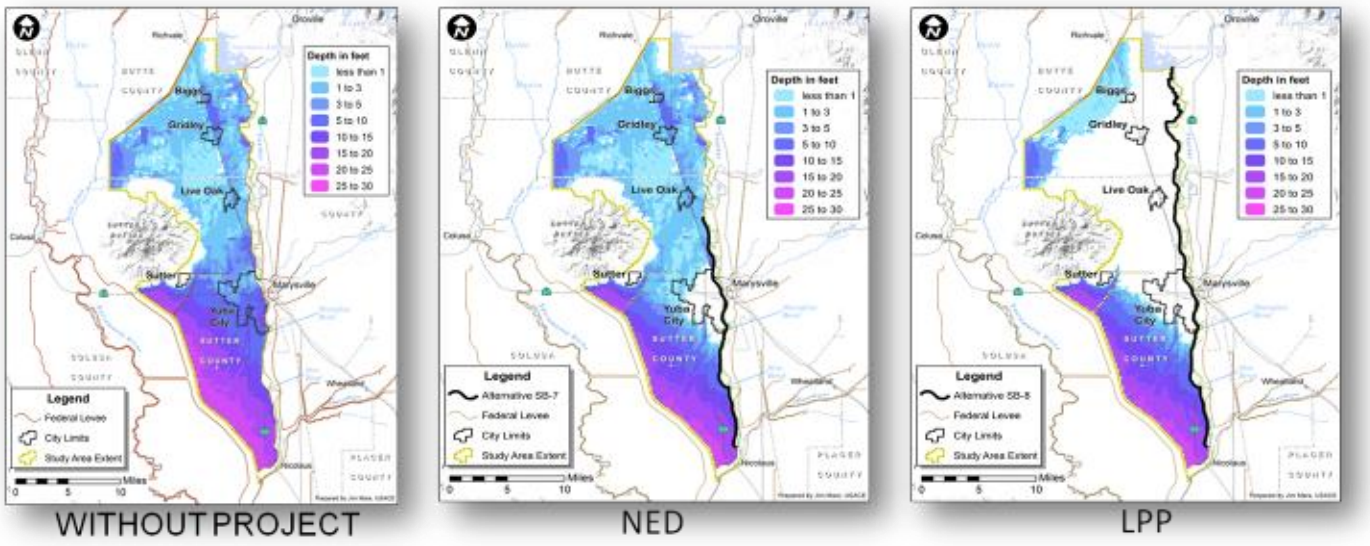
Table 3-22. Net Benefits (Mean, Standard USACE Practice) of the Final Array of Alternatives using October 2013 Prices (Values in Millions) and 3.5% Discount Rate

	Alternative		
Category	SB-1	NED Plan, SB-7	LPP, SB-8
Total First Costs[a]	Not applicable	390	686
Interest during Construction	Not applicable	38	94
O&M	Not applicable	0.28	0.45
Annual Cost	Not applicable	18	33
Annual Benefits	Not applicable	79	87
Net Benefits	Not applicable	61	54
Benefit to Cost Ratio	Not applicable	4.4:1	2.6:1
Benefit to Cost Ratio @7%	Not applicable	2.3:1	1.3:1

[a] Cultural resources data recovery costs ($1.6 million for SB-7 and 3.0 million for SB-8) are not included in economic costs per Corps policy (ER-1105-2-100, Appendix e, paragraph E-63.f.((5)).

3.9.1 Comparison of Accounts and Criteria of the Final Array of Alternatives

As a final comparison for screening for the RP in the multi-objective planning process, a pair-wise comparison and evaluation was completed between the No Action Alternative (SB-1), the NED Plan (SB-7), and the LPP (SB-8) to verify and determine the RP as shown in Table 3-23. Residual 1% ACE floodplains also were used for comparison. See Figure 3-16.



(See the *Figures* folder on the CD for full-sized images.)

Figure 3-16. Final Array of Alternatives with Residual 1% ACE Floodplains

The floodplain comparison shows that the NED Plan would reduce the flood risk only in the Yuba City core area in comparison to the No Action Alternative, resulting in considerable residual risk in terms of public and life safety in the rest of the study area. The LPP addresses the residual NED Plan risk by reducing flood risk and associated public and life safety issues in the northern communities of Live Oak, Gridley, and Biggs while minimizing potentially developable lands in the southern half of the deeper areas of the Sutter Basin. The LPP through previous screening is shown to be the best alternative to provide FRM benefits and best address residual risk of the NED Plan for public and life safety.

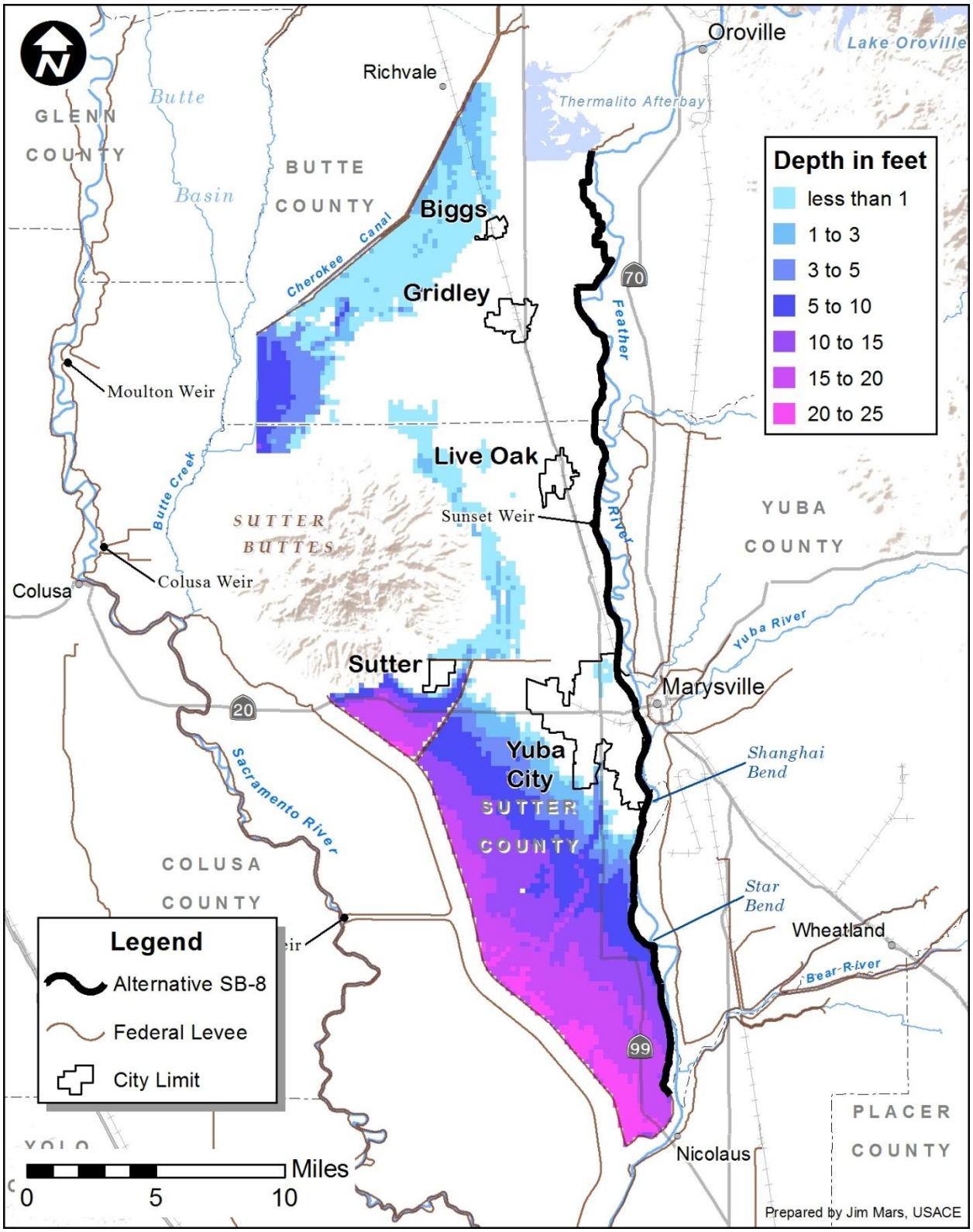
3.10 The Recommended Plan

The multi-objective comparison and assessment between the NED Plan and the LPP was completed. Both the NED Plan and LPP would provide significant benefits that exceed their costs. While the NED Plan is more efficient than the LPP, both plans are efficient. Both the NED Plan and LPP are defined as hydrologically separable because they have separate residual 1% ACE floodplains with resulting distinct economic benefits.

The LPP is supported by the local sponsors SBFCA and CVFPB, and has received ASA(CW) approval with a NED Plan cost-share cap. The LPP will comply with the local sponsor objective to meet the

criteria of the California Government Code requirements for a 200-year level of protection for urban and urbanizing areas by 2025. Refer to Appendix C1b. Hydraulic Design and Analysis.

In a multi-objective context that equally emphasizes the objectives of flood risk management and reducing residual risk to public and life safety across all planning criteria and accounts, the LPP (Alternative SB-8) is recommended as the Recommended Plan (RP) at the NED Plan limit of Federal cost participation. See Figure 3-17.



(See the *Figures* folder on the CD for a full-sized image.)

Figure 3-17. Recommended Plan: Alternative SB-8 (Residual 1% ACE Floodplain)

Table 3-23. Final Array of Alternative Plans—Comparison Summary of Accounts and Criteria

	No Action (SB-1)	NED Plan (SB-7)	LPP (SB-8)
1. PLAN DESCRIPTION			
	Alternative SB-1: The No Action Alternative and future without-project condition provides no physical project constructed by the Federal Government.	Alternative SB-7: The NED Plan is a Feather River levees fix-in-place levee alternative from Sunset Weir to Laurel Avenue.	Alternative SB-8: The LPP is a Feather River levees fix-in-place levee alternative from Thermalito Afterbay to Laurel Avenue.
2. MULTI-OBJECTIVE PLANNING ASSESSMENT			
A. National Economic Development (NED) October 2013 price level, 3.5% Discount Rate			
1. Project Cost (First Cost)[a]	$0	$390,000,000	$686,000,000
2. Annual Cost	$0	$18,000,000	$33,000,000
3. Total Annual Benefit	$0	$79,000,000	$87,000,000
4. Annual Net Benefits	**$0**	**$61,000,000**	**$54,000,000**
5. Benefit – Cost Ratio	**N/A**	**4.4:1**	**2.6:1**
B. Environmental Quality (EQ)			
1. Environmental Safety	The high potential for contaminated floodwaters from the northern community urban facilities (water treatment plants, gas stations, etc.) would remain.	The high potential for contaminated floodwaters from the northern community urban facilities (water treatment plants, gas stations, etc.) would remain.	The LPP would reduce flood risk and reduce risk of potentially contaminated floodwaters from the northern urban community facilities (water treatment plants, gas stations, etc.)
2. Ecosystem	The Sutter Basin is located along the Pacific Flyway, which provides foraging and resting habitat for millions of migrating waterfowl during the winter migration (flooding) season. Flooding would negatively affect "stop-over" feeding and resting areas, and contaminated waters could affect wildlife health.	Residual flooding of thousands of acres would negatively affect "stop-over" feeding and resting habitat, and contaminated waters could affect wildlife health.	Residual flooding would be primarily concentrated in the southern end of the Basin, allowing for significant availability of "stop-over" feeding and resting habitat. There would be a lesser risk of urban area contamination.

	No Action (SB-1)	NED Plan (SB-7)	LPP (SB-8)
C. Regional Economic Development (RED)			
1. RED Effects on Flood Risk Management and Region	Future flooding would destroy part of the infrastructure, resulting in a loss in the region's ability to produce goods and services. Little to no RED benefits.	A 4-year period of construction can result in positive spillovers to suppliers, short-term increases in construction-related employment, increased revenues for local businesses, and a potential increase in wealth for floodplain residents as less is spent on damaged property repairs. Population and economic centers of the basin would be flooded, resulting in slow regional recovery.	Similar to NED Plan, but effects would extend for a 6-year period of construction, resulting in additional RED benefits. Major population and economic centers would have reduced risk of flooding, resulting in faster regional recovery.
D. Other Social Effects (OSE) – Life Safety Evaluation Metrics			
1. Life, Health, and Safety	Continued flood risk and consequences in the Sutter Basin, including the communities of Yuba City, Live Oak, Gridley, and Biggs.	Flood Warning Emergency Evacuation Plan (FWEEP) mitigation is problematic for types of levee failures and limited evacuation routes. Significant life safety residual risk to the communities of Yuba City, Live Oak, Gridley, and Biggs.	Flood Warning Emergency Evacuation Plan (FWEEP) mitigation is problematic for types of levee failures and limited evacuation routes. Life safety residual risk to the communities of Yuba City, Live Oak, Gridley, and Biggs would be significantly reduced.
1a. Remaining Population at Risk	Approximately **96,600** individuals are within the 1% ACE floodplain.	**38,200** people would remain in the 1% ACE floodplain. 60% of population would be removed from the residual 1% ACE floodplain under the NED Plan.	**6,600** people remain in the 1% ACE floodplain. 93% of population would be removed from the residual 1% ACE floodplain under the LPP.
1b. Loss of Life (See Table 3-15)	Potential loss of lives: Day Flood Event-**388**; Night Flood Event-**489**	Potential loss of lives: Day-**157**; Night-**197**	Potential loss of lives: Day-**27**; Night-**34**
1c. Critical Infrastructure – Public Safety	**28** structures deemed as critical from a national perspective are at risk from floods.	**11** structures would remain at risk from floods.	**1** structure would be at risk from floods.
1d. Evacuation Routes (See Figure 3-9)	In the event of a flood, no evacuation route is available out of the basin.	There would be **one** problematic route for evacuation during a flood event. FWEEP would have limited effectiveness.	**Five** evacuation routes would be available in the event of a flood. FWEEP would have more robustness and redundancy.

	No Action (SB-1)	NED Plan (SB-7)	LPP (SB-8)
1e. Potential Developable Floodplains Note: fix-in-place measures are only bringing levees up to authorized elevation and performance.	Currently, 71,800 acres of land are potentially available for future development.	88,200 acres would be potentially available for future development.	100,200 acres of land would be potentially available for future development.
2. Social Vulnerability (Study Area Resiliency)	The social vulnerability index score indicates the study area has medium to high vulnerability. The No Action Alternative may leave communities unable to cope with the recovery from a flood hazard.	The majority of the community of Yuba City would be afforded flood risk reduction; however the communities of Live Oak, Gridley, and Biggs would remain at risk of flood hazards and may be unable to cope and recover.	The Yuba City, Live Oak, Gridley, and Biggs would be provided flood risk reduction, and social vulnerability would be minimized due to a decrease in the probability of flood hazards occurring.
3. Residual Risk (See Table 3-8)	Residual flood risk would remain high throughout the study area.	Residual flood risk for public and life safety would be reduced for most of the Yuba City urban area.	Residual flood risk for public and life safety would be reduced in the high-risk communities of Yuba City, Live Oak, Gridley, and Biggs.
E. Federal Planning Criteria			
Acceptability	N/A	The local sponsors and public support levee fixes and improvements.	The local sponsors and public support levee fixes and improvements.
Effectiveness	N/A	The NED Plan would address the primary planning objectives of providing FRM and reducing some public and life safety risk.	The LPP would address the primary planning objectives of providing additional FRM and reducing public and life safety risk beyond the NED Plan.
Efficiency	N/A	Economic analysis and outputs identified this alternative as the NED Plan with the highest annual net benefits.	Based on economic analysis and outputs, the LPP is not economically incrementally justified; however, the LPP would provide additional annual benefits with a positive BCR.
Completeness	N/A	Significant residual risk to public and life safety in the northern basin communities of Biggs, Gridley, and Live Oaks would remain.	The LPP would reduce residual risk to public and life safety in Yuba City, Biggs, Gridley, and Live Oaks.

[a] Cultural resources data recovery costs ($1.6 million for SB-7 and 3.0 million for SB-8) are not included in economic costs per Corps policy (ER-1105-2-100, Appendix e, paragraph E-63.f.((5)).

4.1 Introduction

This chapter addresses the affected environment and environmental consequences of each of the alternatives in the final array, mitigation measures for adverse impacts, cumulative impacts, and other environmental considerations.

This final integrated feasibility study report and EIR/SEIS provides a supplemental analysis to the Feather River West Levee Project (FRWLP) Final EIS. This chapter refers to the FRWLP Final EIS, as appropriate, to avoid unnecessary duplication. The alternatives in the final array represent modifications to the alternatives evaluated in the FRWLP Final EIS. Alternative SB-8 is similar to FRWLP Alternative 3, but Alternative SB-8 includes design modifications to meet Federal levee standards as described below in Section 4.1.4, *Comparison of FRWLP and SBPFS Alternatives*. Alternative SB-7 includes the same levee improvements as Alternative SB-8 but excludes Reaches 21–41 above Sunset Weir.

The environmental resources within the study area and along the project levees have received extensive study and have been summarized in a number of comprehensive documents prepared by USACE, SBFCA, and the state. The FRWLP Final EIS and the *Sutter Basin Feasibility Study Environmental Without-Project Conditions Report* (ICF International 2012) contain extensive information on the existing conditions. This final integrated report and EIR/SEIS incorporates those documents and supporting appendices by reference and provides only a brief description of the existing resources.

4.1.1 NEPA and CEQA Requirements

The Council on Environmental Quality's (CEQ's) regulations for implementing NEPA specify that a Federal agency preparing an EIS must consider the effects of the proposed action and alternatives on the environment. Environmental effects are categorized as direct, indirect, or cumulative. An EIS must identify relevant, reasonable mitigation measures not already included in the proposed action or alternatives that could avoid, minimize, rectify, reduce, eliminate, or compensate for the project's adverse environmental effects (40 Code of Federal Regulations [CFR] Sections 1502.14, 1502.16, and 1508.8.).

The State CEQA Guidelines explain that the environmental analysis for an EIR must evaluate impacts associated with the project and identify mitigation for any potentially significant impacts. All phases of a proposed project, including construction and operation, are evaluated in the analysis.

An EIR must describe any feasible measures that could minimize significant adverse impacts, and the measures are to be fully enforceable through permit conditions, agreements, or other legally binding instruments (State CEQA Guidelines Section 15126.4[a]). Mitigation measures are not required for impacts that are found to be less than significant.

Under NEPA, preparation of an EIS is triggered if a Federal action has the potential to "significantly affect the quality of the human environment." *Significance* is based on the context and intensity of each potential effect. *Context* refers the affected environment in which a project is proposed. *Intensity* refers to the severity of the effect, which is examined in terms of the type, quality, and sensitivity of the

resource involved; location and extent of the effect; duration of the effect (short- or long-term); and other considerations. Beneficial effects are identified and described. When there is no measurable effect, an impact is found not to occur. The *intensity* of adverse effects refers to the degree or magnitude of a potential adverse effect, which is described as negligible, moderate, or substantial. Context and intensity are considered together when determining whether an impact is significant under NEPA. Thus, it is possible that a significant adverse effect may still exist when the intensity of the impact is determined to be negligible.

As in the FRWLP Final EIS, this report uses both NEPA and CEQA terminology. The terms *environmental impacts*, *environmental effects*, and *environmental consequences* are used synonymously.

4.1.2 Resource Analysis Structure

The resource impact discussions beginning in Section 4.2 below are based on the following structure.

- **Introduction.** This section introduces the scope of the resource analysis.
- **Affected Environment.** This section discusses the regulatory and environmental setting. This section utilizes incorporation by reference from the FRWLP Final EIS where appropriate.
- **Determination of Effects.** This section provides the criteria used in this document to define the level at which an effect would be considered significant in accordance with CEQA and significant in accordance with NEPA. Significance criteria (sometimes called thresholds of significance) used in this EIR/SEIS are based on the checklist presented in Appendix G of the State CEQA Guidelines; factual or scientific information and data; and regulatory standards of Federal, state, and local agencies. The significance thresholds used in this EIR/SEIS also encompass the factors taken into account under NEPA to evaluate the context and the intensity of the effects of an action.
- **Effects and Mitigation Measures.** To comply with NEPA and CEQA, effects are considered and evaluated as to whether they are direct, indirect, or cumulative. Direct effects are those that are caused by the action and occur at the same time and place. Indirect effects are reasonably foreseeable consequences to the physical environment that may occur at a later time or at a distance from the project area. Because direct and indirect effects are often interrelated, typically there is no distinction made between the two in the effects discussion. Cumulative effects for certain resources are analyzed and discussed at the end of this chapter in Section 4.13, *Cumulative and Growth-Inducing Impacts*.

  Effects are listed numerically and sequentially throughout each section. An effect statement precedes the discussion of each effect and provides a summary of the effect topic. The effect statements generally follow the FRWLP Final EIS. The numbering system provides a mechanism for tracking unique effects by resource area.

  Each effect is accompanied by a finding or conclusion, as required under NEPA and CEQA. For the purposes of the analyses in this document, the effect findings are defined more specifically below (in order of increasing severity to the environment).

  - **Beneficial.** This effect would provide benefit to the environment as defined for that resource.
  - **No Effect.** This effect would cause no discernible change in the environment as measured by the applicable significance criteria; therefore, no mitigation would be required.

- **Less than Significant.** This effect would cause no substantial adverse change in the environment as measured by the applicable significance criteria; therefore, no mitigation would be required.
- **Significant.** This effect would cause a substantial adverse change in the physical conditions of the environment. Effects determined to be significant based on the significance criteria fall into two categories: those for which there is feasible mitigation available that would avoid or reduce the environmental effects to less-than-significant levels and those for which there is either no feasible mitigation available or for which, even with implementation of feasible mitigation measures, there would remain a significant adverse effect on the environment. Those effects that cannot be reduced to a less-than-significant level by mitigation are identified as significant and unavoidable, described below.
- **Significant and Unavoidable**. This effect would cause a substantial adverse change in the environment that cannot be avoided or mitigated to a less-than-significant level if the project is implemented. Even if the effect finding is still considered significant with the application of mitigation, the applicant is obligated to incorporate all feasible measures to reduce the severity of the effect.

- **Effects Not Addressed Further in this Document.** In those instances where effects have been adequately addressed in the FRWLP Final EIS, an effect summary and an explanation of why no further study is needed are provided.
- **Mitigation Measures.** Measures to mitigate (i.e., avoid, minimize, rectify, reduce, eliminate, or compensate for) significant effects accompany each significant effect discussion. Similar to the effect descriptions, mitigation measures are listed numerically and sequentially throughout each section. A mitigation measure statement precedes the discussion of each measure and provides a summary of the measure topic. The numbering system provides a mechanism for tracking unique measures by resource area.

4.1.3 Scope of Environmental Analysis

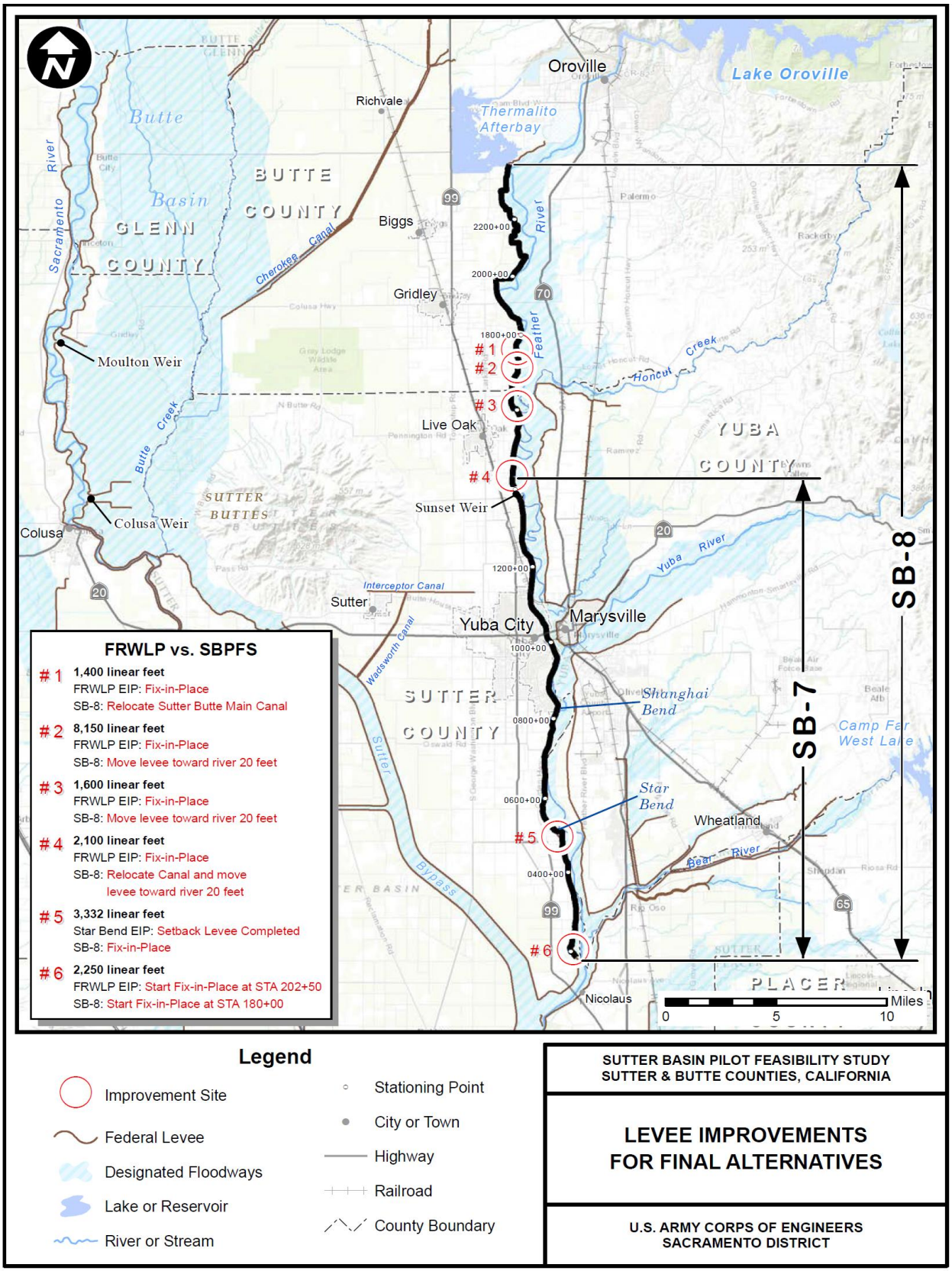
The scope of the integrated Final EIR/SEIS focuses on effects resulting from the alternatives in the final array and the alternatives evaluated in the Final EIS for the FRWLP. All potentially relevant environmental resource areas initially were considered for analysis. In compliance with NEPA and CEQA, the discussion of the affected environment focuses only on those resource areas potentially subject to impacts, and those with potentially significant environmental issues. Section 4.1.6 briefly summarizes the effects on these resources and the rationale for their elimination from detailed analysis.

4.1.4 Comparison of FRWLP and SBPFS Alternatives

The FRWLP Final EIS evaluated the following alternatives to reduce flood risk along the Feather River West Levee from Thermalito Afterbay downstream to approximately 4 miles upstream of the Feather River's confluence with the Sutter Bypass. These alternatives affect the same length of levee but differ between each other primarily in their overall "footprint" of construction (Plate 4-1).

Alternative 1 focuses on those measures predominantly within the existing footprint of the Feather River West Levee. Along with other measures, this alternative primarily proposes cutoff walls as a technique to address the deficiencies while minimizing change in the existing levee footprint. This alternative would minimize real estate acquisition and changes in land use.

Plate 4-1. SBPFS Alternatives and FRWLP Preferred Alternative



FRWLP vs. SBPFS

#1 1,400 linear feet
FRWLP EIP: Fix-in-Place
SB-8: Relocate Sutter Butte Main Canal

#2 8,150 linear feet
FRWLP EIP: Fix-in-Place
SB-8: Move levee toward river 20 feet

#3 1,600 linear feet
FRWLP EIP: Fix-in-Place
SB-8: Move levee toward river 20 feet

#4 2,100 linear feet
FRWLP EIP: Fix-in-Place
SB-8: Relocate Canal and move levee toward river 20 feet

#5 3,332 linear feet
Star Bend EIP: Setback Levee Completed
SB-8: Fix-in-Place

#6 2,250 linear feet
FRWLP EIP: Start Fix-in-Place at STA 202+50
SB-8: Start Fix-in-Place at STA 180+00

Legend

- Improvement Site
- Federal Levee
- Designated Floodways
- Lake or Reservoir
- River or Stream
- Stationing Point
- City or Town
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
SUTTER & BUTTE COUNTIES, CALIFORNIA

LEVEE IMPROVEMENTS FOR FINAL ALTERNATIVES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Alternative 2 includes measures that would not be constrained by the existing footprint of the Feather River West Levee. Along with other measures, this alternative primarily proposes stability berms and seepage berms, which would substantially extend beyond the current levee footprint.

Alternative 3 is the SBFCA preferred alternative. It is a blend of the flood management measures identified in Alternatives 1 and 2, optimized based on the screening criteria. *Optimized* means a number of factors have been considered, such as effectiveness in addressing the deficiencies, compatibility with land use, minimization of real estate acquisition, avoidance of effects, and cost; the footprint has been considered but not held as a primary constraint. This alternative consists of cutoff walls and berms, along with other measures.

Alternatives SB-8 and SB-7 are similar to SBFCA's preferred alternative evaluated in the FRWLP Final EIS, but there are differences between the alternatives. The following is a summary of the major differences between the FRWLP and SBPFS alternatives. Plate 4-1 identifies some of the key differences.

- **Downstream Levee Improvement Extension.** Alternatives SB-8 and SB-7 extend 2,250 feet further south of Laurel Avenue (Station 180+00). The FRWLP alternatives do not extend below Laurel Avenue.
- **Levee Superiority.** Alternatives S-8 and SB-7 incorporate USACE levee superiority design requirements. Based on hydraulic modeling of the existing levee profile, it is estimated that overtopping upstream of the Yuba River confluence would occur between River Miles 43.5 and 45.5 (FRWLP Station 1582+00 to 1601+00). Downstream of the Yuba River, overtopping would occur between River Miles 19 and 20 (FRWLP Station 547+00 to 604+60). Erosion protection matting will be installed at these two locations on the landside of the levee to control erosion and to allow for more controlled failure of the levee due to overtopping. These locations are in non-urbanized areas and initial overtopping is estimated to occur between the mean 0.5% (1/200) ACE and 0.2% (1/200) ACE events.
- **Sutter Butte Canal.** At several locations where the Sutter Butte Canal and the Feather River West Levee lie adjacent to each other, the levee and/or canal would be relocated under Alternative SB-8 in order to provide an operations and maintenance road between the canal and levee. Under the FRWLP, no canal or levee relocation is proposed. Because SB-7 does not include this reach of levee, no levee or canal relocations are proposed under SB-7.
- **USACE Vegetation Management Levee Safety Policy.** USACE policy requires new federally authorized cost shared levee projects be designed to meet the current vegetation management standards. A Vegetation-Free Zone (VFZ) as described by Engineer Technical Letter ETL 1110-2-571, *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*, (Vegetation ETL) would be established and vegetation removed to bring the levee into Vegetation ETL compliance.
- **Real Estate Requirements.** Under the SBPFS, the lands to be acquired for construction and O&M on the landside of the levee would be less than under the FRWLP.

4.1.4.1 Downstream Levee Improvement Extension

An additional 2,250 feet of levee improvement would be constructed below Laurel Avenue (180+00 to 202+50) and consist of a 100-foot wide undrained seepage berm (5 feet thick at berm toe) in combination with a cutoff wall extending to an elevation of 25 feet. The additional work is proposed

because this area is located in an area that is highly conducive to seepage distress, is at or very close to the downstream end of the supplemental site on the Feather River that SBFCA previously requested USACE to evaluate, and overlaps lightly with a berm and toe drain that USACE constructed after the 1997 flood.

4.1.4.2 Levee Superiority

Alternatives SB-7 and SB-8 address USACE requirements for levee superiority. The definition of levee superiority pursuant to Engineer Circular 1110-2-6066, *Design of I-Walls*, (October 31, 2010) is the increment of additional height added to a flood risk–management system to increase the likelihood that when the design event is exceeded, controlled flooding will occur at the design overtopping section. Because alternative SB-7 is based on an existing levee profile, the design top of levee was reviewed relative to the modeled mean water surface profiles to determine the likely initial overtopping location.

4.1.4.2.1 Alternative SB-7

A single initial overtopping location was determined within the SB-7 project reach. It is estimated that the initial overtopping would likely occur between River Miles 19 and 20 (FRWLP Station 547+00 to 604+60). This location is a non-urbanized area and initial overtopping is estimated to occur between the mean 0.5% (1/200) ACE and 0.2% (1/500) ACE events. Within this 1-mile reach, the landward side of the levee would be covered with anchored High Performance Turf Reinforced Mat (HPTRM). This design would increase the erosion resistance of the levee and allow for more controlled failure of the levee due to overtopping.

4.1.4.2.2 Alternative SB-8

Alternative SB-8 extends upstream and downstream of the Yuba River tributary. Initial overtopping locations were identified upstream and downstream of confluence to account for the uncertainty in the aerial centering of storm events. It is estimated that the initial overtopping location upstream of the Yuba River confluence would occur between River Miles 43.5 and 45.5 (FRWLP Station 1582+00 to 1601+00). This location is a non-urbanized area and initial overtopping is estimated to occur between the mean 0.5% (1/200) ACE and 0.2% (1/500) ACE events.

It is estimated that the initial overtopping location downstream of the Yuba River would occur between River Miles 19 and 20 (FRWLP Station 547+00 to 604+60). This location is a non-urbanized area and initial overtopping is estimated to occur between the mean 0.5% (1/200) ACE and 0.2% (1/500) ACE events. This is identical to the reach identified for the SB-7 alternative.

Within both reaches, the landward side of the levee would be covered with anchored HPTRM. This design would increase the erosion resistance of the levee and allow for more controlled failure of the levee due to overtopping.

4.1.4.3 Sutter Butte Canal

The Sutter Butte Canal is operated by the Joint Water Districts–consisting of Richvale Irrigation District, Biggs-West Gridley Water District, Butte Water District, and Sutter Extension Water District. The canal delivers Feather River water supply to all four districts, which are located generally south and west of Lake Oroville and the Feather River along the eastern side of the Sacramento Valley.

The canal is approximately 17 miles long and is predominately unlined. The existing operating capacity ranges from approximately 1,600 cubic feet per second (cfs) at the upstream end to approximately 500 cfs at the downstream end.

Both the Sutter Butte Canal and the Feather River levee have meandering alignments. The canal is adjacent to the levee in some locations and is up to several hundred feet away from the levee in other locations.

The Sutter Butte Canal is adjacent to the levee at three locations, for a combined length of about 3.5 miles. Seepage and stability issues resulting from the canal being adjacent to the levee would be addressed by the construction of a cutoff wall through the levee; however, in all but one area there is no room for a landside easement due to the location of the adjacent canal. The landside easement is required to accommodate an O&M road. The levee encroachment areas are shown on Plates 4-2 and 4-3.

The proposed action for each area is addressed below.

a. Affected Area 1a (1429+00 to 1433+83, FRWLP Reach 21). The proposed option for this area is to move the canal landward into an adjacent agricultural area to provide space between the canal and the levee for the landside O&M road. See Plate 4-2, Canal Relocation Site B.

b. Affected Area 1b (1430+00 to 1449+00, FRWLP Reach 22). The proposed option for this area is to move the levee waterward into the flood overflow area to provide space sufficient for the landside O&M road. See Plate 4-2, Canal Relocation Site B.

c. Affected Area 2 (1611+00 to 1623+00, FRWLP Reach 24). The proposed option for this area is to move the levee waterward into the flood overflow area to provide space sufficient for the landside O&M road. See Plate 4-2, Canal Relocation Site A.

d. Affected Area 3a (1674+00 to 1753+00, FRWLP Reach 28). The proposed option for this area is to move the levee waterward into the flood overflow area to provide space sufficient for the landside O&M road. See Plate 4-3, Canal Relocation Site A.

e. Affected Area 3b (1753+00 to 1765+00, FRWLP Reach 28). The proposed option for this area is to move the canal landward into adjacent agricultural area to provide space between the canal and the levee for the landside O&M road. See Plate 4-3, Canal Relocation Site A.

4.1.4.4 USACE Vegetation Management Levee Safety Policy

The Vegetation ETL, dated April 10, 2009, provides guidance for maintenance of structures in order to provide the authorized level of flood risk management. The Vegetation ETL requires maintenance of a *vegetation-free zone*, consisting of a 3-dimensional zone surrounding all levees, floodwalls, embankment dams, and critical appurtenant structures in all flood damage reduction systems (Figure 4-1). The purpose of the vegetation-free zone is to provide a reliable corridor of access to and along federally authorized and constructed flood risk–management features for surveillance, inspection, maintenance, monitoring, and flood-fighting.

Plate 4-2. Canal Relocation and Levee Realignment (Affected Areas 1a and 1b)

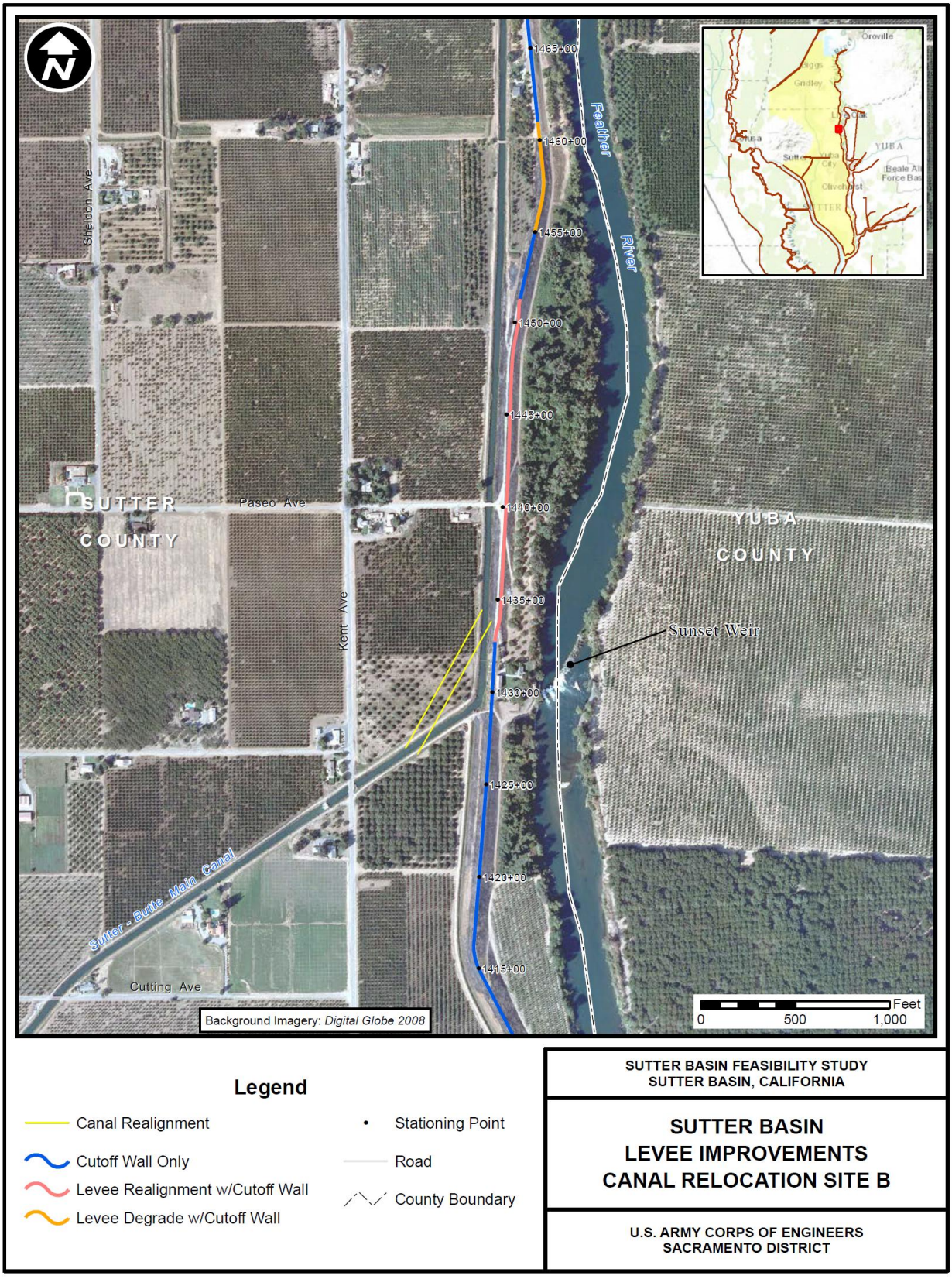
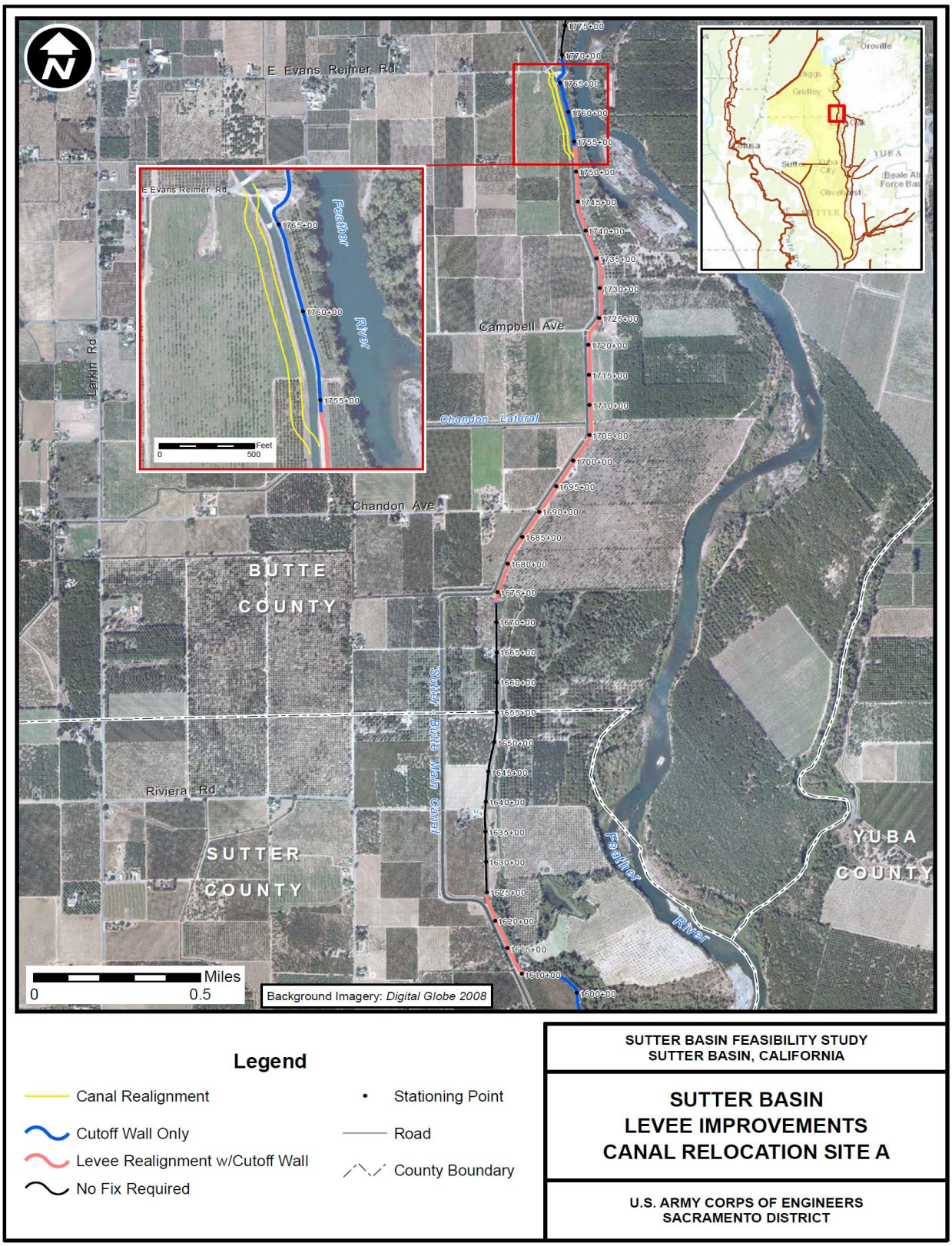


Plate 4-3. Canal Relocation and Levee Realignment (Affected Areas 2, 3a, and 3b)



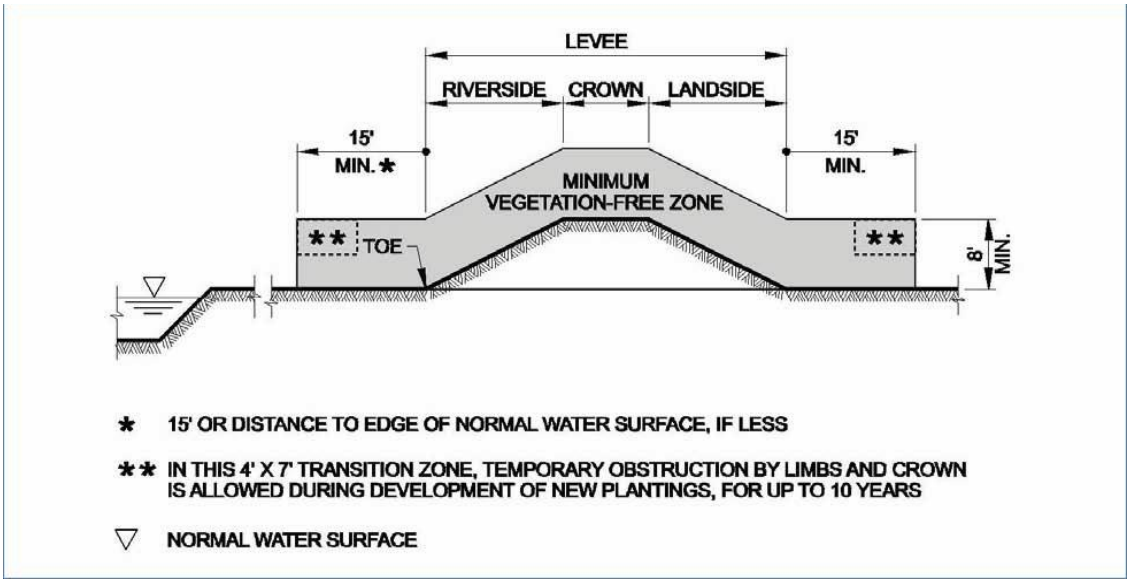


Figure 4-1. Illustration from Chapter 6, Engineer Technical Letter 1110-2-571

This document evaluates alternatives that would comply with USACE's vegetation policy, as established in the Vegetation ETL. Under the FRWLP, no additional vegetation removal would occur solely to comply with USACE's levee vegetation policy. Therefore, alternatives that would confine vegetation losses to the construction footprint have already been evaluated in the FRWLP EIS, and are not evaluated further in this document.

During construction, existing vegetation would be removed adjacent to the riverward and landside toes by root plowing or clearing and grubbing to create the vegetation-free zone. Following construction, disturbed soils including levee side slopes would be seeded with native grass seed to prevent wind and water erosion. A 15-foot-wide vegetation management zone along the riverward and landside toe of the levee would be permanently maintained to be devoid of trees and shrubs.

Approximately 42.00 acres of trees and other vegetation would need to be cleared to construct the levee improvements and to meet USACE vegetation management requirements under SB-8, and 24.40 acres would be cleared under SB-7. Vegetation-free zone requirements account for about 20 acres of vegetation losses under SB-8 and about 12 acres under SB-7.

USACE issued a draft policy guidance letter (Federal Register, February 17, 2012) describing a variance application process under which a levee system may be eligible for a vegetation variance. Under this draft guidance, a vegetation variance can be considered if one of the following conditions applies.

a. The variance is necessary to comply with applicable law concerning the environment, cultural or historic preservation.

b. The variance would protect the right of Tribal Nations, pursuant to treaty, statute, or Executive Order.

c. The variance is necessary to address a unique environmental consideration.

d. A prior vegetation agreement is in place.

However, even if one of the above criteria is met, life safety is still paramount and the vegetation variance must assure that the structural integrity and functionality of the levee are retained. The levee must still be accessible for maintenance, periodic inspection, monitoring during flood events, and access to perform flood-fighting if required. As discussed in Chapter 3, Section 3.8.2.2.2, *Woody Vegetation on Levee*, a variance request or design measures to retain vegetation will be considered during the preconstruction engineering and design phase.

4.1.4.5 Real Estate Requirements for Construction

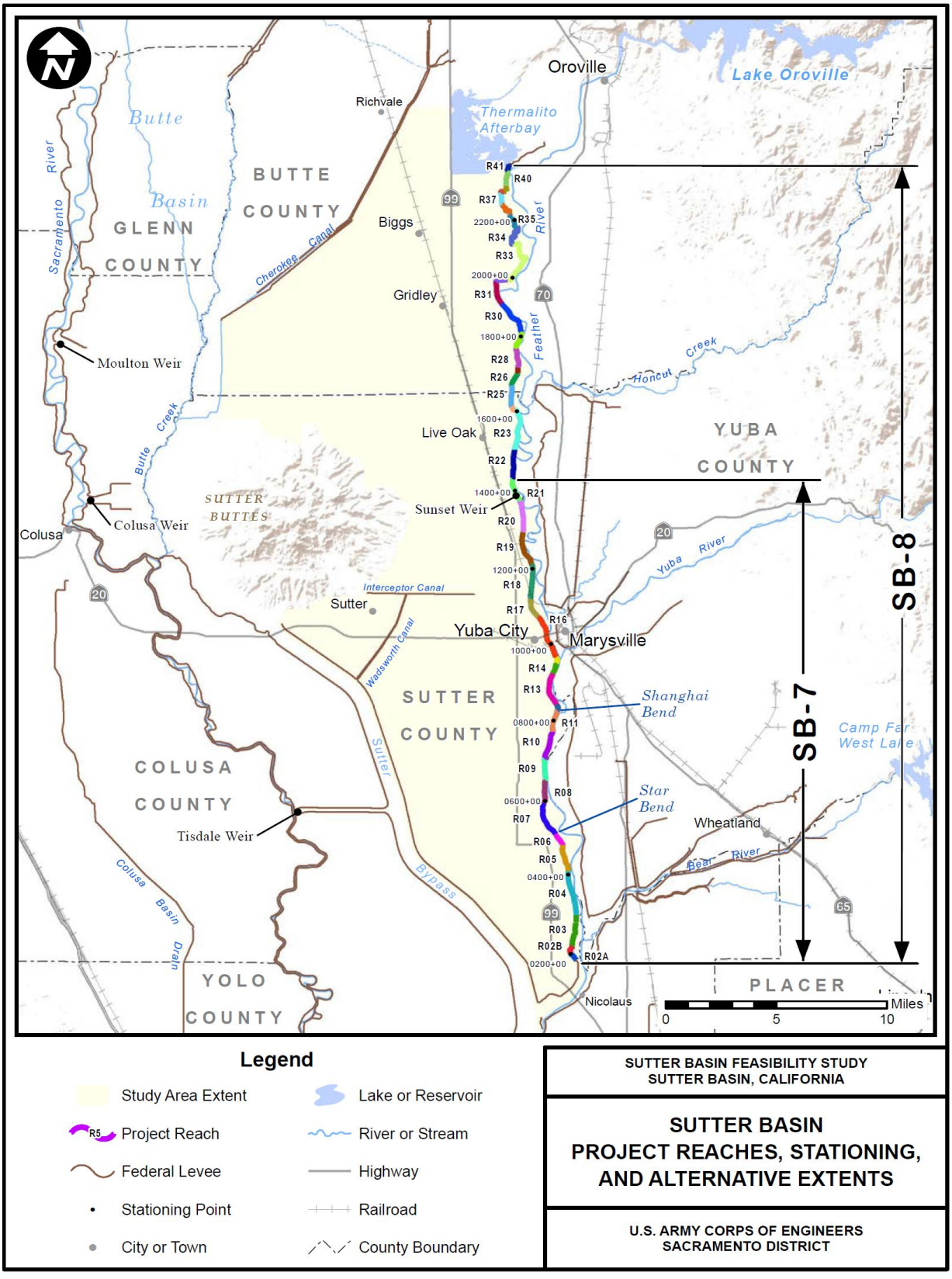
To construct and operate and maintain the project, USACE would coordinate with SBFCA and the California Department of Water Resources (DWR) to acquire, where existing rights are insufficient, a permanent easement of 15 feet on the waterside and landside of the levee (as opposed to 30-foot permanent right-of-way landside of the levee to be acquired under the FRWLP). In developed areas, the project would seek to acquire rights-of-way to the extent necessary to facilitate construction of the project. For temporary construction purposes, the project would seek to acquire temporary easements at areas proposed as staging areas.

4.1.5 Study Area and Project Area

To assist in the description of existing resources and potential impacts associated with the SBPFS, a project area and a study area have been defined as described in sections below. Specifically, the project area is defined as the footprint of where potential project actions would occur. This project area takes into consideration areas of potential direct impact as well as areas potentially affected by immediate indirect or secondary impacts.

The study area encompasses a much larger area that could potentially be indirectly impacted by the SBPFS. The study area, as described in Chapter 1, is defined as the 326-square-mile Sutter Basin located in Northern California in Sutter and Butte Counties within the 14,000-square-mile Sacramento River Watershed. In addition to Yuba City, communities in the basin include Biggs, Gridley, Live Oak, and Sutter.

The project area is the area directly affected by proposed levee improvements. The project area is located along the west levee of the Feather River from Thermalito Afterbay on the north to approximately 4 miles north of the Sutter Bypass on the south. These levees are the same levees proposed for improvement under the FRWLP as described in the FRWLP Final EIS. The direct effects of levee improvements would be located in a corridor roughly 500 feet toward the landside of the existing levees and 100 feet toward the waterside. This corridor was determined as the area in which levee improvements, such as seepage berms, stability berms, relief wells, setback levees, erosion protection, and slurry cutoff walls, are likely to be constructed. The corridor is approximately 41 miles long. For ease of describing existing conditions and identifying affected reaches, the corridor has been divided into 41 relatively homogeneous reaches, as shown on Plate 4-4. (Note that this number is coincidental and one reach does not consistently correspond to a length of 1 mile; additionally, no levee improvements are proposed in Reach 1.). The project area also includes borrow/spoil sites or project mitigation sites outside of this corridor. The reaches are listed in Table 4-2. Figures 4-2 to 4-8 (located at the end of this chapter) show representative photos of the project area.



Legend

- Study Area Extent
- Project Reach (R5)
- Federal Levee
- Stationing Point
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN FEASIBILITY STUDY
SUTTER BASIN, CALIFORNIA

**SUTTER BASIN
PROJECT REACHES, STATIONING,
AND ALTERNATIVE EXTENTS**

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Plate 4-4. Sutter Basin Project Reaches and Alternative Extents

4.1.6 Environmental Resources Eliminated from Detailed Analysis

Certain resources were eliminated from further analysis because they were addressed adequately in the FRWLP Final EIS. Changes to the proposed action would not result in any new or substantially more severe significant direct and indirect effects, including short- and long-term effects, than were analyzed in the FRWLP Final EIS. Table 4-1 summarizes the resources not considered further and the rationale for their elimination. The following is a brief discussion of these resources.

4.1.6.1 Traffic, Transportation, Navigation

The FRWLP Final EIS described the traffic and circulation characteristics of the existing transportation corridors in the project vicinity and analyzed the potential impacts. That information is hereby incorporated by reference.

As described in the FRWLP Final EIS, effects on traffic levels would result primarily from hauling borrow material along highways and local roads from borrow sites to the levee improvement area, and from worker trips to and from the project site. Temporary increases in construction-related traffic, temporary road closures, emergency response times, and other traffic, transportation, and navigation effects from project implementation were determined to be less than significant. Under Alternative SB-8, traffic effects would be comparable in type but potentially of lower magnitude because project construction is anticipated to occur over a 6-year period rather than 3 years under the FRWLP. Alternative SB-7 would have substantially less impact than SB-8 due to SB-7's smaller construction footprint.

4.1.6.2 Noise

Noise impacts would not exceed those previously identified in the FRWLP Final EIS; however, temporary noise effects from construction activities would remain a significant effect of the project. Implementation of SB-8 or SB-7 would result in temporary but significant effects related to construction noise and vibration in the affected area. Construction noise levels are predicted to exceed significance thresholds of 60 dBA-L_{eq} (equivalent continuous noise level) at noise-sensitive uses between the hours of 7:00 a.m. and 10:00 p.m. and 45 dBA-L_{eq} between the hours of 10:00 p.m. and 7:00 a.m. Under Alternative SB-8, the number of sensitive receptors and each receptor's exposure period would be substantially the same as described for the action alternatives evaluated in the FRWLP Final EIS. Alternative SB-7 would also have a significant effect on noise but would affect fewer sensitive receptors than SB-8. Mitigation measures to employ noise-reducing and vibration-reducing construction practices would not be sufficient to reduce the exposure of sensitive receptors to temporary construction noise and vibration to a less-than-significant level. Though temporary, effects would be significant and unavoidable.

Table 4-1. Resources Considered for this Final EIR/SEIS

Resource	Justification
No Further Analysis Needed	
Traffic, Transportation, Navigation	Traffic impacts would not exceed those previously identified. Lengthening the construction period from 3 to 6 years would increase the total duration of traffic impacts, but the magnitude of short-term impacts would be reduced.
Noise	Noise impacts would not exceed those previously identified. Lengthening the construction period from 3 to 6 years would increase the total duration of short-term noise impacts, but the number of sensitive receptors and each receptor's exposure period would be substantially the same due to the linear nature of construction.
Population, Housing, and Environmental Justice	No substantial change in impacts beyond those previously identified in the FRWLP Final EIS.
Utilities and Public Services	No substantial change in impacts beyond those previously identified in the FRWLP Final EIS.
Public Health and Environmental Health	No substantial change in impacts beyond those previously identified in the FRWLP Final EIS.
Further Analysis Conducted	
Flood Risk Management and Geomorphology	At several locations where the existing levee lies directly adjacent to the Sutter Butte Canal, the existing levee would be modified to incorporate a maintenance road to meet USACE levee standards.
Water Quality and Groundwater Resources	Effects on water quality may be greater due to an additional 2,250 feet of levee work proposed downstream of Laurel Avenue and the additional removal of vegetation that provides erosion protection.
Geology, Seismicity, Soils and Mineral Resources	Compliance with USACE levee vegetation management requirements and an additional 2,250 feet of levee work proposed downstream of Laurel Avenue would result in greater land disturbance and potential for soil erosion.
Air Quality and Climate Change	A lengthened construction period of up to 6 years would increase the total duration of construction emissions, but the magnitude of emissions would be reduced. Emission levels would not exceed de minimis thresholds.
Agriculture, Land Use, Socioeconomics	The construction footprint of both action alternatives includes an additional 2,250 feet of levee downstream of Laurel Avenue. Real estate requirements would be less than those of the FRWLP.
Vegetation and Wetlands	Compliance with USACE levee vegetation management requirements would result in greater vegetation impacts than would occur under the FRWLP.
Wildlife	Wildlife would be impacted to a greater degree due to vegetation removal to comply with USACE vegetation management requirements.
Fish and Aquatic Resources	Fish and aquatic resources could be impacted to a greater degree because of the removal of additional vegetation to comply with USACE vegetation management standards.
Visual Resources	Additional vegetation removal may further diminish aesthetics values.
Recreation	Additional vegetation removal may further diminish recreation values.
Cultural Resources	Design modifications could result in additional impacts on cultural resources. The additional work downstream of Laurel Avenue and relocation of the levee and/or the Sutter Butte Canal at several locations would result in additional impacts on the levee and the canal, both of which may be eligible for listing on the National Register for Historic Places, and to prehistoric archaeological sites.

Table 4-2. Summary of Study Reaches

Reach	Beginning Station	Ending Station	Length (feet)	Landmarks	Dominant Adjacent Land Uses
1	0+00	180+50	Not part of the project proposed at this time.		
2	180+50	218+66	3,816	Laurel Avenue	Ruderal grassland; open space
3	218+66	300+66	8,200	Cypress Avenue	Ruderal grassland; open space
4	300+66	410+67	11,001	Central Street; Wilkie Avenue	Orchard; ruderal grassland; riparian forest
5	410+67	478+68	6,801	Wilkie Avenue	Orchard
6	478+68	510+37	3,169	Star Bend	Orchard
7	510+37	596+00	8,563	Abbott Lake	Ruderal grassland; open space
8	596+00	654+75	5,875		Ruderal grassland; open space
9	654+75	706+50	5,175	Boyd's Boat Launch; Nursery	Ruderal grassland; open space
10	706+50	774+00	6,750	Barry Road	Ruderal grassland; open space
11	774+00	830+00	5,600		Ruderal grassland; open space
12	830+00	845+00	1,500	Shanghai Bend	Ruderal grassland; open space
13	845+00	927+00	8,200		Ruderal grassland; open space
14	927+00	954+40	2,740	Airport	Ruderal grassland; open space
15	954+40	968+50	1,410	Airport	Developed; ruderal grassland
16	968+50	1080+00	11,150	Garden Highway: 2nd Street; Twin Cities Memorial Bridge; Colusa Avenue	Developed; ruderal grassland
17	1080+00	1130+86	5,086	Live Oak Boulevard; Union Pacific Railroad	Developed; ruderal grassland
18	1130+86	1213+85	8,299	Live Oak Boulevard; Union Pacific Railroad; Rednall Road	Orchard
19	1213+85	1297+83	8,398		Orchard
20	1297+83	1374+33	7,650		Orchard; ruderal grassland
21	1374+33	1433+83	5,950		Ruderal grassland
22	1433+83	1503+83	7,000		Riparian forest; ruderal grassland
23	1503+83	1609+37	10,554		Orchard
24	1609+37	1623+86	1,449		Riparian forest; ruderal grassland
25	1623+86	1674+37	5,051		Orchard; ruderal grassland
26	1674+37	1707+11	3,274		Orchard
27	1707+11	1721+60	1,449		Ruderal grassland
28	1721+60	1769+31	4,771		Orchard
29	1769+31	1813+33	4,402		Orchard; riparian forest
30	1813+33	1902+00	8,867		Orchard
31	1902+00	1958+00	5,600		Orchard; ruderal grassland
32	1958+00	1989+00	3,100		Orchard
33	1989+00	2122+00	13,300		Orchard
34	2122+00	2182+00	6,000		Orchard
35	2182+00	2224+00	4,200		Orchard; ruderal grassland
36	2224+00	2259+00	3,500		Orchard; ruderal grassland
37	2259+00	2290+00	3,100		Orchard; ruderal grassland
38	2290+00	2303+00	1,300		Ruderal grassland
39	2303+00	2319+00	1,600		Ruderal grassland
40	2319+00	2359+00	4,000		Ruderal grassland
41	2359+00	2368+00	900	Thermalito Afterbay	Ruderal grassland

4.1.6.3 Population, Housing, and Environmental Justice

Effects on population, housing, and environmental justice under Alternatives SB-8 and SB-7 would be similar to effects described in the FRWLP Final EIS, which identified the permanent acquisition of five residences to accommodate project construction of SBFCA's preferred alternative and 17 residences under Alternative 2. For the SBPFS, 31 properties were identified where existing improvements are located within 15 feet of the landside levee toe within the footprint of Alternative SB-8. Seven of the 31 properties have single family homes. Specific project requirements for right-of-way to construct the improvements and remove encroachments that threaten levee integrity would be determined at the final design phase prior to construction. Permanent acquisition, relocation, and compensation services would be conducted in compliance with Federal and state relocation laws (the Federal Uniform Relocation Assistance and Real Property Acquisition Act, the California Relocation Act, and the Relocation Assistance and Real Property Acquisition Guidelines). The displacement of any residences is considered a significant impact, so the permanent acquisition of residences and the potential for temporary displacement of residences under SB-7 and SB-8 would be significant. However, with implementation of Federal and state relocation laws, this impact would be reduced to a less-than-significant level. Pursuant to these Federal and state relocation laws, appropriate compensation would be provided to displaced landowners and tenants, and residents would be relocated to comparable replacement housing. In cases where project construction is temporarily disruptive to nearby residents, assistance would be provided for residents to relocate temporarily during construction activities and compensation would be offered to residents for reasonable rent and living expenses incurred as a result of relocation.

The FRWLP Final EIS evaluated the project's impact on the population to determine whether low-income or minority populations are present and would be adversely affected. That evaluation is incorporated by reference. The proposed action would not disproportionately adversely affect minority or low-income populations because the number of home acquisitions from minority or low-income census blocks would be comparable to home acquisitions in other census blocks. Further, construction-related environmental effects (e.g., temporary exposure to noise, dust, traffic, and hazardous materials) would occur throughout the project area and would not have a disproportionate effect on specific reaches. Implementing the project would protect property, as well as the health and safety of residents. Therefore, the proposed action would reduce the risk of flooding to existing residential, commercial, and industrial development throughout a significant portion of the study area.

Under the No Action Alternative, the additional cost of flood insurance may be absorbed by many low-income populations within the study area and could cause substantial financial hardship on residents' already limited abilities to purchase basic goods and services. Additional costs for low-income residents are more profound than for non-low-income residents because the additional costs would account for a higher proportion of low-income residents' total income, leaving fewer financial resources to address other needs.

4.1.6.4 Utilities and Public Health

Effects on utilities and public health described in the FRWLP Final EIS would be similar under Alternative SB-8. Because of a reduced construction footprint, Alternative SB-7 would have less impact on utilities. As described in the FRWLP Final EIS, construction of the project may damage drainage and irrigation systems and public utility infrastructure, resulting in temporary disruptions to service. Coordination with drainage and irrigation systems users, consultation with service providers, and

implementation of appropriate protection measures would minimize the possibility of any significant effects.

4.1.6.5 Public Health and Environmental Health

The potential effects on public health and safety described in the FRWLP Final EIS would be similar under Alternatives SB-8 and SB-7. Project implementation has the potential to slightly increase risks to the public during construction due to construction activities and the potential for an accidental release of hazardous materials, but the increased risk would be temporary. Effects would be less than significant because risks would be minimized by implementation of a stormwater pollution prevention plan and best management practices to control accelerated erosion, sedimentation, and other pollutants during and after project construction.

4.2 Flood Risk Management and Geomorphic Conditions

4.2.1 Introduction

This section discusses the effects on flood risk management and geomorphic conditions that would result from the No Action Alternative, and Alternatives SB-7 and SB-8, as well as mitigation measures that would reduce significant effects.

4.2.2 Affected Environment

The regulatory and environmental setting for flood risk management and geomorphic conditions are summarized below and are described in greater detail in Section 3.1 of the FRWLP Final EIS, which is incorporated by reference.

4.2.2.1 Watershed

The Sutter Basin study area is situated within the Sacramento River watershed. A map of the Sacramento River watershed is provided as Plate 1-1 in Chapter 1, *Introduction*. The principle watersheds upstream of the study area are the Sacramento River watershed and Feather River watershed. The Sacramento River watershed encompasses the McCloud River, Pit River, and Goose Lake, and Stony Creek. The watershed drains the Sierra Nevada Mountains and Cascade Ranges in the east and the Coast Range and Klamath Mountains in the west. The Feather River watershed encompasses the Yuba and Bear Rivers. These watersheds drain the western slopes of the Sierra Nevada mountain range. The drainage area of the Sacramento River basin upstream of the study area is approximately 12,000 square miles. The drainage area of the Feather River upstream of the study area (including the Yuba and Bear Rivers) is approximately 5,900 square miles.

4.2.2.2 Topography

Elevations within the study area range from 110 feet NAVD88 in the north to 30 feet NAVD88[1] in the south. The study area has a general slope from northeast to southwest. The general slope of the study area is interrupted by two major embankment features which impact hydraulic conveyance within the

[1] The North American Vertical Datum of 1988 (NAVD88) is the vertical control datum of orthometric height established for vertical control surveying in the United States based upon the General Adjustment of the North American Datum of 1988.

floodplain. The raised embankment of the Union Pacific Railroad traverses the study area in a north south alignment and the Sutter Bypass east levee traverses the study area in a north south alignment.

4.2.2.3 Flood Sources

The Sutter Basin study area is susceptible to flooding from multiple sources including Butte Basin, Sutter Bypass, Feather River, Cherokee Canal, Wadsworth Canal, and interior sources.

4.2.2.3.1 Butte Basin

The northwest portion of the study area is within the Butte Basin. The Butte Basin is a natural overflow and flood storage area northwest of the Sutter Buttes and east of the Sacramento River. The basin provides approximately 1 million acre-feet of transitory storage at flood stage (California Department of Water Resources 2010). Excess floodwaters from the Sacramento River enter the Butte Basin via overbank areas along the river and through the Moulton and Colusa Weirs. Butte Creek and its tributaries, including Cherokee Canal, also flow into the Butte Basin. Outflow from the Butte Basin is naturally regulated by hydraulic conditions of Butte Slough and floodplain topography at the upstream entrance to the Sutter Bypass. In order to maintain the flood storage capabilities within Butte Basin, California has included regulation of the overflow area in Title 23 of the California Code of Regulations. In general these standards require approval from the Central Valley Flood Protection Board for any encroachments that could reduce or impede flood flows or that would reclaim any of the floodplain within the Butte Basin (California Department of Water Resources 2010).

4.2.2.3.2 Sutter Bypass

The southwest portions of the study area including the southern portion of Yuba City are susceptible to flooding from the Sutter Bypass. The Sutter Bypass is a leveed flood control channel approximately three quarters of a mile wide, bordered on each side by levees. The bypass is an integral feature of the Sacramento River Flood Control Project's Flood Bypass System. The Sutter Bypass conveys flood waters from the Butte Basin, Sacramento River, and Feather Rivers to the confluence of the Sacramento River and Yolo Bypass at the Fremont Weir.

Downstream of the Feather River the bypass is separated into two conveyance areas by a low levee. The area east of the middle levee conveys flows from the Feather River. This design maintains higher velocities and sediment transport capacity within the Feather River during low flow events while utilizing the large conveyance of the Sutter Bypass during larger events.

The Sutter Bypass also receives minor natural flow and agricultural return flow from Reclamation District 1660 to the west and from Wadsworth Canal and DWR pumping plants 1, 2, and 3 to the east. The Sutter Bypass is described by four hydrologic reaches based on tributary inflows: Butte Slough to Wadsworth Canal, Wadsworth Canal to Tisdale Bypass, Tisdale Bypass to Feather River, and Feather River to Sacramento River.

4.2.2.3.3 Feather River

Nearly the entire study area is susceptible to flooding from the Feather River. The Feather River is a major tributary to the Sacramento River, merging with the Sutter Bypass upstream from the Sacramento River and Fremont Weir. The Yuba and Bear Rivers are major tributaries to the Feather River. Two major flood management reservoirs are located within the Feather River watershed. Oroville Dam and reservoir was completed on the Feather River in 1967. The reservoir has 3,358,000

acre-feet of storage with 750,000 acre-feet of dedicated flood management space. New Bullards Bar dam and reservoir was completed on the Yuba River 1970. The reservoir has 966,000 acre-feet of storage with 170,000 acre-feet of dedicated flood management space. The Feather River is described by four hydrologic reaches based on significant inflows: Thermalito to Honcut Creek, Honcut Creek to Yuba River, Yuba River to Bear River, and Bear River to Sutter Bypass.

4.2.2.3.4 Cherokee Canal

The northern portion of the study area is susceptible to flooding from Cherokee Canal which is a tributary to Butte Creek and the Butte Basin. The leveed canal was constructed from 1959 to 1960 by USACE under the authorization of the Flood Control Act of 1944. The canal drainage area is 94 square miles and varies in elevation from 70 feet to 2,200 feet. The drainage area is bounded by the Feather River watershed to the east and southeast, Butte Creek and its tributaries to the north and west, and by Wadsworth Canal drainage to the south. The design capacity along the Cherokee Canal is 8,500 cubic feet per second (cfs) upstream of the junction with Cottonwood Creek, 11,500 cfs from the junction with Cottonwood Creek to the Biggs Princeton Highway (Afton Road) and 12,500 cfs from the Biggs Princeton Highway to Butte Creek. Based upon the flood frequency analysis at the time of design, the canal was estimated to provide levels of performance for a 4% (1/25) ACE event and mitigated sediment transport problems within its watershed.

4.2.2.3.5 Wadsworth Canal

Wadsworth Canal and associated Interceptor Canals are potential sources of flooding in the southwest portion of the study area. The Wadsworth Canal system is a feature of the Sacramento River Flood Control Project and consists of leveed channels that carry rainfall and agricultural runoff from 91 square miles of Butte and Sutter Counties south to the Sutter Bypass.

1. West Interceptor Canal. The West Interceptor Canal begins near the town of Sutter and extends 1.8 miles east to Wadsworth Canal. The canal is approximately 30 feet wide and includes a 4- to 5-foot-tall Federal Project levee along its right bank. There is no Federal levee along the left bank of the canal. The slope of the canal is approximately 25 feet per mile. The purpose of the canal is to intercept rainfall runoff that would otherwise pond against the eastern levee of the Sutter Bypass. The intercepted flow is diverted into the Wadsworth Canal where it is then conveyed to the Sutter Bypass. During extreme floods the peak flow of the canal would be significantly attenuated by the floodplain storage available along the left bank. The canal is also used for irrigation water. The operations and maintenance manual does not list a design flow for the West Interceptor Canal.
2. East Interceptor Canal. The East Interceptor Canal begins near Yuba City and extends 3.1 miles east to the Wadsworth Canal. The canal is approximately 30 foot wide and includes a 4 to 5 foot tall Federal Project levee along its left bank. The purpose of the canal is to intercept rainfall runoff that would otherwise flow southwest and pond against the eastern levee of the Sutter Bypass. There is no Federal levee along the right bank of the canal. The slope of the canal is negligible and the top of levee has a level grade. The intercepted flow is diverted into the Wadsworth Canal where it is then conveyed to the Sutter Bypass. During extreme floods the peak flow of the canal would be significantly attenuated by the floodplain storage available along the right bank. The canal is also used for irrigation water during the summer irrigation season. The operations and maintenance manual does not list a design flow for the East Interceptor Canal.
3. Wadsworth Canal. Wadsworth Canal begins at the East and West Interceptor Canals near Butte House Road. The canal extends 4.5 miles south to the Sutter Bypass and includes Federal Project

levees along the left and right banks. The canal is a fairly uniform trapezoidal type channel. The purpose of the canal levee is to collect and convey rainfall runoff and irrigation water from the East and West Interceptor Canals to the Sutter Bypass. The existing Operations and Maintenance Manual for Wadsworth Canal describes a design capacity of 1,500 cfs.

4.2.2.3.6 Interior Drainage

Localized flooding problems often are caused by storm drain system overload, or an unusually heavy amount of rainfall. Flooding from intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with urbanization and development as well as inadequate storm drainage systems. The term *flash flood* describes localized floods of great magnitude and short duration. In contrast to riverine flooding, this type of flooding usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort typically occurs in the winter and spring. However, much of the land in the study area is agricultural in nature; consequently, localized flooding does not present as significant a hazard as riverine flooding and is not a significant concern (AMEC 2007:44–45). Runoff from the interior of the study area may result in localized flooding. Interior drainage features include canals and streams tributary to Wadsworth Canal and pumps and culverts along the project levees.

4.2.2.4 Historical Floods

The Feather River near Oroville gage provides an indicator of large historical floods within the study area. The largest 15 floods from 1951 to 2010 are presented in Table 4-3. The magnitudes of historical floods prior to 1967 are not directly comparable to later floods due to significant historical changes in the flood management system. In order to provide a comparison of similar hydrologic conditions, the table includes the estimated unregulated flow for each water year. The ranking of unregulated floods is substantially different than observed flood flows with the 1997 flood being the largest unregulated flood from 1951 to 2010. The following is a description of significant flood events within the study area.

December 1955. The December 1955 flood was the largest peak flow recorded at the Feather River at Oroville gage from 1951 to 2010. Major damage to the study area occurred in December 1955 when the west levee of the Feather River breached near Shanghai Bend, resulting in the deaths of 38 people. The peak flow measured at the Feather River at Oroville stream gage was 203,000 cfs. This flood occurred prior to construction of Oroville Dam (completed 1967) and New Bullards Bar Dam (completed 1970). Therefore, the flood does not reflect existing hydrologic conditions. A hypothetical flood routing of the 1955 flood is presented in the Oroville Dam and Reservoir water control manual. The flood routing indicates the reservoir would have regulated the peak outflow to 150,000 cfs.

December 1964. The December 1964 flood was the fourth largest peak flow recorded at the Feather River at Oroville gage from 1951 to 2010. The main center of precipitation was in the Feather, Yuba, and American River Basins. Rainfall was heaviest on December 22 and 23, 1964. Runoff from streams of the Coast Ranges almost without exception produced peak stages and peak flows that exceeded previous records. Runoff from the Sierra Nevada into the Feather, Yuba and American Rivers surpassed all previous records. This flood occurred during construction of Oroville Dam and was partially regulated to an outflow of 158,000 cfs. A hypothetical flood routing of the 1964 flood is presented in the Oroville Dam and Reservoir water control manual. The flood routing indicates the completed reservoir would have regulated the peak outflow to 150,000 cfs.

Had it not been regulated, the peak flow would have been approximately 260,000 cfs, which would have exceeded the 1955 flood peak by 57,000 cfs.

Table 4-3. Fifteen Largest Annual Maximum Floods, Water Year 1951–Water Year 2010, Feather River at Oroville

	Measured				
Annual Ranking	Water Year	Date of Peak	Peak Flow (CFS)	Regulated Peak Flow (CFS)	Unregulated Peak Flow (CFS)
1	1956	12/23/1955	203,000	150,000	203,000
2	1963	1/31/1963	191,000		191,000
3	1997	1/2/1997	161,000	161,000	312,900
4[a]	1965	12/23/1964	158,000	150,000	260,000
5	1960	2/8/1960	135,000		135,000
6	1986	2/18/1986	134,000	134,000	217,000
7	1953	1/9/1953	113,000		113,000
8	1958	2/24/1958	102,000		102,000
9	1951	11/21/1950	92,100		92,100
10	1957	2/24/1957	83,100		83,100
11	1995	3/14/1995	71,700	71,700	134,200
12	1980	1/15/1980	69,500	69,500	137,600
13	2006	12/31/2005	65,600	65,600	
14	1952	2/1/1952	59,500		59,500
15	1970	1/25/1970	56,300	56,300	117,700

[a] December 1964 flood regulated by a partially completed Oroville Dam.

November 1982–March 1983. Water year 1983 was a result of the "El Niño" weather phenomenon. Northern and Central California experienced flooding incidents from November through March due to numerous storms. In early May, snow water content in the Sierra exceeded 230% of normal, and the ensuing runoff resulted in approximately four times the average volume for Central Valley streams. System failures in the Sacramento River Basin were limited to a private levee on the Sacramento River and one failure on Cache Creek.

February 1986. Flooding in 1986 resulted from a series of four storms over a 9-day period during February. Rains from the first three storms saturated the ground and produced moderate to heavy runoff before the arrival of the fourth storm. Precipitation at Four Trees in the Feather River Basin set both a 24-hour rainfall record for the Sierra Nevada and the monthly record for any station in the state. During the flood, the left levee of the Yuba River failed just upstream of the Feather River confluence. The communities of Linda and Olivehurst were inundated, resulting in one death, 895 destroyed homes, and 150 destroyed businesses.

January 1995. "El Nino" conditions in the Pacific forced major storm systems directly into California during much of the winter and early spring of 1995. The largest storm systems hit California in early January and early March. The major brunt of the January storms hit the Sacramento River Basin and resulted in small stream flooding primarily due to storm drainage system failures.

January 1997. December 1996 was one of the wettest Decembers on record. Watersheds in the Sierra Nevada were already saturated by the time three subtropical storms added more than 30

inches of rain in late December 1996 and early January 1997. The third and most severe of these storms lasted from December 31, 1996, through January 2, 1997. Rain in the Sierra Nevada caused record flows that stressed the flood management system to capacity in the Sacramento River Basin and overwhelmed the system in the San Joaquin River Basin. During the flood, the left levee of the Feather River failed near Arboga. The resulting flood killed one person, destroyed 180 homes and businesses, and prompted evacuation of about 15,000 people from Linda and Olivehurst. Nearly 50,000 people from Yuba City, Marysville, and surrounding areas were evacuated because of fears of additional levee breaks (U.S. Army Corps of Engineers 1998).

December 2005–January 2006. Between December 28, 2005 and January 9, 2006, the state experienced a series of severe storms that impacted the levees within California's Central Valley. Water rose a second time in April 2006 and remained high in some parts of the system until June. Many rivers and streams within the Sacramento and San Joaquin River systems ran above flood stage during these events, and there were significant erosion and seepage problems with the levees. DWR and maintaining agencies conducted the actual flood fight activities while USACE provided technical assistance to the State.

4.2.2.5 Levees and Flood Risk Management

Major storm events can produce high flows throughout the Feather River system. The primary method of flood risk management in the study area is provided by a system of levees or earthen embankments along the Feather River, Sutter Bypass, Wadsworth Canal, and Cherokee Canal that contain high river flows within these constructed channels[2]. Flood risk–management benefits are also provided by flood storage at Oroville Dam and Lake and New Bullards Bar Dam and Lake. There are approximately 72 miles of levees protecting the study area lands from flooding from the Feather, Yuba, and Bear Rivers[3]. All levees on the Feather River within the study area are part of the Sacramento River Flood Control Project (SRFCP) that was constructed by USACE. Some of these levees are now owned and maintained by DWR, while others are maintained by local levee districts.

Recent and ongoing studies have found that some levees in the study area do not meet, or have not been certified as meeting, the current levee design criteria. As a result, much of the study area is considered vulnerable to flooding from levee failure.

4.2.2.5.1 Flood Risk

Maps showing composite floodplains were developed to demonstrate flood risk management assurance relative to a standard assurance criterion. The maps show inundation from any flood source that would not meet a risk and uncertainty based assurance criterion. The assurance criterion was based on the National Flood Insurance Program (NFIP) levee system analysis criteria described in EC 1110-2-6067 and was adopted for use in describing the performance of all ACE events. This criterion is described as "Option 2" in the DWR Urban Levee Design Criteria. The assurance criterion utilized for this study does not account for wind wave overtopping.

- For assurance less than 90% the levee does not pass criteria.

[2] The study area also has a few drainage facilities with pump stations that keep the interior from flooding in certain locations.

[3] The Yuba and Bear Rivers levees are not within the study area; however, the contribution of flows from these rivers directly affects the channel capacity of the Feather River and, thus, the integrity and stability of the Feather River West Levee in the study area.

- For assurance between 90 and 95% levee must have minimum of 3 feet of freeboard to pass criteria.
- For assurance greater than 95% levee must have minimum of 2 feet of freeboard to pass criteria.

The composite floodplains are shown in Plates 4-9 through 4-16, which are located at the end of this chapter. All maps include the natural (non-leveed) flood inundation depths. The maps show greater depths in the southern portion of the study area.

4.2.2.5.2 Flood Warning Time

Flood warning time varies throughout the area and is dependent on the source of flooding. The principle sources of flood warnings are advisories by the National Weather Service (NWS) and river stage forecasts by the California Nevada River Forecast Center (CNRFC).

Flood Warnings are issued by the NWS when flooding of main stem rivers is occurring or imminent (California Nevada River Forecast Center 2013). Main stem river flooding refers to flooding of gauged and forecasted rivers (California Nevada River Forecast Center 2013). NWS can also issue Small River and Stream Flood Warnings for smaller rivers and streams that do not have forecast points.

Flash Flood Warnings are issued when flooding is reported; when precipitation capable of causing flooding is observed by radar and/or satellite; when observed rainfall exceeds flash flood guidance or criteria known to cause flooding; or when a dam or levee failure has occurred or is imminent (California Nevada River Forecast Center 2013). A flash flood is defined as a flood caused by heavy or excessive rainfall in a short period of time, and occurring generally within 6 hours of the causative event (California Nevada River Forecast Center 2013).

In addition to the advisories described above, the NWS in coordination with DWR issues forecasts and guidance for river flows through the CNRFC. In general, river forecasts are based on modeled runoff from observed precipitation, snowmelt estimates, and reservoir operations. The forecast length varies depending on the location. River guidance is based on modeled runoff from forecasted precipitation, snowmelt estimates, and reservoir operations. The forecasts and guidance are issued for a forecast site in a graphical format that compares the future river stage with a monitor stage, flood stage, and danger stage. The combined forecast and guidance are made 5 days into the future.

Flooding from interior drainage sources within the study area is likely to be the result of localized concentrated rainfall. It is assumed these floods would be preceded by a general flood watch issued by the NWS 12 to 24 hours in advance and a Flash Flood Warning 6 hours in advance of the localized flooding.

Flooding from a levee overtopping event along the Feather River would result from a large regional storm event in the Feather, Yuba, and Bear River watersheds. CNRFC river flood forecast points on the Feather River are located at Gridley, Yuba City, Boyd's Landing, and Nicholas. It is assumed that an overtopping flood would be preceded by a flood warning and river guidance issued by the NWS and CNRFC 5 days in advance. A more accurate warning of potential levee overtopping, based on river forecasts, would likely be made 24 to 36 hours in advance. This estimate was based on a review of the flood guidance plots for December 2005–January 2006 flood that indicate an approximate 24- to 36-hour lag between observed rain plus snowmelt in the basin and the peak measured stage at the Feather River near Gridley stream gage forecast point.

Flooding from a levee overtopping event along the Sutter Bypass would result from a large regional storm event in Sacramento River watershed. There are no CNRFC forecast points on the Sutter Bypass.

However, the forecast point on the Sacramento River at Fremont Weir represents flood conditions within the Sutter Bypass. It is assumed these floods would be preceded by a flood warning and river guidance issued by the NWS and CNRFC 5 days in advance. A more accurate warning of potential levee overtopping, based on river forecasts, would likely be made 24 to 36 hours in advance. This estimate was based on a review of the flood guidance plots for the December 2005–January 2006 flood which indicate an approximate 24- to 36-hour lag between observed rain plus snowmelt in the basin and the peak measured stage at the Sacramento River at Fremont Weir gage forecast point.

It is estimated that flooding from a geotechnical levee breach would have little to no advance warning (less than 1 hour) and the floodwave would rapidly inundate the adjacent areas. The levee breach that occurred at Shanghai Bend during the December 1955 flood is an indicator of flood warning times associated with geotechnical related failures. The levee failure was preceded by the Governor of the State of California issuing a "Stage of Emergency" on December 22 due to the abnormal and heavy rainfall (Sutter County 1957). However, the general evacuation order was given approximately 1-hour after the break (Sutter County 1957).

4.2.2.5.3 Federal Emergency Management Agency Mapping

Communities within the study area are enrolled in the NFIP administered by the Federal Emergency Management Agency (FEMA). The NFIP issues Flood Insurance Rate Maps (FIRMs) for use in setting insurance rates and defining floodplain management guidelines. NFIP maps are developed following FEMA mapping guidelines, which are specific to their program. The maps developed for the feasibility study use similar assumptions. However, they do not replace the NFIP maps used to define insurance rates. The effective FEMA NFIP maps in the study area are shown on Plate 4-5[4], and are summarized below.

- Most of the northern portion of the study area, especially the interior section, is designated as (Unshaded) Zone X (outside the 0.2% annual chance floodplain) and (Shaded) Zone X (areas of 0.2% annual chance of flood; areas of 1% annual chance of flood with average depths of less than 1 foot or within drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood).
- The remainder of the study area (the northern fringes associated with the Cherokee Canal and the Feather River) is designated as either Zone A (inundated by 100-year flooding; base flood elevations [BFEs] have not been determined), or is currently being revised with up-to-date FIRM mapping (i.e., the central portion of the study area).

It should be noted that FEMA is updating and modernizing existing FIRMs for most of the United States, including California. Accordingly, and given known levee deficiencies relative to FEMA NFIP requirements, FIRM data for Colusa, Glenn, Yolo, and Yuba Counties (last revised in 1996) may not be entirely indicative of the present status of designated floodplains in the study area. Butte County's FIRM data is from 2011 and is considered up-to-date.

[4] Figure 4-5 is derived from a compilation of parcels that encompass the study area.

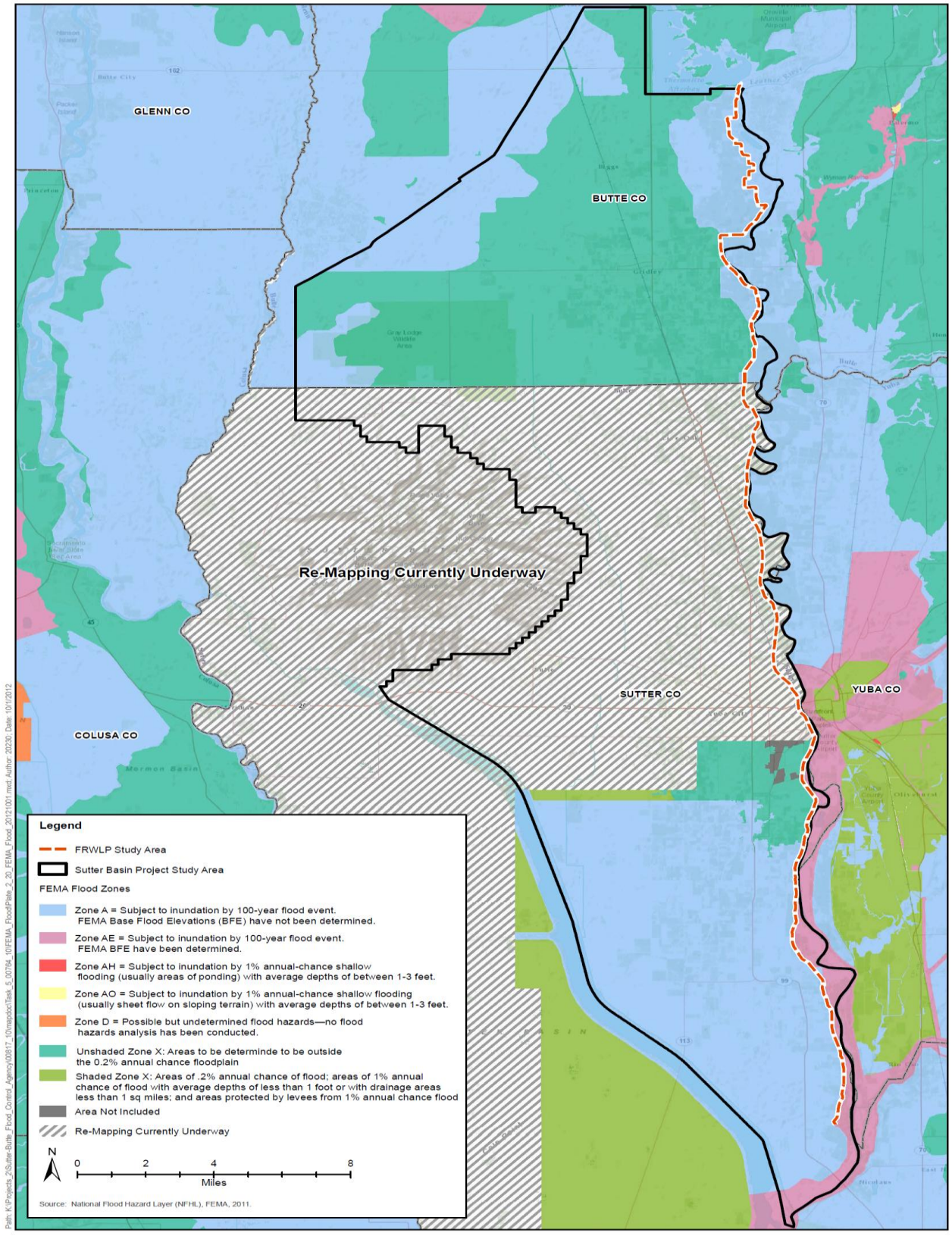


Plate 4-5. FEMA Zones

4.2.2.5.1 USACE Periodic Inspections

The USACE Rehabilitation and Inspection Program (RIP) provides for rehabilitation/repair of Public Law 84-99 eligible (active status) levees that are damaged during flood events. This authority covers post flood repair of both Federally authorized/constructed and non- Federally constructed flood control works. Inspections of Federal levees are funded and conducted under the Inspection of Completed Works (ICW) program. Inspection of non-Federal levees are funded and conducted under the PL 84-99 RIP. As the levees in the Dallas Floodway as described in this report are classified as Federal levees, inspections were funded and conducted under the ICW program.

After Hurricane Katrina struck New Orleans, USACE began assessing the Levee Safety Program (LSP) and reviewing criteria for evaluating levee systems. In January 2010, USACE completed a Periodic Inspection (PI) of the Basin applying the new, more stringent post-Katrina levee rating methods resulting in the *Feather River, Sutter Basin Protection Area, Periodic Inspection, January 2010, Report No. 1.* PI's are conducted to verify proper operation and maintenance; evaluate operational adequacy and structural stability; identify features to monitor over time; and improve the ability to communicate the overall condition. The PI report produced by USACE for the Basin determined that the levee system was "Unacceptable" which resulted with an "Inactive" status for PL 84-99 RIP assistance. Since the PIR was released, a number of the issues have been addressed or repaired by local maintaining entities. Unwanted vegetation growth, encroachments, and erosion are all system-wide issues and make up 97% of Sutter Basin's deficiencies listed in the USACE Unacceptable Items List.

On March 28, 2013, the CVFPB submitted a Letter of Intent (LOI) notifying USACE that the local maintaining agencies within the Sutter Basin led by SBFCA intended to develop and implement a System-Wide Improvement Framework (SWIF) plan. If accepted by USACE, the LOI will allow the Basin's levee system to retain eligibility for RIP assistance for a period of two years while SBFCA develops a SWIF. If the SWIF plan is accepted by USACE, the Basin's levee system will retain eligibility for RIP while the local levee maintainers perform the work described in the SWIF.

4.2.2.6 Geomorphology

In geologic history, the Sacramento and Feather Rivers migrated frequently and freely within their meander belts, which typically exceeded several thousand feet in width (Buer 1984 as cited in North State Resources and Stillwater Sciences 2009: 3-134). Prior to Euroamerican settlement, the mainstem Sacramento and Feather Rivers and tributaries along the valley floor would naturally overtop their banks at regular cycles and flood the adjacent lands, replenishing and depositing sediments.

Since in the late 1800s, the Sacramento and Feather Rivers' channel morphology and sediment transport regime have been progressively altered by human activities, including upstream hydraulic mining and the clearing of riparian vegetation and the construction of levees and upstream dams for flood risk management and water supply.

The geomorphic history of the Feather River has been substantially affected by Nineteenth century hydraulic mining. Prior to the onset of mining, the river was similar to the Sacramento River upstream of Colusa. The rapid introduction of mining debris resulted in extensive shoaling of bendways and a reduction in channel sinuosity. The initial pulse or surge of mining sediment was very fine-grained, silt-dominated material (referred to as *slickens*), which was followed by quartz-dominated sands and gravels. Channel infilling from mining debris resulted in a dramatic decrease in channel capacity on the Feather River. Extensive flooding and overbank deposition onto urban areas and agricultural lands

in the study area resulted. The Feather River subsequently has degraded into these sediments so that hydraulic mining debris presently constitutes the channel banks. The fine-grained slickens form a continuous, cohesive bank toe along the entire study area up to River Mile 28. This erosion-resistant toe generally has resulted in a stable river planform.

If degradation continues, however, coarse-grained, noncohesive pre-mining sediments will be exposed. As a result, channel stability may decrease. Upstream of Marysville, the Feather River is significantly different from the lower Feather River in that it did not receive the tremendous sediment influx introduced by hydraulic and dredge mining. Although hydraulic mining did occur on the upper Feather River, the amount of material introduced was significantly less than that on the Yuba River (Water Engineering & Technology 1990: xix, 1991:137–139).

4.2.3 Determination of Effects

Effects on hydrologic or geomorphic conditions may be considered significant if implementation of an alternative would result in any of the following conditions:

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site.
- Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off site.
- Place within a 100-year flood hazard area structures that would impede or redirect floodflows.
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.

Effects on flood risk management may be considered significant if implementation of an alternative would result in the following conditions.

- Significantly raise flood stage elevations.
- Increase the frequency and duration of inundation of lands.
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee.

An effect on the levee system is considered significant if an alternative would substantially increase any of the following.

- Seepage.
- Levee settlement.
- Wind erosion.
- Bank erosion or bed scour.
- Sediment deposition.
- Subsidence of land adjacent to levees.

In addition, an effect on the levee system is considered significant if an alternative would substantially decrease any of the following.

- Levee stability.
- Inspection, maintenance, or repair capabilities.
- Current level of levee slope protection.
- Emergency response capabilities.
- Channel conveyance capacity.
- The ability of the levees to withstand seismic forces.

4.2.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning flood control and geomorphic conditions are summarized in Table 4-4.

Table 4-4. Summary of Effects for Flood Risk Management and Geomorphic Conditions

Effect	Finding	Mitigation Measure	Finding with Mitigation
Alternatives SB-7 and SB-8			
Effect FC-1: Change in Water Surface Elevations and Flood Safety Attributable to Project Design	No effect	None required	No effect
Effect FC-2: Increase in Channel Bed Incision and Bank Erosion Attributable to Project Design	No effect	None required	No effect
Effect FC-3: Decrease in Through- and Under-Seepage	Beneficial	None required	Beneficial
Effect FC-4: Decrease in Risk of Levee Failure as a Result of Erosion or Seepage	Beneficial	None required	Beneficial
Effect FC-5: Change in Stream Energy and Modification of Floodplain Scour/Deposition	No effect	None required	No effect
Effect FC-6: Alteration of the Existing Drainage Pattern of the Site or Area	Significant	FC-MM-1: Coordinate with Owners and Operators, Prepare Drainage Studies as Needed, and Remediate Effects through Project Design	No effect
Effect FC-7: Increase in Levee Slope Stability	Beneficial	None required	Beneficial

4.2.4.1 Effects Not Addressed Further in this Document

Effect FC-2: Increase in Channel Bed Incision and Bank Erosion Attributable to Project Design. The FRWLP Final EIS addressed effects on geomorphic conditions (Final EIS, Section 3.1.4)) and that analysis is incorporated by reference. The SBPFS alternatives would not increase or intensify current geomorphic processes. Therefore, this effect is not discussed further.

Effect FC-3: Decrease in Through- and Under-Seepage. The FRWLP Final EIS addressed effects on through- and under-seepage. The SBPFS alternatives would reduce or eliminate the potential for seepage and, therefore, result in beneficial effects on flood conditions in the study area. Extending levee improvements downstream of Laurel Avenue would further reduce potential for seepage and flood risk. Therefore, this effect is not discussed further.

Effect FC-4: Increase in Risk of Levee Failure as a Result of Erosion or Seepage. The FRWLP Final EIS addressed effects of slope flattening and that analysis is incorporated by reference. Slope flattening is anticipated to decrease relative erosion rates by alleviating over-steepened banks and not to adversely affect through- and under-seepage potential. Therefore this effect is not discussed further.

Effect FC-7: Increase in Levee Slope Stability. The FRWLP Final EIS addressed the effects on levee slope stability (Final EIS, Section 3.1.4), and that analysis is incorporated by reference. SBPFS alternatives would benefit levee slope stability. Cut-off walls act to limit the through-flow of water at the levee foundation and improve levee slope stability. Therefore, this effect is not discussed further.

4.2.4.2 No Action Alternative

The No Action Alternative represents the continuation of the existing levee deficiencies within the study area. Current levee operations and maintenance activities would continue, but there would be no change in the geomorphic and flood risk–management regimes relative to existing conditions. However, without levee improvements, there is the continued risk of levee failure. Under-seepage and loss of levee foundation soils would be expected to continue. A catastrophic levee failure would result in collapse of levee slopes and loss of soil. If a levee breach were to occur, emergency construction and repair activities would be implemented. Because of the uncertainty of such an event and its magnitude, the effects are unpredictable and, therefore, a precise determination of significance is considered too speculative and cannot be made.

4.2.4.3 Alternative SB-8

Effect FC-1: Change in Water Surface Elevations and Flood Safety Attributable to Project Design

Alternative SB-8 represents minor design modifications to the proposed action analyzed in the FRWLP Final EIS. SB-8 includes the proposed realignment of 11,600 linear feet of existing levee where it lies directly adjacent to the Sutter Butte Canal. The modification would move the levee about 20 feet waterward to provide a 10-foot maintenance road between the canal and the project levee. To evaluate whether moving the levee waterward would affect water surface elevations and increase the potential risk of flooding, changes to flow, depth, duration, and velocity were estimated using a hydraulic model. The hydraulic model results were also used to perform a transfer of risk analysis using Risk and Uncertainty based methods.

The hydraulic model results indicated no measureable change in flow, depth, duration, and velocity within the Feather River (stage change less than 0.005 feet). The 20-foot realignment is located where the levee toe is higher than the 0.5% (1/200) ACE water surface elevation. Therefore, any change in water surface elevation would only occur for flood events more rare than 0.5% (1/200) ACE. In addition, this reach of river is more than 5,000 feet wide, and the 20-foot realignment of the levee would be a small change in the overall hydraulic cross section.

Transfer of flood risk was evaluated by comparing with-project and without-project levee performance values at index points throughout the system. For purposes of evaluating system impacts, the risk analysis is limited to hydrologic and hydraulic parameters and their uncertainties. This approach is consistent with Section 3.b (2) of the memorandum *Clarification Guidance on the Policy and Procedural Guidance for the Approval of Modifications and Alterations of Corps of Engineers Projects* (U.S. Army Corps of Engineers 2008). The analysis is described in detail in Appendix C1b, *Hydraulic Design and Analysis*.

Analysis of Alternative SB-8 found no transfer of flood risk. As described above, the hydraulic model created for Alternative SB-8 computed the same water surface elevations as Alternative SB-1 (No Action Alternative). Because the water surface elevations are the input to the Risk and Uncertainty model, and they did not change, there would be no change in the project performance and no transfer of flood risk.

Effect FC-5: Change in Stream Energy and Modification of Floodplain Scour/Deposition

Realigning 11,600 linear feet of the levee waterward away from the Sutter Butte Canal could potentially affect scour and/or deposition patterns within the channel. Given the current cross sectional capacity of the channel, moving the levee 20 feet waterward would not have a measurable effect on stream energy or floodplain scour or deposition. As described in the FRWLP Final EIS, floodplain capacity would remain similar to existing conditions under most flows. Alternative SB-8 would, therefore, have no effect related to change in stream energy and modification of floodplain scour/deposition. Mitigation is not required.

Effect FC-6: Alteration of the Existing Drainage Pattern of the Site or Area

Project elements of SB-8 in Reaches 22 and 28 include relocating the Sutter Butte Canal at two locations totaling 1,540 linear feet where the levee runs near the channel and where it is undesirable to move the levee waterward (Plates 4-2 and 4-3). This Sutter Butte Canal is an irrigation canal and realignment of the canal would have no impact on local drainage patterns. Replacement canal sections would be constructed in advance of decommissioning, and canal sections would be filled to ensure there is no loss in service during the irrigation season and to ensure that local drainage and ponding areas would not be adversely affected as a result of project construction.

As described in the FRWLP Final EIS, drainage infrastructure maintained by local landowners or local agencies could be affected in some locations, and local surface runoff patterns could be altered. Because interference with drainage could cause or exacerbate localized flooding, this effect could be significant. The implementation of Mitigation Measure FC-MM-1, identified in the FRWLP Final EIS, would reduce this effect to a less-than-significant level.

Mitigation Measure FC-MM-1: Coordinate with Owners and Operators, Prepare Drainage Studies as Needed, and Remediate Effects through Project Design

During final project design, project engineers will coordinate with owners and operators of local drainage systems and landowners served by the systems to evaluate pre- and post-project drainage needs and design features to remediate any project-related substantial drainage disruption or alteration in runoff that would increase the potential for localized flooding. If substantial alteration of runoff patterns or disruption of a local drainage system could result from a project feature, a drainage study will be prepared as part of final project design. The study will consider the design flows of any existing facilities that would be crossed by project features. Based on the study, project engineers will develop appropriate plans for relocation or other modification of these facilities and construction of new facilities, as needed, to ensure equivalent functioning of the system during and after construction. If no drainage facilities (e.g., ditches, canals) would be affected, but project features would have a substantial adverse effect on runoff amounts and/or patterns, new drainage systems will be included in the design of project alternatives to ensure that the project would not result in new or increased localized flooding. Any necessary features to

remediate project-induced drainage problems will be installed before the project is completed or as part of the project, depending on site-specific conditions.

4.2.4.4 Alternative SB-7

Implementation of Alternative SB-7 would potentially result in effects on flood risk management and geomorphic conditions.

Effect FC-1: Change in Water Surface Elevations and Flood Safety Attributable to Project Design

Under Alternative SB-7, no levee improvements would be made above Reach 21; therefore, no canal or levee realignment modifications to the levees adjacent to the Sutter Butte Canal would be made. The levee improvements within the SB-7 reach would not result in any change in the hydraulic characteristics of the reach. Alternative SB-7 would have no effect related to changes in water surface elevations and flood safety. Mitigation is not required.

Effect FC-5: Change in Stream Energy and Modification of Floodplain Scour/Deposition

Effects associated with Effect FC-5 under Alternative SB-7 are identical to those described above for Effect FC-5 under Alternative SB-8, except that no levee realignments are proposed that could potentially affect channel hydraulics and scour and deposition. Alternative SB-7 would, therefore, have no effect related to change in stream energy and modification of floodplain scour/deposition.

Effect FC-6: Alteration of the Existing Drainage Pattern of the Site or Area

Effects associated with Alternative SB-7 would be comparable in type, but less adverse, than under Alternative SB-8 and the alternatives described in the FRWLP Final EIS because Alternative SB-7 would involve less landward disturbance and no relocation of the Sutter Butte Canal. The implementation of Mitigation Measure FC-MM-1 would reduce this effect to a less-than-significant level.

4.3 Water Quality and Groundwater Resources

4.3.1 Introduction

This section discusses the effects on water quality and groundwater resources that would result from the No Action Alternative and Alternatives SB-7 and SB-8, as well as mitigation measures that would reduce significant effects.

4.3.2 Affected Environment

Section 3.2.2 of the FRWLP Final EIS provided a summary of the regulatory setting applicable to water quality and groundwater resources (Section 3.2.2.1), and a general description of water quality and groundwater resource conditions (climate, Feather River water quality, contaminants, and groundwater quantity and quality) within the study area (Section 3.2.2.2). Updated information concerning the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Basin Plan) is provided below. Other than an update to the Basin Plan, the information contained in the FRWLP Final EIS is still applicable and is incorporated by reference.

In summary, the Feather River is included on the State Water Resources Control Board's (State Water Board's) Clean Water Act (CWA) Section 303(d) Total Maximum Daily Load list of impaired waters for chlorpyrifos, Group A pesticides, mercury, and unknown sources of toxicity. Table 4-5 summarizes water quality impairments in surface waters in the study area and the sources of these impairments. Agriculture and urban runoff are the main sources for chlorpyrifos and Group A pesticides. Mercury contamination is associated with legacy deposits from gold mining activities. Turbidity and sediment levels spike during heavy storm runoff in the winter and spring. In the spring and early summer, the water quality is primarily affected by agricultural drainage and natural runoff. During periods of low flows, specifically the late summer–early fall, water quality decreases due to high water temperatures and concentrations of pollutants. For more detailed information, see pages 3.2-5 through 3.2-12 of the FRWLP Final EIS.

Table 4-5. Clean Water Act Section 303(d)-Listed Impaired Water Bodies and Associated Potential Sources within the Study Area

Water Body	Listed Pollutants	Associated Potential Sources
Feather River, Lower (Lake Oroville Dam to Confluence with Sacramento River)	Chlorpyrifos	Agriculture
	Group A pesticides	Agriculture
	Mercury	Resource extraction
	PCBs	Unknown
	Unknown toxicity	Unknown
Oroville Wildlife Area Fishing Pond (Butte County)	Unknown toxicity	Unknown
Gilsizer Slough (from Yuba City to downstream of Township Road, Sutter County)	Diazinon	Agriculture
	Oxyfluorfen	Agriculture
	pH	Unknown
Wadsworth Canal	Chlorpyrifos	Agriculture
	Diazinon	Agriculture
Morrison Slough	Diazinon	Unknown
Sutter Bypass	Mercury	Resources extraction
Live Oak Slough	Diazinon	Agriculture
	Oxyfluorfen	Agriculture
	Dissolved oxygen	Unknown

Source: 2010 Integrated Report (State Water Resources Control Board 2010).
PCBs = polychlorinated biphenyls.
Note: SBPFS alternatives would likely affect only the Feather River.

As described in the FRWLP Final EIS, a preliminary Phase I Environmental Site Assessment was conducted in 2009 by USACE to assess the presence or likely presence of any hazardous substance or petroleum products under conditions that indicate an existing release, a past release, or the material threat of a release into structures, the ground, groundwater, or surface waters of the property. Information was gathered for this report by conducting a pre-site visit search, and a site visit to verify listed Hazardous Toxic Radioactive Wastes (HTRW) threats and discover new ones. The Environmental Site Assessment found the following problem areas.

- 51 registered underground storage tanks (USTs) and 3 aboveground storage tanks (ASTs).
- Five sources are listed as small and large generators of EPA-regulated hazardous waste.

- Five sites that had leaking USTs, two of which have or had affected public drinking water.
- Six known or potential hazardous substance sites under investigation or cleanup.
- Two waste discharge systems.
- Two landfills.
- 12 suspected drug labs.
- One pesticide-producing facility.

One additional site not included in the Environmental Site Assessment was a Superfund site (Onstott Dusters, Inc.). For the majority of the sources, no records were found to indicate that these potential sources have actually caused major contamination, although investigations are still on-going. Several areas of concern were revealed during the investigation. Most of these areas of concern involve registered USTs, hazardous waste generators, minor tank leaks, UST removal and remediation, and accidental releases. During records research and field surveys, no known contamination due to HTRW was confirmed within the construction zone. In conclusion, no evidence was found to indicate that any other potential sources of contamination would interfere with any planned construction of the levees. For additional information, see the Preliminary Phase I Environmental Site Assessment in FRWLP Final EIS, Appendix H.

4.3.2.1 Basin Plan

Pursuant to the Porter-Cologne Act, the Central Valley Regional Water Quality Control Board (Central Valley RWQCB) prepares and updates the Basin Plan for the Sacramento and San Joaquin River Basins every 3 years; the most recent update was completed in October 2011 (Central Valley Regional Water Quality Control Board 2011). The Basin Plan describes the officially designated beneficial uses for specific surface water and groundwater resources and the enforceable water quality objectives necessary to protect those beneficial uses. The study area is located within the Central Valley RWQCB's jurisdiction and is subject to the Basin Plan. The Basin Plan includes numerical and narrative water quality objectives for physical and chemical water quality constituents. The Basin Plan sets numerical objectives for temperature, dissolved oxygen, turbidity, and pH; total dissolved solids, electrical conductivity, bacterial content, and various specific ions; trace metals; and synthetic organic compounds. The Basin Plan also sets narrative objectives for parameters such as suspended solids, biostimulatory substances (e.g., nitrogen and phosphorus), oil and grease, color, taste, odor, and aquatic toxicity. Narrative objectives often are precursors to numeric objectives. The primary method used by the Central Valley RWQCB to ensure conformance with the Basin Plan's water quality objectives and implementation policies and procedures is to issue waste discharge requirements (WDRs) for projects that may discharge wastes to land or water. The WDRs specify the terms and conditions that must be followed during implementation and operation of a project.

4.3.3 Determination of Effects

Effects on water quality and groundwater resources may be considered significant if implementation of an alternative would result in any of the following conditions.

- Violate any water quality standards or WDRs.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, resulting in a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g.,

the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).

- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Substantially degrade water quality.

As part of the project, four environmental commitments could reduce or eliminate water quality and groundwater effects. These environmental commitments call for development and implementation of four plans and were included in the assessment of alternatives' effects.

- Stormwater Pollution Prevention Plan (SWPPP).
- Bentonite Slurry Spill Contingency Plan (BSSCP), also known as a frac-out plan.
- Spill Prevention, Control, and Counter-Measure Plan (SPCCP).
- Turbidity monitoring plan.

4.3.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning water quality and groundwater resources are summarized in Table 4-6.

Table 4-6. Summary of Effects for Water Quality and Groundwater Resources

Effect	Finding	Mitigation Measures	Finding with Mitigation
Alternatives SB-7 and SB-8			
Effect WQ-1: Effects on Surface Water Quality from Excessive Turbidity or Total Suspended Solids	Less than significant	None required	Less than significant
Effect WQ-2: Release of Contaminants into Adjacent Surface Water Bodies from Construction-Related Hazardous Materials	Less than significant	None required	Less than significant
Effect WQ-3: Effects on Groundwater or Surface Water Quality Resulting from Contact with the Water Table	Significant	WQ-MM-1: Implement Provisions for Dewatering WQ-MM-2: Complete Phase I and Phase II (if Necessary) Environmental Site Assessment Investigations and Implement Required Measures	Less than significant
Effect WQ-4: Effects on Groundwater Wells Due to Project Encroachment	Less than significant	None required	Less than significant

4.3.4.1 No Action Alternative

The No Action Alternative represents the continuation of the existing levee deficiencies along the portion of the Feather River in the study area. Current levee operations and maintenance activities would continue, but there would be no change in the geomorphic and flood risk–management regimes relative to existing conditions. No levee improvements would be made to increase the level of protection. No construction-related effects relating to water quality and groundwater resources such as release of contaminants or sediments to surface water would occur.

However, without levee improvements, the present risk of levee failure would continue. Under-seepage and loss of levee foundation soils would be expected to continue. A catastrophic levee failure would result in collapse of levee slopes and loss of soil that could result in increased erosion, which could raise turbidity and cause sedimentation in adjacent water bodies. Additionally, adverse water quality effects due to levee failure in which flooding occurs in urban, suburban, and agricultural areas would likely be considerable and could include bacterial and chemical (e.g., pesticides, petroleum products, heavy metals) contamination. Indirect effects to water quality from flooding could include damage to water supply systems, damage to sewage and sewer systems, insufficient supply of drinking water and water for washing, increase in waterborne infections, and overflow of toxic waste sites. Because of the uncertainty of such an event and its magnitude, the effects are unpredictable and therefore a precise determination of significance is considered too speculative and cannot be made.

4.3.4.2 Alternative SB-8

Effect WQ-1: Effects on Surface Water Quality from Excessive Turbidity or Total Suspended Solids

As described in the FRWLP Final EIS, soil-disturbing construction activities (i.e., grading, excavation, vegetation clearing) can result in temporary impacts on surface water from the exposure of bare soils to stormwater. Construction activities would disturb existing vegetation cover and soils, would expose large areas of disturbed ground that then could be subject to rainfall and erosion, and could cause temporary discharges of sediment and other contaminants in stormwater runoff to drainage channels and the Feather River.

Construction-related soil disturbance effects associated with Alternative SB-8 would be comparable in type, but of a greater magnitude, than effects of Alternative SB-7 and slightly greater than the FRWLP preferred alternative, Alternative 3. Table 4-7 identifies the construction area disturbance for each alternative. These areas could be cleared of vegetation or otherwise physically disturbed during construction. Alternative SB-8 includes the removal of vegetation outside the immediate area necessary for construction of levee improvements to create a vegetation-free zone to bring the levees into Federal compliance in accordance with the Vegetation ETL.

Unvegetated and cleared areas are more likely to experience erosion than vegetated areas due to reduced water infiltration and retention. This could cause sedimentation and increased turbidity or total settleable solids (TSS) levels. The affected vegetation does not shade the river so there is no potential for water quality impacts due to loss of shade to the river.

Table 4-7. Acres Disturbed by Construction of Alternatives

Alternative	Disturbed Acres*
SB-7	677.96
SB-8	1,031.45
FWRLP Alternative 1	1,184.11
FRWLP Alternative 2	1,795.66
FRWLP Alternative 3	974.53

* These totals include permanent and temporary work areas but do not include borrow site acreages.

Although the areal extent of the area subject to disturbance is substantial, significant large-scale erosion and generation of contaminated runoff is unlikely because construction would be reduced or would not occur during the winter months and the majority of the construction would occur on the landside of the existing levee. In addition, GIS-based estimates indicate that the distance from the project footprint to the water's edge during typical summer base flows would average approximately 1,400 feet and range from approximately 50 feet to 5,600 feet. Plus, temporary erosion control measures would be implemented during construction to minimize stormwater pollution resulting from erosion and sediment migration from the construction areas.

Best Management Practices (BMPs) would be used to prevent nonpoint source pollution, to control stormwater runoff, and to minimize sediment damage to water quality and aquatic habitats.

Two environmental commitments are targeted at reducing or eliminating erosion and sedimentation effects: the SWPPP environmental commitment (see Section 3.8.5.1) and the turbidity monitoring plan environmental commitment (see Section 3.8.5.4). The SWPPP would include erosion control measures to ensure the land disturbance activities do not cause erosion that would increase sediment in the Feather River. Site-specific erosion control measures would also be developed as part of a SWPPP. A SWPPP typically contains, but is not limited to, the following BMPs.

- **Timing of construction.** The construction contractor will conduct all construction activities during the typical construction season to avoid ground disturbance during the rainy season.
- **Staging of construction equipment and materials.** To the extent possible, equipment and materials will be staged in areas that have already been disturbed.
- **Minimize soil and vegetation disturbance.** The construction contractor will minimize ground disturbance and the disturbance/destruction of existing vegetation. This will be accomplished in part through the establishment of designated equipment staging areas, ingress and egress corridors, and equipment exclusion zones prior to the commencement of any grading operations.
- **Stabilize grading spoils.** Grading spoils generated during construction will be temporarily stockpiled in staging areas. Silt fences, fiber rolls, or similar devices will be installed around the base of the temporary stockpiles to intercept runoff and sediment during storm events. If necessary, temporary stockpiles may be covered with an appropriate geotextile to increase protection from wind and water erosion.
- **Install sediment barriers.** The construction contractor will install silt fences, fiber rolls, or similar devices to prevent sediment-laden runoff from leaving the construction area.
- **Stormwater drain inlet protection.** The construction contractor will install silt fences, drop inlet sediment traps, sandbag barriers, and similar devices.

- **Permanent site stabilization.** The construction contractor will install structural and vegetative methods to permanently stabilize all graded or otherwise disturbed areas once construction is complete. Structural methods may include the installation of biodegradable fiber rolls and erosion control blankets. Vegetative methods may involve the application of organic mulch and tackifier and/or the application of an erosion control seed mix.

Implementation of a SWPPP will substantially minimize the potential for project-related erosion and associated adverse effects on water quality.

As part of a turbidity monitoring plan (see Section 3.8.5.4), USACE or its contractor would monitor turbidity in the adjacent water bodies, where applicable criteria apply, to determine whether turbidity is being affected by construction and to ensure that construction does not result in a substantial rise in turbidity levels above ambient conditions, in accordance with the Basin Plan turbidity objectives. The monitoring program would include monitoring ambient turbidity conditions 200 feet upstream and 200 feet downstream of construction activities. Grab samples would be collected at a downstream location that is representative of the flow near the construction site. If construction is creating a visible sediment plume, the sample would represent the plume. During all in-water construction activities, samples would be collected hourly to ensure compliance. During all other construction activities, samples would be collected on a random weekly basis.

If turbidity exceeds Basin Plan standards, construction-related earth-disturbing activities would be modified to alleviate the problem. USACE or its contractor would notify the Central Valley RWQCB of the issue and provide an explanation of the cause.

The implementation of these environmental commitments would reduce potential effects on surface water quality from construction-related turbidity or TSS to a less-than-significant level. No mitigation is required.

Effect WQ-2: Release of Contaminants into Adjacent Surface Water Bodies from Construction-Related Hazardous Materials

Similar to potential effects on surface water quality from excessive turbidity or total suspended solids, Alternative SB-8 also has a greater potential than SB-7 and the FRWLP preferred alternative for stormwater runoff of construction-related contaminants due to the greater amount of area disturbed by construction (Table 4-7).

As described in the FRWLP Final EIS, construction might involve storage and use of toxic and other harmful substances near the Feather River (or in areas that drain to the Feather River or other water bodies), which could result in discharge of these substances to the Feather River or other water bodies. Construction activities would involve the use of heavy equipment, cranes, compactors, and other construction equipment that use petroleum products such as fuels, lubricants, hydraulic fluids, and coolants, all of which can be toxic to fish and other aquatic organisms. The use of this equipment could contribute a direct source of contamination if equipment and construction practices were not properly followed. An accidental spill or inadvertent discharge from such equipment could affect the water quality of the river or water body.

The combination of the environmental commitments described in Section 3.8.5 would reduce the effect of any release, as well as reduce the likelihood that a release would occur. These environmental commitments require the development of the SWPPP, an SPCCP, a BSSCP, and a turbidity monitoring plan. All plans would be prepared prior to the commencement of construction activities.

An SPCCP is intended to prevent discharge of petroleum products into navigable water or adjoining shorelines. USACE or its contractor would develop and implement an SPCCP to minimize the potential for effects from spills of hazardous, toxic, or petroleum substances during construction and operation activities. The SPCCP would be completed before construction activities begin. Implementation of this measure would comply with state and Federal water quality regulations. The SPCCP would describe spill sources and spill pathways, methods to reduce the likelihood of spills, and actions that would be taken in the event of a spill (e.g., an oil spill from engine refueling would be immediately cleaned up with oil absorbents). The SPCCP would outline descriptions of containment facilities and practices such as doubled-walled tanks, containment berms, emergency shut-offs, drip pans, fueling procedures, and spill response kits. It would also describe how and when employees are trained in proper handling procedures and spill prevention and response procedures.

A BSSCP is typically developed for activities that involve the use of bentonite materials (e.g., the construction of slurry walls). The BSSCP is intended to minimize the potential for accidental release of bentonite (which is used in excavation and tunneling activities), provide for timely detection of accidental bentonite release, and ensure a *minimum-effect* response in the event of an accidental bentonite release. If the SWPPP and SPCCP fail to prevent a spill, then construction would stop, and the spill would be properly cleaned up.

Adherence to these environmental commitments would reduce the effect on surface water bodies from construction-related hazardous materials use to a less-than-significant level. No mitigation is required.

Effect WQ-3: Effects on Groundwater or Surface Water Quality Resulting from Contact with the Water Table

Alternative SB-8 would be expected to have similar potential impacts on groundwater as described in the FRWLP Final EIS for FRWLP Alternative 3 because the amount of cutoff wall construction and the construction methods would be nearly identical.

As described above, a preliminary Phase I Environmental Site Assessment has been conducted to identify potential HTRW sites. No known contamination due to HTRW was confirmed within the construction zone; however, a full Phase I Environmental Site Assessment has not been conducted.

As described in the FRWLP Final EIS, trenching and excavation associated with a cutoff wall and levee reconstruction could extend to a depth that would expose the water table, creating an immediate and direct path to the groundwater basin that would allow contaminants to enter the groundwater system. Primary construction-related contaminants that could reach groundwater include increased sediment, oil and grease, and hazardous materials. The release of contaminants into the groundwater and surface waters would constitute a significant effect. Dewatering of the construction area (i.e., removing groundwater that may fill trenches dug for cutoff wall construction) is not expected to occur during project construction. However, if dewatering became necessary, it could result in the release of contaminants to surface or groundwater. Mitigation Measure WQ-MM-1 would address these effects.

The construction of a cutoff wall is not expected to require digging or trenching at depths where groundwater aquifers are used for drinking water. Even if trenching activities were to reach a groundwater aquifer used for drinking water, the slurry wall material is relatively benign and would not remain in a liquid state long enough to allow for significant lateral movement within the aquifer.

With the implementation of Mitigation Measures WQ-MM-1 and WQ-MM-2 and the environmental commitments for a SWPPP, SPCCP, and BSSCP, effects on groundwater or surface water quality resulting from contact with the water table would be reduced to less than significant.

Mitigation Measure WQ-MM-1: Implement Provisions for Dewatering

Before discharging any dewatered effluent to surface water, USACE or its contractors will obtain a Low Threat Discharge and Dewatering NPDES permit from the Central Valley RWQCB if the dewatering is not covered under the Central Valley RWQCB's NPDES Construction General Permit. Under the dewatering permit, discharging activities involve extensive water quality monitoring in order to adhere to the strict effluent and receiving water quality criteria outlined in the permit. As part of the permit, the permittee will design and implement measures as necessary so that the discharge limits identified in the relevant permit are met.

For example, if dewatering is needed during the construction of any cutoff walls, the Low Threat Discharge and Dewatering NPDES permit would require treatment or proper disposal of the water prior to discharge. Treatment measures will be selected to achieve maximum sediment removal and represent the best available technology that is economically achievable. Implemented measures could include the retention of dewatering effluent until particulate matter has settled before it is discharged, use of infiltration areas, and other BMPs.

Final selection of water quality control measures will be subject to approval by USACE. USACE will verify that coverage under the appropriate NPDES permit has been obtained before allowing dewatering activities to begin. USACE will perform routine inspections of the construction area to verify that the water quality control measures are properly implemented and maintained. USACE will notify its contractors immediately if there is a noncompliance issue and will require compliance.

Mitigation Measure WQ-MM-2: Complete Phase I and Phase II (if Necessary) Environmental Site Assessment Investigations and Implement Required Measures

To further investigate the potential for hazardous toxic radioactive wastes (HTRW) in the project area, a full Phase I Environmental Site Assessment would be performed during the project design phase. If the Phase I Environmental Site Assessment indicates the presence of HTRW, a Phase II Environmental Site Assessment would be performed involving chemical analysis for hazardous substances and/or petroleum hydrocarbons. If HTRW is encountered during construction, USACE or the non-federal sponsor will implement required measures for the proper transport and disposal of such materials in accordance with the appropriate local, state, and Federal laws and regulations.

Effect WQ-4: Effects on Groundwater Wells Due to Project Encroachment

Alternative SB-8 would be expected to have potential impacts on groundwater similar to those described in the FRWLP Final EIS for FRWLP Alternative 3 because the amount of cutoff wall construction would be nearly identical and the construction methods are the same.

Because a cutoff wall may block lateral water transfer from the river to an aquifer, cutoff walls could have a significant impact if drinking water wells are located in close proximity to construction zones where a slurry cutoff wall is constructed. Less water may be available to the well and water quality

may be affected because the well pump may take in more sediment due to the potential lowering of the aquifer.

Hydraulic separation causes no reduction in flow or stage in the Feather River. Water exchanges between the river and adjacent aquifer are slow and steady, and continue via deep percolation from the river to the deep aquifer which exists below the cutoff wall.

As described in the FRWLP Final EIS, the potential groundwater effects resulting from the slurry cutoff walls were studied and USACE and SBFCA determined that the effect on groundwater wells would be less than significant. Modeling conducted by HDR for SBFCA and USACE using two models (Central Valley Hydrologic Model (CVHM), which is a U.S. Geological Survey Model, and a locally developed model) found that all scenarios showed a negligible change in groundwater levels. Results of the CVHM model indicated a negligible change in groundwater levels in the northern study area along the Feather River, and a 3-foot increase in groundwater levels in the southern study area. However, the depth to groundwater in the southern area is 10 to 30 feet below the ground surface and a 3-foot change was determined by USACE as likely to not have any significant effect on groundwater in the area.

4.3.4.3 Alternative SB-7

Effect WQ-1: Effects on Surface Water Quality from Excessive Turbidity or Total Suspended Solids

Construction of Alternative SB-7 would have less potential to affect surface water quality than other alternatives. As shown in Table 4-7, construction-related soil disturbance effects associated with Alternative SB-7 would be comparable in type, but would affect substantially less area, than Alternative SB-8 and the alternatives described in the FRWLP Final EIS.

Implementation of the environmental commitments detailed in the Alternative SB-8, Effect WQ-1 discussion above, and Chapter 3, *Plan Formation*, would ensure that water quality is protected from excessive turbidity and TSS from the construction proposed under Alternative SB-7. The effect would be less than significant. No mitigation is required.

Effect WQ-2: Release of Contaminants into Adjacent Surface Water Bodies from Construction-Related Hazardous Materials

Construction of Alternative SB-7 would have less potential to release contaminants to surface waters than other alternatives because the amount of construction would be limited to a shorter reach and, therefore, would disturb less area.

Implementation of the environmental commitments detailed in Chapter 3, *Plan Formation*, would ensure that water quality is protected from construction-related hazardous materials. This effect would be less than significant. No mitigation is required.

Effect WQ-3: Effects on Groundwater or Surface Water Quality Resulting from Contact with the Water Table

Implementation of Alternative SB-7 would have less potential to affect groundwater or surface waters from contact with the water table than SB-8 because construction would be limited to a shorter reach.

Construction practices under this alternative would be similar to those under Alternative SB-8. The release of contaminants would constitute a significant impact.

USACE would adhere to environmental commitments detailed in Chapter 3, Plan Formation. Adherence to the environmental commitments and implementation of Mitigation Measures WQ-MM-1 and WQ-MM-2 would reduce effects on groundwater or surface water quality resulting from contact with the water table to a less-than-significant level.

Effect WQ-4: Effects on Groundwater Wells Due to Project Encroachment

Implementation of Alternative SB-7 would have less potential to affect groundwater wells than Alternative SB-8 would have because the SB-7 cutoff wall construction would affect a shorter reach of levee.

As stated in Effect WQ-4 under Alternative SB-8, the model prepared by HDR estimated a 3-foot change in groundwater levels in the southern portion of the study area, which would be the largest change in the entire study area. Such a change is not anticipated to be a significant effect on groundwater levels. This effect is considered less than significant. No mitigation is required.

4.4 Geology, Seismicity, Soils and Mineral Resources

4.4.1 Introduction

This section evaluates the potential impacts on geology, seismicity, soils and mineral resources that would result from the No Action Alternative and Alternatives SB-8 and SB-7.

4.4.2 Affected Environment

Section 3.3, *Geology, Seismicity, Soils and Mineral Resources*, of the FRWLP Final EIS described existing regulatory and environmental setting for these resources. This information remains unchanged and is hereby incorporated by reference.

4.4.3 Determination of Effects

Effects on geology, seismicity, soils, and minerals may be considered significant if implementation of an alternative would result in any of the following conditions.

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Strong seismic ground shaking.
  - Seismic-related ground failure, including liquefaction.
  - Landslides.
- Result in substantial soil erosion or the loss of topsoil.
- Be located on a geologic unit or soil that is unstable, or that would become unstable as result of the project, and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction or collapse.
- Be located on expansive soil, creating substantial risks to life or property.

- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.
- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other lands use plan.

4.4.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning geology, soils, seismicity, and mineral resources are summarized in Table 4-8.

Table 4-8. Summary of Effects for Geology, Soils, Seismicity, and Mineral Resources

Effect	Finding	Mitigation Measures	Finding with Mitigation
Alternatives SB-7 and SB-8			
Effect GEO-1: Beneficial Change in Levee Stability	Beneficial	None required	Beneficial
Effect GEO-2: Increase Exposure of People or Structures to Hazards Related to Strong Seismic Ground Shaking	Less than significant	None required	Less than significant
Effect GEO-3: Cause Accelerated Erosion and Sedimentation Resulting from Construction-Related Ground Disturbance	Less than significant	None required	Less than significant
Effect GEO-4: Cause Structural Damage and Injury Resulting from Development on Expansive Soils	Less than significant	None required	Less than significant
Effect GEO-5: Cause Accelerated Erosion and Sedimentation Resulting from Use of Imported Borrow	Less than significant	None required	Less than significant
Effect GEO-6: Loss, Injury, or Death from Slope Failure at Borrow Sites	Less than significant	None required	Less than significant
Effect GEO-7: Cause the Loss of a Known Mineral Resource of Regional or Local Importance as a Result of Construction of Proposed Project	Less than significant	None required	Less than significant
Effect GEO-8: Cause the Loss of a Known Mineral Resource of Regional or Local Importance as a Result of Placement of Proposed Project	Less than significant	None required	Less than significant

4.4.4.1 Effects Not Addressed Further in this Document

Effect GEO-1: Beneficial Change in Levee Stability

The FRWLP Final EIS addressed effects on levee stability and its conclusions are applicable to SB-8 and SB-7. Proposed levee improvements under the FRWLP alternatives and SB-8 and SB-7 would improve the stability of the Feather River West Levee by reducing through- and under-seepage and improving levee geometry. Alternatives SB-8 and SB-7 would both have a beneficial effect. The proposed modifications in the SBPFS would not change the analysis in the FRWLP Final EIS. Therefore, this issue is not discussed further.

Effect GEO-2: Increase Exposure of People or Structures to Hazards Related to Strong Seismic Ground Shaking

The FRWLP Final EIS addressed effects from seismic ground shaking. The proposed alternatives would not increase the potential for failure or damage of the levees from a seismic event and, therefore, would have a less than significant impact. This issue is not discussed further.

Effect GEO-4: Cause Structural Damage and Injury Resulting from Development on Expansive Soils

The FRWLP Final EIS addressed potential for damage or injury from development on expansive soils. The effect on expansive soils is considered less than significant because modifications to the levee design would be made if expansive or weak soils are documented onsite. Therefore, this issue is not discussed further.

Effect GEO-5: Cause Accelerated Erosion and Sedimentation Resulting from Use of Imported Borrow

The FRWLP Final EIS addressed the effects that excavation of borrow material at offsite locations could have on accelerated erosion and loss of topsoil and determined the effect would be less than significant. The quantity of borrow material required for Alternatives SB-8 and SB-7 would be similar to requirements of the FRWLP. As described in the FRWLP Final EIS, the first choice for borrow material would be a local commercial quarry or other permitted source. USACE would implement soil supply protection measures, such as maximizing onsite use through gradation, placement, and treatment and preserving and replacing topsoil at borrow sites, so that borrow sites could continue in their current use or otherwise be returned to their pre-project condition. Therefore, this issue is not discussed further.

Effect GEO-6: Loss, Injury, or Death from Slope Failure at Borrow Sites

The FRWLP Final EIS addressed the risk to safety from slope failure at borrow sites. Adherence to applicable design specifications and standards would ensure that the hazard of failure of excavations and settlement would be controlled to a safe level. This effect would be less than significant. Therefore, this issue is not discussed further.

Effect GEO-7: Cause the Loss of a Known Mineral Resource of Regional or Local Importance as a Result of Construction of Proposed Project

The FRWLP Final EIS addressed effects on mineral resources. The amount of aggregate needed for the project is not expected to substantially affect the availability of this resource. This effect would less than significant and is not discussed further.

Effect GEO-8: Cause the Loss of a Known Mineral Resource of Regional or Local Importance as a Result of Placement of Proposed Project

The FRWLP Final EIS addressed the issue and determined that there would be no effect on the availability of aggregate resources because no structures would be constructed that would interfere with access to permitted mineral resources and no permitted mineral resource extraction mines exist in the project corridor. Therefore, this issue is not discussed further.

4.4.4.2 No Action Alternative

The No Action Alternative represents the continuation of the existing levee deficiencies in the study area. Current levee operations and maintenance activities would continue, but there would be no change in the geomorphic and flood risk–management regimes relative to existing conditions.

Without levee improvements, there is the continued risk of levee failure, under-seepage and through-seepage, and loss of levee foundation soil. If a levee overtopping or breach were to occur, floodwaters would likely erode topsoil. A catastrophic levee failure could collapse miles of levee slopes, alter regional and local hydrology, and increase erosion and sedimentation. This condition would cause severe damage to soils, scour holes, and eroded and unstable landforms. Moreover, subsequent flooding could occur prior to levee repairs that would result in additional erosion and loss of topsoil. It is assumed that these effects would be significant; however, given the uncertainty of the occurrence or magnitude of such an event, the effects cannot be quantified based on available information.

Furthermore, the beneficial effects of project implementation, such as improved levee stability and decreased levee bank erosion, would not be realized under the No Action Alternative.

4.4.4.3 Alternative SB-8

Effect GEO-3: Cause Accelerated Erosion and Sedimentation Resulting from Construction-Related Ground Disturbance

The ground-disturbing activities associated with construction of SB-8 could potentially cause greater soil erosion and sedimentation of local drainages and waterways than the FRWLP alternatives. Alternative SB-8 would likely require a greater amount of ground disturbance than all other SBPFS and FRWLP alternatives because it would have the largest construction footprint. It has the largest construction footprint because of the 2,250 linear feet of additional levee improvement proposed below Laurel Avenue, the vegetation removal to bring the levees into Vegetation ETL compliance, and the relocation of the Sutter Butte Canal and adjacent levee.

Of primary concern are the ground-disturbing activities associated with vegetation clearing to meet USACE vegetation management guidance. Vegetation would be cleared on levee slopes and 15 feet out from the waterside and landside levee toes, potentially resulting in significant erosion and sedimentation. Although the areal extent of the area subject to disturbance is substantial, significant large-scale erosion and generation of runoff is unlikely because construction would be reduced or would not occur during the winter months.

Site-specific measures that would control erosion would be described in more detail in the SWPPP, which is included in the environmental commitments described in further detail in Chapter 3, *Plan Formation*, and summarized in Section 4.3, *Water Quality and Groundwater Resources*. The SWPPP is also a requirement of the NPDES General Permit.

With implementation of the SWPPP, erosion and sediment-related effects would be less than significant. No mitigation is required.

4.4.4.4 Alternative SB-7

Effect GEO-3: Cause Accelerated Erosion and Sedimentation Resulting from Construction-Related Ground Disturbance

The potential effects related to accelerated erosion and sedimentation under Alternative SB-7 would be substantially less than under SB-8 because of the significantly smaller construction footprint. With implementation of environmental commitments related to water quality, effects would be less than significant. No mitigation is required.

4.5 Air Quality and Climate Change

4.5.1 Introduction

This section discusses the potential effects on air quality and climate change resulting from the No Action Alternative, and Alternatives SB-7, and SB-8, along with mitigation measures to reduce significant effects.

4.5.2 Affected Environment

Section 3.5, *Air Quality*, and Section 3.6, *Climate Change and Greenhouses Gases*, of the FRWLP Final EIS described the existing regulatory (Federal and state laws, and regional and local regulations and policies) and environmental setting for these resource conditions. This information remains unchanged and is hereby incorporated by reference.

4.5.3 Determination of Effects

Effects on air quality would be considered significant if implementation of an SBPFS alternative would result in any of the following conditions.

- Conflict with or obstruct implementation of an applicable air quality plan.
- Violate any local or State air quality management district CEQA standard or contributes substantially to an existing or projected air quality violation.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project is in nonattainment under applicable Federal or state ambient air quality standards (including releasing emissions which exceed quantitative thresholds for ozone precursors).
- Expose sensitive receptors to substantial pollutant concentrations.
- Create objectionable odors affecting a substantial number of people.
- Generate greenhouse gas (GHG) emissions that exceed thresholds.
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.
- Fail to address changes in flood frequency and floodwater elevation caused by global climate change.

4.5.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning air quality and climate change are summarized in Table 4-9.

Table 4-9. Summary of Effects for Air Quality and Climate Change

Effect	Finding	Mitigation Measure	Finding with Mitigation
Alternatives SB-7 and SB-8			
Effect AQ-1: Obstruction of an Applicable Air Quality Plan	Less than significant	None required	Less than significant
Effect AQ-2: Exceedance of Applicable Thresholds for Construction Emissions	Significant	AQ-MM-1 Provide Advance Notification of Construction Schedule and 24-Hour Hotline to Residents AQ-MM-2: Implement Fugitive Dust Control Plan If Unmitigated Emissions Exceed PM_{10} or $PM_{2.5}$ Thresholds AQ-MM-3. General Measures to Reduce Emissions AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0)	Significant and unavoidable
Effect AQ-3: Exceedance of the Federal General Conformity Thresholds during Construction	Less than significant	None required	Less than significant
Effect AQ-4: Long-Term Operations and Maintenance Emissions of ROG, NO_X, and PM_{10}	Less than significant	None required	Less than significant
Effect AQ-5: Exposure of Sensitive Receptors to Toxic Air Emissions	Less than significant	None required	Less than significant
Effect AQ-6: Exposure to Objectionable Odors from Diesel Exhaust	Less than significant	None required	Less than significant
Effect CC-1: Increase in GHG Emissions during Construction Exceeding Threshold	Less than significant	CC-MM-1: Implement Measures to Minimize GHG Emissions during Construction	Less than significant
Effect CC-2: Conflict with an Applicable Plan, Policy, or Regulation Adopted for the Purpose of Reducing the Emissions of GHGs	Less than significant	None required	Less than significant
Effect CC-3: Failure to Address Changes in Flood Frequency and Floodwater Elevation Caused by Global Climate Change	Less than significant	None required	Less than significant

4.5.4.1 No Action Alternative

Under the No Action Alternative, USACE and SBFCA would not implement the proposed 41 miles of remediation work along the Feather River West Levee system. Current levee operations and maintenance activities would continue, but no levee improvements would be made to increase the level of performance. Potential flood fighting activities would result in temporary effects on air quality that would likely be less than effects analyzed under construction of the SBPFS alternatives. The types of construction equipment would be similar, but the flood fighting activities would be expected to be a shorter duration. The No Action Alternative would likely result in a continuation of the current air quality standards violations. Because of the uncertainty of such an event (levee overtopping or levee breach) and its magnitude, the effects are unpredictable and therefore a precise determination of significance is considered too speculative and cannot be made.

4.5.4.2 Alternatives SB-7 and SB-8

Alternative SB-7 consists of Contracts A, B, C1, and C2. Alternative SB-8 consists of Contracts A, B, C1, C2, D1, and D2 (see Table 4-10). Alternatives SB-7 and SB-8 would create short-term effects on air quality in Sutter and Butte County. This section describes the potential air quality effects of Alternatives SB-7 and SB-8 by yearly contract, including exhaust emissions from construction equipment and worker commute and delivery vehicles, fugitive dust generated by construction activities, and vehicle travel over unpaved roads. To complete the analysis, information was collected on projected construction activities, duration, and timing, equipment use, and activities for each construction year.

Table 4-10. Construction Contract by Corresponding Reach and Year

Contract	A	Star Bend[a]	B	C1	C2	D1	D2
Corresponding Reach	2–5	6	7–12	13–18	19–25	26–33	34–41
Proposed Year of Construction	2018–2019	2018–2019	2017–2018	2013–2014	2014–2015	2015–2016	2016–2017

[a] Included as part of Contract A analysis.

Emissions associated with vehicle exhaust for employee commute vehicles and delivery trucks were estimated using Sacramento Metropolitan Air Quality Management District's (SMAQMD) Road Construction Emission Model Version 6.3.2, (Appendix D). These emissions were based on assumptions in Table 4-11. Emissions associated with the operation of construction equipment were estimated using the SMAQMD's *Guide to Air Quality Assessment in Sacramento County* (Sacramento Metropolitan Air Quality Management District 2009). Construction equipment usage from similar projects was used to estimate daily and annual exhaust emissions for construction equipment. Emissions are considered significant if emissions exceed local thresholds established by the local air quality management districts, the Feather River Air Quality Management District (FRAQMD) and the Butte County Air Quality Management District (BCAQMD)for construction activities. Tables 4-12 and 4-13 display district thresholds.

Table 4-11. Construction Equipment per Contract

Emission Source	Contract A
Total Soil Import/Export per Day: Total Truck Trips per Day:	Reaches 2–5: 3,054 cubic yards of soil 153 Trips
Emission Source	Contract B
Total Soil Import/Export per Day: Total Truck Trips per Day:	Reaches 6–12: 2,925 cubic yards of soil 146 Trips
Emission Source	Contract C1
Total Soil Import/Export per Day: Total Truck Trips per Day:	Reaches 13–18: 1,720 cubic yards of soil 86 Trips
Emission Source	Contract C2
Total Soil Import/Export per Day: Total Truck Trips per Day:	Reaches 19–25: 2,095 cubic yards of soil 195 Trips
Emission Source	Contract D1
Total Soil Import/Export per Day: Total Truck Trips per Day:	Reaches 26–33: 1,460 cubic yards of soil 73 Trips
Emission Source	Contract D2
Total Soil Import/Export per Day: Total Truck Trips per Day:	Reaches 34–41: 1,601 cubic yards of soil 42 Trips
Employee Commute Trips Per Contract Area:	120 employee trips per day, 20 miles each way
Average Round Trip for Trucks: Average Load Per Truck: Range of Hauling Days:	35 miles 20 cubic yards 60–90
Combustion Engine Construction Equipment	Chain saws (2) Chippers (1) Signal Boards (2) Dump trucks for delivery/hauling (20) Excavators (2) Dozer (2) Pickup trucks (4) Grader (1) Loader (2) Trencher (1) Paving equipment (1 each): rollers, pavers, surfacing machines Heavy-duty water tank trucks (1)

Table 4-12. Maximum Daily Construction Emission Estimates (pounds per day)

Project Component	NO_X	ROG	PM_{10}	PM_{25}	CO	CO_2	Air Quality District/ Agency
Contract A	419.5	53.2	20.8	15	321.2	67,500.9	
Contract B	372.3	49.2	19.1	13.4	290	66,677.1	FRAQMD
Contract C1	300	41.1	16.6	11.3	214.6	59,060.7	
Contract C2	127	18.2	7.2	10.5	98.3	61,466.5	
FRAQMD CEQA Threshold	**25**	**25**	**80**	**N/A**	**N/A**	**N/A**	
Contract D1	247	36.3	14.7	9.5	185.7	13,612.6	BCAQMD
Contract D2	229.8	34.9	14	8.9	180.5	55,336.2	
BCAQMD CEQA Threshold	**137**	**137**	**137**	**N/A**	**N/A**	**N/A**	

N/A = not applicable. California Ambient Air Quality Standards not based upon emission rate, but prohibit increases in ambient CO concentrations by 5% or more.
FRAQMD = Feather River Air Quality Management District.
BCAQMD = Butte County Air Quality Management District.

Potential air pollutants generated during construction include emissions of particulate matter of 10 microns in diameter or less (PM_{10}) from debris moving activities and vehicle travel on unpaved roads, and exhaust emissions from the operation of construction equipment, delivery and haul trucks, and employee vehicles. Tailpipe exhaust emissions include ozone precursors (nitrogen oxides [NO_X] and reactive organic gases [ROG]) and PM_{10}. The air quality estimates are based on construction equipment emissions for Contracts A, B, C1, C2, D1, and D2 which would be constructed from 2013 through 2019 (one contract per year). Table 4-10 shows the reaches and years that correspond to each construction contract.

Remediation work would include levee degradation, cutoff wall installation, seepage berm construction and levee prism reconstruction with existing and borrow materials. Estimated equipment used would include a hydraulic crane, generator, excavators, loaders, rollers, blades, transit mixer, water tank, end-dump truck, 6 x 4 3-axle trucks, asphalt finisher, a street sweeper, and a generator. Some equipment would be used to remove trees and other vegetation at the sites, the crane and excavators would be used for the cutoff walls, loaders to move levee material, and large trucks to transport soil and aggregate. A water truck would be used to control dust. Table 4-11 shows a list of construction equipment to be used.

The FRWLP preferred alternative proposes a 3-year construction schedule, which would result in significant impacts on air quality over a shorter time frame. Alternatives SB-7 and SB-8 construction schedules would not exceed general conformity thresholds, resulting in less severe impacts on air quality over a longer time (4 and 6 years, respectively).

The estimated maximum daily emissions in pounds per day for construction of all contracts are displayed in Table 4-12. The estimated average annual emissions in tons per year for the construction period are displayed in Table 4-13.

Table 4-13. Average Annual Construction Emission Estimates (tons per year)

Project Component	NO_X	ROG	PM_{10}	PM_{25}	CO	CO_2	Air Quality District/Agency
Contract A	14.7	11.9	.9	.6	11.2	2,434.8	Federal
Attainment Status	Severe Nonattainment	Severe Nonattainment	Attainment	Nonattainment	Moderate Attainment	N/A	
De minimis Threshold	25	25	N/A	100	100	N/A	
Contract B	13.2	1.7	.8	.5	10.2	2,413.1	
Contract C1	11	1.5	.7	.4	8	2,212	
Contract C2	10.2	1.4	.7	.4	8	2,275.5	
Contract D1	9.2	1.3	.7	.4	7	2,250	
Contract D2	7.9	1.3	.6	.4	6.9	2,113.6	
Attainment Status	Nonattainment	Nonattainment	Attainment	Nonattainment	Moderate Attainment	N/A	
De minimis Threshold	100	100	N/A	100	100	N/A	

N/A = Not applicable due to being unclassified for all criteria pollutants based on Federal standards or unclassified for PM_{10}.

The U.S. Environmental Protection Agency developed the General Conformity Rule (40 CFR Section 93.153), which became effective on January 31, 1994, to implement Section 176(c) of the Federal Clean Air Act (42 USC Section 7506(c)). The underlying principle of the General Conformity Rule is that Federal actions must not cause or contribute to any violation of a National Ambient Air Quality Standards (NAAQS). A conformity determination is required for each pollutant where the total of direct and indirect emissions caused by a Federal action in a nonattainment area exceeds de minimis threshold levels listed in the General Conformity Rule. If the total direct emissions associated with the project are below the de minimus levels indicated in Table 4-13, general conformity requirements do not apply, and the project is considered in conformity and would not result in an adverse effect.

Based on the analysis, construction of Alternatives SB-7 or SB-8 would result in the temporary increase in emissions of ROG, CO, NO_X, and PM_{10}. Estimated daily emissions of NO_X for Contracts A, B, C1, D1, and D2 would exceed FRAQMD and BCAQMD CEQA thresholds. Estimated daily emissions of ROG for Contracts A, B, C1, would exceed FRAQMD and BCAQMD CEQA thresholds (Table 4-12). These temporary increases in emissions are considered to be significant without mitigation. The conformity de minimis thresholds for NO_X, ROG, particulate matter that is 2.5 microns or less in diameter ($PM_{2.5}$), and carbon monoxide (CO) would not be exceeded (Table 4-13). The proposed BMPs included in Section 4.5.4.2.1, *Mitigation,* below would reduce any temporary increases in emissions that effect air quality.

Effects on Air Quality

Alternatives SB-7 and SB-8 would not exceed Federal de minimis thresholds. Based on the above discussion of Tables 4-12 and 4-13, construction would result in the temporary increase in emissions of ROG, CO, NO_X, and PM_{10}. Estimated daily emissions of NO_X for Contracts A, B, C1, D1, and D2 would

exceed FRAQMD and BCAQMD thresholds. Estimated daily emissions of ROG for Contracts A, B, C1, would exceed FRAQMD thresholds (Table 4-12).

Alternative SB-7 (Contracts A, B, C1, and C2) would exceed FRAQMD thresholds for ROG only. Daily construction NO_X emissions would be mitigated to zero by paying fees to FRAQMD (approximately $8,700). Temporary emissions increases of ROG, CO, NO_X, and PM_{10} would occur over 4 years.

Alternative SB-8 (Contracts A, B, C1, C2, D1, and D2) would exceed FRAQMD thresholds for ROG only. Daily construction NO_X emissions would be mitigated to zero by paying fees to FRAQMD and BCAQMD (approximately $12,200). Based upon the increased project extents, SB-8 would result in 2 more years of temporary emissions increases of ROG, CO, NO_X, and PM_{10} and require approximately $3,500 more in mitigation fees.

Effect AQ-1: Obstruction of an Applicable Air Quality Plan

The project construction process and equipment will normally have a significant effect on the environment if it will violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations, or fugitive dust. A project is deemed inconsistent with an air quality plan if it would result in population or employment growth that exceeds the growth estimates in the applicable air quality plan—thus generating emissions not accounted for in the applicable air quality plan emissions budget. Consequently, proposed projects need to be evaluated to determine whether they would generate population and employment growth and, if so, whether that growth would exceed the growth rate included in the relevant air quality plan.

As described in Section 4.13, *Cumulative and Growth-Inducing Impacts*, the implementation of flood risk–reduction measures would maintain or improve the level of performance to the standard upon which county and city general plan growth has been based (i.e., 100-year) and for which effects have been analyzed associated with build-out. Therefore, SB-8 and SB-7 would not conflict with or obstruct the implementation of air quality plans. This effect would be less than significant. No mitigation is required.

Effect AQ-2: Exceedance of Applicable Thresholds for Construction Emissions

The project construction process and equipment will normally have a significant effect on the environment if it will violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations. Without mitigation, construction-related emissions would exceed emission thresholds for NO_X, ROG thresholds in the FRAQMD, and NO_X thresholds in the BCAQMD, which would result in a significant effect. Mitigation Measures AQ MM-1 through AQ-MM-5, described below, would help to reduce these effects. Table 4-14 through 4-19 shows the unmitigated construction emissions for Construction Contracts A, B, C1, and C2 in FRAQMD's jurisdiction and the unmitigated construction emissions for Construction Contract D1 and D2 in BCAQMD's jurisdiction. After applying Mitigation Measures AQ-MM-1 through AQ-MM-5, NO_X emissions for all contracts would be mitigated to net zero. However, the maximum daily emissions still would exceed the ROG thresholds in the FRAQMD's jurisdiction for Contracts A, B, and C1. Therefore, this effect would be significant and unavoidable after mitigation. Tables 4-14 to 4-19 display mitigated construction emissions in FRAQMD and BCAQMD jurisdictions for all contracts.

Table 4-14. Contract A Mitigated Construction Emissions in Feather River Air Quality Management District Jurisdiction

	Maximum Daily Emissions, lb/day					
Emission Category	**NO_X**	**ROG**	**PM_{10}**	**$PM_{2.5}$**	**CO**	**CO_2**
Total Unmitigated Daily Emissions	419.5	53.2	20.8	15	321.2	67,500.9
Mitigation Measure AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment (20% NO_X Reduction and 45% PM Reduction for Off-Road Equipment)	-83.9	0	-9.36	-6.75	0	0
Emissions after Mitigation Measure AQ-MM-4	335.6	53.2	11.44	8.25	0	67,500.9
AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0) (purchases to mitigate for general conformity)	335.6	0	0	0	0	0
Daily Emissions after Mitigation Measure AQ-MM-5	0	53.2	11.44	8.25	321.2	67,500.9
Feather River AQMD CEQA Threshold	25	25	80	NA	NA	NA
Exceeds Threshold?	No	Yes	No	NA	NA	NA

Table 4-15. Contract B Mitigated Construction Emissions in Feather River Air Quality Management District Jurisdiction

	Maximum Daily Emissions, lb/day					
Emission Category	**NO_X**	**ROG**	**PM_{10}**	**$PM_{2.5}$**	**CO**	**CO_2**
Total Unmitigated Daily Emissions	372.3	49.2	19.1	13.4	290	66,677.1
Mitigation Measure AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment (20% NO_X Reduction and 45% PM Reduction for Off-Road Equipment)	-74.46	0	-8.59	-6.03	0	0
Emissions after Mitigation Measure AQ-MM-4	297.84	49.2	10.51	7.37	0	66,677.1
AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0) (purchases to mitigate for general conformity)	297.84	0	0	0	0	0
Daily Emissions after Mitigation Measure AQ-MM-5	0	49.2	11.44	8.25	290	66,677.1
Feather River AQMD CEQA Threshold	25	25	80	NA	NA	NA
Exceeds Threshold?	No	Yes	No	NA	NA	NA

Table 4-16. Contract C1 Mitigated Construction Emissions in Feather River Air Quality Management District Jurisdiction

	Maximum Daily Emissions, lb/day					
Emission Category	**NO_X**	**ROG**	**PM_{10}**	**$PM_{2.5}$**	**CO**	**CO_2**
Total Unmitigated Daily Emissions	300	41.1	16.6	11.3	214.6	59,060.7
Mitigation Measure AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment (20% NO_X Reduction and 45% PM Reduction for Off-Road Equipment)	-60	0	-7.47	-5.08	0	0
Emissions after Mitigation Measure AQ-MM-4	297.84	41.1	9.13	6.22	0	59,060.7
AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0) (purchases to mitigate for general conformity)	240	0	0	0	0	0
Daily Emissions after Mitigation Measure AQ-MM-5	0	41.1	9.13	6.22	214.6	59,060.7
Feather River AQMD CEQA Threshold	25	25	80	NA	NA	NA
Exceeds Threshold?	No	Yes	No	NA	NA	NA

Table 4-17. Contract C2 Mitigated Construction Emissions in Feather River Air Quality Management District Jurisdiction

	Maximum Daily Emissions, lb/day					
Emission Category	**NO_X**	**ROG**	**PM_{10}**	**$PM_{2.5}$**	**CO**	**CO_2**
Total Unmitigated Daily Emissions	127	18.2	7.2	10.5	98.3	61,466.5
Mitigation Measure AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment (20% NO_X Reduction and 45% PM Reduction for Off-Road Equipment)	-25.4	0	-3.24	-4.72	0	0
Emissions after Mitigation Measure AQ-MM-4	101.6	18.2	3.96	5.77	0	61,466.5
AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0) (purchases to mitigate for general conformity)	101.6	0	0	0	0	0
Daily Emissions after Mitigation Measure AQ-MM-5	0	18.2	3.96	6.22	98.3	61,466.5
Feather River AQMD CEQA Threshold	25	25	80	NA	NA	NA
Exceeds Threshold?	No	No	No	NA	NA	NA

Table 4-18. Contract D1 Mitigated Construction Emissions in Butte County Air Quality Management District Jurisdiction

	Maximum Daily Emissions, lb/day					
Emission Category	**NO_X**	**ROG**	**PM_{10}**	**$PM_{2.5}$**	**CO**	**CO_2**
Total Unmitigated Daily Emissions	247	36.6	14.7	9.5	175.7	13,612.6
Mitigation Measure AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment (20% NO_X Reduction and 45% PM Reduction for Off-Road Equipment)	-49.4	0	-6.61	-4.27	0	0
Emissions after Mitigation Measure AQ-MM-4	197.6	36.6	8.08	5.22	0	13,612.6
AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0) (purchases to mitigate for general conformity)	197.6	0	0	0	0	0
Daily Emissions after Mitigation Measure AQ-MM-5	0	36.6	8.08	5.22	175.7	13,612.6
Butte County AQMD CEQA Threshold	137	137	137	NA	NA	NA
Exceeds Threshold?	No	No	No	NA	NA	NA

Table 4-19. Contract D2 Mitigated Construction Emissions in Butte County Air Quality Management District Jurisdiction

	Maximum Daily Emissions, lb/day					
Emission Category	**NO_X**	**ROG**	**PM_{10}**	**$PM_{2.5}$**	**CO**	**CO_2**
Total Unmitigated Daily Emissions	229.8	34.9	14	8.9	180.5	55,336.2
Mitigation Measure AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment (20% NO_X Reduction and 45% PM Reduction for Off-Road Equipment)	-45.8	0	-6.3	-4	0	0
Emissions after Mitigation Measure AQ-MM-4	184	34.9	7.7	4.9	0	55,336.2
AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction NO_X Emissions to Net Zero (0) (purchases to mitigate for general conformity)	184	0	0	0	0	0
Daily Emissions after Mitigation Measure AQ-MM-5	0	34.9	7.7	4.9	180.5	55,336.2
Butte County AQMD CEQA Threshold	137	137	137	NA	NA	NA
Exceeds Threshold?	No	No	No	NA	NA	NA

Effect AQ-3: Exceedance of the Federal General Conformity De Minimis Thresholds during Construction

The SBPFS is subject to the Federal General Conformity Rule, which sets applicability thresholds based on annual-average emissions. Table 4-13 shows the forecast annual-average construction emissions for each construction contract A through D. The conformity de minimis thresholds for NO_X, ROG, $PM_{2.5}$, and CO would not be exceeded (Table 4-13). The proposed BMPs included in Section 4.5.4.2.1,

Mitigation, below would further reduce any temporary increases in emissions that effect air quality. Therefore, the effect relative to the general conformity threshold would be less than significant.

Effect AQ-4: Long-Term Operations and Maintenance Emissions of ROG, NO_X, and PM_{10}

Following project construction, the facilities generally would be maintained as needed. Construction activities involve more equipment over a longer duration. Maintenance work would be less extensive and would take place over a few days per year, as required. In addition, maintenance and operation activities are part of the existing environmental baseline and thus would not create a substantial source of new emissions. The effect relative to the thresholds for construction emissions and general conformity threshold would be less than significant. No mitigation is required.

Effect AQ-5: Exposure of Sensitive Receptors to Toxic Air Emissions

Construction of the SBPFS alternatives would result in short-term diesel exhaust emissions from onsite heavy-duty equipment. Particulate exhaust emissions from diesel-fueled engines (DPM) were identified as a toxic air contaminant by the California Air Resources Board (CARB) in 1998. Construction would result in the generation of DPM emissions from the use of off-road diesel equipment required for site grading and excavation, paving, and other construction activities.

The assessment of health risks associated with exposure to diesel exhaust typically is associated with chronic exposure, in which a 70-year exposure period often is assumed. However, while cancer can result from exposure periods of less than 70 years, acute exposure periods (i.e., exposure periods of 1–3 years) to diesel exhaust are not anticipated to result in an increased health risk, as health risks associated with exposure to diesel exhaust typically are seen in exposures periods that are chronic. Construction of SBPFS alternatives is not expected to take place at the same construction site for more than 1 to 2 years, and the number of pieces of heavy equipment expected to be used at the same construction site would be limited. Furthermore, as required by CARB regulation, no in-use off-road diesel vehicles may idle for more than 5 consecutive minutes. The effect relative to the thresholds for construction emissions would be less than significant. In addition, implementation of Mitigation Measures AQ-MM-3 and AQ-MM-4 would further reduce exhaust emissions during construction. No further mitigation is required.

Effect AQ-6: Exposure to Objectionable Odors from Diesel Exhaust

The SBPFS alternatives would not result in any major sources of odor, nor would it involve operation of any of the common types of facilities that are known to produce odors (e.g., landfill, wastewater treatment facility). In addition, odors associated with diesel exhaust from the use of onsite construction equipment would be intermittent and temporary and would dissipate rapidly from the source with an increase in distance. Furthermore, as required by CARB regulation, no in-use off-road diesel vehicles may idle for more than 5 consecutive minutes. Implementation of Mitigation Measures AQ-MM-1 through AQ-MM-5 would further reduce exhaust emissions during construction. Therefore, the effect would be less than significant.

Effect CC-1: Increase in GHG Emissions during Construction Exceeding Threshold

Construction of each project component would contribute to the generation of GHG emissions through short-term construction activities at the project site. Short-term air pollution in the form of particulate matter (fugitive dust) and carbon dioxide (CO_2) may be caused by construction activity, including truck and equipment movement, grading, and earthwork. CARB has established 7,000 metric tons of

CO_2 per year baseline to provide context to the scale for the proposed project. The alternative contracts are estimated to produce less than 7,000 tons per year of CO_2 based on figures in Table 4-13. The effect relative to project construction activities contributing to the generation of GHG emissions would be less than significant. No mitigation is required.

Effect CC-2: Conflict with an Applicable Plan, Policy, or Regulation Adopted for the Purpose of Reducing the Emissions of GHGs

While no Federal or state agency has established thresholds of significance for GHG or other contributions to global climate change, California Air Resources Board (CARB) has established 7,000 metric tons of CO_2 per year baseline to provide context to the scale for the proposed project. The alternative contracts are estimated to produce less than 7,000 tons per year of CO_2 based on figures in Table 4-13. The effect relative to project construction activities contributing to the generation of GHG emissions would be less than significant. No mitigation is required.

Effect CC-3: Failure to Address Changes in Flood Frequency and Floodwater Elevation Caused by Global Climate Change

The intent of the project is to address inadequacies of the existing project levee system. The primary risk of flooding in the Sutter Basin has been determined to be geotechnical failure of the existing project levees. Recent geotechnical analysis and evaluation of historical performance during past flood events have resulted in a greater understanding of under- and through-seepage modes and a revision of levee design criteria. The project levees within the study area do not meet current USACE levee design criteria and are at risk of breach failure at stages considerably less than levee crest elevations. The risk of unexpected levee failure coupled with the consequence of basin-wide flooding presents a continued threat to public safety, property, and critical infrastructure in the Sutter Basin. The effect relative to project construction activities contributing to the generation of GHG emissions would be less than significant. No mitigation is required.

4.5.4.2.1 Mitigation

To reduce the temporary increase of emissions, BMPs would be implemented by the construction contractor at each repair site. These BMPs include dust and PM_{10} abatement by watering, limiting onsite idling time of heavy equipment, and ensuring that all internal combustion engine equipment is properly tuned to the manufacturer's specification. These practices would result in minimizing emissions during the construction period.

Standard construction practices would ensure that exhaust emissions from all off-road diesel-powered equipment do not exceed 20% opacity for more than 3 minutes in any 1 hour. Opacity is the degree to which smoke blocks light, and the basis for measuring the amount of smoke coming from a diesel-powered vehicle. Poorly maintained or malfunctioning engines are sometimes the cause of excessive smoke. Any equipment found to exceed 20% opacity by a qualified inspector would be repaired immediately. The appropriate local air quality agency would be notified within 48 hours of identification of noncompliant equipment.

USACE or a representative would also be required to provide a plan for approval by FRAQMD and BCAQMD demonstrating that the construction activities would not exceed state and Federal thresholds. The plan would demonstrate that heavy-duty (more than 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% NO_X reduction and 45% particulate reduction compared

with the most recent CARB fleet average at time of construction. To reduce emissions for this project, USACE would implement Mitigation Measures AQ-MM-1 through AQ-MM-5.

Mitigation Measure AQ-MM-1: Provide Advance Notification of Construction Schedule and 24-Hour Hotline to Residents

USACE will provide advance written notification of the proposed construction activities to all residences and other air quality–sensitive uses within 500 feet of the construction site. Notification will include a brief overview of the proposed project and its purpose, as well as the proposed construction activities and schedule. It also will include the name and contact information of USACE's project inspector or a representative for ensuring that reasonable measures are implemented to address a problem.

The construction contractor will post a publicly visible sign with the telephone number and person to contact regarding dust complaints. This person will respond and take corrective action within 48 hours. The phone number of the appropriate air quality agency (FRAQMD or BCAQMD) also will be visible to ensure compliance with the agencies' regulations.

Mitigation Measure AQ-MM-2: Implement Fugitive Dust Control Plan If Unmitigated Emissions Exceed PM_{10} or $PM_{2.5}$ Thresholds

The construction contractor will implement all applicable and feasible fugitive dust control measures required by FRAQMD and BCAQMD, including those listed below. This requirement will be incorporated into the construction contract.

- Prior to mobilizing to the job site the construction contractor will submit a dust control plan to FRAQMD and BCAQMD.
- Water active unpaved areas at all construction sites at least twice daily in dry conditions or more frequently as required, with the frequency of watering based on the type of operation, soil, and wind exposure.
- Prohibit all grading activities and water all areas of disturbed soil under windy conditions (more than 20 miles per hour).
- Limit onsite vehicles to a speed that prevents visible dust emissions to extend beyond unpaved roads.
- Cover all trucks hauling dirt, sand, or loose materials.
- Cover active and inactive storage piles where appropriate.
- Cover or hydroseed unpaved areas that will remain inactive for extended periods.
- Apply soil stabilizers to active and inactive areas where appropriate.
- Install wheel washers at the entrance to construction sites for all exiting trucks.
- Sweep streets if visible soil material is carried out from the construction site. Sweeping will be done at least once per day unless conditions warrant a more frequent application.
- Install wind fencing and phase grading operations where appropriate.

Mitigation Measure AQ-MM-3: General Measures to Reduce Emissions

USACE will implement the following mitigation measures.

- No open burning of removed vegetation. Vegetative material will be chipped or delivered to waste or energy facilities.
- 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.
- Reduce use, trips, and unnecessary idling of heavy equipment. Shut down idling equipment that is not used for more than 5 consecutive minutes as required by California law.
- Construction equipment exhaust emissions will not exceed 40% opacity or Ringelmann 2.0. Operators of vehicles and equipment found to exceed opacity limits will take action to repair the equipment within 72 hours or remove the equipment from service.
- Maintain all construction equipment in proper tune according to manufacturer's specifications.
- Locate stationary diesel-powered equipment and haul truck staging areas as far as practical from sensitive receptors.
- Use existing power sources (e.g., power lines) or clean fuel generators rather than conventional diesel generators, when feasible.
- Substitute gasoline-powered for diesel-powered equipment when feasible.
- 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 CARB Portable Equipment Registration with the state or a local district permit. The owner/operator will be responsible for arranging appropriate consultations with CARB or the air districts to determine registration and permitting requirements prior to equipment operation at the site.

Mitigation Measure AQ-MM-4: Fleet-Wide Emission Reductions for Large Off-Road Equipment

Prior to mobilizing to the job site, the construction contractor will assemble a comprehensive inventory list (make, model, engine year, horsepower, emission rates) of all heavy-duty off-road (portable and mobile) equipment (50 horsepower and greater) that will be used an aggregate of 40 or more hours for the construction project. The construction contractor then will apply the following mitigation measure to those pieces of equipment.

The construction contractor will provide a plan, for approval by FRAQMD and BCAQMD, demonstrating that the heavy-duty off-road equipment to be used at the project sites, including owned, leased, and subcontractor equipment, will achieve a project-wide fleet-average reduction of 20% for NO_X and 45% for DPM compared with the most recent CARB fleet average at time of construction. USACE will use the construction mitigation calculator downloaded from the Sacramento Metropolitan Air Quality Management District web site (or similar tool approved by FRAQMD and BCAQMD) to perform the fleet average evaluation (Sacramento Metropolitan Air Quality Management District 2009). Acceptable options for reducing emissions may include use of

late model engines, low-emission diesel products, alternative fuels, engine retrofit technology (Carl Moyer Guidelines), or installation of after-treatment emission control devices. FRAQMD and BCAQMD will be contacted to review and approve the alternative measures.

Mitigation Measure AQ-MM-5: Pay Required Fees to FRAQMD and BCAQMD to Offset Annual Construction Emissions to Net Zero (0)

After implementing the general tailpipe emission control measures listed in MM-AQ-4 to reduce daily-average construction emissions, USACE will pay offsite mitigation fees to FRAQMD and BCAQMD to offset annual-average NO_X emissions as required to reduce the maximum annual construction emissions to net zero (0). Prior to issuance of grading permits for the project, USACE will consult with FRAQMD and BCAQMD to define the best construction information and the appropriate computational tools to be used for the calculations. USACE will submit calculations to FRAQMD and BCAQMD documenting the tons of NO_X to be offset over the duration of the construction phase of the project. USACE will consult with FRAQMD and BCAQMD to define the required fee payment based on the most recent Carl Moyer program cost value. Prior to the approval of project plans or the issuance of grading permits, USACE will submit proof that the offsite air quality mitigation fee has been paid to FRAQMD and BCAQMD, and that the construction air quality mitigation plan has been approved by FRAQMD, and BCAQMD.

CC-MM-1: Implement Measures to Minimize GHG Emissions during Construction

To minimize GHG emissions for this project, USACE will implement Mitigation Measures AQ-MM-1 through AQ-MM-5.

4.6 Agriculture, Land Use, and Socioeconomics

4.6.1 Introduction

This section discusses the effects on agriculture, land use, and socioeconomics that would result from the No Action Alternative and Alternatives SB-7 and SB-8. The FRWLP Final EIS describes in greater detail existing conditions and the regulatory setting for these resource conditions. That information is incorporated by reference.

4.6.2 Affected Environment

4.6.2.1 Regional Context

Sutter and Butte Counties are mostly rural, and agriculture is the dominant land use, accounting for nearly 86% of land use in Sutter County (Sutter County 2011a) and nearly 60% of land use in Butte County. Within the Sutter County portion of the study area, the urbanized areas are the incorporated cities of Yuba City and Live Oak and the unincorporated community of Sutter. Within the Butte County portion of the study area, the incorporated areas are Gridley and Biggs.

Yuba City, the Sutter County seat and the most densely populated portion of the study area, lies 42 miles north of Sacramento. Its boundaries encompass approximately 14 square miles (9,355 acres) of land. Portions of the city abut the west bank of the Feather River. As of January 2010, Yuba City's population was 64,929 (California Department of Finance 2011). The majority of Sutter County's population lives in Yuba City, which contains a broad range of residential, commercial, office, industrial, open space, and public facility uses.

The California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP) provides data for use in planning for the present and future of California's agricultural land resources. The FMMP rates agricultural land according to soil quality and irrigation status within the designations discussed below.

Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion.

Unique Farmland

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, fruits, and vegetables.

Farmland of Statewide Importance

Farmland of statewide importance is land of statewide or local importance identified by state or local agencies for agricultural use, but it is not of national significance.

Farmland of Local Importance

Farmland of local importance is land identified as important to the local agricultural economy by a county's board of supervisors and a local advisory committee.

4.6.2.1.1 Sutter County Agriculture

The dominant crops produced in the county are rice and other field crops, dried plums, English walnuts, almonds and other fruits and nuts, seed crops, tomatoes and other vegetable crops, nursery products, and apiary and livestock products. As of 2010, food and agricultural production accounted for approximately 20% of the total economic output of all industries in the county (Sutter County 2010). Orchards, with their associated fruit and nut crops, predominate within the Sutter County portion of the study area, from Reaches 2 through 11 and north of Yuba City from Reach 18 to the Sutter-Butte County line (Reach 25). Along these reaches, agricultural lands not planted to orchard crops are currently in use for field crops.

The FMMP designates certain parcels of Sutter County farmland as one of the previously discussed classifications. According to the most recent mapping, the county has approximately 162,673 acres of prime farmland, 105,395 acres of farmland of statewide importance, 17,752 acres of unique farmland, and 53,538 acres of grazing land (California Department of Conservation, Division of Land Resource Protection 2011). Within the Sutter County portion of the project area, much of the land along the west bank of the Feather River is classified as prime farmland, with farmland of statewide importance located immediately south of Yuba City and near Live Oak (Plate 4-6).

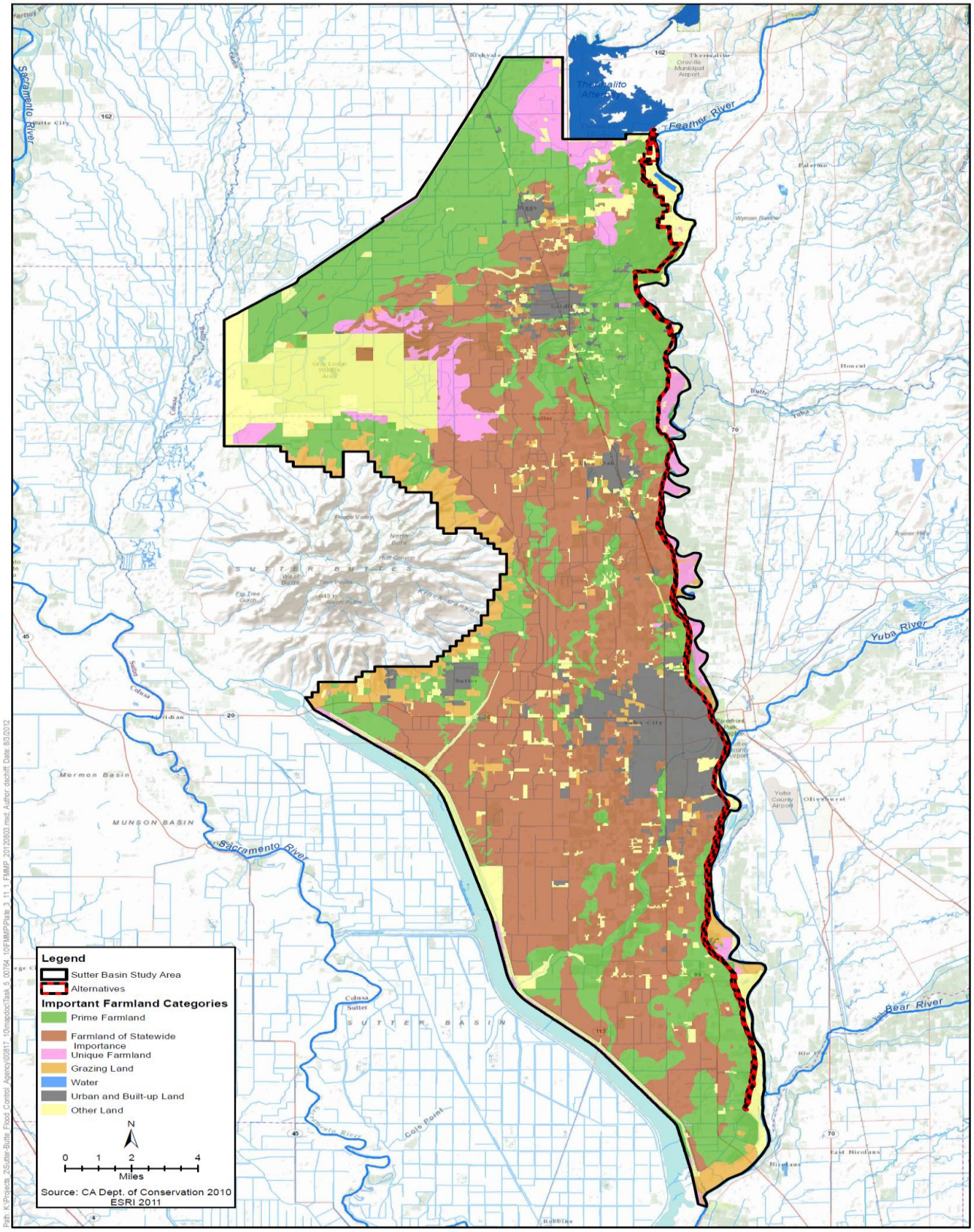


Plate 4-6. Important Farmland in Study Area

Under the California Land Conservation Act of 1965, commonly referred to as the Williamson Act, agricultural and open space lands are preserved through contracts with private landowners. By entering into a Williamson Act contract, the landowner foregoes the possibility of converting agricultural land to nonagricultural use for a rolling period of 10 years in return for lower property taxes. Local governments receive an annual subvention of forgone property tax revenues from the state via the Open Space Subvention Act of 1971. No parcels within the Sutter County portion of the project area are currently under Williamson Act protection.

4.6.2.1.2 Butte County Agriculture

Butte County is mostly rural, and most of the agricultural land is located within the western portion of the county. The main crops produced in Butte County are fruits and nuts. Field, seed, and vegetable crops, and livestock, apiary, and nursery products are also grown in Butte County. The three most land-intensive crops in the county are rice, almonds, and English walnuts, accounting for more than one-third of the agricultural land (Butte County 2011).

Only about one-third of Butte County is designated by the FMMP as important farmland; however, this land is almost exclusively located in the flat, western half of the county. According to the most recent mapping, Butte County has approximately 193,290 acres of prime farmland; 21,792 acres of farmland of statewide importance; 22,190 acres of unique farmland; and 403,078 acres of grazing land (California Department of Conservation, Division of Land Resource Protection 2010). Within the Butte County portion of the project area, prime farmland, located along the western edge of the Feather River between Reaches 25 and 40 (Plate 4-6), is the most common. A small area of unique farmland lies south of Thermalito Afterbay.

Butte County has Williamson Act tracts scattered throughout its western half. As of 2009, the most recent data available, Williamson Act contracts protected 217,151 acres of the county's agricultural land (California Department of Conservation, Division of Land Resources Protection 2010). Within the Butte County portion of the project area, the Williamson Act lands consist primarily of prime farmland (California Department of Conservation, Division of Land Resource Protection 2011).

4.6.2.1.3 Socioeconomics

Sutter County is one of northern California's major agricultural counties (California Employment Development Department 2010), and its traditional job base is agriculture. Agriculture and agriculture-related support industries have been and continue to be the county's top "competitive edge" private industries (California Economic Development Partnership 2009). Sutter County has a labor force of 41,800, and its unemployment rate was 18.7% as of February 2013(California Employment Development Department 2013a).

Agriculture is a major employment sector in Butte County (Butte County 2010:117). According to the Butte County General Plan 2030, in 2008 the estimated gross value of agricultural production countywide was approximately $580 million, an increase of almost $73 million over the 2007 production value. Trends indicate that agriculture will maintain a strong position within Butte County's economy. The county has a total labor force of 104,700, and its unemployment rate was 11.7% as of February 2013 (California Employment Development Department 2013b).

4.6.2.2 Project Area Land Use, Ownership, and Jurisdiction

The proposed project would take place within a narrow strip of Sutter and Butte Counties, including a small area on the eastern edge of Yuba City, approximately 41 miles long and 600 feet wide, along and encompassing the Feather River West Levee. About 71% of the project area is located in Sutter County and 29% of the project area is located in Butte County. Maintenance responsibilities for the project improvements would be located entirely within the area of Levee Districts (LDs) 9 and 1, and DWR's Maintenance Areas (MAs) 3, 7, and 16. MA 3 is responsible for the lowermost reaches of the project area, followed by LD 1, LD 9, MA 16, and MA 7 from south to north. The existing Feather River West Levee is part of the SRFCP within an easement obtained by the State.

With the exception of urbanized Yuba City, agriculture and its accessory use dominates the land use pattern of the Sutter County project reaches. Because the proposed project would primarily affect lands west of the Feather River, this discussion focuses on those areas, with some exceptions. South of Yuba City, most of the project area lands are designated either AG-20 (agriculture, 20-acre minimum parcel size) or AG-80 (agriculture, 80-acre minimum) by Sutter County; lands east of the project area but within the Feather River floodway are primarily designated OS (open space), with a floodplain overlay. In keeping with these designations, agricultural uses predominate west of the Feather River from Reaches 2 through 11, consisting mainly of orchards interspersed with parcels devoted to field crops. A variety of farm structures, including residences, barns, shop buildings, and other agricultural accessory uses, are scattered throughout the project area reaches. Abbott Lake lies immediately east of Reach 7, and Boyd's Boat Launch is located east of Reach 9. From the northernmost section of Reach 11 through Reach 17, the project area follows the eastern edge of Yuba City, with the exception of Reaches 14 and 15, which pass east of the city limit through lands designated open space by Sutter County. Near the northern part of Yuba City, the project area crosses the Union Pacific Railroad line, re-entering unincorporated Sutter County near the transition from Reach 17 to 18, and continues northward, east of Live Oak, to the county line through lands designated AG-20, an area of agricultural uses similar in character to those south of Yuba City. As with the southern Sutter County project area, lands immediately east of the project reaches are designated open space with a floodplain overlay. Reach 25 is the northernmost portion of the project area within Sutter County.

Alternative SB-7 is entirely contained within Sutter County ending at Reach 24. Alternative SB-8 continues further north through Reach 41 at the Thermalito Afterbay.

Project Reaches 25 through 41 are within the boundaries of Butte County, and are characterized by agricultural and open space uses. Agricultural uses in this area consist primarily of orchards, with associated residences and agricultural facilities. Lands between Reaches 25 and 40 carry either an AG-40 or a public/quasi public zone designation, including in the community of East Gridley, located immediately south of East Gridley Road within Reach 30. East Gridley contains a variety of uses, including residential, commercial, and school facilities. North of East Gridley, from Reach 31 to Reach 40, agricultural uses again predominate. The final project reach, 41, is located at the southern edge of Thermalito Afterbay and falls within a Resource Conservation Zone.

4.6.3 Determination of Effects

Effects on agricultural land, land use, and socioeconomics may be considered significant if an alternative would result in any of the effects listed below.

4.6.3.1 Agriculture

For the purposes of this analysis, effects on agriculture are considered significant if implementation of the proposed project would result in any of the following conditions.

- Irretrievable conversion of a substantial acreage of prime farmland, unique farmland, or farmland of statewide importance.
- Conflicts with existing zoning for agricultural use, or a Williamson Act contract.
- Changes to the existing environment which, because of their location or nature, could result in substantial loss of crop production in the project area.

4.6.3.2 Land Use

For the purposes of this analysis, effects on land use are considered significant if implementation of the proposed project would result in any of the following conditions.

- Physically divide an established community.
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigating an environmental effect.
- Conflict with any applicable habitat conservation plan (HCP) or natural community conservation plan (NCCP).

The actions being studied would not physically divide an established community, because the affected rural areas do not constitute established communities and the structures that would be removed within Yuba City are located at the edge of the city along the Feather River. Consequently, the first criterion above does not apply to the SBPFS and is not considered further in this analysis.

FRWLP Final EIS Section 3.12, *Population, Housing, and Environmental Justice*, addressed the potential displacement of residents and businesses, and that analysis is incorporated by reference.

Implementation of the project would not conflict with any applicable HCP or NCCP. Both the Yuba-Sutter Natural Community Conservation Plan and Habitat Conservation Plan (Yuba-Sutter NCCP/HCP) and the Butte Regional Conservation Plan (BRCP) are currently in development but have not yet been adopted. Consequently, the third criterion above does not apply to the SBPFS and is not considered further in this analysis.

4.6.3.3 Socioeconomics

For the purposes of this analysis, socioeconomic effects are considered significant if implementation of the proposed project would result in any of the following conditions.

- A substantial change in employment.
- Conflict with any applicable socioeconomic plan or policy.

4.6.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning agriculture, land use, and socioeconomics are summarized in Table 4-20. Table 4-21 summarizes permanent and temporary impact on prime farmland, unique farmland, and farmland of statewide importance.

Table 4-20. Summary of Effects for Agriculture, Land Use, and Socioeconomics

Effect	Finding	Mitigation Measures	Finding with Mitigation
Alternatives 7 and 8			
Effect AG-1: Temporary Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Accommodate Construction Activities	Less than significant	None required	Less than significant
Effect AG-2: Irretrievable Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance	Less than significant	None required	Less than significant
Effect AG-3: Conflict with Existing Zoning for Agricultural Use	Less than significant	None required	Less than significant
Effect AG-4: Conflict with Williamson Act Contract	Less than significant	None required	Less than significant
Effect AG-5: Loss of Agricultural Production	Less than significant	None required	Less than significant
Effect LU-1: Conflict with Applicable Land Use Plan, Policy, or Regulation	Less than significant	None required	Less than significant
Effect SOC-1: Employment Effects during Construction	Beneficial	None required	Beneficial
Effect SOC-2: Conflict with Applicable Socioeconomic Plan or Policy	Less than significant	None required	Less than significant

Table 4-21. Summary of Permanent and Temporary Impacts on Prime Farmland, Unique Farmland, and Farmland of Statewide Importance

	Permanent Impacts						Temporary Impacts					
	Sutter County			Butte County			Sutter County			Butte County		
SB-7	Prime	Unique	FSWI	Prime	Unique	FSWI	Prime	Unique	FSWI	Prime	Unique	FSWI
Levee Prism	27.82	--	--	--	--	--	--	--	--	--	--	--
O&M Corridor	2.96	--	--	--	--	--	--	--	--	--	--	--
Canal Realign	--	--	--	--	--	--	--	--	--	--	--	--
Staging	--	--	--	--	--	--	41.79	4.01	4.02	--	--	--
Borrow	--	--	--	--	--	--	271.95	--	678.22	--	--	--
Totals	**30.78**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**313.74**	**4.01**	**682.24**	**0.00**	**0.00**	**0.00**
	Permanent Impacts						Temporary Impacts					
	Sutter County			Butte County			Sutter County			Butte County		
SB-8	Prime	Unique	FSWI	Prime	Unique	FSWI	Prime	Unique	FSWI	Prime	Unique	FSWI
Levee Prism	27.83	3.84	--	0.54	--	--	--	--	--	--	--	--
O&M Corridor	2.97	2.79	--	0.12	2.79	--	--	--	--	--	--	--
Canal Realign	5.83	--	2.69	--	--	--	--	--	--	--	--	--
Staging	--	--	--	--	--	--	46.21	6.91	5.42	12.86	1.42	--
Borrow	--	--	--	--	--	--	54.92	--	758.66	--	--	--
Totals	**36.63**	**6.63**	**2.69**	**0.66**	**2.79**	**0.00**	**101.13**	**6.91**	**764.08**	**12.86**	**1.42**	**0.00**
	Permanent Impacts						Temporary Impacts					
FRWLP	Sutter County			Butte County			Sutter County			Butte County		
(Alternative 3)	Prime & Unique		FSWI	Prime & Unique		FSWI	Prime & Unique		FSWI	Prime & Unique		FSWI
Levee Improvement	122.4		22.8	74		0	unknown			unknown		
Totals	**122.4**		**22.8**	74		**0**						

FWSI = Farmland of Statewide Importance.

4.6.4.1 Effects Not Addressed Further in this Document

The following effects have been addressed in the FRWLP Final EIS and the proposed modifications in the SBPFS would not result in any new or more severe effects than those described in the FRWLP Final EIS.

Effect AG-3: Conflict with Existing Zoning for Agricultural Use

As stated in the FRWLP Final EIS, local jurisdictions recognize flood risk–management measures and facilities as consistent with all zoning districts. Alternatives being considered would, therefore, not conflict with existing agricultural zoning and this issue is not discussed further.

Effect LU-1: Conflict with Applicable Land Use Plan, Policy, or Regulation

The FRWLP Final EIS addressed conflicts with land use plans and policies. Flood risk–management activities are typically considered public uses, which are largely consistent with the land use policies and regulations governing the project area.

Effect SOC-1: Employment Effects during Construction

The FRWLP Final EIS addressed effects on employment that would apply to the SBPFS alternatives. Construction activities would temporarily increase employment and personal income in the local area (SB-8 more than SB-7 because of the greater amount of construction proposed), but the increase in employment is not considered substantial when compared with total employment in the region. This effect on employment would be beneficial. This issue is not discussed further.

Effect SOC-2: Conflict with Applicable Socioeconomic Plan or Policy

As addressed in the FRWLP Final EIS, proposed levee improvements would be generally consistent with the socioeconomic policies of the City of Yuba City, City of Live Oak, Sutter County, and Butte County general plans. Consistency with the relevant socioeconomic plans, policies and regulations would constitute a less-than-significant effect. This issue is not discussed further.

4.6.4.2 No Action Alternative

The No Action Alternative represents the continuation of the existing deficiencies along the portion of the Feather River in the study area. Current levee operations and maintenance activities would continue, but there would be no change in the geomorphic and flood risk–management regimes relative to existing conditions.

In the event of a levee failure, flooding could have severe consequences for agriculture and land use in the study area, thereby affecting economic productivity. Flooding could cause inundation, erosion, sedimentation, or damage to agricultural equipment, outbuildings, and processing facilities, all of which could lead to reduced agricultural productivity. This damage could cause abandonment of or prolonged delay in cultivation of productive lands, which could ultimately result in a change in the use of these lands that may be difficult to reverse. This damage could cause depression of the local economy. In such an event, the effects could be potentially significant; however, because the effects of levee failure are unpredictable, a precise determination of significance cannot be made.

4.6.4.3 Alternative SB-8

Effect AG-1: Temporary Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Accommodate Construction Activities

During construction of Alternative SB-8, temporary staging areas to house construction materials and equipment would be necessary. Temporary earthen access ramps would also be built to facilitate construction activities and allow equipment to access the levees. Because of these construction requirements, implementation of Alternative SB-8 would temporarily convert up to 46.21 acres of prime farmland, 6.91 acres of unique farmland and 5.42 acres of farmland of statewide importance from agricultural use within Sutter County, as well as up to 12.86 acres of prime farmland and 1.42 acres of unique farmland within Butte County. However, all of this farmland in both Sutter County and Butte County could be returned to its original use after completion of project construction. The temporary conversion of this farmland would constitute a less-than-significant effect. No mitigation is required.

Effect AG-2: Irretrievable Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance

To accommodate the flood risk–management facilities and improvements proposed under Alternative SB-8, 36.63 acres of prime farmland, 6.63 acres of unique farmland, and 2.69 acres of farmland of statewide importance in Sutter County and 0.66 acres of prime farmland and 2.79 acres of unique farmland in Butte County would be permanently converted to nonagricultural use. This acreage represents 0.023% of the prime farmland, 0.034% of the unique farmland, and 0.003% of the farmland of statewide importance acreage in Sutter County and 0.0003% of the prime farmland and 0.013% of the unique farmland acreage in Butte County. The conversion of agricultural land under alternative SB-8 would occur only in a narrow corridor adjacent to the existing levee. Continued farming on the remainder of the affected parcel would be feasible and economically viable. Furthermore, the proposed improvements to the flood risk–management system would indirectly benefit hundreds of thousands of acres of valuable agricultural land in Sutter and Butte Counties, including prime farmland, unique farmland, and farmland of local importance, by providing increased protection from future flood damage. Consequently, the conversion of this farmland would constitute a less-than significant effect. No mitigation is required.

Minimization of farmland effects can be accomplished through spacing of staging areas and using temporary rights-of-way (temporary easements), thereby allowing acreage to return to farm use. BMPs would be used during construction to minimize stormwater runoff and other related impacts on adjoining fields and orchards.

Effect AG-4: Conflict with a Williamson Act Contract

Public agencies may acquire Williamson Act contracted land for a variety of public improvements, including water resource management, provided that there is no other noncontracted land reasonably feasible for the purpose, and that the lower cost of contracted land is not a primary factor in its decision.

No lands in the Sutter County portion of the project area are currently under Williamson Act contract; however, within Butte County, approximately 76.98 acres of contracted lands fall within the footprint of Alternative SB-8. Of these 76.98 acres, 67.18 acres would be permanently converted to flood risk–management uses and 9.75 acres would be returned to agricultural use following project construction.

Implementation of Alternative SB-8 would, therefore, conflict with Williamson Act contracts on 67.18 acres of land within Butte County. The 67.18 acres of permanently converted land represents 0.03% of Butte County's contracted Williamson Act lands. Furthermore, the nature of the proposed project precludes consideration of lands in other areas. Because a substantial amount of farmland would not be lost, this would constitute a less-than-significant effect. No mitigation is required.

Effect AG-5: Loss of Agricultural Production

As discussed above for Effect AG-2, implementation of Alternative SB-8 would involve the permanent conversion of up to 45.95 acres of agricultural land within Sutter County and up to 70.63 acres of agricultural land within Butte County. This loss would primarily consist of orchard and field crop land. The loss of a total of 116.58 acres of productive agricultural land, with associated annual losses in agricultural production, would represent a loss of approximately 0.01% of the total agricultural land under production in Sutter and Butte Counties. This loss in farmland does not represent a substantial loss in agricultural production; therefore, the effect would be less than significant. No mitigation is required.

4.6.4.4 Alternative SB-7

Effect AG-1: Temporary Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Accommodate Construction Activities

The temporary conversion of farmland would be substantially less under Alternative SB-7 than under SB-8 because levee improvements would end at Reach 24 instead of extending upstream to Reach 41. The Sutter-Butte County line is located within Reach 25, meaning that farmland in Butte County would not be affected.

During construction of Alternative SB-7, temporary staging areas to house construction materials and equipment would be necessary. Temporary earthen access ramps would also be built to facilitate construction activities and allow equipment to access the levees. Because of these construction requirements, implementation of Alternative SB-7 would temporarily convert up to 313.74 acres of prime farmland, 4.01 acres of unique farmland, and 682.24 acres of farmland of statewide importance from agricultural use within Sutter County. However, all of this farmland in Sutter County would be returned to its original use after completion of project construction. The temporary conversion of this farmland constitutes a less-than-significant effect. No mitigation is required.

Effect AG-2: Irretrievable Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance

Implementation of Alternative SB-7 would affect substantially less farmland than SB-8 and the FRWLP would affect. The permanent conversion of farmland would be confined within Sutter County. However, Butte County would receive less indirect flood risk benefit to its agricultural lands.

To accommodate the flood risk–management facilities and improvements proposed under Alternative SB-7, 30.78 acres of prime farmland in Sutter County would be permanently converted to nonagricultural use. This acreage represents 0.018% of the prime farmland acreage in Sutter County. This loss in farmland does not represent a substantial loss in agricultural production. The conversion of agricultural land under Alternative SB-7 would occur only in a narrow corridor adjacent to the existing levee. Continued farming on the remainder of the affected parcels would be feasible and economically viable. Furthermore, the proposed improvements to the flood risk–management system

would indirectly benefit hundreds of thousands of acres of valuable agricultural land in Sutter County and to a lesser extent Butte County, including prime farmland, unique farmland, and farmland of local importance, by providing increased protection from future flood damage. Consequently, the conversion of this farmland would constitute a less-than-significant effect. No mitigation is required.

Effect AG-4: Conflict with a Williamson Act Contract

No lands in the Sutter County portion of the project area are currently under contract; therefore, SB-7 would have no effect on contracted Williamson Act lands.

Effect AG-5: Loss of Agricultural Production

As discussed above for Effect AG-2, implementation of Alternative SB-7 would involve the permanent conversion of up to 30.78 acres of agricultural land within Sutter County. This loss would primarily consist of orchard and field crop land. This loss of productive agricultural land, with associated annual losses in agricultural production, would represent approximately 0.0004% of the total agricultural land under production in Sutter County. This loss in farmland does not represent a substantial loss in agricultural production; therefore the effect would be a less than significant. No mitigation is required.

4.7 Vegetation and Wetlands

4.7.1 Introduction

The following section describes the environmental setting for vegetation and wetlands. The effects on vegetation and wetlands resulting from the No Action Alternative, SB-7, and SB-8 are discussed along with mitigation measures required to reduce significant effects. Additional information on biological resources is provided in Appendix F of the FRWLP Final EIS.

4.7.2 Affected Environment

The FRWLP Final EIS (Section 3.8.2.1) described the Federal, state, regional, and local regulations, laws, policies, and ordinances relevant to this resource. That information is incorporated by reference.

Section 3.8.2.2 in the FRWLP Final EIS described the vegetation and wetland resources in the project area. That information is incorporated by reference in this document. The following is brief summary of that information.

As described in the FRWLP Final EIS, to assess existing conditions and effects, a biological study area was defined consisting of the construction footprint, staging areas, and borrow sites for the alternatives being considered in detail. The biological study area included the alternative with the most expansive footprint plus a 100-foot-wide strip on either side of the levee to account for indirect effects. To assess conditions within this area, ICF International has conducted field surveys consisting of land cover mapping and special-status species wildlife habitat identification. A delineation of wetlands and other waters was also conducted as described in the FRWLP Final EIS.

4.7.2.1 Land Cover Types

The information gathered was used to map the cover types in the biological study area. The approximate acreages of land cover types in the biological study areas are shown in Table 4-22. A description of each land type is provided below.

Table 4-22. Acreages of Land Cover Types in the Biological Study Area

Land Cover Type	Levee Construction Area	Borrow Sites	Total
Wildlands			
Riparian forest	147.11	0	147.11
Riparian scrub-shrub	33.10	7.86	40.96
Oak woodland	0.62	0	0.62
Wetlands and Other Waters of the United States[a]			
Forested/shrub wetlands	41.364	0	41.364
Seasonal wetlands	14.745	0	14.745
Open water	17.374	1.16	18.534
Tailings wetlands	9.175	3.59	12.765
Streams/river	38.911	0	38.911
Ditch/canal	32.067	0	33.247
Pond basin	3.327	0	3.327
Agricultural lands			
Orchard	1,188.29	9.43	1,197.72
Field and row crops	137.00	41.22	178.22
Developed/disturbed areas			
Developed	412.34	0.49	412.83
Ruderal	866.21	105.71	971.92

[a] Wetlands and Other Waters of the United States acreages from the Approved Preliminary Jurisdictional Delineation for the FRWLP dated May 1, 2013

Source: Feather River West Levee Project Final EIS

4.7.2.1.1 Wildlands

Riparian Forest

Riparian forest occurs on both sides of the levee, with most of it occurring along the Feather River. Riparian forest also forms a fringe around some of the tailings ponds. Riparian forests support an overstory dominated by mature native and nonnative trees. The dominant overstory species are valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii* ssp. *fremontii*), and Goodding's black willow (*Salix gooddingii*). Other trees commonly observed in the riparian forest are box elder (*Acer negundo* var. *californicum*), arroyo willow (*S. lasiolepis*), Oregon ash (*Fraxinus latifolia*), black locust (*Robinia pseudoacacia*) and western sycamore (*Platanus racemosa*). The shrub layer of most of the riparian forest in the biological study area is extremely dense, and species commonly observed are Himalayan blackberry (*Rubus armeniacus*), poison oak (*Toxicodendron diversilobum*), button bush (*Cephalanthus occidentalis*), wild rose (*Rosa* spp.) and blue elderberry (*Sambucus nigra* ssp*. caerulea*). Blue elderberry is the host plant for the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), which is Federally listed as threatened. Many of the trees and shrubs in the riparian forest are covered in California grape (*Vitis californica*). The herbaceous understory of riparian forest contains a mixture of native and introduced species. Representative species present include horsetails (*Equisetum* spp.), mugwort (*Artemisia douglasiana*), and curly dock (*Rumex crispus*). Several patches of the invasive giant reed (*Arundo donax*) occur along the edges of riparian areas. Some areas of

riparian forest are considered wetlands and are discussed below under Section 4.7.2.1.2, *Wetlands and Other Waters of the United States*.

Riparian Scrub-Shrub

Riparian scrub-shrub in the biological study area occurs on both sides of the levee and consists of areas that are dominated by shrubs such as willows (*Salix* spp.), blue elderberry, coyote brush (*Baccharis pilularis*), Himalayan blackberry, and button bush. The herbaceous understory of this land cover type is comparable to riparian forest.

Oak Woodland

The biological study area contains two small patches of oak woodland. The oak woodlands are predominately valley oak but some ornamental tree species are also present. The understory of oak woodland contains annual grasses mixed with native and nonnative forbs. Representative understory species are wild oat (*Avena* spp.), soft chess (*Bromus hordeaceus*), ripgut brome (*B. diandrus*), field hedge parsley (*Torilis arvensis*), and the invasive yellow starthistle (*Centaurea solstitialis*).

4.7.2.1.2 Wetlands and Other Waters of the United States

The biological study area contains numerous features that are wetlands and other (i.e., nonwetland) waters of the United States. The information presented in this section pertaining to wetlands and other waters is based on summarized findings and data from the delineation conducted by HDR in 2012 and revisions made based a field review of the delineation by USACE.

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR Section 328.3[b]). In order 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) as cited in 33 CFR Section 328.3[b]. For other water features such as rivers, streams, and ditches, the extent of potential USACE jurisdiction is determined by identification of the ordinary high water mark (OHWM), which is defined as "that line on shore established by the fluctuations of water and indicated by physical character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (33 CFR Section 328.3[e]). The types and acreages of the wetlands and other waters of the United States in the biological study area are listed above in Table 4-22. The descriptions of wetland and other waters below are based on summarized information from HDR.

Forested/Shrub Wetlands

Forested/shrub wetlands occur on the waterside of the levee along the margins of the Feather River, but are outside the OHWM of the river and are concentrated in the southern half of the biological study area. The vegetation in riparian forest wetlands is comparable to that of nonwetland riparian forest and nonwetland riparian scrub-shrub (described above); however, the forested/shrub wetlands exhibit positive indicators of all three Federal wetland criteria.

Seasonal Wetlands

Areas categorized as seasonal wetlands consist of areas that are predominantly vegetated by either floating vegetation or emergent (rooted) vegetation. Common floating vegetation is filamentous algae,

common duckweed (*Lemna minor*), and bladderwort (*Utricularia* sp.). Typical emergent vegetation present is floating primrose willow (*Ludwigia peploides*), tall flatsedge (*Cyperus eragrostis*), lady's thumb (*Persicaria maculosa*), and narrowleaf cattail (*Typha angustifolia*). Seasonal wetlands are scattered throughout the southern half of the biological study area. Based on the absence of a plant community with species that are typically found only in vernal pools (e.g., coyote thistle [*Eryngium* sp.]), the seasonal wetlands in the biological study area were determined not to be vernal pools.

Open Water

Areas categorized as open water following the USACE field review of the delineation consist of features where water is flowing or standing that contain sparse, if any, emergent vegetation. Open water features occur in tailings at the northern end of the biological study area and are interspersed with riparian habitats in the southern end of the biological study area.

Tailings Wetland

Tailings wetlands occur at the northern end of the biological study area and contain a mixture of floating and emergent vegetation bounded by shrubs and trees. Common floating and emergent species are common rush (*Juncus effusus*), tall flatsedge, lady's thumb, spikerush (*Eleocharis* spp.) floating primrose willow, and common duckweed. Typical shrubs and trees are Pacific willow (*Salix lasiandra*), Goodding's black willow, and valley oak.

Stream/Rivers

The biological study are contains two unnamed streams and the Feather River. The unnamed streams are located in the Feather River floodplain within Reach 16 and convey water at least seasonally (i.e., during the wetter winter months). The streams do not have an apparent link to the Feather River but likely have a hydrologic connection during times of high flow. The Feather River connects to the Sacramento River outside the biological study area.

Ditch/Canal

The drainage ditches and canals scattered within the biological study area are anthropogenic features that drain water from active agricultural lands during the growing season or following a rain event. They consist of the Sutter Butte Canal, and other linear, concrete-lined features that convey water across multiple parcels. Many of these features are unvegetated; however, some support emergent vegetation or shrubs along their margins.

Pond/Basin

Ponds and basins in the biological study area consist of artificial and excavated depressions, some of which contain water year-round.

4.7.2.1.3 Agricultural Lands

Most of the biological study area consists of agricultural lands (i.e., orchards and field and row crops).

Orchards

Orchards are the dominant land cover type and occur throughout the biological study area. The majority of the orchards are almonds, English walnuts, plums, or peaches that are actively maintained (i.e., irrigated, pruned). The age of the orchards ranges from small, immature trees in protective

sheaths to mature, established trees. The density of herbaceous vegetation in the areas between tree rows is highly variable and depends on the type and frequency of maintenance (e.g., mowing, herbicide application). Where present, the herbaceous vegetation is dominated by nonnative, weedy species.

Field and Row Crops

Most of the field and row crops are located in the southern portion of the biological study area (south of Barry Road). Field and row crops include both active and fallow fields that exhibit indicators of tillage. Common field and row crops in the biological study area are sweet corn, alfalfa, wheat, and tomatoes. Active field and row crops are maintained with irrigation and herbicide application. Alfalfa hay is harvested several times during the growing season. The margins of field and row crops typically support weed species.

4.7.2.1.4 Developed/Disturbed Areas

Developed

Developed areas in the biological study area consist of urban areas (residential and commercial development), ranchettes, rural neighborhoods, agricultural outbuildings, farm equipment storage areas, pumping stations, and a plant nursery.

Ruderal

Most of the areas mapped as ruderal occur as swaths on both sides of the centerline of the levee where the native soil has been substantially altered. The largest ruderal areas are located between Vance Avenue and the north terminus of the biological study area. Ruderal areas reflect past and ongoing disturbance associated with agriculture, levee construction and maintenance, and excavation (e.g., dredge tailings). Scattered trees observed in ruderal areas are typically valley oak, Fremont cottonwood, and Goodding's black willow. Shrubs are scattered in ruderal areas, and species commonly observed are coyote brush, invasive tree tobacco (*Nicotiana glauca*), and Himalayan blackberry. Blue elderberry shrubs are also present in ruderal areas. The herbaceous layer of ruderal areas is dominated by annual grasses such as wild oat, soft chess, ripgut brome, and foxtail barley (*Hordeum murinum* ssp. *leporinum*). Numerous nonnative forbs such as yellow starthistle, prickly lettuce (*Lactuca serriola*), field hedge parsley, mustard (*Brassica* spp.), and rose clover (*Trifolium hirtum*) occur throughout ruderal areas. Native forbs observed in ruderal areas are Spanish lotus (*Lotus purshianus*), California poppy (*Eschscholzia californica*), annual fireweed (*Epilobium brachycarpum*), and western verbena (*Verbena lasiostachys*).

4.7.2.1.5 Sensitive Natural Communities

Sensitive natural communities are designated as such because of their high level of species diversity, high productivity, unusual nature, limited distribution, or declining status. Local, state, and Federal agencies consider these habitats important. California Department of Fish and Wildlife (CDFW) maintains the California Natural Diversity Database (CNDDB), a current list of rare, natural communities throughout the state. Three sensitive natural communities recognized by the CNDDB have been reported in the 7.5-minute U.S. Geological Survey (USGS) quadrangles that overlap the biological study area: Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and northern hardpan vernal pool (California Department of Fish and Game 2012). The riparian forest in the biological study area could be considered either Great Valley cottonwood riparian forest or Great

Valley mixed riparian forest; therefore, the riparian forest in the biological study area is a sensitive natural community. The riparian scrub-shrub, forested/shrub wetlands, and seasonal wetlands would also be considered sensitive natural communities. No vernal pools were observed in the biological study area field surveys.

4.7.2.2 Special-Status Plant Species

Special-status plant species are plants that are legally protected under the federal Endangered Species Act (ESA), the California Endangered Species Act (CESA), or other regulations, and species considered sufficiently rare by the scientific community to qualify for such listing. For the purposes of this document, special-status plant species fall into the following categories.

- Species listed or proposed for listing as threatened or endangered under ESA (50 CFR Section 17.12 [listed plants]) and various notices in the Federal Register (FR) (proposed species).
- Species that are candidates for possible future listing as threatened or endangered under ESA (76 FR 66370, October 26, 2011).
- Species listed or proposed for listing by the State of California as threatened or endangered under CESA (California Code of Regulations, Title 14, Section 670.5).
- Species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines Section 15380).
- Plants listed as rare under the California Native Plant Protection Act (California Fish and Game Code Section 1900 et seq.).
- Plants considered by CDFW and the California Native Plant Society (CNPS) to be "rare, threatened, or endangered in California" (Rare Plant Ranks 1B and 2) (California Department of Fish and Game 2010; California Native Plant Society 2012).
- Plants identified by CDFW and CNPS about which more information is needed to determine their status, and plants of limited distribution (Rare Plant Ranks 3 and 4), which may be included as special-status species on the basis of local significance or recent biological information (California Department of Fish and Game 2010; California Native Plant Society 2012).

Nine special-status plant species have been reported in the seven USGS quadrangles that overlap the biological study area (California Department of Fish and Game 2010, 2012; California Native Plant Society 2012; U.S. Fish and Wildlife Service 2012). Table 4-23 lists the scientific name, common name, status, distribution, habitat requirements, and known/potential presence in the biological study area. Two species, slender Orcutt grass (*Orcuttia tenuis*) and Greene's tuctoria (*Tuctoria greenei*), are vernal pool species that lack potential habitat in the biological study area. Vernal pools were not observed in the biological study area during the 2010 and 2011 contractor field surveys.

Table 4-23. Special-Status Plants Identified during Prefield Investigation as Having Potential to Occur in the Biological Study Area

Common and Scientific Name	Legal Status[a] Federal/State/ Rare Plant Rank	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Reported Blooming Period	Potential for Occurrence in Biological Study Area
Ferris's milk-vetch *Astragalus tener* var. *ferrisiae*	–/–/1B.1	Historical range was the Central Valley from Butte County to Alameda County but currently occurs only in Butte, Glenn, Colusa, and Yolo Counties.	Seasonally wet areas in meadows and seeps, subalkaline flats in valley and foothill grassland; 2–75 meters in elevation.	Apr–May	Low potential to occur in ruderal areas outside the toe of the levee, but habitat conditions are of poor quality and suitable microhabitat may not be present.
Recurved larkspur *Delphinium recurvatum*	–/–/1B.2	Central Valley from Colusa* to Kern Counties.	Alkaline soils in valley and foothill grassland, saltbush scrub, cismontane woodland; 3–750 meters in elevation.	Mar–Jun	Low potential to occur in oak woodland and ruderal areas outside the toe of the levee, but habitat conditions are of poor quality and suitable microhabitat may not be present.
Ahart's dwarf rush *Juncus leiospermus* var. *ahartii*	–/–/1B.2	Eastern Sacramento Valley, northeastern San Joaquin Valley with occurrences in Butte, Calaveras, Placer, Sacramento, and Yuba Counties.	Mesic areas in valley and foothill grassland, vernal pool margins; 30–229 meters in elevation.	Mar–May	Low potential to occur in ruderal areas outside the toe of the levee, but habitat conditions are of poor quality and suitable microhabitat may not be present.
Veiny monardella *Monardella douglasii* ssp. *venosa*	–/–/1B.1	Occurrences in the northern and central Sierra Nevada foothills; also historically known from the Sacramento Valley.	Heavy clay soils in cismontane woodland, valley and foothill grassland; 60–410 meters in elevation.	May–Jul	Low potential to occur in oak woodland and ruderal areas outside the toe of the levee, but habitat conditions are of poor quality and suitable microhabitat may not be present.
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	–/–/1B.1	Inner North Coast Ranges, western Sacramento Valley.	Mesic areas in cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools; 5–1,740 meters in elevation.	Apr–Jul	Low potential to occur in oak woodland and ruderal areas outside the toe of the levee, but habitat conditions are of poor quality and suitable microhabitat may not be present.

Common and Scientific Name	Legal Status[a] Federal/State/ Rare Plant Rank	Geographic Distribution/Floristic Province[b]	Habitat Requirements	Reported Blooming Period	Potential for Occurrence in Biological Study Area
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B.1	Sierra Nevada and Cascade Range foothills from Siskiyou to Sacramento Counties.	Vernal pools; 35–1,760 meters in elevation.	May–Sep	No potential habitat in the biological study area.
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/E/1B.1	Central Sierra Nevada foothills, eastern San Joaquin Valley.	Clay soils in cismontane woodland, valley and foothill grassland; 15–150 meters in elevation.	Mar–Apr	Low potential to occur in ruderal areas outside the toe of the levee, but habitat conditions are of poor quality and suitable microhabitat may not be present.
Sanford's arrowhead *Sagittaria sanfordii*	–/–/1B.2	Scattered locations in Central Valley and Coast Ranges from Del Norte to Fresno Counties.	Freshwater marshes, sloughs, canals, and other slow-moving water habitats; below 650 meters in elevation.	May–Oct	Low potential to occur in ponds, inundated floodplain, and irrigation canals.
Greene's tuctoria *Tuctoria greenei*	E/R/1B.1	Scattered distribution along eastern Central Valley and foothills from Shasta to Tulare Counties.	Dry vernal pools; 30–1,070 meters in elevation.	May–Jul (uncommon in Sep)	No potential habitat in the biological study area.

[a] Status explanations:

Federal

E = listed as endangered under the Federal Endangered Species Act.
T = listed as threatened under the Federal Endangered Species Act.
– = no listing.

State

E = listed as endangered under the California Endangered Species Act.
– = no listing.

California Rare Plant Rank[5]

1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
0.1 = seriously endangered in California.
0.2 = fairly endangered in California.
* = presumed extirpated from that County.

[b] Floristic provinces as defined in Baldwin et al. 2012.

[5] In March, 2010, CDFW changed the name of "CNPS List" or "CNPS Ranks" to "California Rare Plant Rank" (or CRPR). This was done to reduce confusion over the fact that CNPS and CDFW jointly manage the Rare Plant Status Review groups (300+ botanical experts from government, academia, nongovernmental organizations, and the private sector) and that the rank assignments are the product of a collaborative effort and not solely a CNPS assignment.

Six species were determined to have low potential for occurrence because the potential habitat in oak woodland and ruderal areas outside the toe of the levee constitutes a relatively small portion of the biological study area and has been reduced in value by past and ongoing disturbance (e.g., agricultural activities, dredging). Additionally, suitable microhabitat requirements, such as subalkaline flats, heavy clay soils, and acidic clay soils, for these species may not be met. Sanford's arrowhead was determined to have low potential to occur along the edges of irrigation canals, inundated areas of the river's floodplain within riparian forest, and ponds on the land side of the levee that support a fringe of riparian forest.

4.7.3 Determination of Effects

Effects on special status plant species may be considered significant if an alternative would result in any of the following conditions.

- A substantial adverse effect, either directly or through habitat modification, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by CDFW, USFWS or the National Marine Fisheries Service (NMFS).
- A substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by CDFW or USFWS.
- A substantial adverse effect on federally protected wetlands as defined by CWA Section 404 (including, but not limited to, marshes and vernal pools) through direct removal, filling, hydrological interruption, or other means.
- A conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- A conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan.

4.7.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning vegetation and wetlands are summarized in Table 4-24.

4.7.4.1 No Action Alternative

The No Action Alternative represents the continuation of the existing deficiencies in levees along 41 miles of the west bank of the Feather River between the Sutter Bypass and Thermalito Afterbay. No levee improvements would be made to increase the level of flood protection. No construction-related effects on vegetation or wetlands would occur.

Because no levee improvements would be made under the No Action Alternative, the risk that the Feather River West Levee could fail because of seepage or slope stability/geometry issues would continue. These effects could include significant loss of vegetation and habitat quality because of both the hydraulic forces of the flood itself and the clean-up efforts. The effects could be potentially significant; however, given the uncertainty of the occurrence or magnitude of such an event, potential effects on vegetation and waters of the United States cannot be fully quantified based on available information.

Table 4-24. Summary of Effects on Vegetation and Wetlands

Effect	Finding	Mitigation Measure	Finding with Mitigation
SB-7 and SB-8			
Effect VEG-1: Disturbance or Removal of Riparian Trees	Significant	VEG-MM-1: Compensate for the Loss of Woody Riparian Trees VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor	Significant and unavoidable (short term) and less than significant (long term after establishment of compensatory vegetation)
Effect VEG-2: Loss of Wetlands and Other Waters of the United States as a Result of Project Construction	Significant	VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor VEG-MM-5: Compensate for the Loss of Wetlands and Other Waters	Less than significant
Effect VEG-3: Disturbance or Removal of Protected Trees as a Result of Project Construction	Significant	VEG-MM-1: Compensate for the Loss of Woody Riparian Trees VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor	Less than significant
Effect VEG-4: Potential Loss of Special-Status Plant Populations Caused by Habitat Loss Resulting from Project Construction	Significant	VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel VEG-MM-4: Retain a Biological Monitor VEG-MM-6: Retain Qualified Botanists to Conduct Floristic Surveys for Special-Status Plants during Appropriate Identification Periods VEG-MM-7: Avoid or Compensate for Substantial Effects on Special-Status Plants	Significant and unavoidable
Effect VEG-5: Introduction or Spread of Invasive Plants as a Result of Project Construction	Less than significant	None required	Less than significant
Effect VEG-6: Conflict with Provisions of an Adopted HCP/NCCP or Other Approved Local, Regional, or State Habitat Conservation Plan	No effect	None required	No effect

Effect VEG-1: Disturbance or Removal of Riparian Trees

Implementation of the USACE levee vegetation policy under the No Action Alternative is characterized by three possible scenarios.

- Full application of the Vegetation ETL, meaning prohibition and removal of woody vegetation within the levee prism or within 15 feet of the landside or waterside levee toes.
- Modified application of the Vegetation ETL, assuming the continued existence into the future of the vegetation conditions at the time of the analysis. This may include future application of a variance (not as part of this Sutter Basin project) or application of the Central Valley Flood Protection Plan concepts for management of woody vegetation, meaning trimming and thinning to allow visibility and accessibility, selective retention and removal based on engineering inspection and evaluation, and Life Cycle Management. A System Wide Improvement Framework (SWIF) may also be a component of future compliance.
- Continuation of existing maintenance requirements in accordance with the SRFCP operations and maintenance manual.

A tree survey was conducted by ICF International in fall 2012. Arborists with ICF collected data on location, species, size (diameter at breast height), overall health, and dripline diameter of trees. As described in the FRWLP Final EIS, approximately 7,600 trees are located in the biological study area, including riparian trees, orchards, and nonnative or ornamental trees.

Under full implementation of the Vegetation ETL, the only plant species permitted in the vegetation-free zone would be nonirrigated perennial grasses, with preference given to native species that are appropriate to local climate, growth conditions, and surrounding or adjacent land uses. Table 4-25 identifies the number of native or nonnative trees observed within the ETL vegetation-free zone and the number located within various areas of the levee cross section. As shown, 1,178 native trees and 1,636 nonnative trees are located within the ETL vegetation-free zone of the existing levee within Reaches 2–41. Of the 2,814 trees in total, 544 native trees and 401 nonnative trees are located on the levee itself. There are 397 native trees on the waterside levee slope and 560 native trees within the 15-foot zone out from the waterside levee toe. The 957 native trees on the waterside of the levee averaged about 16 inches in diameter at breast height (dbh).

Permanent loss of woody vegetation to comply with USACE levee vegetation policy would result in significant effects on riparian habitat. These effects are considered significant and unavoidable in the short term, although it is assumed that compensation vegetation would be required by the regulatory agencies and the long-term effect would be less than significant after establishment of compensatory vegetation.

Under the modified Vegetation ETL application scenario, the number of trees that would be removed to comply with a variance or levee inspection criteria is unknown, but would be expected to be relatively low. Over time, much of the woody vegetation may be lost due to the natural life-cycle of each tree if not replaced; however, substantial loss would not be expected to occur within 50 years or considerably longer in the case of long-lived riparian trees such as oaks and cottonwoods. Therefore, these effects are considered less than significant.

Table 4-25. Trees and Shrubs within ETL Vegetation-Free Zone for Reaches 2-41

Reach	Waterside Levee Slope				Waterside Offset[a]				Landside Levee Slope				Landside Offset[a]			
	Native	dbh	Nonnative	dbh	Native	dbh	Nonnative	dbh	Native	dbh	Nonnative	dbh	Native	dbh	Nonnative	DBH
Reach 2	1	11			46	786							4	82	2	16
Reach 3	2				97	1,971	2	17								
Reach 4	86	2,229			32	310									22	255
Reach 5	31	567	10	43	14	168	4	20	1		7	30	5		10	57
Reach 6																
Reach 7	2	18			18	278	1	18								
Reach 8	4	61	4	33	18	286	4	37							7	12
Reach 9	1				2	12	3	18							8	64
Reach 10					5	27			2	40	7	71	6	169	24	300
Reach 11	2	97			23	208			1	18			2	41	1	16
Reach 12					4	33	1	34								
Reach 13	8	216			7	96										
Reach 14	5	215			16	321										
Reach 15	1	48														
Reach 16	130	3,043	9	61	21	254	7	59	28	346	63	559	2	23	35	320
Reach 17	1	56							1	43						
Reach 18			1	3	106	528									17	134
Reach 19					10	97	6	52	2						54	411
Reach 20	4						1	18							11	94
Reach 21	2		6	84	2	12	6	37								
Reach 22	6	44			37	359	17	230	11	73	15	248	9	87	40	422
Reach 23	12	178	3	25	17	140	54	950	3	48	5	28	4	72	167	1,140
Reach 24	9	186	6	70	13	158	5	35	2	88						
Reach 25	2	21	2	15	3	60	17	209	1	3	24	130			77	323
Reach 26	3	14	1	36	2	62	4	62								
Reach 27																

Reach	Waterside Levee Slope				Waterside Offset[a]				Landside Levee Slope				Landside Offset[a]			
	Native	dbh	Nonnative	dbh	Native	dbh	Nonnative	dbh	Native	dbh	Nonnative	dbh	Native	dbh	Nonnative	DBH
Reach 28	6	118	8	94	12	122	32	450								
Reach 29	1	6	22	243	1		13	183			5	28			8	126
Reach 30	1	34	6		9	166	62	988	12	238	5	62			10	80
Reach 31	32	259	16	126	6	53	40	533	11	147	5	96	5	51	4	46
Reach 32							19	276	4	126			1	18	36	668
Reach 33	5	14	43	211	3	46	61	910			3	46			121	1,761
Reach 34	2	115	5	85			44	511			24	332			92	1,252
Reach 35	15	255	1	15	27	418	14	78			21	306			11	136
Reach 36	2	14	3	36	1	28			8	170	32	360	2	49	8	71
Reach 37	7	92	3	28	1	16	2	48	40	366	5	49	1	3	35	345
Reach 38			4	30					5	26	3	27	1		1	10
Reach 39	2															
Reach 40	7	48	1	2	2	16			15	196	10	133	12	333	12	166
Reach 41	5	65			5	49	1	3			13	164	20	239	2	12
Total[b]	397	8,024	154	1,240	560	7,080	420	5,776	147	1,928	247	2,669	74	1,167	815	8,237

[a] The landside and waterside offset is the area extending 15 feet out from the levee's waterside and landside toes.

[b] The totals at the bottom of the table represent the total number of trees and tree diameters (dbh) for all reaches within each levee cross-section location.

Under the continued O&M maintenance scenario, it is anticipated that some vegetation removal would occur to bring the levee system into compliance with the existing SRFCP O&M manual. The amount of tree removal that would be required is unknown but would likely be similar to conditions under the Central Valley Flood Protection Plan for vegetation and less than under the Vegetation ETL. SBFCA has submitted a Letter of Intent to USACE under USACE's SWIF program which would result in development of a plan by SBFCA to comply with vegetation maintenance requirements in the O&M manual. It is anticipated that the loss of vegetation under the No Action Alternative could be a significant effect; however, with the implementation of compensation required by regulatory agencies, the effect in the long term would be less than significant.

4.7.4.2 Alternatives SB-8 and SB-7

Implementation of SB-8 or SB-7 would potentially result in effects on vegetation and wetlands. Because of its smaller construction footprint, SB-7 would affect less acreage of wildland land cover types, including habitats such as riparian forest that are sensitive natural communities or that represent potential habitat for special-status species. Plate 4-7 shows the affected cover types within the construction footprints of SB-8 and SB-7. Plate 4-7, which is composed of 28 sheets, is located at the end of this chapter.

Effect VEG-1: Disturbance or Removal of Riparian Trees

Both SB-8 and SB-7 would have a significant adverse impact on riparian vegetation if the losses are not compensated for. Implementation of SB-8, which includes the proposed improvements from SB-7, would result in the same types of effects (i.e., Effect VEG-1 through Effect VEG-6) on vegetation and wetland resources. Implementation of SB-8 would result in a greater loss of riparian habitats than SB-7 (Table 4-26).

Table 4-26. Vegetation and Land Type Effects by Alternative Scenario

Land Cover Types	FRWLP (acres)	SB-7 with Vegetation ETL (acres)	SB-7 with Vegetation ETL Variance (acres)	SB-8 with Vegetation ETL (acres)	SB-8 with Vegetation ETL Variance (acres)
Wildlands					
Riparian forest	22.19	24.40	22.12	42.00	32.28
Riparian scrub-shrub	1.29	0.02	0.02	0.50	0.50
Oak woodland	0.22	1.00	1.00	1.30	1.30
Subtotal	*23.70*	*25.42*	*23.14*	*43.80*	*34.08*
Agricultural Lands					
Orchards	101.71	37.80	37.80	85.80	85.80
Field and row crops	4.75	0.70	0.70	3.80	3.80
Subtotal	*106.46*	*38.50*	*38.50*	*89.60*	*89.60*
Developed/ Disturbed Areas					
Developed	196.00	125.00	125.00	199.00	199.00
Ruderal	550.80	395.50	395.50	552.00	552.00
Subtotal	*746.80*	*520.50*	*520.50*	*751.00*	*751.00*
Total	**876.96**	**584.42**	**582.14**	**884.40**	**874.68**

The greatest impact on wildland acreage under SB-8 would result from Vegetation ETL compliance (43.80 acres). Compared with SB-7, SB-8 would result in an additional 0.48 acre impact on riparian scrub-shrub, 17.6 acres of impact on riparian forest, and 0.3 acre of impact on oak woodlands. FRWLP Alternative 3 would impact the least amount of wildlands at 23.70 acres. If not for removal of vegetation to comply with the Vegetation ETL, vegetation losses under SB-8 would be similar to the FRWLP. Vegetation ETL variance scenarios for SB-7 and SB-8 would reduce impacts by 1.7 and 9.72 acres, respectively.

The total number of riparian trees to removed on the waterside of the levee would be approximately 891 for SB-8, and 652 for SB-7 as shown in Table 4-27. Under the Vegetation ETL, the number of trees that would need to be removed would be approximately 5,294 for SB-8, and 4,616 for SB-7. The FRWLP proposes to remove 6,846 trees. Under an approved Vegetation ETL variance, these losses would be reduced to 1,375 under SB-8 and 911 under SB-7 as shown in Table 4-28. As shown, the majority of trees in the construction footprint are orchard trees.

The project's effect on the spatial distribution of woodland habitat was also evaluted to assess the potential for habitat fragmentation. Historic losses of riparian forest in conjunction with project implementation could cause further fragmentation of floodplain forest leading to constrictions in habitat core areas and increases in overall habitat edges, which, in turn, would affect patch sizes, and distances between patches, and impervious surfaces. This loss of vegetative structure and spatial complexity would leave the remaining floodplain forest susceptible to disease and incursions of nonnative species and exotics leading to increased competition and a general loss of the native-based, functioning community.

The amount of affected riparian habitat is relatively insignificant compared to the amount of existing floodplain riparian habitat. To assess existing habitat acreage, USACE staff calculated riparian and agricultural floodplain acreage numbers using Google Earth area polygon feature in conjunction with the U.S. Fish and Wildlife Wetlands and Riparian map application. Roughly, about 23,030 acres of floodplain area exists along the Feather River within the 41-mile reach, of which about 8,700 acres is riparian forest. Approximately 24 acres of riparian habitat loss would occur on the waterside of the levees. This represents less than 0.3 percent of the total amount of existing riparian forest.

Under SB-8, the USFWS calculated that about 11 discontinuous miles of levee improvements would be constructed within 300 feet of the river's edge (USFWS Final FWCA Report, Appendix D). Under SB-7, about 7 discontinuous miles of levee are within 300 feet. According to the USFWS, removing vegetation from areas where stands' width is already narrow causes a greater loss of habitat and, therefore, a larger effect on wildlife species. According to the USFWS, narrowing of riparian habitat could isolate some species that require larger stands of habitat. While implementation of the Vegetation ETL would narrow the riparian stands in some locations, the project with the proposed mitigation plan would not significantly fragment woodland habitat in the study area. Under the proposed mitigation plan (Mitigatation Measure VEG-MM-1), about 88 acres of floodplain riparian forest at the Star Bend Conservation Area and the Three Rivers Levee Improvement Authority's Feather River Floodway Corridor Restoration Project. In combination together, these mitigation actions will increase the extent of floodplain habitat and improve connectivity along the riparian corridor. Habitat restoration at Star Bend would allow for greater connectivity of riparian habitat between the Abbott and O'Connor Lakes Wildlife Units of CDFW's Feather River Wildlife Area.

Under the existing SRFCP O&M manual, small trees and shrubs are allowed on the waterside levee slope and landside and waterside berm. Existing O&M activities would be modified under the project to reflect current Corps levee maintenance standards as described in Section 4.4.1.4. In those areas where a vegetation ETL variance is not obtained, O&M of the project would include maintenance of a vegetation management zone free of woody vegetation. The levee slopes and a 15-foot zone along the landside and waterside levee toes would be permanently maintained devoid of trees and shrubs by control and eradication via mowing, burning, and/or herbicide application. Because no additional vegetation removal would occur beyond the vegetation removed by construction, O&M activities per se would not result in an additional impact on vegetation, therefore vegetation effects from O&M would be less than significant.

Table 4-27. Effects on Riparian Trees on the Waterside of the Levee by Project Alternative

Tree Species	FRWLP Alternative 3	SB-7 with Vegetation ETL	SB-7 with Vegetation ETL Variance	SB-8 with Vegetation ETL	SB-8 with Vegetation ETL Variance
Riparian Trees	209	652	614	891	753

Table 4-28. Riparian and Nonriparian Tree Comparison

Tree Type	FRWLP	SB-7 with Vegetation ETL	SB-7 with Vegetation ETL Variance	SB-8 with Vegetation ETL	SB-8 with Vegetation ETL Variance
Riparian	1,609	1,139	911	1,629	1,375
Non Riparian	1,132	248	219	259	223
Orchard	4,105	3,229	2,825	3,406	2,999
Total	**6,846**	**4,616**	**3,955**	**5,294**	**4,579**

Implementation of Mitigation Measures VEG-MM-1, VEG-MM-2, VEG-MM-3, and VEG-MM-4 would reduce this effect. Because of the length of time required for newly planted trees to reach mature size, this effect would be significant and unavoidable in the short term and less than significant in the long term after establishment of compensatory vegetation.

Mitigation Measure VEG-MM-1: Compensate for the Loss of Woody Riparian Trees

For direct effects on woody riparian trees, compensation for the loss of riparian habitat will be implemented to ensure no net loss of habitat functions and values. Under the Fish and Wildlife Coordination Act, the USFWS has recommended that USACE compensate for loss of natural habitat at a ratio of at least 2:1 (USFWS Coordination Act Report, Appendix D).

A mitigation and monitoring plan that describes how riparian habitat will be enhanced or recreated and monitored over a minimum period of time, as determined by the appropriate state and Federal agencies, is included in Appendix D. Proposed compensatory mitigation for the Recommended Plan (Alternative SB-8) includes establishment of approximately 88 acres of floodplain riparian forest at the Star Bend Conservation Area and the Three Rivers Levee Improvement Authority's Feather River Floodway Corridor Restoration Project.

SBFCA will monitor and maintain the plantings as necessary for 5 years, including weed removal, irrigation, and plant protection. SBFCA will submit annual monitoring reports of

survival to the regulatory agencies issuing permits related to habitat effects, including CDFW, USACE, NMFS, and USFWS. Replanting will be necessary if success criteria are not met, and replacement plants subsequently will be monitored and maintained to meet the success criteria. The riparian habitat mitigation will be considered successful when the sapling trees established meet the success criteria, the habitat no longer requires active management, and vegetation is arranged in groups that, when mature, replicate the area, natural structure, and species composition of similar riparian habitats in the region.

Onsite areas (adjacent to the levees) that are outside the USACE vegetation-free zone may also be considered in the future detailed design phase; however, mitigation site selection will avoid areas where future levee alternatives or maintenance is likely.

Mitigation Measure VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species

To clearly demarcate the project boundary and prevent special-status species from moving through the project area, temporary exclusion fencing will be installed along the project boundaries (including access roads and staging areas) prior to the start of construction activities. Temporary fencing will be continuously maintained until all construction activities are completed.

A USFWS- and CDFW-approved biological monitor will be on-site during installation of the fencing to survey and relocate animals outside the work area boundaries. Federally and state-listed species will be relocated only if authorized by USFWS and CDFW. The exclusion fencing will be removed only after construction of the project phase is completed.

Mitigation Measure VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel

Before any work occurs in the biological study area, including grading, a qualified biologist will conduct mandatory contractor/worker awareness training for construction personnel. The awareness training will be provided to all construction personnel to brief them on the need to avoid effects on sensitive biological resources (e.g., riparian habitat, special-status species, special-status wildlife habitat) and the penalties for not complying with permit requirements. The biologist will inform all construction personnel about the life history of special-status species with potential for occurrence onsite, the importance of maintaining habitat, and the terms and conditions of the biological opinion or other authorizing document. Proof of this instruction will be submitted to USFWS, CDFW, or other overseeing agency, as appropriate.

The training also will cover the restrictions and guidelines that must be followed by all construction personnel to reduce or avoid effects on special-status species during project construction.

Mitigation Measure VEG-MM-4: Retain a Biological Monitor

USACE or its contractors will retain qualified biologists to monitor construction activities adjacent to sensitive biological resources (e.g., special-status species, riparian habitat, wetlands, elderberry shrubs). The biologists will assist the construction crew, as needed, to comply with all project implementation restrictions and guidelines. In addition, the biologists will be

responsible for ensuring that USACE or its contractors maintain the construction barrier fencing adjacent to sensitive biological resources.

Any worker who inadvertently injures or kills a special-status wildlife species or finds an individual dead, injured, or entrapped will immediately report the incident to the biological monitor. The monitor will immediately notify USACE, which will notify the USFWS Endangered Species Office and/or the local CDFW warden or biologist within 3 working days. USACE will follow up with written notification to USFWS or CDFW within 5 working days.

Effect VEG-2: Loss of Wetlands and Other Waters of the United States as a Result of Project Construction.

Construction of SB-7 or SB-8 would result in the fill of features that may be waters of the United States, including irrigation ditches, open water, and seasonal wetlands. Placement of fill would occur in jurisdictional features that are within the footprint of the cutoff wall and seepage berms.

The greatest impact on wetlands and other waters would occur within open waters. SB-8 and SB-7 would affect 7.86 and 5.01 acres, respectively, as shown in Table 4-29. The Vegetation ETL variance scenarios for SB-8 and SB-7 do not result in acreage differences. The Vegetation ETL compliance scenarios would affect woody vegetation within the levee vegetation-free zone but not waters of the United States.

Table 4-29. Wetlands and Other Waters Effects by Alternative

Land Cover Types	Alternative SB-7 (acres)	Alternative SB-8 (acres)
Irrigation/canal ditch	1.4	7.1
Riparian forest wetland	0.324	0.324
Stream	0	0
Tailings wetland	0	0.131
Seasonal wetlands	0.18	0.18
Open water	0.19	0.19
Total	**5.01**	**7.86**

Alternative SB-8 would affect 7.1 acres of irrigation canals and ditches and SB-7 affects 1.4 acres. SB-8 would result in an additional 5.7-acre impact on irrigation canals and ditches. SB-8 would affect 0.131 acres of tailing wetlands at the northern end of the project. SB-7 would not affect tailing wetlands.

Waters of the United States are regulated by USACE and the Environmental Protection Agency. Wetlands are considered sensitive communities. The project would have a substantial adverse effect on federally protected wetlands and other waters of the United States through direct removal, filling, and hydrologic interruption; therefore, this effect would be considered significant. Implementation of the environmental commitment to develop a SWPPP and Mitigation Measures VEG-MM-2, VEG-MM-3, VEG-MM-4, and VEG-MM-5 would reduce this effect to a less-than-significant level.

Mitigation Measure VEG-MM-5: Compensate for the Loss of Wetlands and Other Waters

The proposed Mitigation and Monitoring Plan accompanying the document (Appendix D) will compensate for the loss of wetlands through the purchase of mitigation credits from mitigation

banks in the region. Purchase of credits at a mitigation ratio developed in coordination with regulatory agencies will ensure no net loss of habitat functions and values.

Effect VEG-3: Disturbance or Removal of Protected Trees as a Result of Project Construction

Construction of SB-7 and SB-8 would result in the disturbance or removal of numerous trees that may be protected. The FRWLP Final EIS identified the disturbance or removal of trees as possibly in conflict with Yuba City Ordinance 01-98. Many of these affected trees are in riparian habitat and are included in the discussion in Effect VEG-1 above. Other trees occur in non-riparian valley oak woodland.

The removal or harming of protected trees as a result of construction activities could conflict with local and state codes which could be a significant effect. Implementation of the environmental commitment to compensate for loss of vegetation and Mitigation Measures VEG-MM-1, VEG-MM-2, VEG-MM-3, and VEG-MM-4 would reduce the effects to a less-than-significant level.

Effect VEG-4: Potential Loss of Special-Status Plant Populations Caused by Habitat Loss Resulting from Project Construction

No known occurrences of special-status plants are in the project area; however, blooming-period surveys of the project area have not been conducted for special-status plant species with potential to occur in the region. Surveys would occur before construction, as described in Mitigation Measure VEG-MM-6 below. Because of the historical and ongoing disturbance of most of the project area, there is low potential for the presence of special-status plants. However, if one or more of these species are present in the project area, project construction would result in their removal.

Nearly all improvement measures associated with SB-7 and SB-8 require clearing and grubbing of the project footprint prior to construction. If special-status plants are present within the project footprint, they would be removed.

Plants that may occur in the project area under this alternative include one Federally and state-listed endangered species (Hartweg's golden sunburst) and seven species that are on the CNPS list for rare and endangered plants. Loss of CNPS-listed plant species would be regulated by CDFW if the loss is substantial and could affect the long-term survival of the affected population. Because the presence and extent of any special-status plants in the project construction area are unknown, this effect would be considered significant.

Depending on the plant (listed versus unlisted) and the extent of effect on the population, implementation of Mitigation Measures VEG-MM-2, VEG-MM-3, and VEG-MM-4 may avoid or reduce this effect to a less-than-significant level. The final significance determination will need to be made after floristic surveys have been conducted (Mitigation Measure VEG-MM-6) and through consultation with the appropriate resource agency (USFWS and/or CDFW). In addition, Mitigation Measure VEG-MM-7 requires the project proponent to avoid indirect or direct effects on special-status plants wherever feasible. Because the effectiveness of these measures to reduce this effect to a lesser level is not known at this time, this effect is considered significant and unavoidable.

Mitigation Measure VEG-MM-6: Retain Qualified Botanists to Conduct Floristic Surveys for Special-Status Plants during Appropriate Identification Periods

Qualified botanists will survey the biological study area to document the presence of special-status plants before project implementation. The botanists will conduct a floristic survey that

follows the CDFW botanical survey guidelines (California Department of Fish and Game 2009). All plant species observed will be identified to the level necessary to determine whether they qualify as special-status plants or are plant species with unusual or significant range extensions. The guidelines also require that field surveys be conducted when special-status plants that could occur in the area are evident and identifiable, generally during the reported blooming period. To account for different special-status plant identification periods, one or more series of field surveys may be required in spring and summer.

If any special-status plants are identified during the surveys, the botanist will photograph and map locations of the plants, document the location and extent of the special-status plant population on a CNDDB Survey Form, and submit the completed Survey Form to the CNDDB. The amount of compensatory mitigation required will be based on the results of these surveys.

Mitigation Measure VEG-MM-7: Avoid or Compensate for Substantial Effects on Special-Status Plants

If one or more special-status plants is identified in the biological study area during preconstruction surveys, USACE will redesign or modify proposed project components to avoid indirect or direct effects on special-status plants wherever feasible. If special-status plants can be avoided by redesigning projects, implementation of Mitigation Measures VEG-MM-2, VEG-MM-3, and VEG-MM-4 would avoid significant effects on special-status plants.

If complete avoidance of special-status plants is not feasible, the effects of the project on special-status plants would be compensated through offsite preservation at a ratio to be negotiated with the resource agencies. Suitable habitat for affected special-status plant species will be purchased in a conservation area, preserved, and managed in perpetuity. Detailed information will be provided to the agencies on the location and quality of the preservation area, the feasibility of protecting and managing the area in perpetuity, and the responsible parties. Other pertinent information also will be provided, to be determined through future coordination with the resource agencies.

Effect VEG-5: Introduction or Spread of Invasive Plants as a Result of Project Construction

Invasive plants are already present throughout project area. However, construction activities could introduce new invasive plants to the project area or contribute to the spread of existing invasive plants to uninfested areas outside the project area. Invasive plants or their seeds may be dispersed by construction equipment if appropriate prevention measures are not implemented. The introduction or spread of invasive plants as a result of the project could have a significant effect on sensitive natural communities within and outside the project area by displacing native flora. The implementation of the appropriate BMPs described in the environmental commitment to avoid or minimize the spread or introduction of invasive plants would ensure that the proposed project would not have a significant effect on sensitive natural communities from the introduction or spread of invasive plants. With implementation of the environmental commitment, this would be a less-than-significant effect. No additional mitigation is required.

Effect VEG-6: Conflict with Provisions of an Adopted HCP/NCCP or Other Approved Local, Regional, or State HCP

There are no adopted HCP/NCCPs applicable to the proposed project. There are two plans under development in the region: the Yuba-Sutter NCCP/HCP and the Butte Regional Conservation Plan.

The proposed project is within the planning area of both of these conservation plans. Because these plans are currently under development and neither of these plans has been adopted, the project would not conflict with provisions of these plans, and there would be no effect. No conflict is anticipated should these plans be adopted prior to construction.

4.8 Wildlife

4.8.1 Introduction

The following section describes the regulatory and environmental setting for wildlife. The effects on wildlife species from the No Action Alternative, Alternative SB-8, and Alternative SB-7 are discussed along with mitigation measures to reduce significant effects. Additional information regarding wildlife is provided in Appendix F of the FRWLP Final EIS.

4.8.2 Affected Environment

The regulatory and environmental setting described in the FRWLP Final EIS has remained unchanged and that information is incorporated by reference in this integrated report. The FRWLP Final EIS addressed existing conditions for wildlife habitats and special-status wildlife species.

4.8.2.1 Biological Study Area

The biological study area generally includes the 41 miles of the Feather River's western levee from south of the Thermalito Afterbay to approximately 4 miles north of the Sutter Bypass. The biological study area for the proposed project includes the areas directly affected by construction, plus a 100-foot buffer on either side to account for potential indirect effects on the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB). The biological study area also includes the Star Bend Mitigation Area, where impacts on VELB and riparian habitat would be compensated.

4.8.2.1.1 Field Surveys

As described in the FRWLP Final EIS, the biological study area has been surveyed to identify habitats for special-status (defined below) wildlife in the affected area and elderberry shrub (habitat for the VELB) surveys. An assessment of habitat for giant garter snake was also conducted by ICF and HDR. Species observed during the surveys are listed in Table 4-30.

Table 4-30. Wildlife Species Observed in the Biological Study Area

Common Name	Scientific Name
Amphibians	
Bullfrog	*Lithobates catesbeianus*
Reptiles	
Western fence lizard	*Sceloporus occidentalis*
Birds	
Acorn woodpecker	*Melanerpes formicivorus*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Carduelis tristis*
American kestrel	*Falco sparverius*
American white pelican	*Pelecanus erythrorhynchos*
Bald eagle	*Haliaeetus leucocephalus*
Barn swallow	*Hirundo rustica*
Belted kingfisher	*Megaceryle alcyon*
Black phoebe	*Sayornis nigricans*
Brewer's blackbird	*Euphagus cyanocephalus*
Bushtit	*Psaltriparus minimus*
California towhee	*Pipilo crissalis*
Canada goose	*Branta canadensis*
Cooper's hawk	*Accipiter cooperii*
Dark-eyed junco	*Junco hyemalis*
Double-crested cormorant	*Phalacrocorax auritus*
European starling	*Sturnus vulgaris*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Green heron	*Butorides virescens*
Gull sp.	*Larus* sp.
Killdeer	*Charadrius vociferus*
Mallard	*Anas platyrhynchos*
Mourning dove	*Zenaida macroura*
Osprey	*Pandion haliaetus*
Red-tailed hawk	*Buteo jamaicensis*
Red-shoulder hawk	*Buteo lineatus*
Red-winged blackbird	*Agelaius phoeniceus*
Rock dove	*Columba livia*
Snowy egret	*Egretta thula*
Spotted towhee	*Pipilo erythrophthalmus*
Swainson's hawk	*Buteo swainsonii*
Turkey vulture	*Cathartes aura*
Western kingbird	*Tyrannus verticalis*
Western meadow lark	*Sturnella neglecta*
Western scrub jay	*Aphelocoma californica*
Yellow-billed magpie	*Pica nuttalli*
Yellow-rumped warbler	*Dendroica coronata*
Mammals	
Black-tailed deer	*Odocoileus hemionus columbianus*
Black-tailed jack rabbit	*Lepus californicus*
Coyote	*Canis latrans*
Desert cottontail	*Sylvilagus audubonii*
Northern river otter	*Lontra canadensis*

Elderberry shrub surveys were conducted by ICF biologists in 2011 and in 2012 and concurrently with arborist surveys in summer 2012. When the bases of shrubs were accessible, stem counts, heights, and widths of shrubs were recorded, and shrubs were surveyed for VELB exit holes. Where dense poison oak, blackberry, and/or other vegetation surrounds elderberry shrubs, stem counts and exit hole surveys could not be conducted. All visible elderberry shrubs (and shrub clusters) within 100 feet of the maximum extent of the alternative boundaries were recorded using GPS. Where there wasn't property access, or where dense poison oak, blackberry, and/or other vegetation surrounds elderberry shrubs, stem counts and exit hole surveys could not be conducted. All shrubs to be removed will be surveyed prior to removal, as discussed in Section 4.8.4.2.

4.8.2.1.2 Special-Status Wildlife Species

Special-status wildlife species are defined as animals that are legally protected under the ESA, CESA, or other regulations and species that are considered sufficiently rare by the scientific community to qualify for such listing.

Based on the USFWS (2012) species list and CNDDB (California Department of Fish and Game 2012) records search for the quadrangles overlapping the affected area, 23 special-status wildlife species were identified as having potential to occur in the affected area. Of these 23 species, four are known to occur in the affected area (western pond turtle, Swainson's hawk, western yellow-billed cuckoo, and bank swallow). Swainson's hawk was observed in the affected area during 2011 field surveys. Though not reported to occur in the affected area, 10 other special-status wildlife species have a moderate or high potential to occur in the affected area given their known range, reports of occurrence, and/or the presence of suitable habitat. These species are Antioch Dunes anthicid beetle (*Anthicus antiochensis*), Sacramento anthicid beetle (*A. sacramento*), Sacramento Valley tiger beetle (*Cicindela hirticollis abrupta*), VELB, giant garter snake, northern harrier, bald eagle, western burrowing owl, tricolored blackbird, and silver-haired bat. The remaining nine special-status wildlife species have low or no potential to occur. Seven additional species were added as having at least a moderate potential to occur in the affected area based on species habitat requirements and professional judgment (white-tailed kite, loggerhead shrike, purple martin, yellow warbler, pallid bat, hoary bat, and western red bat). All wildlife species considered, as well as regulatory status, distribution, habitat requirements, and potential to occur in the affected area, are listed in Table 4-31. The 21 special-status wildlife species that are known to occur or have a high or moderate potential to occur in the affected area are described in detail in the FRWLP Final EIS.

Table 4-31. Rare and Special-Status Wildlife Species Identified As Having Potential to Occur in SB-7 and SB-8 Affected Area

Common and Scientific Names	Status[a] Federal/ State/Other	Geographic Distribution	Habitat Requirements	Potential Occurrence in Affected Area
Invertebrates				
Antioch Dunes anthicid beetle *Anthicus antiochensis*	–/–/–	Population in Antioch Dunes believed extinct. Present in several localities along the Sacramento and Feather Rivers.	Loose sand on sand bars and sand dunes.	Moderate—suitable habitat may be present in the affected area; known locations within 2 miles south of the affected area.
Sacramento anthicid beetle *Anthicus sacramento*	–/–/–	Dune areas at mouth of Sacramento River; western tip of Grand Island, Sacramento County; upper Putah Creek and dunes near Rio Vista, Solano County; Ord Ferry Bridge, Butte County.	Found in sand slip-faces among willows; associated with riparian and other aquatic habitats.	Moderate—suitable habitat may be present in the affected area; known locations within 2 miles south of the affected area.
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	–/–/–	Lower Sacramento Valley (i.e., Sacramento River, lower American River, and Cache Creek).	Found in sandy areas among willows in riverine and riparian habitats.	Moderate—suitable habitat may be present in the affected area; known locations within 2 miles south of the affected area.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–/–	Streamside habitats below 3,000 feet throughout the Central Valley.	Riparian and oak savanna habitats with elderberry shrubs; elderberries are the host plant.	High—suitable habitat present; species occurrences in affected area.
Conservancy fairy shrimp *Branchinecta conservatio*	E/–/–	Disjunct occurrences in Solano, Merced, Tehama, Ventura, Butte, and Glenn Counties.	Large, deep vernal pools in annual grasslands.	None—no suitable habitat present in affected area.
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–/–	Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County. Isolated populations also in Riverside County.	Common in vernal pools; also found in sandstone rock outcrop pools.	None—no suitable habitat present in affected area.
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–/–	Shasta County south to Merced County.	Vernal pools and ephemeral stock ponds.	None—no suitable habitat present in affected area.

Common and Scientific Names	Status[a] Federal/ State/Other	Geographic Distribution	Habitat Requirements	Potential Occurrence in Affected Area
Amphibians				
California tiger salamander *Ambystoma californiense*	T/T/–	Central Valley, including Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to northeastern San Luis Obispo County.	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy.	Low—limited suitable aquatic habitat and unsuitable surrounding upland habitat; no occurrences in affected area.
California red-legged frog *Rana draytonii*	T/SSC/–	Found along the coast and coastal mountain ranges of California from Marin County to San Diego County and in the Sierra Nevada from Tehama County to Fresno County.	Permanent and semi-permanent aquatic habitats, such as creeks and coldwater ponds, with emergent and submergent vegetation. May estivate in rodent burrows or cracks during dry periods.	None—considered extirpated from the valley floor (U.S. Fish and Wildlife Service 2002).
Western spadefoot *Spea hammondii*	–/SSC/–	Sierra Nevada foothills, Central Valley, Coast Ranges, coastal counties in southern California.	Shallow streams with riffles and seasonal wetlands, such as vernal pools in annual grasslands and oak woodlands.	Low—limited suitable aquatic habitat and unsuitable surrounding upland habitat; no occurrences in affected area.
Reptiles				
Western pond turtle *Emys marmorata*	–/SSC/–	Occurs from the Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through the Sacramento Valley, and on the western slope of Sierra Nevada.	Occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests.	High—suitable habitat present; one occurrence in the affected area.

Common and Scientific Names	Status[a] Federal/ State/Other	Geographic Distribution	Habitat Requirements	Potential Occurrence in Affected Area
Giant garter snake *Thamnophis gigas*	T/T/–	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno.	Sloughs, canals, low gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter.	Moderate—suitable habitat present; no occurrences in affected area but numerous occurrence within 5 miles of affected area in water bodies potentially connected to canals and ditches in the affected area.
Birds				
Greater sandhill crane *Grus canadensis tabida*	–/T/–	Breeds in Siskiyou, Modoc, Lassen, Plumas, and Sierra Counties. Winters in the Central Valley, southern Imperial County, Lake Havasu National Wildlife Refuge, and the Colorado River Indian Reserve.	Summers in open terrain near shallow lakes or freshwater marshes. Winters in plains and valleys near bodies of fresh water.	Low—limited suitable wintering habitat; one occurrence within 5 miles of the affected area.
Swainson's hawk *Buteo swainsoni*	–/T/–	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley. Highest nesting densities occur near Davis and Woodland, Yolo County.	Nests in oaks or cottonwoods in or near riparian habitats. Forages in grasslands, irrigated pastures, and grain fields.	High—suitable nesting and foraging habitat; seven records in and immediately adjacent to the affected area.
Northern harrier *Circus cyaneus*	–/SSC/–	Occurs throughout lowland California. Has been recorded in fall at high elevations.	Nests and forages in grasslands, meadows, marshes, and seasonal and agricultural wetlands.	Moderate—suitable foraging habitat, limited suitable nesting habitat; one occurrence within 5 miles of the affected area.
White-tailed kite *Elanus leucurus*	–/FP/–	Lowland areas west of Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border.	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging.	Moderate—suitable nesting and foraging habitat; no occurrences in affected area.

Common and Scientific Names	Status[a] Federal/ State/Other	Geographic Distribution	Habitat Requirements	Potential Occurrence in Affected Area
Bald eagle *Haliaeetus leucocephalus*	–/E, FP/–	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in the Lake Tahoe Basin. Reintroduced into central coast. Winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierra Nevada, and east of the Sierra Nevada south of Mono County.	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean.	High—suitable nesting and foraging habitat along Feather River; one occurrence within 0.5 mile of the affected area.
California black rail *Laterallus jamaicensis coturniculus*	–/T/–	Permanent resident in the San Francisco Bay and eastward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial Counties.	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations.	Low—no suitable nesting and foraging habitat; no occurrences within 5 miles of the affected area.
Western yellow-billed cuckoo *Coccyzus americanus*	C/E/–	Nests along the upper Sacramento, lower Feather, south fork of the Kern, Amargosa, Santa Ana, and Colorado Rivers.	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub jays are abundant.	High—suitable nesting and foraging habitat; two occurrences in the affected area.
Western burrowing owl *Athene cunicularia hypugea*	–/SSC/–	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas. Rare along south coast.	Level, open, dry, heavily grazed or low-stature grassland or desert vegetation with available burrows.	Moderate—suitable foraging habitat; limited suitable nesting habitat; no occurrences in affected area.
Loggerhead shrike *Lanius ludovicianus*	–/SSC/–	Resident and winter visitor in lowlands and foothills throughout California. Rare on coastal slope north of Mendocino County, occurring only in winter.	Prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches.	Moderate—suitable nesting and foraging habitat; no occurrences in the affected area.

Common and Scientific Names	Status[a] Federal/ State/Other	Geographic Distribution	Habitat Requirements	Potential Occurrence in Affected Area
Purple martin *Progne subis*	–/SSC/–	Coastal mountains south to San Luis Obispo County, west slope of the Sierra Nevada, and northern Sierra and Cascade ranges. Absent from the Central Valley except in Sacramento. Isolated, local populations in southern California.	Nests in abandoned woodpecker holes in oaks, cottonwoods, and other deciduous trees in a variety of wooded and riparian habitats. Also nests in vertical drainage holes under elevated freeways and highway bridges.	Moderate—suitable nesting and foraging habitat; no occurrences in the affected area.
Bank swallow *Riparia riparia*	–/T/–	Occurs along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower American Rivers, in the Owens Valley, and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou Counties. Small populations near the coast from San Francisco County to Monterey County.	Nests in bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam.	High—suitable foraging habitat present; suitable nesting habitat may be present but unlikely; eight occurrences within and adjacent to the affected area.
Yellow warbler *Dendroica petechia*	–/SSC/–	Nests over all of California except the Central Valley, the Mojave Desert region, and high altitudes in the Sierra Nevada. Winters along the Colorado River and in parts of Imperial and Riverside Counties.	Nests in riparian areas dominated by willows, cottonwoods, sycamores, or alders or in mature chaparral; also may use oaks, conifers, and urban areas near stream courses.	Moderate—suitable nesting and foraging habitat; no occurrences in the affected area.
Tricolored blackbird *Agelaius tricolor*	–/SSC/–	Permanent resident in the Central Valley from Butte County to Kern County; breeds at scattered coastal locations from Marin County south to San Diego County and at scattered locations in Lake, Sonoma, and Solano Counties; rare nester in Siskiyou, Modoc, and Lassen Counties.	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grain fields; habitat must be large enough to support 50 pairs; probably requires water at or near the nesting colony.	Moderate—suitable nesting and foraging habitat; no occurrences in the affected area.

Common and Scientific Names	Status[a] Federal/ State/Other	Geographic Distribution	Habitat Requirements	Potential Occurrence in Affected Area
Mammals				
Western red bat *Lasiurus blossevillii*	–/SSC/ WBWG: High priority	Scattered throughout much of California at lower elevations.	Found primarily in riparian and wooded habitats. Occurs at least seasonally in urban areas. Day roosts in trees in the foliage. Found in fruit orchards and sycamore riparian habitats in the Central Valley.	Moderate—suitable roosting and foraging habitat; no occurrences within 5 miles of the affected area probably because of the lack of bat surveys in the affected area.
Hoary bat *Lasiurus cinereus*	–/–/ WBWG: Moderate priority	Occurs throughout California from sea level to 13,200 feet.	Found primarily in forested habitats. Also found in riparian areas and in park and garden settings in urban areas. Day roosts in foliage of trees.	Moderate—suitable roosting and foraging habitat; no occurrences have been recorded within 5 miles of the affected area (probably due to the lack of bat surveys in the affected area).
Silver-haired bat *Lasionycteris noctivagans*	–/–/WBWG: Moderate priority	Found from the Oregon border south along the coast to San Francisco Bay and along the Sierra Nevada and Great Basin region to Inyo County. Also occurs in southern California from Ventura and San Bernardino Counties south to Mexico. Has been recorded in Sacramento, Stanislaus, Monterey, and Yolo Counties.	During spring and fall migrations, may be found anywhere in California. Summer habitats include coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley foothill and montane riparian habitats. Roosts in hollow trees, snags, buildings, rock crevices, caves, and under bark.	Moderate—suitable roosting and foraging habitat; two occurrences within 5 miles of the affected area.
Pallid bat *Antrozous pallidus*	–/SSC/ WBWG: High priority	Occurs throughout California, except the high Sierra, from Shasta to Kern County and the northwest coast, primarily at lower and mid elevations.	Occurs in a variety of habitats from desert to coniferous forest. Most closely associated with oak, yellow pine, redwood, and giant sequoia habitats in northern California and oak woodland, grassland, and desert scrub in southern California. Relies heavily on trees for roosts.	Moderate—suitable roosting and foraging habitat; no occurrences have been recorded within 5 miles of the affected area (probably due to the lack of bat surveys in the affected area).

Common and Scientific Names	Status[a] Federal/ State/Other	Geographic Distribution	Habitat Requirements	Potential Occurrence in Affected Area
Western mastiff bat *Eumops perotis californicus*	–/SSC/ WBWG: High priority	Occurs along the western Sierra primarily at low to mid-elevations and widely distributed throughout the southern coast ranges. Recent surveys have detected the species north to the Oregon border.	Found in a wide variety of habitats from desert scrub to montane conifer. Roosts and breeds in deep, narrow rock crevices, but also may use crevices in trees, buildings, and tunnels.	Low— uncommon in the Central Valley and roost sites primarily associated with crevices in cliff faces and boulders. No occurrences within 5 miles of the affected area.
Ringtail *Bassariscus astutus*	-/FP/-	Found throughout most of California except for the San Joaquin Valley and portions of southern deserts.		High-known to occur along the Feather River within the study area

[a] Status explanations:

Federal

E = listed as endangered under the Federal Endangered Species Act.

T = listed as threatened under the Federal Endangered Species Act.

C = candidate species for which USFWS has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list, but issuance of the proposed rule is precluded.

– = no listing.

State

E = listed as endangered under the California Endangered Species Act.

T = listed as threatened under the California Endangered Species Act.

FP= fully protected under the California Fish and Game Code.

SSC = species of special concern in California.

– = no listing.

Other

WBWG = Western Bat Working Group 2007. Available: <http://www.wbwg.org/spp_matrix.html>.

Moderate priority = species status is unclear because of a lack of data; this designation indicates a level of concern that should warrant (1) closer evaluation and more research of the species and possible threats and (2) conservation actions benefiting the species.

High priority = species are imperiled or at high risk of imperilment.

4.8.3 Determination of Effects

Effects on wildlife may be considered significant if implementation of an alternative would result in any of the following conditions.

- Have a substantial adverse effect, either directly or through habitat modification, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by CDFW or USFWS.
- Interferes substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflicts with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- Conflicts with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan.
- Contributes to a substantial reduction or elimination of species diversity or abundance.

4.8.3.1 Assessment Methods

Potential direct effects (permanent and temporary) on wildlife habitat were quantified based on estimated habitat losses within proposed construction footprints and staging areas by alternative. Potential indirect effects of each project alternative were evaluated more qualitatively because they would occur farther from the project area or later in time, and are more difficult to evaluate quantitatively. As mentioned above, borrow sites recently were identified and have not been surveyed yet. Depending on the habitats present at these sites, additional wildlife species may be affected. Information collected during surveys will be needed to determine effects and appropriate mitigation measures.

Direct effects can be either temporary (return to baseline conditions within a year of disturbance) or permanent in duration. These effects were used to assess effects on wildlife resources.

4.8.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning wildlife resources are summarized in Table 4-32.

Table 4-32. Summary of Effects on Wildlife

Effect	Finding	Mitigation Measure	Finding with Mitigation
SB-7 and SB-8			
Effect WILD-1: Potential Mortality of or Loss of Habitat for Antioch Dunes Anthicid, Sacramento Anthicid, and Sacramento Valley Tiger Beetles	Significant	WILD-MM-1: Fence and Avoid Habitat for Antioch Dunes Anthicid, Sacramento Anthicid, and Sacramento Valley Tiger Beetles and Implement Protective Measures	Less than significant
Effect WILD-2: Potential Mortality or Disturbance of VELB and its Habitat (Elderberry Shrubs)	Significant	WILD-MM-2: Conduct VELB Surveys Prior to Elderberry Transplantation WILD-MM-3: Implement Protect VELB and its Habitat WILD-MM-4: Compensate for Effects on VELB and its Habitat	Less than significant
Effect WILD-3: Potential Mortality or Disturbance of Western Pond Turtle	Significant	WILD-MM-5: Conduct Preconstruction Surveys for Western Pond Turtle and Monitor Construction Activities if Turtles are Observed	Less than significant
Effect WILD-4: Potential Disturbance or Mortality of and Loss of Suitable Habitat for Giant Garter Snake	Significant	WILD-MM-6: Avoid and Minimize Construction Effects on Giant Garter Snake WILD-MM-7: Compensate for Permanent Loss of Suitable Giant Garter Snake Habitat	Less than significant
Effect WILD-5: Potential Loss or Disturbance of Nesting Swainson's Hawk and Loss of Nesting and Foraging Habitat	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-9: Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction and Implement Protective Measures during Construction	Less than significant
Effect WILD-6: Potential Mortality or Disturbance of Nesting Special-Status and Non–Special Status Birds and Removal of Suitable Breeding Habitat	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-10: Conduct Nesting Surveys for Special-Status and Nonspecial-Status Birds and Implement Protective Measures during Construction	Less than significant
Effect WILD-7: Potential Loss or Disturbance of Western Burrowing Owl and Loss of Nesting and Foraging Habitat	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-11: Conduct Surveys for Western Burrowing Owl prior to Construction and Implement Protective Measures if Found WILD-MM-12: Compensate for the Loss of Occupied Western Burrowing Owl Habitat	Less than significant
Effect WILD-8: Potential Injury, Mortality or Disturbance of Tree-Roosting Bats and Removal of Roosting Habitat	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-13: Identify Suitable Roosting Habitat for Bats and Implement Avoidance and Protective Measures	Less than significant
Effect WILD-9: Potential Injury, Mortality or Disturbance of Ringtail and Removal of Habitat	Significant	WILD-MM-14: Identify Suitable Shelter and Denning Habitat for Ringtail and Implement Avoidance and Protective Measures	Less than significant

Effect	Finding	Mitigation Measure	Finding with Mitigation
Effect WILD-10: Disturbance to or Loss of Common Wildlife Species and Their Habitats	Significant	WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds WILD-MM-9: Conduct Focused Surveys for Nesting Swainson's Hawk prior to Construction and Implement Protective Measures during Construction WILD-MM-10: Conduct Nesting Surveys for Special-Status and Nonspecial-Status Birds and Implement Protective Measures during Construction	Less than significant
Effect WILD-11: Potential Disruption of Wildlife Movement Corridors	Less than significant	None required	Less than significant

4.8.4.1 No Action Alternative

The No Action Alternative represents the continuation of the existing deficiencies in levees along 44 miles of the west bank of the Feather River between the Sutter Bypass and Thermalito Afterbay. Current levee O&M activities would continue, but there would be no change in the geomorphic and flood risk–management regimes relative to existing conditions. No construction-related effects on wildlife, such as displacement or loss of habitat, would occur.

Because no levee improvements would be made under the No Action Alternative, the risk that the levees along the west bank of the Feather River could fail because of seepage or slope stability/geometry issues would continue. A catastrophic levee failure would result in flooding and inundation that could significantly affect wildlife and upland or wetland habitats, resulting in mortality of individuals, physical displacement, and temporary loss or permanent alterations of habitat. In addition, cleanup and repair activities could result in physical displacement for extended periods of time and significant effects on habitat. A major flood event along the Feather River corridor could result in damage to the riparian forest between the river and the levees. Given the importance of this riparian corridor for numerous special-status species and for the Pacific flyway (a major travel route for migratory birds in North America) in general, loss or fragmentation of this habitat would be a significant effect, and it could take decades for a mature riparian forest to reestablish itself in the affected areas. Given the uncertainty of the occurrence or magnitude of such an event, potential effects on wildlife and its habitats cannot be quantified based on available information.

4.8.4.2 Alternatives SB-8 and SB-7

USACE reinitiated Section 7 Endangered Species Act consultation with the USFWS and the NMFS for the project. USACE prepared biological assessments to assess effects to listed species for submittal to USFWS and NMFS. The USFWS issued an amended biological opinion and NMFS issued a letter concurring with the USACE's determination that implementation of SB-8 is not likely to adversely affect listed fish species (Appendix D). Implementation of this alternative would potentially result in effects on the Federally-listed giant garter snake (GGS) and the valley elderberry longhorn beetle

(VELB). Below is the list of Terms and Conditions included in the Incidental Take Statement accompanying the USFWS BO that will be implemented to protect the federally-listed GGS and VELB.

USFWS Incidental Take Terms and Conditions:

All the conservation measures as described in the project description, and as restated here in this biological opinion, must be fully implemented and adhered to.

The Corps, SBFCA, and PG&E shall include full implementation and adherence to the conservation measures as outlined in the biological opinion as a condition of any permit or contract issued for the project.

In order to monitor whether the amount or extent of take anticipated from implementation of the proposed project is approached or exceeded, the Corps and SBFCA shall adhere to the following reporting requirement. Should this anticipated amount or extent of incidental take be exceeded, the Corps must immediately reinitiate formal consultation as per 50 CFR 401.16.

a. *For those components of the proposed project that will result in habitat degradation or modification whereby incidental take in the form of harm or mortality is anticipated, the Corps and SBFCA will provide weekly updates to the Service with a precise accounting of the total acreage of habitat affected or number of elderberry shrubs and size of stems at ground level transplanted. Updates shall also include any information about changes in the Project Description not analyzed in this biological opinion.*

SBFCA and the Corps shall provide a photo documentation report showing pre- and post-project area conditions for giant garter snake.

The magnitude of the majority of permanent habitat losses would be greater under SB-8 than under SB-7 and, temporary losses of habitat would be greater for some land cover types than under SB-7. Table 4-33 summarizes the specific effects on special-status species habitat for SB-8 and SB-7.

The following mitigation measures, which are described in Section 4.7, *Vegetation and Wetlands*, would apply to the wildlife resources discussed below and would be implemented to avoid and minimize effects on special-status wildlife. For brevity, these measures are not repeated for each species or group of species discussed below.

Mitigation Measure VEG-MM-2: Install Exclusion Fencing and/or K-rails along the Perimeter of the Construction Work Area and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species

Mitigation Measure VEG-MM-3: Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel

Mitigation Measure VEG-MM-4: Retain a Biological Monitor

Table 4-33. Effects on Special-Status Species Habitat under Alternative SB-8

Special-Status Species	Habitat	Acres of Permanent/ Temporary Effects	
		SB-8	SB-7
Antioch Dunes anthicid, Sacramento anthicid, and Sacramento Valley tiger beetles	Sandy riparian areas	0/0	0/0
Valley elderberry longhorn beetle	Elderberry shrubs	162[a]	79[a]
Giant garter snake and western pond turtle	Aquatic habitat in drainage, canals and irrigation ditches, freshwater emergent areas, and open water	0/11.9	0/0
Giant garter snake	Upland habitat in ruderal areas within 200 feet of aquatic habitat	3.54/96.79	3.54/17.00
Swainson's hawk, white-tailed kite, bald eagle, western yellow-billed cuckoo, purple martin, yellow warbler, and other birds	Nesting and foraging habitat in riparian forest	15.44/7.95	13.12/5.96
Swainson's hawk, white-tailed kite, northern harrier, burrowing owl, and tricolored blackbird	Foraging habitat in field and row crops and in ruderal areas	533.09/104.21	239.09/71.90
Bank swallow	Bluffs and banks of streams/ levees adjacent to water	0/0	0/0
Bats	Roosting habitat in riparian forest and orchard	113.21/14.39	78.11/9.92

[a] For valley elderberry longhorn beetle, effects are given in numbers of shrubs, not acres.

Effect WILD-1: Potential Mortality of or Loss of Habitat for Antioch Dunes Anthicid, Sacramento Anthicid, and Sacramento Valley Tiger Beetles

Construction activities that remove or disturb sandy riparian areas could result in the mortality of larvae or adults of Antioch Dunes anthicid, Sacramento anthicid, and Sacramento Valley tiger beetles. Beetles could be crushed by construction equipment or personnel, and suitable habitat could be modified or removed during ground-disturbing activities. Because these beetle species are rare and are only known from few locations in the project vicinity, loss of individuals and modification or removal of habitat would be considered significant effects. Implementation of the following mitigation measure would reduce these effects to a less-than–significant level.

Mitigation Measure WILD-MM-1: Conduct Focused Surveys for Habitat for Antioch Dunes Anthicid, Sacramento Anthicid, and Sacramento Valley Tiger Beetles and Implement Protective Measures

Wildlife biologists will conduct surveys for suitable habitat for Antioch Dunes anthicid, Sacramento anthicid, and Sacramento Valley tiger beetles. The biologists will map these areas using a GPS unit. If possible, these areas will be avoided during construction. If avoidance is not possible, a qualified entomologist will survey the suitable habitat areas for the presence of these

three beetle species to determine their presence. If recommended by the entomologist and supported by the wildlife agencies, the beetles may be relocated to suitable habitat prior to the start of construction in the habitat to be affected.

Effect WILD-2: Potential Mortality or Disturbance of VELB and its Habitat (Elderberry Shrubs)

Elderberry shrubs, which provide habitat for the VELB, would be removed or disturbed by activities associated with construction of SB-7 or SB-8. Removal or disturbance of elderberry shrubs could result in the mortality or disturbance of VELB. Noise and dust generated during construction also may indirectly affect adult VELB or exposed larvae or eggs (Talley and Holyoak 2009:10). Soil disturbance adjacent to shrubs may affect the roots and subsequent health of elderberry shrubs. Shrubs located farther from the construction area and those sheltered by surrounding vegetation are expected to have fewer construction-related effects than shrubs that are closer to the construction area and in more open areas. Yearly levee maintenance would remove woody vegetation that develops including elderberry shrubs when young and less than 1-inch at ground level, therefore there should be no long-term effects from levee maintenance on VELB. Table 4-34 shows the number of elderberry shrubs directly impacted and estimated compensation. The removal or disturbance of elderberry shrubs (162 for SB-8 and 79 for SB-7) would be considered a significant effect on VELB. Implementation of the following mitigation measures would reduce this effect to a less-than-significant level.

Table 4-34. Permanent Effects on Elderberry Shrubs and Compensation Acreage Requirements

Permanent Effects and Compensation	FRWLP	SB-7	SB-8
Compensation Acreage	11.16	9.94	20.38
Number of Shrubs Affected	91	79	162

Mitigation Measure WILD-MM-2: Conduct VELB Surveys Prior to Elderberry Shrub Transplantation

Surveys of elderberry shrubs to be transplanted will be conducted by a qualified biologist prior to transplantation. Surveys will be conducted in accordance with the Conservation Guidelines for the VELB (U.S. Fish and Wildlife Service 1999). Surveys will consist of counting and measuring the diameter of each stem, and examining elderberry shrubs for the presence of VELB exit holes. Survey results and an analysis of the number of elderberry seedlings/cuttings and associated native plants required as compensation will be submitted to USFWS.

Mitigation Measure WILD-MM-3: Implement Measures to Protect VELB and its Habitat

Complete avoidance of effects on VELB is assumed when a 100-foot buffer around elderberry shrubs is established and maintained during construction (U.S. Fish and Wildlife Service 1999). Elderberry shrubs/clusters within 100 feet of the construction area that will not be removed will be protected during construction. Elderberry shrubs in the construction area that cannot be protected will be transplanted between November 1 and February 14 in accordance with USFWS-approved procedures outlined in *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (U.S. Fish and Wildlife Service 1999). Elderberry shrubs within 100 feet of the

construction area that will not be removed will be protected with orange construction barrier fencing.

Mitigation Measure WILD-MM-4: Compensate for Effects on VELB and its Habitat

Compensation for direct effects on VELB will be provided for in accordance with the Biological Opinion to be issued by the USFWS. Permanent effects on elderberry shrubs are shown in Table 4-34. Elderberry shrubs that cannot be avoided will be transplanted to a USFWS-approved conservation area (i.e., the Star Bend Conservation Area). Elderberry seedlings or cuttings and associated native species will also be planted in the conservation area. Each elderberry stem measuring 1 inch or greater in diameter at ground level that is adversely affected (i.e., transplanted or destroyed) will be replaced in the conservation area with elderberry seedlings or cuttings at a ratio ranging from 1:1 to 8:1 (new plantings to affected stems). The numbers of elderberry seedlings/cuttings and associated riparian native trees/shrubs to be planted as replacement habitat are determined by stem size class of affected elderberry shrubs, presence or absence of exit holes, and whether the shrub lies in a riparian or nonriparian area. Stock of either seedlings or cuttings would be obtained from local sources. The numbers of elderberry seedlings/cuttings and associated riparian native trees/shrubs will be estimated based on existing elderberry shrub survey data and adjusted according to elderberry survey data collected during implementation of Mitigation Measure WILD-MM-2.

Effect WILD-3: Potential Mortality or Disturbance of Western Pond Turtle

Aquatic and upland (overwintering, nesting) habitat for western pond turtle may be removed or temporarily disturbed by construction activities. Western pond turtles may be killed, injured, or disturbed by activities that remove suitable aquatic or upland habitat. Construction activities (such as grading and movement of heavy equipment) could result in the destruction of pond turtle nests containing eggs or young individuals if affected areas are being used for egg deposition. Declines in populations of western pond turtles throughout the species range have been documented (Jennings and Hayes 1994). Loss of individuals in the project area could diminish the local population and lower reproductive potential, which could contribute to the further decline of this species. The loss of upland nesting sites or eggs also would decrease the local population. This effect would be significant, but implementation of the following mitigation measure would reduce this effect to a less-than-significant level.

Mitigation Measure WILD-MM-5: Conduct Preconstruction Surveys for Western Pond Turtle and Monitor Construction Activities if Turtles are Observed

One week before and within 24 hours of beginning work in suitable aquatic habitat, a qualified biologist (one who is familiar with different species of turtles) will conduct surveys for western pond turtle. The surveys should be timed to coincide with the time of day and year when turtles are most likely to be active (during the cooler part of the day between 8 a.m. and 12 p.m. during spring and summer). Prior to conducting the surveys, the biologist should locate the microhabitats for turtle basking (logs, rocks, brush thickets) and determine a location to quietly observe turtles. Each survey should include a 30-minute wait time after arriving onsite to allow startled turtles to return to open basking areas. The survey should consist of a minimum 15-minute observation time per area where turtles could be observed. If western pond turtles are observed during either survey, a biological monitor should be present during construction activities in the aquatic habitat where the turtle was observed and will capture and remove, if

possible, any entrapped turtle. The biological monitor also will be mindful of suitable nesting and overwintering areas in proximity to suitable aquatic habitat and periodically inspect these areas for nests and turtles. The biological monitor's CDFW scientific collecting permit will include capture and relocation of turtles.

Effect WILD-4: Potential Disturbance or Mortality of and Permanent Loss of Suitable Habitat for Giant Garter Snake

Construction of SB-7 and SB-8 would result in temporary and permanent losses of suitable aquatic and upland habitat for giant garter snake (Table 4-35). Under SB-8 and SB-7, the installation of erosion protection matting on the landside slope of the levee to control erosion in an overtopping event could impact the snake. The erosion protection matting could impact suitable upland habitat by preventing the formation of burrows by ground squirrels which the snake utilizes. Construction activities in suitable habitat could also result in the injury, mortality, or disturbance of giant garter snakes. Loss of habitat and potential injury or mortality of snakes are considered significant effects because the project could reduce the local population size of a federally and state-listed species. This effect would be significant, but implementation of the following mitigation measure would reduce this effect to a less-than-significant level.

Table 4-35. Temporary and Permanent Effects on Giant Garter Snake Habitat

	Levee Construction Area (In Acres)			Borrow Sites	Total Acreage		
Habitat	FRWLP	SB-7	SB-8	In Acres	FRWLP	SB-7	SB-8
Temporary Effects							
Aquatic habitat	9.59	0	11.9	127.72	137.31	0	139.62
Upland habitat (ruderal within 200 feet of aquatic habitat)	96.79	17	96.79	175.47	272.26	17	272.26
Permanent Effects							
Aquatic habitat	0	0	0	0	0	0	0
Upland habitat (ruderal within 200 feet of aquatic habitat)	0	3.54	3.54	0	0	3.54	3.54

Mitigation Measure WILD-MM-6: Avoid and Minimize Construction Effects on Giant Garter Snake

The following conservation measures would be implemented to avoid, minimize, and compensate for effects on giant garter snake and its habitat.

- To the maximum extent possible, all construction activity in giant garter snake aquatic and upland habitat and within 200 feet of aquatic habitat will be conducted during the snake's active period (between May 1 and October 1). During this timeframe, potential for injury and mortality is lessened because snakes are actively moving and avoiding danger. Giant garter snakes are more vulnerable to danger during their inactive period because they are occupying underground burrows or crevices and are more susceptible to direct effects, especially during excavation. Small irrigation ditches on the landside of the levee that need to be moved outward from the existing levee will be completely dried, removed, and relocated during the May 1–October 1 timeframe. For work that cannot be conducted

between May 1 and October 1, additional protective measures will be determined during consultation with USFWS.

- To reduce the likelihood of snakes entering the construction area, exclusion fencing and orange barrier fencing will be installed along the edge of the construction area that is within 200 feet of suitable habitat. The exclusion and barrier fencing will be installed during the active period for giant garter snakes (May 1 to October 1) to reduce the potential for injury and mortality during this activity. The exclusion fencing will consist of silt fencing buried below ground level. The exclusion fencing will ensure that giant garter snakes are excluded from the construction area and that suitable upland and aquatic habitat is protected throughout construction.
- A USFWS-approved biologist will conduct a preconstruction survey in suitable habitat no more than 24 hours before construction. Prior to construction activities each morning, construction personnel will inspect exclusion and orange construction barrier fencing to ensure they are both in good working order. If any snakes are observed in the construction area during this inspection or at any other time during construction, the USFWS-approved biologist will be contacted to survey the site for snakes. The project area will be re-inspected and surveyed whenever a lapse in construction activity of 2 weeks or more has occurred. If a snake (believed to be a giant garter snake) is encountered during construction, activities will cease until appropriate corrective measures have been completed or it has been determined that the snake will not be harmed.
- Vegetation clearing within 200 feet of the banks of suitable giant garter snake aquatic habitat will be limited to the minimum area necessary. Giant garter snake habitat within or adjacent to the project area will be flagged and designated as an environmentally sensitive area, to be avoided by all construction personnel.
- The movement of heavy equipment within 200 feet of potential giant garter snake aquatic habitat will be confined to designated haul routes to minimize habitat disturbance.
- Temporarily affected suitable habitat will be restored to pre-project conditions.

Mitigation Measure WILD-MM-7: Compensate for Permanent Loss of Suitable Giant Garter Snake Habitat

To compensate for the direct and indirect effects on habitat for giant garter snake, USACE proposes to purchase mitigation credits at a USFWS- and CDFW-approved conservation bank (Table 4-36).

Table 4-36. Giant Garter Snake Habitat Mitigation Table

Impact Type	Impact Unit	Impact	Mitigation Ratio	Mitigation Need	Mitigation Area
Aquatic Habitat	Acreage	0 acres	3:1	0 acres	0 acres
Upland Habitat	Acreage	3.54 acres	3:1	10.62 acres	10.62 acres

Effect WILD-5: Potential Loss or Disturbance of Nesting Swainson's Hawk and Loss of Nesting and Foraging Habitat

Construction is anticipated to occur between April 15 and November 30, which is during the breeding season of Swainson's hawks (March through August). Swainson's hawks were flying through the affected area during the 2011 field surveys. There are 12 records of Swainson's hawk nests in the affected area and within 0.5 mile of the affected area (California Department of Fish and Game 2012). The majority of these records are for observations of nesting between 2001 and 2004. Ten of the reported nests are located south of Olivehurst. There are numerous additional records of occurrences within 5 miles of the affected area. The affected area and adjacent areas contain numerous suitable nest trees for Swainson's hawks. Field and row crops and ruderal areas provide suitable foraging habitat for Swainson's hawks in the affected area.

Construction activities and removal of trees could result in the loss or disturbance of Swainson's hawk during the nesting season. Removal of nests or suitable nesting habitat and construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Removal of active nest trees or anticipated disturbance that may result in nest abandonment would require an incidental take permit from CDFW. Because the availability of foraging habitat has been closely tied to the breeding success of this species, projects that would significantly modify suitable Swainson's hawk foraging habitat are considered to the have potential to significantly affect this species (California Department of Fish and Game 1994). Loss of Swainson's hawk eggs or nests, any activities resulting in nest abandonment, and loss of nesting and foraging habitat would be considered significant effects. Implementation of Mitigation Measure VEG-MM-1, Compensate for the Loss of Woody Riparian Trees, would compensate for the loss of potential nesting habitat for Swainson's hawk. The loss of foraging habitat from conversion of agricultural land would not be significant. Implementation of the following mitigation measures would reduce these effects to a less-than-significant level.

The removal of vegetation is not anticipated to have a significant effect on the regional productivity of Swainson's hawks. Mitigation Measure WILD-MM-8 Conduct Vegetation Removal Activities outside the Breeding Season for Birds and Mitigation Measure WILD-MM-9 Conduct Focused Surveys for Nesting Swainson's Hawk Prior to Construction and Implement Protective Measures during Construction would reduce the potential for shorterm effects to regional productivity of the species. Additionally, the overall longterm regional productivity of Swainson's hawk habitat will be improved by the new 85 acreas of riparian and 2.6 acres of oak woodland mitigation plantings which will offset the 15.44 acres of permenant effects.

Mitigation Measure WILD-MM-8: Conduct Vegetation Removal Activities outside the Breeding Season for Birds

To the maximum extent feasible, vegetation (trees, shrubs, ruderal areas) removal/trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction surveys for nesting birds and additional protective measures will be implemented (see Mitigation Measure WILD-MM-9). Removal of trees with active Swainson's hawk nests and active raptors will be avoided. Because white-tailed kite is fully protected, removal of trees with active nests and activities that may result in loss of white-tailed kites are prohibited.

Mitigation Measure WILD-MM-9: Conduct Focused Surveys for Nesting Swainson's Hawk Prior to Construction and Implement Protective Measures during Construction

During the spring prior to construction, focused surveys for Swainson's hawk will be conducted in the project area and in a buffer area up to 0.5 mile around the project area. The size of the buffer area surveyed will be based on the type of habitat present and line of sight from the construction area to surrounding suitable breeding habitat.

If active nests are found, a 0.25-mile buffer or other distance determined appropriate through consultation with CDFW will be maintained between construction activities and the active nest(s) until it has been determined that young have fledged. In addition, a qualified biologist (experienced with raptor behavior) will be present onsite daily during construction activities occurring during the breeding season to watch for any signs of stress. If nesting birds are observed to exhibit agitated behavior indicating that they are experiencing stress, construction activities will cease until the qualified biologist, in consultation with CDFW, determines that young have fledged.

Effect WILD-6: Potential Mortality or Disturbance of Nesting Special-Status and Non–Special Status Birds and Removal of Suitable Breeding Habitat.

Special-status birds that may nest in the riparian forest in and adjacent to the affected area include Swainson's hawk, white-tailed kite, bald eagle, western yellow-billed cuckoo, purple martin, and yellow warbler. Bank swallow may nest adjacent to the affected area in the banks of the Feather River. Northern harrier may nest in ruderal areas in the affected area. Loggerhead shrike may nest in shrubs and trees in more open portions of the affected area. Tricolored blackbirds may nest in blackberry brambles or field crops. Numerous nonspecial-status birds also may nest in these areas. Because construction is anticipated to occur between April 15 and November 30, effects on nesting birds may occur. Vegetation removal and other construction activities during the breeding season (generally February 1 through August 31) could result in the mortality or disturbance of nesting birds in and adjacent to the construction area. The removal of riparian forest, ruderal areas, and field crops would reduce the amount of available nesting habitat for special-status and nonspecial-status birds.

Removal of nest trees during the breeding season or anticipated disturbance that may result in nest abandonment and subsequent loss of eggs or young of Swainson's hawk, bald eagle, western yellow-billed cuckoo, or bank swallow would require an incidental take permit from CDFW.

Construction activities and removal of trees could result in the loss or disturbance of breeding pairs of Swainson's hawk during the nesting season. Removal of nests or suitable nesting habitat and construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Removal of active nest trees or anticipated disturbance that may result in nest abandonment would require an incidental take permit from DFG. Loss of Swainson's hawk eggs or nests, any activities resulting in nest abandonment, and loss of nesting and foraging habitat would be considered significant effects. Implementation of Mitigation Measure VEG-MM-1, Compensate for the Loss of Woody Riparian Habitat, would compensate for the loss of potential nesting habitat for Swainson's hawk. Implementation of the following mitigation measures would reduce these effects to a less-than-significant level.

Because white-tailed kite is fully protected, removal of trees with active nests and activities that may result in loss of white-tailed kites are prohibited. Removal of nests or suitable nesting habitat (trees,

shrubs, ruderal areas, field crops) and construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Such losses could affect the local population of special-status and nonspecial-status species and would be considered a significant effect. Implementation of Mitigation Measure WILD-MM-8 and the mitigation measure below, would reduce this effect to a less-than-significant level.

Mitigation Measure WILD-MM-10: Conduct Nesting Surveys for Special-Status and Nonspecial-Status Birds and Implement Protective Measures during Construction

Nesting surveys will be conducted before the start of construction. Surveys will include a search of all suitable nesting habitat (trees, shrubs, ruderal areas, field crops) in the construction area. In addition, a 500-foot area around the project area will be surveyed for nesting raptors, and a 50-foot buffer area will be surveyed for other nesting birds. If no active nests are detected during these surveys, no additional measures are required.

If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). The extent of the buffers will be determined by the biologists in coordination with USFWS 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.

Effect WILD-7: Potential Loss or Disturbance of Western Burrowing Owl and Loss of Nesting and Foraging Habitat

Construction is anticipated to occur during the breeding season of western burrowing owl (March through August). Burrowing owls also could be present year-round. Construction activities and removal of nesting habitat (burrows in ruderal areas and on the edges of agricultural areas) could result in the loss or disturbance of western burrowing owl. Removal of occupied burrows and construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Permanent or temporary loss of foraging or burrow habitat for this species also would result from construction activities. Nesting burrowing owls are protected under the Migratory Bird Treaty Act (MBTA) and California Fish and Game Code Sections 3503 and 3503.5. Loss of active breeding or wintering burrows or disturbance of breeding burrows resulting in mortality of young and displacement of adults would be considered a significant effect. Implementation of Mitigation Measure WILD-MM-8 and the mitigation measures below would reduce this effect to a less-than-significant level.

Mitigation Measure WILD-MM-11: Conduct Surveys for Western Burrowing Owl Prior to Construction and Implement Protective Measures if Found

CDFW recommends burrowing owl surveys whenever burrowing owl habitat is present on or within 500 feet of a project site. Breeding season and nonbreeding season surveys will be conducted in accordance with recommendations of the CDFW and USFWS.

If burrowing owls are found during any of the surveys, compensatory mitigation best practices as described below will be used. Because ample lead time is necessary for putting compensation

in place, these efforts should begin as soon as possible after presence of burrowing owls is determined.

Regardless of results from the surveys described above, initial take avoidance (preconstruction) surveys will be conducted no less than 14 days prior to and 24 hours before initiating ground disturbing activities. Burrowing owls may re-colonize a site after only a few days. As such, subsequent take avoidance surveys will be conducted if a few days pass between project activities. If no burrowing owls are found, no further mitigation is required. If burrowing owls are found, USACE will use avoidance, minimization measures, monitoring, and reporting of such measures as recommended by the CDFW and USFWS.

Mitigation Measure WILD-MM-12: Compensate for the Loss of Occupied Burrowing Owl Habitat

If burrowing owls have been documented to occupy burrows at the project site in the last 3 years, current scientific literature supports the conclusion that the site should be considered occupied and mitigation is required. Mitigation would then be determined in consultation with the USFWS and the CDFW.

Effect WILD-8: Potential Injury, Mortality or Disturbance of Tree-Roosting Bats and Removal of Roosting Habitat

Construction is anticipated to occur during the maternity season of bats (April 1 through September 15) and beginning of the hibernation period (November 1). The proposed project would result in the loss of trees, which provide suitable roosting habitat (cavities, crevices, furrowed bark, and foliage) for special-status bats (western red bat and pallid bat) and bats for which conservation actions are warranted (hoary bat and silver-haired bat) (Western Bat Working Group 2007). Tree removal/trimming and noise or other construction activities could result in the injury, mortality, or disturbance of roosting bats, if present in cavities, crevices, furrowed bark, or foliage of trees. Because no work on bridges or other structures in the affected area is expected, effects on bats that may roost on these structures (pallid bat or maternity colonies of nonspecial-status bats) are not anticipated. Mortality of tree-roosting bats during the maternity season or hibernation period that results from tree removal/trimming or other disturbances could affect the local populations of these species and would be considered a significant effect. Implementation of Mitigation Measure WILD-MM-8 and the following mitigation measure would lessen effects on western red bat, pallid bat, and other bat species.

Mitigation Measure WILD-MM-13: Conduct Preconstruction Surveys for Roosting Bats and Implement Avoidance and Protective Measures

If tree removal/trimming cannot be conducted between September 15 and October 30, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat before removal/trimming. High-quality habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage–roosting bat species. If suitable habitat and/or bat sign is detected, biologists will conduct evening visual emergence surveys of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the

season that construction will be taking place. Night vision goggles and/or full-spectrum acoustic detectors should be used during emergence surveys to assist in species identification. All emergence surveys will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). Additional passive monitoring using full spectrum bat detectors may be needed if identification of bat species is required. Survey methods would be discussed with CDFW prior to the start of surveys.

Avoidance and minimization measures may be necessary if sensitive bats species are detected during surveys and/or acoustic monitoring and will be determined in coordination with CDFW and the USFWS.

Effect WILD-9: Potential Injury, Mortality or Disturbance of Ringtail and Removal of Habitat

Levee construction is anticipated to occur during the ringtail breeding and maternity period (February through August). The proposed project would result in the loss of trees, some of which may provide suitable shelter and denning habitat (hollow trees, logs, snags) for ringtails. The project may also disturb burrows that provide suitable denning habitat. Newborn/young ringtails are especially vulnerable during May through August, when they are unable to leave the maternal den. Removal of suitable shelter or denning habitat, noise, or other construction activities could result in the injury, mortality, or disturbance of ringtails. Mortality of ringtail, a fully protected species, could affect the local population along the Feather River and would be considered a significant effect. Because ringtail is a fully state-protected species, take of this species is prohibited. Implementation of the following mitigation measure would avoid effects on ringtail.

Mitigation Measure WILD-MM-14: Identify Suitable Shelter and Denning Habitat for Ringtail and Implement Avoidance and Protective Measures

Prior to the start of construction wildlife biologists will survey the area to be impacted for suitable burrows and examine trees to be removed for suitable hollow areas that may provide shelter or denning habitat for ringtail. All hollow trees, snags, downed logs, and appropriately sized burrows that will be removed will be thoroughly examined. If necessary, a ringtail specialist will be contracted to confirm the suitability of habitat and determine if suitable habitat is occupied through the use of remote cameras or other non-invasive methods for determining occupancy. Riparian woodlands and areas adjacent to riparian woodlands should be considered suitable habitat and be searched for appropriate shelter/denning habitat. Survey methods should be discussed with CDFW and/or a ringtail specialist prior to the start of surveys.

Effect WILD-10: Disturbance to or Loss of Common Wildlife Species and Their Habitats

The project area contains both natural and human-influenced habitats that support numerous common wildlife species. These species include a wide variety of terrestrial and aquatic invertebrates, birds and raptors, amphibians, reptiles, and mammals, some of which are listed in Table 4-30. These nonspecial-status species also could be directly and indirectly affected by project construction.

The effects on wildlife include short-term and long-term effects. Short-term effects are generally the result of physical disturbance during construction (i.e., clearing of vegetation, noise, pollution, and soil compaction), while long-term effects are generally the result of habitat modification. The effects described below are considered significant for both SB-8 and SB-7 but with the implementation of

Mitigation Measures WILD-MM-8, WILD-MM-9 and WILD-MM-10 would be reduced to a less-than-significant level.

The clearing of vegetation would cause impacts to wildlife, but these impacts are expected to be offset in the long-term by the implementation of Mitigation Measure VEG-MM-1, Compensate for the Loss of Woody Riparian Trees. Under SB-8, habitat losses would occur linearly along 41 miles of levee where vegetation extends into the vegetation-free zone or is otherwise impacted by construction. Under SB-7, about 27 miles of levee improvements are proposed. The location of the river relative to the levee varies significantly, averaging approximately 1,400 feet and ranging from approximately 50 to 5,600 feet from the Feather River during typical summer base flows. Under SB-8 and the FRWLP Alternatives, the USFWS has calculated that about 11 discontinuous miles of levee improvements would be constructed within 300 feet of the river's edge (USFWS Final FWCA Report, Appendix D). Under SB-7, about 7 discontinuous miles of levee are within 300 feet. According to the USFWS, removing vegetation from areas where stands' width is already narrow causes a greater loss of habitat and, therefore, a larger effect on wildlife species. According to the USFWS, narrowing of riparian habitat could isolate some species that require larger stands of habitat.

Construction-related activities would directly and/or indirectly affect most animals that reside within the areas of impact. Heavy machinery may adversely affect smaller, low-mobility species, particularly amphibians, reptiles, and small mammals. Construction activities may adversely affect the young (i.e., nestlings and fledglings) of some birds and potentially destroy some nests. To the maximum extent feasible and in compliance with the MBTA, vegetation (trees, shrubs, ruderal areas) removal/trimming will be scheduled during the nonbreeding season of birds (September 1–January 31) as described in Mitigation Measure WILD-MM-8. If vegetation removal cannot be removed in accordance with this timeframe, preconstruction surveys for nesting birds and additional protective measures will be implemented (see Mitigation Measure WILD-MM-9, and WILD-MM-10).

Mobile species, such as birds and larger mammals, may avoid initial clearing and construction activities and move into adjacent areas outside the affected areas. Heavy machinery may also cause soil compaction, which may adversely affect fossorial animals (i.e., those that live underground). Construction activities may temporarily deprive some animals of cover, and, therefore, potentially subject them to increased natural predation. The increased noise and activity levels during construction could potentially disturb the daily activities (e.g., breeding, foraging, etc.) of species inhabiting the areas adjacent to the affected areas. Dust and gaseous emissions should minimally affect wildlife. Although construction activities may disrupt the normal behavior of many wildlife species, little permanent damage to these populations should result. Such impacts would be temporary and without long-term implications.

Following construction, periodic levee maintenance activities may disturb wildlife species due to noise and physical disturbance. However, because the existing levee would remain in place, with only minor exterior differences (e.g., presence of seepage berms, canal/levee realignment), the effects on wildlife from O&M activities would not be appreciably different from existing or future without project conditions.

Effect WILD-11: Potential Disruption of Wildlife Movement Corridors

Terrestrial wildlife species may use the Feather River or the levee as a movement corridor. Additionally, smaller, more localized movement corridors may be present in the 41-mile project

area of Alternative SB-8 or the 23-mile length of Alternative SB-7. During construction of levee improvements, movement through the project site would be temporarily impeded by the placement of physical barriers (fencing) used to protect resources within or near the construction footprint. Additionally, animals may avoid movement through the project area or along the Feather River because of the extensive amount of noise and human activity associated with construction. Upon completion of levee improvements, the affected area would have a different footprint but generally would be available as a movement corridor. Mitigation Measure VEG-MM-1 would compensate for the "narrowing" of riparian stands and habitat fragmentation by improving connectivity along the riparian corridor. No permanent barriers would be installed as part of the proposed project. This effect is considered less than significant, and no mitigation is required.

Summary of Potential Mitigation Measures

A summary of the timing of potential mitigation measures is provided in Table 4-37.

Table 4-37. Timing of Potential Mitigation Measures

Species	Requirement	Timing
Valley elderberry longhorn beetle	1) Transplant elderberry shrubs	November 1–February 15 Prior to the start of any construction activities Mitigation credits must be purchased prior to groundbreaking. Timing of onsite mitigation would be determined in coordination with USFWS.
	2) Install orange barrier fencing around shrubs to be protected.	
	3) Compensate for impacts by purchasing mitigation credits or planting elderberries and associated natives onsite.	
Western pond turtle	Preconstruction survey	One week before and within 24 hours of beginning work during the cooler part of the day (8 a.m. and 12 p.m. during spring and summer)
Giant garter snake	1) Construction activity in giant garter snake aquatic and upland habitat within 200 feet of aquatic habitat	Between May 1 and October 1
	2) Install exclusion fencing and orange barrier fencing along the edge of the construction area that is within 200 feet of suitable habitat	Install on or after May 1
	3) Preconstruction survey	Within 24 hours of the start of construction in or within 200 feet of suitable habitat
Nesting birds	1) Vegetation removal/trimming	September 1–January 31
	2) Preconstruction Surveys (3)	February 1–June 1
Swainson's hawk	Preconstruction surveys	February through July
Burrowing owl	Breeding and wintering surveys (8)	Four surveys between February 15 and April 15 and four surveys spread evenly between September 1 and January 31
	Preconstruction surveys (2)	Preconstruction surveys no less than 14 days before and 24 hours before ground disturbance
Bats	1) Tree removal	September 15–October 30
	2) Disturbance of maternity colony	No disturbance until September 15
	3) Monitor tree removal	October 30–August 31

4.9 Fish and Aquatic Resources

4.9.1 Introduction

The following section describes the regulatory and environmental setting for fish and aquatic resources. The effects resulting from No Action Alternative, SB-7, and SB-8 are discussed along with mitigation measures required to reduce significant effects.

4.9.2 Affected Environment

The regulatory setting and environmental setting remain unchanged from those described in the FRWLP Final EIS and that information is hereby incorporated by reference in this integrated report. The FRWLP Final EIS addressed the Federal and state laws, and local policies and regulations relevant to fish and aquatic resources.

4.9.3 Determination of Effects

The purpose of this assessment is to determine whether the proposed project's effects on fish and aquatic resources are significant. Federal legislation requires that all Federal agencies consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect "essential fish habitat." Essential fish habitat 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 are considered essential fish habitat. The phrase "adversely affect" refers to the creation of any impact that reduces the quality or quantity of essential fish habitat. Federal activities that occur outside of an essential fish habitat but that may, nonetheless, have an impact on essential fish habitat waters and substrate must also be considered in the consultation process. Federal agencies undertaking water projects are required to fully consider recommendations made by USFWS, NMFS, and State fish and wildlife resource agencies in project reports and to include measures to reduce impacts on fish and wildlife in project plans. Criteria defining significant effects under CEQA are provided in Mandatory Findings of Significance in Section 15065(a)(1) of the State CEQA Guidelines. The project may have a significant effect on the environment if it has the potential to substantially degrade the quality of the environment; substantially reduce the habitat of a fish or wildlife species; cause a fish or wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; substantially reduce the number or restrict the range of an endangered, rare, or threatened species.

Consistent with this guidance, effects on fish and aquatic habitat are broadly defined as significant for this analysis if the project would contribute to any of the following effects in the study area.

- Degradation in the quantity or suitability of aquatic habitat of sufficient magnitude and/or duration to reduce the population levels of species of primary management concern.
- Loss of existing riparian habitat, especially that occurring below OHWM.
- Increase in predation of substantial magnitude and/or frequency to reduce the population levels of fish species in the Feather River.
- Interference with the movement of any resident or migratory fish species.
- Substantial long- or short-term loss of habitat quality or quantity.
- Substantial adverse effects on rare or endangered species, candidate species, other special-status species, or habitat of the species.

To further characterize effects on specific habitat parameters, qualitative thresholds (Table 4-38) were used to assess how individual construction effect mechanisms may contribute to the overall project effect.

Table 4-38. Construction-Related Impact Indicators

Impact Mechanism	Indicator Value
Shaded riverine aquatic habitat quantity and quality	Loss of existing shaded riverine aquatic habitat value, acreage, and riverside length resulting in habitat modification or degradation in the form of a reduction in physical habitat availability or habitat constituent element suitability for a species to substantially affect this species, relative to the basis of comparison.
Erosion, sedimentation, and turbidity	Increase in erosion, sedimentation, and turbidity resulting in habitat modification or degradation in the form of a reduction in physical habitat availability or habitat constituent element suitability for a species to substantially affect this species, relative to the basis of comparison.
Potential hazardous materials and chemical spills	Potential hazardous materials and chemical spills resulting in habitat modification or degradation in the form of a reduction in physical habitat availability or habitat constituent element suitability for a species to substantially affect this species, relative to the basis of comparison.
Hydrostatic pressure waves, noise, and vibration	Hydrostatic pressure waves, noise, and vibration resulting in habitat modification or degradation in the form of a reduction in physical habitat availability or habitat constituent element suitability for a species to substantially affect this species, relative to the basis of comparison.
Predation risk	Increase in predation of a species to substantially affect this species, relative to the basis of comparison.

4.9.3.1 Assessment Methods

In order to determine the proposed project's effects on fish species, fish biologists reviewed existing resource information related to the study area to evaluate whether sensitive habitats and special-status fish species are known from or could occur in the study area.

Construction activities near or in water can cause a range of short- and long-term effects on fish and aquatic resources. Short-term effects are those associated with construction-related activities that typically are limited to the immediate project area and duration of construction. The assessment methods for evaluating potential short-term, construction-related effects in the project area considered construction timing; physical habitat disturbance; potential for physical injury, hazardous spills, turbidity, sedimentation, and erosion resulting from short-term changes in habitat conditions; and the lifestage periodicity and habitat use by species of primary management concern. Long-term effects are those that result in adverse changes to habitat variables that reduce the suitability of fish habitat over a long time period.

Overall, potential effects on fish and aquatic resources were qualitatively assessed by identifying key effect mechanisms associated with construction activities, including the proximity to the Feather River, and evaluating the risk of those effects to harm fish or aquatic resources. Effects assessment methods rely on an understanding of potential effect mechanisms, general construction activities and timing, and a detailed understanding of species habitat use and life history characteristics. The potential effect mechanisms associated with construction activities that could occur under the project alternatives are described below.

4.9.3.1.1 Erosion, Sedimentation, and Turbidity

Ground-disturbing activities, such as grading, excavation, and vegetation removal, can result in large areas of exposed soils that are susceptible to erosion. Increased erosion could increase

sedimentation and siltation, resulting in increased turbidity in the Feather River, adjacent to the project area.

Construction-related increases in sedimentation and siltation above background condition potentially could affect listed anadromous fish and their habitat by reducing egg and alevin (juveniles still relying on the yolk sac for energy) survival, interfering with feeding activities, causing breakdown of social organization, and reducing primary and secondary productivity. The magnitude of potential effects on fish would depend on the timing and extent of sediment loading and flow in the stream before, during, and immediately following construction. Therefore, the effects assessment considers each of the flow and sediment factors to qualitatively evaluate whether the project alternatives would change conditions in the Feather River as a result of increased erosion, sedimentation, and turbidity.

4.9.3.1.2 Hazardous Materials and Chemical Spills

Use and storage of hazardous materials and chemicals (e.g., diesel fuel, lubricants, uncured concrete) near waterways potentially could impair water quality if chemicals or other construction materials are spilled or enter waterways. In general, construction-related chemical spills could affect fish by increasing physiological stress, reducing biodiversity, altering primary and secondary production, and possibly causing direct mortality (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998). Therefore, the effects assessment qualitatively evaluates the potential for hazardous materials and chemical spills to alter aquatic habitat conditions in the Feather River.

4.9.3.1.3 Habitat Modification

Long-term effects of levee repair and bank protection projects on aquatic habitat include loss or degradation of Shaded Riverine Aquatic (SRA) cover, including physical alteration of bank slope, substrate, and instream and overhead cover. Therefore, the potential for significant effects on fisheries resources was based on an assessment of the degree to which the project would affect these key habitat attributes in nearshore and seasonal inundation areas of the Feather River. Analyzing seasonal inundation areas involves understanding the relationships between the characteristics that define the floodplain, such as topography, vegetative cover, water surface elevation, depth, duration, and frequency of hydrologic events. Analysis of effects on woody vegetation relative to OHWM is the primary method for determining effects on critical habitat.

4.9.3.1.4 Hydrostatic Pressure Waves, Noise, and Vibration

No proposed in-water construction activities would occur under any of the action alternatives evaluated in this EIR/SEIS. Therefore, the potential for hydrostatic pressure waves, noise, and vibration to affect fish is relatively small. However, installation of sheet piles along proposed levee segments would involve equipment and activities that could produce subsurface pressure waves that could reach the Feather River and potentially affect fish and aquatic resources. These waves could result in underwater noise and vibration, thereby temporarily altering in-river conditions.

Of particular concern is the noise associated with pile driving that can cause sharp and dramatic hydrostatic pressure waves and vibration that can adversely affect all life stages of fish over relatively long distances (Washington et al. 1992). Hydrostatic pressure waves potentially could rupture the swim bladders and other internal organs of all life stages of fish in the immediate construction area (Bonneville Power Administration 2002; Jones & Stokes Associates 2001;

Washington et al. 1992). Additionally, noise and vibration generated by pile driving activities potentially could have sublethal effects on individual fish by inciting movement into lower quality habitats (Bonneville Power Administration 2002).

There is evidence that lethal effects can occur from pile driving, but accurately analyzing and addressing these effects, as well as sublethal effects (e.g., injury, temporary hearing threshold shifts, stress, behavioral disturbance), is complicated by several factors. Sound levels and particle motion produced from pile driving can vary depending on pile type, pile size, substrate composition, and type of equipment used. Also, the effects of underwater noise vary among species as a function of species morphology and species physiology. Further, Oriard (1985) and Jones & Stokes Associates (2001) noted that the effects of energy resulting from blasting in rock adjacent to waterways differs depending on the composition and slope of the bank and specifically is reduced relative to in-water blasting. Presumably, pile driving activities on land result in similar reductions in energy transfer to waterways, and thus would result in lesser effects than in-river pile driving activities. Therefore, the effects assessment qualitatively evaluates whether the project alternatives would be anticipated to change conditions in the Feather River as a result of hydrostatic pressure waves and increased noise and vibration caused by construction along the levee footprint.

4.9.3.1.5 Predation Risk

Proposed construction activities may increase river turbidity, reduce habitat suitability, and cause disorientation, which in turn could affect normal fish behavior. Deviation from normal behavior, associated with increased turbidity, reportedly increases the risk of predation (DeVore et al. 1980; Birtwell et al. 1984). However, it also has been reported that increased turbidity potentially could decrease predation on fish. In a study conducted in the Fraser River, it was found that juvenile Pacific salmon were less likely to encounter and be consumed by fish predators in turbid waters relative to clear waters (Gregory and Levings 1998). The effects assessment qualitatively evaluates whether the project alternatives would alter habitat conditions in the Feather River that potentially could increase the risk of predation.

Table 4-38 displays construction-related impact indicators.

4.9.4 Effects and Mitigation Measures

This section describes the environmental consequences relating to fish under the No Action Alternative and Alternatives SB-8 and SB-7. It describes the methods used to determine the effects of the action and lists the thresholds used to conclude whether an effect would be significant. The effects that would result from implementation of the action, findings with or without mitigation, and applicable mitigation measures are presented in a table under each alternative.

Effects and mitigation measure requirements concerning fish and aquatic resources are summarized in Table 4-39.

Table 4-39. Summary of Effects on Fish and Aquatic Resources

Effect	Finding	Mitigation Measure	Finding with Mitigation
Alternatives SB-7 and SB-8			
Effect FISH-1: Loss or Degradation of Riparian and SRA Cover (including Critical Habitat)	Less than significant	None required	Less than significant
Effect FISH-2: Construction-Related Erosion Resulting in Substantially Increased Sedimentation and Turbidity	Less than significant	None required	Less than significant
Effect FISH-3: Adverse Effects on Fish Health and Survival Associated with Potential Discharge of Contaminants during Construction Activities	Less than significant	None required	Less than significant
Effect FISH-4: Adverse Effects Caused by Construction Equipment Noise and Vibration	Less than Significant	None required	Less than Significant

4.9.4.1 No Action Alternative

The No Action Alternative represents the continuation of the existing deficiencies along the portion of the Feather River in the study area. Current levee operations and maintenance activities would continue, and there would be no change in the geomorphic and flood risk–management regimes relative to existing conditions.

Under the No Action Alternative, no construction-related release of contaminants would occur. Further, there would be no noise and disturbance effects or construction-related loss of habitat for special-status fish species. Because no levee improvements would be made under the No Action Alternative, the risk that the Feather River West Levee could fail because of under-seepage, slope stability, or geometry issues would continue. Failure of the Feather River West Levee, depending on the magnitude of the event, could cause catastrophic flooding.

A catastrophic levee failure could result in the displacement of fish into flooded areas and the potential for stranding and mortality. In addition, adverse water quality effects could result from the release of hazardous materials during a flood event, which could lead to stress and direct mortality of fish and could adversely affect migration, spawning, and rearing habitat of fish species in the Feather River and adjacent water bodies. Emergency clean-up and earth-moving activities also could result in an increase in sediment and turbidity and the release of hazardous materials into the Feather River and adjacent waterways that could adversely affect migration, spawning, or rearing habitat or result in direct mortality of special-status fish species. Depending on the magnitude of the flood, emergency clean-up activities could last for days, weeks, or even months. If a flood occurred in late winter, clean-up activities could last into the spring, a critical time for migration, movement, and rearing of spring-run Chinook salmon, steelhead, and green sturgeon. Given the unpredictable nature of emergency clean-up activities, is it likely that implementation of BMPs and measures to reduce effects on fish would not be possible. Restoration of this critical habitat could take decades. All of these effects would be considered significant; however, given the uncertainty of the occurrence or magnitude of such an event, potential effects on fish cannot be quantified based on available information.

O&M activities such as removal of vegetation and levee repair on the land side and waterside of the levees could occur at varying levels depending on which No Action scenario is implemented (See

Section 4.7.4.1). Effects from these activities are anticipated to be less than significant since all work is above the OHWM. Estimates of the total acres of riparian vegetation losses are presented in Section 4.7, *Vegetation and Wetlands*.

Effect FISH-1: Loss or Degradation of Riparian and SRA Cover (including Critical Habitat)

Loss of riparian and SRA cover resulting from removal of riparian vegetation and IWM along the shoreline of a river can adversely affect aquatic organisms and their habitat. Riparian vegetation serves important functions in stream ecosystems by providing shade, sediment storage, nutrient inputs, channel and streambank stability, habitat diversity, and cover and shelter for fish (Murphy and Meehan 1991). Shoreline areas are particularly important to juvenile salmonids and other native fishes that depend on such habitat for shelter from fast currents, protection from predators, and favorable feeding and growth conditions relative to open-water habitat. Riparian vegetation also acts to moderate stream temperatures. The effect of riparian vegetation on stream temperatures is greatest on small streams and decreases with increasing stream size. Because of the large size of the Feather River relative to its existing shoreline canopy, the effect of riparian vegetation in moderating water temperatures is minor compared with the effects of reservoir operations, discharge, and meteorological conditions (National Marine Fisheries Service 2006).

Moderate- to high-quality SRA cover is present in some areas where dense riparian vegetation and IWM occurs below the OHWM. Full application of the Vegetation ETL would not affect SRA cover or critical habitat below the OHWM. The removal of trees would be considered a loss of riparian habitat and the effect would be considered significant and unavoidable at least in the short term, but would be mitigated to a less-than-significant level over the long term with compensatory mitigation as described in Section 4.7.4.2, *Vegetation and Wetlands*. Under a variance or modified application of the Vegetation ETL, the effect would be considered less than significant because there would not be a substantial temporal loss and because the existing riparian and SRA cover below the OHWM within the project area would remain intact.

4.9.4.2 Alternative SB-8

Effect FISH-1: Loss or Degradation of Riparian and SRA Cover (including Critical Habitat)

SB-8 construction activities are assumed to result in removal of all riparian vegetation within the construction footprint. No construction activities are proposed in-river or below the OHWM; all activities that would result in physical disturbance and removal of vegetation on the waterside slope of the levee would be limited to areas above the OHWM. Therefore, no physical modification of critical habitat for ESA-listed fish species would be expected. Most of the affected areas are set well back from the river, averaging approximately 1,400 feet and ranging from approximately 50 to 5,600 feet from the Feather River during typical summer base flows. The NMFS has concurred in a letter dated September 26, 2013 with USACE's determination that SB-8 "is not likely to adversely affect" listed fish species (Appendix D). Although not directly modifying critical habitat, the removal of vegetation from these areas may indirectly affect critical habitat through temporal reductions in large wood recruitment, nutrient contributions, and other riparian functions. NMFS determined that the proposed action would adversely affect essential fish habitat (EFH) designated under the Magnusson-Stevens Conservation and Management Act. NMFS in their September 26, 2013 concurrence letter (Appendix D) provided conservation recommendations pursuant to the Act. USACE adopted the conservation recommendations of the NMFS to avoid or minimize adverse effects to EFH.

To compensate for permanent and temporary loss of woody riparian vegetation, compensatory mitigation is proposed (VEG-MM-1) to ensure no net loss of habitat functions and values as described in the mitigation and monitoring plan (MMP) (Appendix D). For the purposes of NEPA and CEQA, the effect on fisheries resources would be less than significant.

Effect FISH-2: Construction-Related Erosion Resulting in Sedimentation and Turbidity

Temporary disturbance of fish and degradation of habitat may occur during construction activities for SB-8. Construction activities occurring along the levee footprint could cause increased sedimentation and turbidity during spawning periods that would result in significant and adverse effects on special-status species. However, with the project environmental commitment to implement a SWPPP, described in Section 4.3.4.2, and standard erosion and sediment control BMPs, these effects are expected to be less than significant.

Effect FISH-3: Adverse Effects on Fish Health and Survival Associated with Potential Discharge of Contaminants during Construction Activities

Accidental spills or leakage of contaminants such as bentonite, gasoline, lubricants, and other petroleum-based products could kill or injure fish in the project area. Adverse effects related to contaminant spills and leaks are potentially significant but would be adequately mitigated by implementing a spill prevention, control, and countermeasure plan and a SWPPP, as described in Section 4.3.4.2, as part of the environmental commitments for the project. Therefore, potential effects associated with contaminant spills are expected to be less than significant.

Effect FISH-4: Adverse Effects Caused by Construction Equipment Noise and Vibration

Construction activities near the Feather River may result in noise and vibrations that could potentially adversely affect fish is described in the FRWLP Final EIS. Temporary disturbance to fish may occur during construction activities including driving of sheet piles through the crown of the levee. Sheet piles would be used only as a site-specific treatment (rather than applied on a reach-wide basis) such as at roadway or railroad crossings, and would be restricted to the levee crown above the OHWM where sound waves would be expected to attenuate quickly before reaching the Feather River. Consequently, pile driving activities would have negligible noise and vibration effects on fish in the Feather River. Therefore, the level of underwater noise from the upland sheet pile driving under SB-8 is anticipated to result in a less-than-significant effect on fish.

4.9.4.3 Alternative SB-7

Effect FISH-1: Loss or Degradation of Riparian and SRA Cover (including Critical Habitat)

SB-7 construction activities are assumed to result in removal of all riparian vegetation within the construction footprint. An estimate of the total acreage of riparian vegetation to be removed is presented in Section 4.7, *Vegetation and Wetlands*, Table 4-26. No construction activities are proposed in-river or below the OHWM; all activities that would result in physical disturbance and removal of vegetation on the waterside slope of the levee would be limited to areas above OHWM. Therefore, no physical modification of critical habitat for ESA-listed fish species would be expected. Most of the affected areas are set well back from the river, averaging approximately 1,400 feet and ranging from approximately 50 to 5,600 feet from the Feather River during typical summer base flows. Although not directly modifying critical habitat, the removal of vegetation from these areas

may indirectly affect critical habitat through temporal reductions in large wood recruitment, nutrient contributions, and other riparian functions.

To compensate for permanent and temporary loss of woody riparian vegetation, compensatory mitigation is proposed (VEG-MM-1) to ensure no net loss of habitat functions and values as described in the MMP (Appendix D). For the purposes of NEPA and CEQA, the effect on fisheries resources would be less than significant with implementation of mitigation.

Effect FISH-2: Construction-Related Erosion Resulting in Sedimentation and Turbidity

Temporary disturbance of fish and degradation of habitat may occur during construction activities. Construction activities occurring along the levee footprint could cause increased sedimentation and turbidity during spawning periods, resulting in significant adverse effects on special-status species (salmonids and green sturgeon). However, with implementation of the environmental commitment to implement a SWPPP, and standard erosion and sediment control BMPs as part of the project, these effects are expected to be less than significant.

Effect FISH-3: Adverse Effects on Fish Health and Survival Associated with Potential Discharge of Contaminants during Construction Activities

Accidental spills or leakage of contaminants such as bentonite, gasoline, lubricants, and other petroleum-based products could kill or injure fish in the project area. Effects on fish may potentially exist during construction activities on the waterside slope of the levee. Adverse effects related to contaminant spills and leaks would be potentially significant but would be adequately mitigated by implementing a spill prevention, control, and countermeasure plan and a SWPPP. Therefore, potential effects associated with contaminant spills are expected to be less than significant.

Effect FISH-4: Adverse Effects Caused by Construction Equipment Noise and Vibration

Temporary disturbance of fish resulting from construction generated noise and vibration may occur as described for SB-8, but effects would be limited to a shorter length of levee (about 27 miles instead of about 41 miles). Because construction would occur only on land adjacent to the Feather River and not in the watercourse itself, potential effects associated with noise and vibration would be less than significant.

4.10 Visual Resources

4.10.1 Introduction

This section evaluates potential impacts of the alternatives on visual resources. Section 3.13, *Visual Resources*, of the FRWLP Final EIS addressed the visual resources of the project area; described the visual character and quality; evaluated the significance and quality of views of the area; and analyzed the potential impacts the FRWLP would have on visual resources, and that information is incorporated by reference.

4.10.2 Affected Environment

4.10.2.1 Regulatory Setting

The *Regulatory Setting* section in the FRWLP Final EIS has remained unchanged and that information is incorporated by reference. The FRWLP Final EIS did not identify any Federal or state policies related to visual resources that apply to the implementation Feather River West Levee improvements.

4.10.2.2 Environmental Setting

The following is brief summary of the visual character of the region and project area based on information contained in the FRWLP Final EIS.

4.10.2.2.1 Visual Character of the Region

The study area is located in the region of California's Sacramento Valley (valley). Yuba City is the largest city in the project area and is connected by State Route 99 to the smaller cities of Gridley and Live Oak. The city of Biggs in Butte County is located a short distance off State Route 99.

Agricultural land, planted predominantly with row crops and orchards, stretches for miles in the region. A patchwork of fields surrounds the suburban outskirts of cities and communities, separating developed areas. When haze is at a minimum, these fields offer expansive views that extend over agricultural fields and recent development in the foreground to the middleground and background. The Sutter Buttes can be seen vividly rising up from the flat valley floor in the background, based on the viewer's location in the landscape. Views of the Coast Range to the west are common. Background views to the Sierra Nevada foothills to the east are rarer because of atmospheric haze.

While much of the valley is still in agricultural production, agricultural land has been and continues to be converted to suburban land uses. This trend is evident around the outskirts of Yuba City, Gridley, and Live Oak. Smaller, agrarian communities have not experienced a great deal of new development or growth over the past decade. Development in the region is typified by a growing core of residential, commercial, and some industrial land uses, with agricultural fields surrounding the city outskirts.

4.10.2.2.2 Visual Character and Quality of the Project Vicinity

The project area can be divided into two categories based on, and defined by, similar existing visual characteristics, visual qualities, and associated viewer groups: rural reaches and urban reaches.

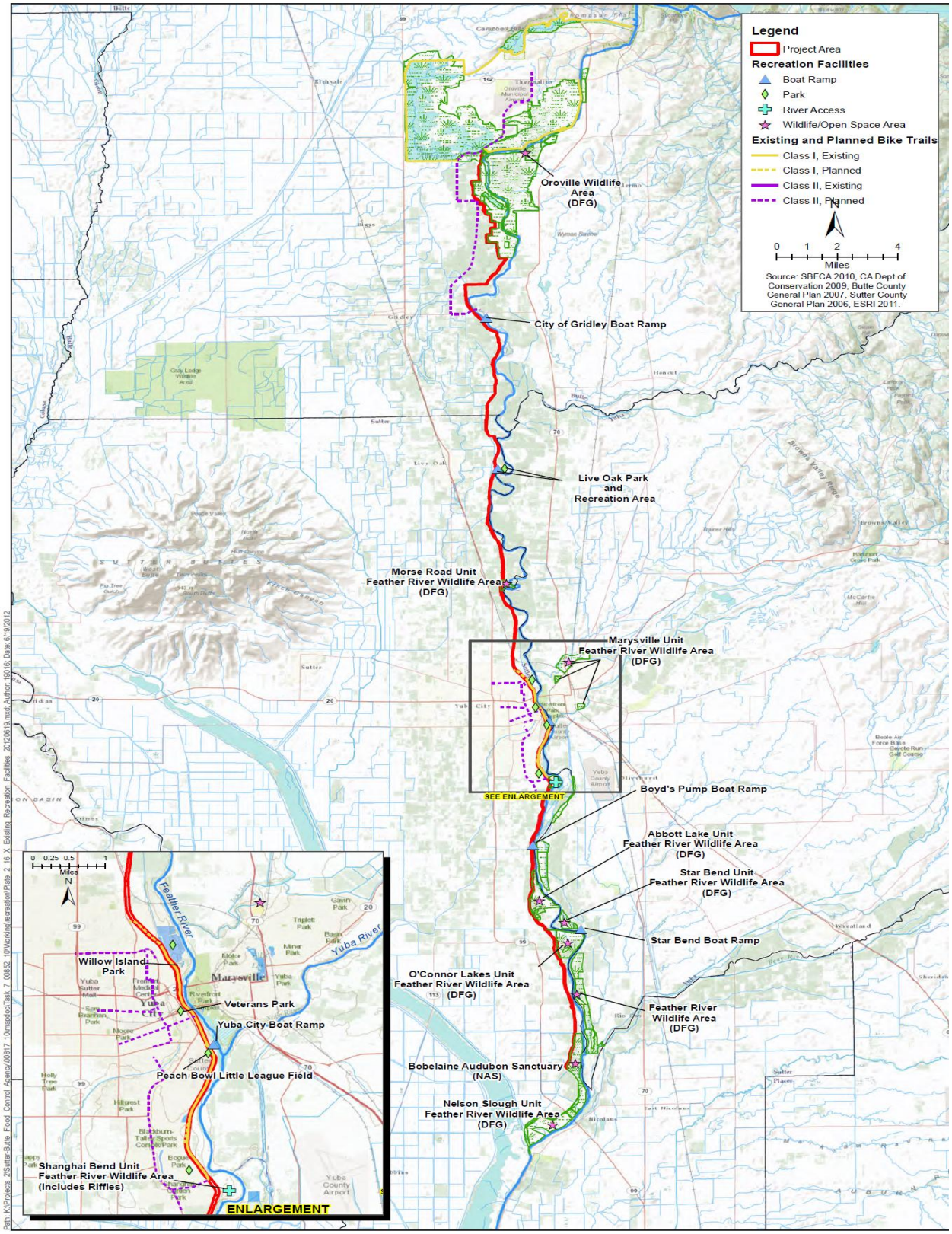
Rural Reaches

Rural reaches include portions of the project area where the adjacent land use is primarily large blocks of land used for agriculture. These agricultural fields are routinely leveled, disked, and planted in row crops or orchards. Consistency in the visual character is found by the common element of agriculture in the foreground and middleground.

Rural reaches comprise Reaches 2 through 11 (up to station 820+00) and Reaches 18 (beginning at station 1150+00) to 41. While the character of these rural reaches is primarily agricultural, they do contain public recreation opportunities, as shown in Plate 4-8, including the Feather River Wildlife

Areas (Nelson Slough Unit, O'Connor Lakes Unit, Abbot Lake Unit, and Morse Road Unit), Bobelaine Audubon Sanctuary, Boyd's Boat Ramp, Live Oak Park and Recreation Area, City of Gridley Boat Ramp, and the Oroville Wildlife Area. These public areas provide visual and recreational opportunities to appreciate the river and its surrounding environment. Aside from those public areas, the rural reaches are defined by agricultural uses that stretch for miles.

Plate 4-8. Existing Recreation Facilities near the Project Area



The rural reaches of the project area have been evaluated for scenic character and quality. As described in the FRWLP Final EIS, visual quality ratings were assigned for vividness, intactness, and unity on a scale of 0 to 7, with 7 being the highest quality. The overall visual quality of the rural reaches was determined to be moderate (3.5–4.3). Vividness (V=3.5–4), intactness (I=3.5–4.5), and unity (U=3.5–4.5) were determined to be moderate to moderately high because the vast amount of agricultural fields and orchards coupled with the mature vegetation along the river corridor provide a more unique and pleasing visual experience.

Urban Reaches

Urban reaches are those areas in the project area where the adjacent land uses have a higher density of residential, commercial, and industrial uses. The only urban reaches in the project area are in Yuba City, which includes Reach 11 (starting at station 820+00) through Reach 18 (ending at station 1150+00).

Adjacent development in the project area for these reaches is composed of residential subdivisions; commercial and industrial uses; park, recreation, and open space land uses; and the Sutter County Airport. Along these reaches are significant roadways, such as State Route 20 (Colusa Avenue), the Twin Cities Memorial Bridge, Shanghai Bend Road, 2nd Street, and Live Oak Boulevard.

The overall visual quality of the urban reaches is moderately low to moderate (3.2–3.8). Vividness (V=2.5–3.5), intactness (I=3.5–4), and unity (U=3.5–4) are moderately low to moderate (FRWLP Final EIS, page 3.13-6). This is because the contrasting built elements of Yuba City that combine with the Feather River corridor lack a coherent and harmonious visual pattern. The urbanization associated with Yuba City does not provide visual order; rather, it encroaches into the Feather River corridor.

4.10.2.2.3 Viewer Groups and Viewer Responses

The primary viewer groups in the project area are people living or conducting business near levees; travelers using highways and smaller local roads; and recreational users (including boaters and beachgoers along the Feather River; anglers using canals, creeks, and rivers; trail users; equestrians; bicyclists; and joggers). Residents are considered to have high sensitivity to changes in the viewshed because of their potential exposure to such views, proximity to the project area, and sense of ownership. Viewer sensitivity is considered high among recreational users in the project area because they are more likely to value the natural environment, appreciate the visual experience, have an enhanced sense of ownership, and be more sensitive to changes in views. Recreational uses consist of boating and fishing; hunting in the bypasses; birding; and walking, running, jogging, and bicycling along trails, levee crowns, and local roads.

4.10.3 Determination of Effects

Effects on visual resources may be considered significant if an alternative would result in any of the following conditions.

- Cause a substantial, demonstrable negative aesthetic effect on a scenic vista or view open to the public.
- Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.

- Substantially degrade the existing visual character or quality of the site and its surroundings.
- Create a new source of substantial light or glare that would adversely affect day or nighttime public views.

According to professional standards, a project may be considered to have an adverse (i.e., significant) effect if it would substantially:

- Conflict with local guidelines or goals related to visual quality.
- Alter the existing natural viewsheds, including changes in natural terrain.
- Alter the existing visual quality of the region or eliminate visual resources.
- Increase light and glare in the project vicinity.
- Result in backscatter light into the nighttime sky.
- Result in a reduction of sunlight or introduction of shadows in community areas.
- Obstruct or permanently reduce visually important features.
- Result in long-term (persisting for 2 years or more) adverse visual changes or contrasts to the existing landscape as viewed from areas with high visual sensitivity.

There are no roadways in or near the project area that are designated in Federal or state plans as scenic highways; therefore, there would be no effects on a state scenic highway.

4.10.4 Effects and Mitigation Measures

This section describes the environmental consequences relating to visual resources. Effects and mitigation measure requirements concerning visual resources are summarized in Table 4-40.

Table 4-40. Summary of Effects for Visual Resources

Effect	Finding	Mitigation Measures	Finding with Mitigation
Alternatives SB-7 and SB-8			
Effect VIS-1: Result in Temporary Visual Effects from Construction	Significant	None available	Significant and unavoidable
Effect VIS-2: Adversely Affect a Scenic Vista	Significant	None available	Significant and unavoidable
Effect VIS-3: Substantially Degrade the Existing Visual Character or Quality of the Site and Its Surroundings	Significant	None available	Significant and unavoidable
Effect VIS-4: Create a New Source of Substantial Light or Glare That Would Adversely Affect Day and Nighttime Public Views	Less than significant	None required	Less than significant

4.10.4.1 Effects Not Addressed Further in this Document

Effect VIS-4: Create a New Source of Substantial Light or Glare That Would Adversely Affect Day and Nighttime Public Views

The FRWLP Final EIS addressed new sources of substantial light or glare that would adversely affect day or nighttime views in the project area. Alternatives SB-7 and SB-8 would not create permanent new sources of light and glare, or result in changes to these conclusions; therefore, this issue is not discussed further.

4.10.4.2 No Action Alternative

The No Action Alternative represents the continuation of the existing deficiencies along the portion of the Feather River in the study area. Current levee operations and maintenance activities would continue, but there would be no change in the geomorphic and flood risk–management regimes relative to existing conditions. No levee improvements would be made to decrease flood risk. No construction-related effects relating to visual resources such as vegetation removal, displacement of agricultural land or development, or construction of a new levee, cutoff wall, and landside seepage and stability berms would occur.

It assumed under the future without-project conditions, that the existing vegetation that is in noncompliance with the standard project operations and maintenance manual would be removed. SFBCA has provided the Corps of Letter of Intent to apply for a SWIF to bring the levee into compliance. The extent of vegetation removal under the SWIF would be confined to the levee prism, which would involve less vegetation removal than under full application of the Vegetation ETL. Full application of the Vegetation ETL would require prohibition and removal of woody vegetation within the levee prism and within 15 feet of the landside or waterside levee toes. The degree of visual change in character and diminishment in visual quality from loss of the trees could be potentially significant and unavoidable if the losses are not adequately mitigated.

Without implementation of the SBPFS alternatives, visual resources are expected to remain similar to existing conditions, aside from vegetation removal pursuant to the O&M manual. The visual character could change in the event of a levee failure. Catastrophic flooding has the potential to destroy vegetation, infrastructure, and development. Such an event would cause a change in the existing visual character and potentially could lay waste to miles of land. Scenic vistas would be significantly altered for an extended period of time, or irreparably damaged, because views across this landscape would be so changed. The necessary cleanup after such an event would introduce considerable heavy equipment and associated vehicles, including bulldozers, excavators, water trucks, and haul trucks, into the viewshed. It is assumed that these effects would be significant; however, given the uncertainty of the occurrence or magnitude of such an event, the effects cannot be quantified based on available information.

4.10.4.3 Alternative SB-8

The effects of SB-8 on visual resources would be similar to Alternative 3 described in the FRWLP Final EIS, except as discussed below.

Effect VIS-1: Result in Temporary Visual Effects from Construction.

Alternative SB-8 would have substantially greater impacts on vegetation than under the proposed FRWLP. All vegetation, except for erosion-controlling grasses, within the immediate construction footprint and within 15 feet of the waterside and landside levee toe would be removed during construction, in addition to the vegetation that would be removed for construction access and staging. The removal of mature landscape and native trees would substantially change the aesthetic qualities of the area. In reaches where only a narrow band of vegetation exists, complete removal of vegetation could result in a drastic visual change. Complete removal would contrast sharply from the existing visual landscape from one that is vegetated to one without vegetation. Visual effects would be significant because of the proximity to highly sensitive residential viewers, roadway users, and recreationists. Trees and other vegetation cannot be replanted to reduce the severity of this short- and long-term effect. The magnitude of this effect is considered significant and unavoidable.

Effect VIS-2: Adversely Affect a Scenic Vista

The river and numerous roadways throughout and near the project area offer scenic vistas of contrasting landscape features. Development associated with Yuba City and the expansive agricultural fields are softened by the riparian corridors that line the river. Vistas from the river would be affected by vegetation removal; however, removal of vegetation could create new vistas. Both Alternatives SB-8 and SB-7 would adversely affect vistas in the urban reaches to an equal extent; however, the total disturbance area would be considerably greater for Alternative SB-8. Vegetation to be cleared from the VFZ would have a substantial effect on the visual character and result in a substantial reduction in the overall visual quality, including scenic vistas. Therefore, these effects are considered significant and unavoidable with no mitigation available due to the nature of the effects.

Effect VIS-3: Substantially Degrade the Existing Visual Character or Quality of the Site and Its Surroundings

As discussed under Effect VIS-1 and VIS-2, the magnitude of the loss of vegetation to be cleared from the VFZ coupled with the loss of agricultural land, would have a substantial effect on the visual character and result in a substantial reduction in the overall visual quality. Both Alternatives SB-7 and SB-8 would adversely affect vistas in the urban reaches of Yuba City to an equal extent. Accordingly, these effects are considered significant and unavoidable with no mitigation available due to the nature of the effects.

4.10.4.4 Alternative SB-7

Effect VIS-1: Result in Temporary Visual Effects from Construction

This effect would be comparable in type to the effect under Alternative SB-8, but at a lesser magnitude because there would be no construction above Sunset Weir. However, alternative SB-7 would similarly adversely affect visual quality in the urban reaches of Yuba City. Accordingly, these effects are considered significant and unavoidable with no mitigation available due to the nature of the effects.

Effect VIS-2: Adversely Affect a Scenic Vista

This effect would be comparable in type to the effect under Alternative SB-8, but at a lesser magnitude. However, Alternative SB-7 would similarly adversely affect visual quality in the urban reaches of Yuba City. Accordingly, these effects are considered significant and unavoidable with no mitigation available due to the nature of the effects.

Effect VIS-3: Substantially Degrade the Existing Visual Character or Quality of the Site and Its Surroundings

The magnitude of the loss of vegetation to be cleared from the VFZ coupled with the loss of agricultural land would be less under SB-7 than under SB-8, but there would still be a substantial effect on the visual character and vistas in the urban reaches of Yuba City. Accordingly, these effects are considered significant and unavoidable with no mitigation available due to the nature of the effects.

4.11 Recreation

4.11.1 Introduction

This section evaluates potential impacts of the alternatives on recreation. Section 3.14, *Recreation*, of the FRWLP Final EIS described recreation facilities and opportunities in the study and project areas. The FRWLP Final EIS analyzed the potential impacts the FRWLP would have on recreation, and that information is incorporated by reference.

4.11.2 Affected Environment

4.11.2.1 Environmental Setting

The following is brief summary of the visual character of the project area excerpted from the FRWLP Final EIS.

The Feather River and its adjacent levees are a popular recreation venue for local residents and visitors. While recreation opportunities vary among locations along the river, recreationists are attracted to water-based recreation as well as land-based recreation on the levees and facilities surrounding the river. Water-based recreation activities include boating, fishing, kayaking, canoeing, floating, tubing, water skiing, and swimming. Land-based activities include bicycling, walking, hiking, hunting, bird-watching, wildlife viewing, enjoying nature trails, photography, and picnicking. Access to the right (west) bank of the Feather River is provided by state wildlife areas, local parks, and a wildlife sanctuary. Many parts of the shoreline, especially north of Yuba City, are inaccessible to recreationists.

4.11.2.2 Formal Recreation Facilities

Of the 41 project reaches that comprise the project area, flood management measures are proposed in 34 of the reaches. Recreation facilities and resources are located in, or adjacent to, 22 of the project reaches. The following formal recreation facilities and resources in, adjacent to, or within view of the project area are described below from north to south (Plate 4-8).

4.11.2.2.1 Oroville Wildlife Area

The Oroville Wildlife Area (OWA) is managed by the California Department of Fish and Wildlife. The OWA is 11,869 acres in size and is primarily riparian woodland along the Feather River and Thermalito Afterbay (California Department of Fish and Game 2012). There are approximately 10.5 miles of levee on the west side of the Feather River within the OWA. About 5.5 miles of this levee are within the project area, Reaches 33 through 41.

4.11.2.2.2 City of Gridley Boat Ramp

The City of Gridley Boat Ramp is managed by the City of Gridley. The City of Gridley Boat Ramp is located within view of the FRWLP Reach 30 on the east side of the Feather River outside of the project area. The boat ramp is next to the city's water treatment plant and provides opportunities for boating and day use (City of Gridley 2010:18).

4.11.2.2.3 Live Oak Park and Recreation Area

The Live Oak Park and Recreation Area is managed by Sutter County. The campground, RV park, and boat ramp at the facility allow for camping and boating in addition to swimming, picnicking, and day use (City of Live Oak 2010:2). The Live Oak Park and Recreation Area is located within Reach 23.

4.11.2.2.4 Feather River Wildlife Area

The Feather River Wildlife Area (FRWA) is composed of eight separate wildlife area management units. Five wildlife area units are located on the west side of the Feather River and are within the project area. These five areas from north to south are: Morse Road Unit, Shanghai Bend Unit, Abbott Lake Unit, O'Connor Lakes Unit, and Nelson Slough Unit. These five unites total 1,724 acres (California's Protected Areas Database 2012). Three units are located on the east side of the Feather River and are visible from and have views to the project area. These three areas from north to south are: Marysville Unit, Star Bend Unit, and Lake of the Woods Unit. Morse Road Unit is a 62-acre management unit located within project Reach 19. Marysville Unit is located across from project Reaches 16 and 17. Shanghai Bend Unit is a 98-acre management unit located within project Reaches 11 through 13. Abbott Lake Unit is a 409-acre management unit located within project Reaches 7 and 8. Star Bend Unit is located across from project Reaches 6 and 7. O'Connor Lake Unit is a 467-acre management unit located within project Reaches 5 and 6. Lake of the Woods Unit is located across from project Reaches 3 through 5. Nelson Bend Unit is a 688-acre management unit located within project Reach 2 (California's Protected Areas Database 2012).

4.11.2.2.5 Park and Recreation Facilities within Yuba City

There are six park and recreation facilities in Yuba City within the project area. From north to south these are: Feather River Parkway Bike Trail, Willow Island Park, Veterans Park, Yuba City Boat Ramp, Peach Bowl Little League Fields, and Yuba Sutter Dog Park (City of Yuba City 2004:6-4). The most notable are the Feather River Parkway Bike Trail and Willow Island Park.

Feather River Parkway Bike Trail is 5 miles long between Northgate Drive and Shanghai Bend Road located within Reaches 12 through 17. The trail is heavily used (McIntire pers. comm.). The trail will connect to Yuba City's Class I and Class II bike trail network at Northgate Drive, B Street, and Shanghai Bend Road in the future (Feather River Air Quality Management District 1995: 16).

Willow Island Park is 172 acres in size and is located within project Reaches 16 and 17. Construction is under way. The first phase of Willow Island Park includes pedestrian and bicycle trails, a picnic area, and a parking lot, with more amenities planned for future phases. Willow Island Park is expected to be a heavily used park once completed (McIntire pers. comm.).

4.11.2.2.6 Boyd's Pump Boat Ramp

The Boyd's Pump Boat Ramp, just south of Yuba City, is a public boat launching facility on the Feather River managed by Sutter County. The facility has a parking area and boat ramp that provides an opportunity for motorized and nonmotorized boat launching. This facility is located within Reach 9.

4.11.2.2.7 Bobelaine Audubon Sanctuary

The Bobelaine Audubon Sanctuary is a 430-acre wildlife sanctuary owned by the National Audubon Society and managed by volunteers of the Sacramento Audubon Society. Bobelaine is a rare remnant of the riparian forests that once projected 2 to 5 miles on either side of the rivers in the Great Central Valley of California. The sanctuary is registered as a "State Ecological Reserve" and is protected by the California Department of Fish and Wildlife and the National Audubon Society. It is also listed as part of an "Important Bird Area" by the National Audubon Society. Hiking, walking, and wildlife viewing are all allowed recreational uses within the preserve (Sacramento Audubon Society 2012). Bobelaine Audubon Sanctuary is located within Reaches 2 and 3.

4.11.2.3 Regulatory Setting

The *Regulatory Setting* portion of FRWLP Final EIS, Section 3.14, lists the following Federal and state policies related to recreation.

- Federal:
  - 2004 Engineering Manual 1110-1-400 (EM) prepared by USACE.
  - Recreation Facility Design Guidelines prepared by U.S. Department of the Interior.
- State:
  - *Feather River Wildlife Area Management Plan* (California Department of Fish and Game 1991).

4.11.3 Determination of Effects

Effects on recreation may be considered significant if implementation of an alternative would result in any of the following conditions.

- Increase the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated.
- Include recreation facilities or require the construction or expansion of recreation facilities that might have an adverse physical effect on the environment.
- Substantially restrict or reduce the availability or quality of existing recreation opportunities in the project vicinity.

- Implement operational or construction-related activities related to the placement of project facilities that would cause a substantial long-term disruption of any institutionally recognized recreation activities.
- Result in increased risk to recreationists in or adjacent to the project vicinity.

The proposed alternatives do not include the construction of recreation facilities.

4.11.4 Effects and Mitigation Measures

As described in the FRWLP Final EIS, there is a substantial variety of type and intensity of recreation occurring at sites along the Feather River within the project area. Effects and mitigation measure requirements concerning recreation are summarized in Table 4-41.

Table 4-41. Summary of Effects for Recreation

Effect	Finding	Mitigation Measures	With Mitigation
Alternatives SB-7 and SB-8			
Effect REC-1: Temporary Changes in Recreation Opportunities during Construction	Less than significant	None required	Less than significant
Effect REC-2: Long-Term or Permanent Loss of Recreation Opportunities in the Levee Corridor	Less than significant	None required	Less than significant

4.11.4.1 No Action Alternative

Under No Action, construction activities associated with the proposed program would not occur. While pre-scheduled levee maintenance activities and any required emergency repairs would continue to be conducted, the levees, riverbanks, and associated recreation uses would remain unchanged from their current (baseline) conditions. Levees would be subject to ongoing risk of levee failure. Failure of the levee and subsequent flooding would result in potentially significant effects on recreation resources and public safety.

4.11.4.2 Alternative SB-8

The effects of SB-8 on recreation resources would be similar to effects under the FRWLP preferred alternative. Recreation activities would be disrupted during construction along the levee crown and adjacent construction and staging areas likely would be closed to public access at most of the project sites during construction. In places where construction occurs close to recreation areas, the areas themselves may not be closed but the proximity to construction equipment and activity may degrade recreation experiences.

In addition to the adverse effects during construction, levee improvements proposed for Alternative SB-8 would follow USACE policies regarding vegetation on levees, which does not allow woody vegetation on the slopes of the levee or within 15 feet of the waterside and landside levee toes. This would require the removal of a substantial amount of mature trees and vegetation in addition to those losses that would otherwise occur under the FRWLP.

Many recreation activities are enhanced by or depend on the presence of mature woody vegetation. Recreationists, such as anglers, pedestrians, cyclists, boaters, and swimmers, use woody vegetation

for shade, while wildlife and nature viewers enjoy the various wildlife and aesthetic values that this vegetation supports and for the visual characteristics it contributes to the landscape. Permanent loss of woody vegetation on and within 15 feet of levees could reduce the quality of existing recreation activities.

At construction sites where feasible, implementation of Mitigation Measure VEG-4 MM-1: Compensate for the Loss of Woody Riparian Habitat (described in Section 4.7, *Vegetation and Wetlands*), would reduce but may not fully compensate for effects. At construction sites where this mitigation measure is not feasible to implement onsite because of the Vegetation ETL, the effect would remain adverse and unavoidable, but less than significant because recreation opportunities degraded by vegetation removal, such as hiking, hunting, and wildlife viewing are not unique but are allowed and supported by the several nearby recreation facilities. No loss of developed recreation facilities or infrastructure would be displaced by the project. The riparian habitat compensation proposed under Measure VEG-4 MM-1 at the Star Bend Conservation Area and TRLIA restoration site would enhance recreation opportunities in these areas.

4.11.4.3 Alternative SB-7

Effects associated with Alternative SB-7 would be comparable in type to those described above for Alternative SB-8, but at a lesser magnitude due to the reduced footprint of the alternative. At construction sites where feasible, implementation of Mitigation Measure VEG4 MM-1: Compensate for the Loss of Woody Riparian Habitat (described in Section 4.7, *Vegetation and Wetlands*), would reduce but may not fully compensate for effects. At construction sites where this mitigation measure is not feasible, the effect would remain adverse and unavoidable, but less than significant as described above for Alternative SB-8.

4.12 Cultural Resources

4.12.1 Introduction

This section evaluates potential impacts of the alternatives on cultural resources. Section 3.17, *Cultural Resources*, of the FRWLP Final EIS described the regulatory and environmental setting and the potential impacts of the FRWLP. That information is incorporated by reference.

4.12.2 Affected Environment

The identification of cultural resources to this point has consisted of a record and literature search at the Northeast Information Center, a built environment survey conducted by ICF International (ICF), and a pedestrian survey for prehistoric resources, also conducted by ICF. The results of these surveys have not yet been formally reported. In order to satisfy the requirements of CEQA, ICF plans to conduct archaeological test excavations on all archaeological sites encountered in the course of the pedestrian survey to determine their significance and to evaluate project impacts on those sites.

Consultation with Native American tribes is a key aspect of USACE consideration of cultural resources. The tribes whom USACE has contacted are listed in the FRWLP Final EIS. USACE has been in continued consultation with the two tribes that have responded to outreach efforts so far: the United Auburn Indian Community (UAIC) and Enterprise Rancheria. Consultation with the UAIC has resulted in the identification of a new, presently unnamed prehistoric site that may exist within the

project area. USACE will continue to include all these tribes in all decisions regarding cultural resources.

USACE has identified tentative areas of potential effects (APE) for each of the project alternatives. These areas are largely the same as the final APE that has been formally determined and documented by USACE and the California State Historic Preservation Officer (SHPO) for the FRWLP project. Differences that exist between these areas are described in more detail in Section 4.12.4, *Effects and Mitigation Measures*, below.

USACE negotiated a programmatic agreement (PA) with SHPO that outlines the specific processes that USACE will follow to identify and treat cultural resources (Appendix D). The PA took effect after it was signed by USACE and SHPO on June 8, 2012, and was subsequently transmitted to the Advisory Council on Historic Preservation. USACE's adherence to the processes outlined in the PA constitutes full compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, 16 USC Section 470f (Section 106).

In accordance with the terms of the PA, before construction begins, the following will occur.

- USACE and SHPO will formally agree upon a final APE for the project. The APE comprises the entirety of the area where cultural resources could potentially be affected by the project.
- USACE, in consultation with SHPO, will fully inventory the APE for cultural resources. This inventory will include both the pedestrian survey efforts conducted to date by ICF, as well as subsurface prospection efforts.
- In consultation with SHPO, USACE will evaluate all cultural resources in the APE for their eligibility for listing in the National Register of Historic Places (NRHP). Work necessary for these evaluations may include detailed recordation, background research, and test excavation.
- In consultation with the SHPO, the public, interested Native American Tribes, or other identified stakeholders, USACE will provide adequate mitigation to resolve any unavoidable adverse effects on NRHP eligible cultural resources (historic properties).

4.12.3 Determination of Effects

Effects on cultural resources are considered significant for the purposes of this EIR/SEIS if the project alternative would result in any of the following, under the respective laws that govern the undertaking.

- Under NEPA, effects are significant if they would 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 Section 800.5(a)[1]). These are the criteria of adverse effect under NHPA. USACE uses the NHPA threshold of adverse effect to determine significant effects under NEPA. Therefore, significant effects under NEPA only include effects on resources that are NRHP-eligible or NRHP-listed; effects on resources considered significant under state law are not significant effects under NEPA if those resources do not qualify for listing in the NRHP.
- Under CEQA, an effect is significant if it involves demolition or materially altering the qualities that justify the resource for eligibility or inclusion on the California Register of Historic Resources (State CEQA Guidelines Section 15064.5[b][2][A],[C]).

- Under CEQA, a project also would have a significant impact if it would demolish or materially alter the qualities that justify the inclusion of the resource on a local register (State CEQA Guidelines Section 15064.5[b][2][B]) or its identification as a historical resource survey meeting the requirements of Public Resources Code Section 5024.1(g).
- CEQA also covers effects on unique archaeological sites. Effects on unique archaeological sites are significant if the project would demolish or materially impair the characteristics that allow a site to qualify as a unique archaeological resource (Public Resources Code Section 21083.2[g]).
- CEQA protects interred human remains. Under CEQA, an effect is significant if the project would disturb human remains, including remains interred outside of established cemeteries (State CEQA Guidelines, Appendix G checklist).

4.12.4 Effects and Mitigation Measures

Effects and mitigation measure requirements concerning cultural resources are summarized in Table 4-42. Effects on NRHP eligible properties and archaeological sites would be resolved through the processes outlined in the PA. Though the resolution of adverse effects under Section 106 would reduce most effects to a less-than-significant level under NEPA and Section 106, those effects could remain significant for the purposes of CEQA.

Table 4-42. Summary of Effects for Cultural Resources

Effect	Finding	Mitigation Measures	Finding with Mitigation
Alternatives SB-7 and SB-8			
Effect CR-1: Effects on Identified Archaeological Sites Resulting from Construction of Levee Improvements and Ancillary Facilities	Significant	CR-MM-1: Perform Field Studies, Evaluate Identified Resources and Determine Effects, and Develop Treatment to Resolve Significant Effects	Significant and unavoidable
Effect CR-2: Potential to Disturb Unidentified Archaeological Sites	Significant	CR-MM-2: Implement a Cultural Resources Discovery Plan, Provide Related Training to Construction Workers, and Conduct Construction Monitoring	Significant and unavoidable
Effect CR-3: Potential to Disturb Human Remains	Significant	CR-MM-3: Monitor Culturally Sensitive Areas during Construction and Follow State and Federal Laws Governing Human Remains if Such Resources Are Discovered	Significant and unavoidable
Effect CR-4: Direct and Indirect Effects on Built Environment Resources Resulting from Construction Activities	Significant	CR-MM-4: Conduct Inventory of Built Environment Resources, Evaluate Identified Properties, Assess Effects, and Prepare Treatment to Resolve and Mitigate Significant Effects	Significant and unavoidable

The effects and mitigation measures outlined below are described in more detail in the FRWLP Final EIS.

4.12.4.1 No Action Alternative

This alternative would result in no change from the existing conditions. The No Action Alternative would result in no impacts beyond the naturally occurring degradation incurred by taphonomy, decomposition, and erosion.

4.12.4.2 Alternative SB-8

Effect CR-1: Effects on Identified Archaeological Sites Resulting from Construction of Levee Improvements and Ancillary Facilities

A range of archaeological resources has been identified that may be affected by this alternative (See Effects Discussion below). Identified prehistoric resources contain midden (habitation debris), human burials, hearths (charred remains from cooking), and lithic debris (remains from manufacture of stone tools). Deposits with these constituents often have data potential for archaeological research, which strives to describe human adaptations and their changes over time and to construct meaningful explanations for these changes. Because material in these sites may be useful for this purpose, it is likely that many of these sites have significance within the meaning of the NRHP. Furthermore, because many of these resources are expansive (each in excess of 30 meters across), they are each likely to contain some portion of the deposit with sufficient integrity to yield meaningful data. Additional research value may be associated with specific deposits that cannot be identified in advance. Therefore, these sites are likely to be eligible for inclusion in the NRHP because they may yield information pertinent to prehistoric archaeological research (30 CFR Part 60.4[d]). These sites thus are likely to qualify as historic properties. Identified resources may be significant under other NRHP eligibility criteria. Individual sites and their potential register eligibility are described in the FRWLP FEIS in Appendix I, Section I.4, Identified Resources Affected by the Action Alternatives. Potential resource-specific treatments are identified in Table I-4 of that same document.

Identified historic-era archaeological sites are associated with the themes of mining, transportation, and settlement. These themes are significant because they are associated with the historic-era economy and development of the region. For these reasons, it is likely that many of these sites have significance within the meaning of the NRHP. In addition, because these sites contain physical remnants of the activities associated with these themes, they may be able to elucidate significant details regarding the settlement of the region and expansion of Euro-American populations into the Sacramento Valley. For this reason, these sites may have data potential within the meaning of the NRHP. While these sites have not been revisited to assess their integrity, these resources are expansive and it is likely that some portion of the deposits remain with sufficient integrity to yield useful data. For these same reasons, these sites are likely to have significance and integrity for the NRHP as defined in 30 CFR Section 60.4, because these sites may yield information in historic research regarding the theme of settlement and resource extraction in California, a theme that is significant at the local, state, and national levels (30 CFR Section 60.4(a)). The NRHP may include resources that are significant at the state, local, and national levels (U.S. Department of the Interior 1999:i). These sites thus are likely to qualify as historic properties.

In addition, USACE would conduct both pedestrian and subsurface inventory efforts in order to identify other buried and obscured sites in advance of construction. Sites that may be identified through these efforts have the potential to qualify as historic properties.

Construction of levee improvements and ancillary activities such as borrow operations have the potential to directly disturb identified resources (including sites that may be located through subsurface inventory) through ground-disturbing excavation or by placement of large, durable new features, such as seepage berms or stability berms, over these resources. Because direct disturbance through excavation would disrupt the associations that contain meaningful information, this work could result in significant effects under Section 106 (36 CFR Section 800.5(a)(1)). Mitigation Measure CR-MM-1 is available to reduce these effects. In addition, this mitigation addresses management steps necessary under Section 106 to resolve significant effects by attempting to avoid or minimize those effects or to recover consequential information where avoidance is not feasible. Because feasible management steps cannot guarantee that all effects would be avoided (even where such effects would be resolved under Section 106), these effects would remain significant and unavoidable.

Mitigation Measure CR-MM-1: Perform Field Studies, Evaluate Identified Resources and Determine Effects, and Develop Treatment to Resolve Significant Effects

USACE will complete the following mitigation and management steps to satisfy Section 106. The record and literature search and pedestrian surveys conducted for the FRWLP project provide sufficient baseline information to anticipate potentially significant effects under NEPA. However project designs are not presently specific enough to make a formal determination of adverse effect under NHPA. Pursuant to the PA and this mitigation measure, the USACE would make such a determination when the necessary information is available.

- USACE will ensure that an inventory and evaluation report for cultural resources is completed within all areas where effects on archaeological resources may occur.
- The work will be led or supervised by cultural resources specialists who meet the Secretary of the Interior's professional qualification standards provided in 36 CFR Part 61.
- Inventory methods will include pedestrian surveys and probabilistic subsurface sampling through appropriate subsurface excavation methods.
- Identified resources and newly identified resources will be mapped and described on California Department of Parks and Recreation (DPR) 523 forms. Mapping will be performed by recording data points with GPS hardware through which data can be imported and managed digitally. Mapping of previously identified resources will be limited to updates of existing records where necessary to describe the current boundaries of the resource.
- For all identified resources, USACE will perform an evaluation to determine if they qualify as historic properties per the criteria provided in 36 CFR Part 60.4.
- The recorded resources and the resource evaluations will be summarized in an inventory and evaluation report (unless testing is required to complete the evaluation, as described below).
- USACE will make a finding of effect; a significant effect will occur if the project would alter, directly or indirectly, the qualities that make a resource eligible for listing in the NRHP (36 CFR Part 800.5[a][1]).
- Where necessary, USACE will conduct test excavation to support the evaluation and finding of effect. Test excavation is typically performed to retrieve a suitable sample of material to determine the constituents and integrity of the resource. Test excavation will be conducted

in consultation with SHPO and other relevant parties. Test excavation will follow a testing plan developed in consultation with SHPO, either for the specific resource or as part of the treatment methods developed pursuant to the PA.

- For all resources subject to significant effects, USACE will implement treatment in consultation with SHPO and other relevant parties including Native American stakeholders and the public.

Construction will also be monitored, and discoveries of human remains will be treated as prescribed under Mitigation Measures CR-MM-2 and CR-MM-3, below.

Effect CR-2: Potential to Disturb Unidentified Archaeological Sites

The footprint of Alternative SB-8 is sensitive for buried and obscured archaeological sites that cannot always be identified in advance of construction. Because much of the right-of-way occurs within natural floodplains, archaeological sites in the right-of-way are subject to the geological processes associated with river systems and flooding. During prehistory, sites were formed over many millennia. When habitation ceased or flood events occurred, interrupting human occupation, these sites may have been obscured by the deposition of sediment. In addition, because of the intensity of farming activity in the historic era, surface manifestations for prehistoric sites may have been obscured by cultivation, leaving portions of the site below grade with no visible indication above ground. Geological processes may obscure historic-era sites as well. In addition, USACE does not currently have rights-of-entry to complete inventory in the entire project area; previously unidentified sites may occur in these locations. An inventory will occur in these locations pursuant to Mitigation Measure CR-MM-1.

Because these sites may contain important data useful in research, and may have integrity to convey this data, these sites may qualify as historic properties. Disturbance of these resources through direct excavation would result in significant effects under Section 106 by disrupting scientifically meaningful associations.

While probabilistic subsurface excavation is a standard tool that is available to identify such sites, the scale of the project area and the size of such sites in relation to the acreage affected by the project create conditions where identification of all buried and unknown sites may not be possible. For these reasons, these sites may remain undetected prior to construction. It is particularly worth noting that the construction of deep slurry cutoff walls may disturb deeply buried early Holocene or Pleistocene sites that exist far below grade where there is no feasible means to identify such resources prior to disturbance. Buried sites may contain human remains in addition to archaeological debris. While mitigation is available to minimize these effects under Mitigation Measure CR-MM-2, this mitigation would not ensure that these effects would be avoided. For this reason, this effect is significant and unavoidable.

Mitigation Measure CR-MM-2: Implement a Cultural Resources Discovery Plan, Provide Related Training to Construction Workers, and Conduct Construction Monitoring

Prior to ground-disturbing construction, USACE will include a cultural resources discovery plan in the contract conditions of the construction contractor, incorporating the following actions to be taken in the event of the inadvertent discovery of cultural resources:

- An archaeological monitor will be present to observe construction at geographic locations that are sensitive for unidentified cultural resources. Such locations will consist of

construction areas near identified cultural resource(s) sites (within a 200-foot radius around the known boundaries of identified resources) and where ground-disturbing construction will occur within 1,500 feet of major water features.

- In the event of an archaeological resource discovery, work will cease in the immediate vicinity of the find, based on the direction of the archaeological monitor or the apparent distribution of cultural resources if no monitor is present. A qualified archaeologist will assess the significance of the find and make recommendations for further evaluation and treatment as necessary.
- Discovered resources will be mapped and described on California Department of Parks and Recreation (DPR) 523 forms. Mapping will be performed by recording data points digitally with GPS hardware.
- In consultation with SHPO, USACE will evaluate identified resources to determine if they are historic properties. Test excavations will be performed where necessary to support evaluation. Evaluation and treatment will follow the standards and order of priority described above for Mitigation Measure CR-MM-1, with the exception of timing. Discoveries may occur after the EIR/SEIS is completed and, thus, need not be described in that document.
- In consultation with SHPO, USACE will make a finding of effect for eligible resources, and for all adversely affected resources, resolve adverse effects as required under the PA (Appendix J).
- If human remains are discovered as part of the deposit, SBFCA, USACE, and the contractors will coordinate with the county coroner and the Native American Heritage Commission (NAHC) to make the determinations and perform the management steps prescribed in California Health and Safety Code Section 7050.5 and Public Resources Code Section 5097.98.
- If Native American human remains are discovered on Federal land, work in the immediate vicinity will cease, and SBFCA and USACE will contact the relevant representative of the Federal agency where the remains were discovered, as prescribed in the Native American Graves Protection and Repatriation Act (NAGPRA), 25 USC Section 3002(d). After notification from the relevant agency representative and treatment of the remains as required under NAGPRA, work may continue. Disposition of the remains will follow the ownership priority described in NAGPRA (25 USC Section 3002[a]).

SBFCA and USACE will develop a list of cultural resources staff who can respond to cultural resources discoveries and SBFCA and USACE will also develop training materials for construction workers regarding management direction following discoveries. The staff list and training materials will be provided to the supervisory field staff. SBFCA and USACE, or their archaeological consultant, will conduct training for construction workers that provides an overview of cultural resources identification and this mitigation measure.

Effect CR-3: Potential to Disturb Native American Human Remains

The project area is located in an area of moderate to high sensitivity for archaeological cultural remains, including Native American burials. Some of the identified archeological resources contain burials, and the remaining right-of-way is sensitive for additional archaeological sites. Ground-disturbing work necessary to construct proposed levee improvements may inadvertently damage

and disturb these resources before they can be discovered. In particular, slurry cutoff walls may disturb these resources at depths where the resource cannot be identified, even during monitoring.

Slurry cutoff wall construction occurs through use of a bentonite mixture that obscures artifacts and cultural material, making identification infeasible or at least unlikely during monitoring of these features in particular. Mitigation Measure CR-MM-3 would reduce the severity of this effect, but it cannot guarantee the effect would be avoided. For these reasons, this effect remains significant and unavoidable.

Mitigation Measure CR-MM-3: Monitor Culturally Sensitive Areas during Construction and Follow State and Federal Laws Governing Human Remains if Such Resources Are Discovered

USACE will retain a qualified archaeologist to monitor areas of sensitivity for previously unidentified archaeological resources and Native American human remains, as required under Mitigation Measure CR-MM-2. The following actions will be taken:

If Native American human remains are discovered as part of the deposit or in isolation, work will cease in the immediate vicinity and within the radius necessary to avoid further disturbance. USACE, and the contractors will coordinate with the county coroner and NAHC to make the determinations and perform the management steps prescribed in California Health and Safety Code Section 7050.5 and PRC Section 5097.98. This coordination requires the following steps.

- The county coroner will be notified so that he/she may determine if an investigation regarding the cause of death is required. If the coroner determines that the remains are of prehistoric Native American origin, the coroner will notify the NAHC.
- Upon notification, the NAHC will identify the most likely descendant (MLD), and the MLD will be given the opportunity to reinter the remains with appropriate dignity. If the NAHC fails to identify the MLD or if the parties cannot reach agreement as to how to reinter the remains as described in PRC Section 5097.98(e), the landowner will reinter the remains at a location not subject to further disturbance. USACE will ensure the protections prescribed in PRC Section 5097.98(e) are performed, such as the use of conservation easements and recording of the location with the relevant county.
- If Native American human remains are discovered on Federal land, work in the immediate vicinity will cease, and USACE will contact the relevant representative of the Federal agency where the remains were discovered, as prescribed in 25 USC Section 3002(d) (NAGPRA). After notification from the relevant agency representative and treatment of the remains as required under NAGPRA, work may continue. Disposition of the remains will follow the ownership priority described in NAGPRA (25 USC Section 3002[a]).
- SBFCA and USACE will include an overview of the potential for encountering human remains and an overview of this mitigation measure in the training performed under Mitigation Measure CR-MM-2.

Effect CR-4: Direct and Indirect Effects on Built Environment Resources Resulting from Construction Activities

Identified built environment resources consist of structures associated with the historical themes of transportation, water conveyance, and commercial development. Known built environment resources that may be impacted are discussed below in Section 4.12.4.2.1, *Effects Discussion*.

Because these resources are associated with the historical settlement and development of the region, they may have significance within the meaning of the NRHP. If these resources retain their setting and character-defining elements, they may have integrity under the NRHP. For these reasons, these resources may qualify as historic properties under NRHP (36 CFR Part 60.4[a]). It should be noted that the settlement, development, and reclamation of the Sacramento Valley is significant at both the local and state levels.

Demolition of these structures may be required for the construction of new levee improvements such as seepage berms, stability berms, or wider levee prisms. In addition, even if demolition does not occur, these new features may not be consistent with the setting. Construction may also generate substantial vibration (e.g., soil compaction is typically required for seepage berm construction). Vibration may damage structures. For these reasons, construction may impair the ability of these resources to convey their significance, resulting in a significant effect under NEPA and Section 106. The basis for the conclusion that individual resources are register-eligible is provided in the FRWLP FEIS in Appendix I, Section I.4, *Identified Resources Affected by the Action Alternatives*. Potentially affected built environment resources and potential resource-specific treatments are identified in Appendix I, Table I-5 of that document.

Although mitigation is available to reduce this effect, mitigation cannot guarantee these effects would be avoided entirely. Because mitigation cannot guarantee avoidance of these effects, this effect remains significant.

An inventory for the right-of-way required for the project alternatives has not been completed because not all rights-of-entry have been secured. The presence of identified built environment resources and a review of aerial photographs indicate that the right-of-way is sensitive for additional unidentified built environment resources. Such resources may consist of individual structures and residences or landscape-scale features such as rural historic landscapes (U.S. Department of the Interior 1999). In addition, built environment features such as community gathering halls or traditional activity areas may consist of traditional cultural properties (Parker and King 1998). The right-of-way for the proposed alternatives is sensitive for these types of resources because of the intensity of activity in the historic (and prehistoric) era and because the rural setting makes it more likely that these resources may have remained intact. These resources may qualify as historic properties under NRHP for their integrity, if they remain intact, and their association with important historic-era themes identified in this setting.

The construction of new levee improvements such as seepage berms, stability berms, or wider levee prisms may require demolition of built environment resources that would be identified through inventory and evaluation efforts. Even if demolition does not occur, these new features may not be consistent with the setting. For these reasons, construction may impair the ability of these resources to convey their significance. While mitigation is available to reduce these effects under Mitigation Measure CR-MM-4, this mitigation cannot guarantee all effects would be avoided. For these reasons, this effect remains significant and unavoidable.

Mitigation Measure CR-MM-4: Conduct Inventory of Built Environment Resources, Evaluate Identified Properties, Assess Effects, and Prepare Treatment to Resolve and Mitigate Significant Effects

USACE will ensure that an inventory and evaluation report is completed for all areas where effects on built environment resources may occur.

- The scope of the inventory will include the entire area where effects may occur. Such effects consist of direct disturbance, damage through vibration, and/or changes to the setting.
- The work will be led or supervised by architectural historians who meet the Secretary of the Interior's professional qualification standards provided in 36 CFR Part 61.
- Inventory methods and evaluation will include pedestrian surveys, photographic documentation, and historical research using primary and secondary sources, interviews, and oral histories.
- Identified resources will be mapped and described on forms provided by DPR. Mapping will be performed by recording data points digitally with GPS hardware.
- USACE, in consultation with SHPO, will evaluate these resources to determine if they are historic properties (36 CFR Part 60.4).
- The recorded resources and the resource evaluations will be summarized in an inventory report.
- USACE in consultation with SHPO will make a finding of effect to determine if the project will result in significant effects on NRHP-eligible resources. A finding of adverse (i.e., significant) effect will be made if the project would alter, directly or indirectly, the qualities that make a resource eligible for listing on the NRHP (36 CFR 800.5[a][1]).
- For all resources subject to significant effects (or adverse effects under NHPA), USACE will develop and implement treatment. Where avoidance or relocation is not feasible, standard treatment such as documentation through the Historic American Building Survey, Historic American Landscape Survey, or Historic American Engineering Record will be completed. Other documentation such as district documentation, interpretive displays, or walking tours may also be considered and implemented as appropriate.

4.12.4.2.1 Effects Discussion

Impacts on certain resources can be anticipated based on information collected during the record search and the pedestrian survey conducted by ICF staff for the FRWLP project. These specific resources are described below, but the list is not exhaustive. Subsurface prospection will likely result in the identification of more resources than are presently known.

The APE for Alternative SB-8 would include the entire FRWLP APE but would extend 2,250 feet further south. Additionally, to provide an operations and maintenance road along the levee, USACE proposes to move the levee and/or the Sutter Butte Canal in various locations where the two features are too close together to accommodate the access road. This would result in additional impacts on the levee and the canal, both of which may be NRHP eligible, and on prehistoric archaeological sites including CA-BUT-496, and CA-BUT-52.

Most of the 2,250-foot segment where SB-8 would extend south beyond the limit of the FRWLP APE was inspected by USACE archaeologists, who did not encounter evidence of cultural resources visible on the surface. However, a berm located on private property abuts the dam in this area and may be a prehistoric mound site. USACE personnel were not able to gain access to this landscape feature, but the size and shape of it are consistent with the dimensions of known prehistoric mounds. Additionally, a prehistoric village and burial site, CA-SUT-57, is located close by. Pursuant to the PA, USACE would conduct a more detailed inventory of this area prior to construction, including subsurface prospection.

Most of the cultural resources impacts that would result from the construction of SB-8 are anticipated by the FRWLP Final EIS. These include impacts on the levee itself, the Sutter Butte Canal, historic buildings and neighborhoods in Yuba City, other built environment resources identified in the FRWLP Final EIS, and several known prehistoric archaeological sites (CA-SUT-5, CA-SUT-10, CA-SUT-20, CA-SUT-77, CA-BUT-52, CA-BUT-53, CA-BUT-496, CA-BUT-1123, and the unnamed site identified by UAIC). These sites and properties are described in more detail in the FRWLP Final EIS.

Borrow areas and utility relocations associated with SB-8 have not yet been surveyed or fully defined. These areas would be inventoried and any resources encountered would be treated pursuant to the PA.

In the course of further inventory work, including subsurface prospection, it is likely that USACE would encounter additional cultural resources. Prior to the initiation of construction, these resources would be evaluated and treated as described in the PA in consultation with SHPO, the public, and interested Native American Tribes or other identified stakeholders. USACE, in consultation with SHPO and the Tribes, would formally make a determination of adverse effects under NHPA once all the required information is at hand.

4.12.4.3 Alternative SB-7

4.12.4.3.1 Effects Discussion

The general effects and mitigation measures for Alternative SB-7 are the same as those described above for Alternative SB-8, though Alternative SB-7 is geographically less expansive than Alternative SB-8 and would impact fewer cultural resources. Based on the information at hand, it is possible to anticipate that construction of Alternative SB-7 would affect known cultural resources including the levee itself, the historic buildings and neighborhoods in Yuba City, other built environment resources identified in the FRWLP Final EIS, and several prehistoric archaeological sites (CA-SUT-5, CA-SUT-10, CA-SUT-20, CA-SUT-77, and the unnamed site identified by UAIC). All of these impacts are anticipated by the FRWLP Final EIS.

Proposed borrow areas have not yet been surveyed. The records and literature search indicates that one of the proposed borrow locations at Star Bend would impact a fourth prehistoric archaeological site, CA-BUT-17. Inventories of the remaining borrow sites and other sites that may be defined in the future could result in the identification of more impacts.

Any unknown cultural resources found in the course of further inventory work would be evaluated for NRHP eligibility, and effects on those resources would be resolved as necessary, following the processes outlined in the PA. USACE, in consultation with SHPO and the Tribes, would formally make a determination of adverse effects under the NHPA once all the required information is at hand.

4.13 Cumulative and Growth-Inducing Impacts

4.13.1 Growth-Inducing Effects

4.13.1.1 Introduction

Chapter 4 of the FRWLP Final EIS discussed cumulative and growth-inducing impacts. The regulatory background information and the methods used to analyze growth-inducing effects remains the same for analysis of Alternatives SB-8 and SB-7. The conclusions about growth-inducing effects remain applicable to Alternative SB-8. However, Alternative SB-7, which would reduce flood risk primarily in the urban area of Yuba City, would expose a smaller area to potential growth-inducing impacts. The discussion in the FRWLP Final EIS is included below, along with updates that consider Alternative SB-7.

CEQ regulations require an EIS to consider the potential indirect effects of a proposed action (40 CFR Section 1502.16(a) and (b)). The indirect effects of an action include those that occur later in time or farther away in distance but are still reasonably foreseeable. They may include "growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate" (40 CFR Section 1508.8[b]).

In addition, 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]).

4.13.1.2 Growth Projections

Population is not static, and the population of California has been growing significantly. According to the California Department of Finance, "California's population is projected to reach almost 60 million people by 2050, adding over 25 million since the 2000 decennial census" (California Department of Finance 2007). The California Department of Finance provides population data estimates and projections for cities and counties throughout California. Population information for Butte and Sutter Counties is provided below.

4.13.1.2.1 Butte County

Between April 2000 and January 2010, the overall population of Butte County increased by 9.2%, growing from 203,171 to 221,768 people. Within that same timeframe, the incorporated city of Gridley saw an increase of 19.3%, with the estimated population rising from 5,408 to 6,454, and the city of Biggs saw a 0.9% decrease in population, going from 1,793 to 1,787. For comparison, the state's population rose 14.1% during the same period, from 33,873,086 to 38,648,090 (California Department of Finance 2010). Although the county population has been increasing steadily, the population of the unincorporated portion of the county has been declining as people move to urban areas and cities annex areas to accommodate this growth (Butte County 2010: 32). Butte County had a population density of approximately 134 persons per square mile in 2010, compared with the state average of 239 persons per square mile (U.S. Census Bureau 2010).

The population of Butte County is expected to reach 281,442 by 2020 (California Department of Finance 2007). The city of Gridley population is expected to reach 8,774 by 2020, assuming a growth rate of 2.86% per year (Redamonti pers. comm.). The city of Biggs is expected to reach a population of 2,136, based on a 1.5% growth rate per year (City of Biggs 1998:1–5).

By 2050, the total population of Butte County is expected to reach 441,596 (California Department of Finance 2007). Based on the Department of Finance's unofficial 2070 population estimates for Butte and Sutter Counties prepared for the Sutter Basin Project, Butte County is expected to reach a total population of 512,095. These projections are based on very preliminary analyses of migration and fertility trends, which could change. Also, it is important to note that 60-year projections are subject to an enormous amount of potential external changes that could render these values inaccurate (Schwarm pers. comm.). Despite the preliminary nature of these projections, the population in the affected area is expected to continue to increase, and it can be assumed that employment, income, and the demand for housing also would increase.

4.13.1.2.2 Sutter County

Between April 2000 and January 2010, the overall population of Sutter County increased by 25.6%, growing from 78,930 to 99,154. Within that same timeframe, the incorporated cities of Live Oak and Yuba City saw increases of 41.1% and 77.8%, respectively, with their estimated populations rising from 6,229 to 8,791 and 36,758 to 65,372. In contrast, the state's population rose more slowly (14.1%) during that time, as noted above (California Department of Finance 2010).

Nearly two-thirds of the county's residents live in the cities of Live Oak and Yuba City (California Department of Finance 2010). Sutter County is primarily rural, with extensive agricultural areas and a low population density (Sutter County 2010:1–7). The county had a population density of approximately 157 persons per square mile in 2010, compared with the state average of 239 persons per square mile (U.S. Census Bureau 2010).

The population of Sutter County is expected to reach 141,159 by 2020 (California Department of Finance 2007), and Yuba City's population is expected to reach 79,000, based on an average annual growth rate of 2.5% per year (City of Yuba City 2004:2-3). According to the county's general plan (Sutter County 2010:4-2):

> For nearly 40 years, and, in particular, since 1990, most of the growth in Sutter County has taken place in its two cities, Yuba City and Live Oak. Yuba City annexations and new development in the incorporated cities has increased the share of the county's incorporated population from 40% in 1970 to 75% in 2007. As a result, fewer people resided in unincorporated areas of the county in 2007 than in 1970. This trend is assumed to continue during the time horizon of the 2006–2013 housing element.

By 2050, Sutter County is expected to more than triple in size (+255%). In 2050, the total population of Sutter County is expected to reach 282,894 (California Department of Finance 2007). Based on the California Department of Finance's unofficial 2070 population estimates for Butte and Sutter Counties for the Sutter Basin Project, Sutter County is expected to reach a total population of 341,216. As is described for Butte County above, based on these projections, the population in the affected area would continue to increase, and it can be assumed that employment, income, and the demand for housing also would increase.

4.13.1.2.3 Current and Planned Development

To accommodate current populations and growth, development has been planned in Butte and Sutter Counties in accordance with California law. The key land use planning documents are the following general plans:

- Butte County General Plan 2030 (Butte County 2010).
- City of Biggs General Plan 1997–2015 (City of Biggs 1998).
- City of Gridley General Plan (City of Gridley 2010).
- Sutter County 2030 General Plan (Sutter County 2010).
- City of Yuba City General Plan (City of Yuba City 2004).
- City of Live Oak General Plan (City of Live Oak 2010).

To account for growth relative to flood risk management, the local governments in the affected area have in place the following flood risk–management programs. This list is not a comprehensive inventory, but rather is meant to demonstrate the responsibility communities are showing for flood risk management and to provide a representation of the types of programs currently being implemented.

Butte County

- Butte County Flood Mitigation Plan.
- Public education and awareness programs.
- Land use planning and development restrictions in floodplains.
- Emergency Preparedness and Evacuation Plan.
- FEMA Community Rating System (CRS) Program.

City of Biggs

- Development restrictions in flood-prone areas.
- Emergency response plan and emergency evacuations routes.

Sutter County

- Sutter County Floodplain Management Ordinance, which includes the following flood-risk management measures.
    - Standards of construction to prevent flood damage.
    - Development restrictions in floodways.
- FEMA CRS Program.
- Emergency Operations Plan.
- Emergency Action Plan.
- Public Outreach Strategy Team.

City of Yuba City

- Flood Damage Prevention Ordinance, which includes the following flood-risk management measures.
  - Standards of construction to prevent flood damage.
  - Development restrictions in floodways.
- FEMA Community Rating System Program: Class 7.
- Emergency Evacuation Plan.
- Floodplain development permit requirement.
- Public Outreach Program.

City of Live Oak

- Development restrictions in flood-prone areas.
- Emergency Response Plan and emergency evacuations routes.

4.13.2 Effects and Mitigation Measures

An action that removes an obstacle to growth is considered to be growth-inducing. Consequently, where flood risk may be seen as an obstacle to growth in an area, levee improvements that would reduce that risk may be considered to remove an obstacle to growth and, thereby, be indirectly growth-inducing.

Growth inducement may lead to environmental effects, such as increased demand for utilities and public services, increased traffic and noise, degradation of air or water quality, degradation or loss of plant or animal habitats, and conversion of agricultural and open space land to urban uses. Growth within a floodplain area increases the risk to people or property of flooding.

However, if the induced growth is consistent with or provided for by the adopted land use plans and growth management plans and policies for the affected area (e.g., city and county general plans, specific plans, transportation management plans), those plans may ensure that these effects are either less than significant or mitigated to a less-than-significant level. In some instances, significant and unavoidable effects would occur as a result of implementation of land use plans. All effects associated with this planned growth are the responsibility of the city or county in which the growth takes place. Local land use plans provide for land use development patterns and growth policies that encourage orderly urban development supported by adequate urban public services, such as water supply, roadway infrastructure, sewer services, and solid waste services.

4.13.2.1 No Action Alternative

Under the No Action Alternative, USACE and SBFCA would not implement levee improvements. The levees protecting the study area would continue to deteriorate and require improvements to meet both FEMA's and the State's minimum acceptable levels of performance. Under the No Action Alternative, population growth trends may change as result of FEMA and State restrictions on development. In addition, the associated risk to human health and safety, property and the adverse economic effect that serious flooding could cause would continue, and the risk of a catastrophic flood would remain high. Although no improvements would be implemented, regular operations and

maintenance of the levee system would continue as prescribed and as presently executed by the local maintaining entities.

Despite the likelihood of Federal or State-led implementation of repairs, for the purposes of evaluating effects under the No Action Alternative, the feasibility study assumes that the improvements would not be made. This assumption provides the most conservative approach for disclosure and comparison of potential effects. Therefore, the No Action Alternative assumes no levee repair or strengthening would be implemented, the purpose and objectives would not be met, and flood risk would continue.

4.13.2.2 Alternatives SB-8 and SB-7

Alternatives SB-7 and SB-8 would incrementally reduce flood risk for the levee reaches proposed for improvement. SB-8 would expose a larger area than SB-7 to potential growth-inducing impacts. The levees proposed for improvement represent only a portion of the total levee system protecting Butte and Sutter Counties. The remaining unimproved levees in the system also would determine FEMA mapping and build-out decisions. As described in the FRWLP Final EIS, the levee reach proposed for improvement under SB-8 and the FRWLP preferred alternative would potentially remove approximately 6,300 acres from the current officially mapped FEMA floodplain. As acknowledged in Section 4.2.2.5.3 of this document, FEMA is updating and modernizing existing FIRMs for most of the United States, including California. Accordingly, and given known levee deficiencies, FIRM data may not be entirely indicative of the present status of designated floodplains. Therefore, areas yet to be updated by FEMA may also be potentially removed from the FEMA floodplain.

The project would facilitate build-out for areas planned for growth in adopted municipal general plans. Such build-out growth is part of the planned development of Butte and Sutter Counties. The counties and incorporated cities have general plans under which growth and increases in population could lead to effects on air and water quality, water supply, traffic, and noise conditions, and increases in the demand for such public services as schools, fire protection, police, sewer, solid waste disposal, and electric and gas utilities. The expansion of such services could result in significant effects. The effects of this growth have been analyzed in the CEQA documents associated with these plans (Butte County General Plan, City of Biggs General Plan, City of Gridley General Plan, Sutter County 2030 General Plan, City of Yuba City General, City of Live Oak General Plan). Mitigation measures that would reduce or eliminate these effects are included in the CEQA documents that were prepared for these local actions.

In addition to areas currently approved for build-out growth, the potential exists for additional new development to be induced as a result of improved levels of flood risk performance in areas not currently planned for urbanization. It should be further noted that while Alternatives SB-7 and SB-8 would remove a potential obstacle to growth by reducing the area subject to FEMA floodplain designation, they would not directly facilitate growth (e.g., develop new water supply, utilities, or other infrastructure). Ultimately, the effects associated with growth in Butte and Sutter Counties are the responsibility of cities and counties in which they occur, in combination with specific project proponents.

4.13.3 Cumulative Effects

4.13.3.1 Introduction

The FRWLP Final EIS identified other past, present, and reasonably foreseeable projects that could interact with SBPFS actions to create cumulative effects. Cumulative effects were identified and mitigation was recommended for significant cumulative effects. This information is hereby incorporated by reference. Cumulative effects are addressed in this integrated EIR/SEIS only in the environmental resource areas of vegetation, wildlife, and visual resources. All other cumulative effects are adequately addressed in the FRWLP Final EIS. The modifications proposed under SB-8 and SB-7 to the FRWLP preferred alternative would not result in any new cumulative or substantially more severe cumulative significant direct and indirect effects, including short- and long-term effects, than were analyzed in the FRWLP Final EIS.

4.13.3.2 Vegetation and Wetlands

Construction, the implementation of USACE's Vegetation ETL, and levee maintenance activities to maintain a vegetation-free zone would result in substantially greater direct loss of riparian vegetation and other habitats under both Alternatives SB-8 and SB-7 than would occur under the FRWLP. Levee repairs on other reaches of the Feather River and future implementation of the Vegetation ETL policy throughout the SRFCP also may result in losses of vegetation and wetlands, and permanent loss could contribute to a significant cumulative impact. Consideration of a variance under the Vegetation ETL and habitat compensation would lessen the loss of riparian habitat. As stated in the FRWLP Final EIS, it is expected that each project would be required to mitigate for such loss due to regulatory requirements, thereby reducing any cumulative effect to a less-than-significant level; however, temporal losses could be significant until the vegetation has reestablished and matured sufficiently to offset the loss in habitat values.

4.13.3.3 Wildlife

As described above, Alternatives SB-8 and SB-7 would result in the direct loss of habitat and, thus, associated special-status species as a result of construction and as a result of implementation of USACE's Vegetation ETL. Effects on wildlife from operation and maintenance (e.g. disturbance to wildlife from noise and physical disturbance) would be similar to the effects of existing levee maintenance and therefore not result in significant cumulative effects. As described in the FRWLP Final EIS, the loss of these habitats would contribute to the cumulative effects on wildlife, along with projects that remove these types of habitats in the project region. The Feather River corridor provides important nesting, roosting, foraging, cover, and movement habitat for numerous wildlife species, including several listed and rare species. Additional levee improvement projects along the Feather River levee system would result in losses of riparian habitat as a result of construction or implementation of the Vegetation ETL. Coordination with USFWS, NMFS, CDFW and appropriate local agencies would be required for such projects to ensure appropriate compensation for effects on riparian habitat. Because special-status species are protected under state and Federal laws, other projects also would be required to minimize injury and mortality and compensate for loss of their habitats. It is expected that each project would be required to mitigate for such loss, thereby reducing any cumulative effect to a less-than-significant level; however, temporal losses could be significant until the vegetation has reestablished and matured sufficiently to offset the loss in habitat values.

4.13.3.4 Visual Resources

The SBPFS would potentially result in significant and unavoidable visual effects in reaches with sensitive viewers for both SB-7 and SB-8. The effects are primarily associated with vegetation removal. The SBPFS would have greater impact on existing visual values than the FRWLP because of the greater amount of vegetation removal under the SBPFS. As other projects to achieve flood risk reduction in the region are implemented, these effects would be additive and could be cumulatively significant and unavoidable despite mitigation measures to compensate for loss of riparian vegetation.

4.13.4 Other Required Disclosures

4.13.4.1 Relationship between Local Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

NEPA requires that an EIS consider the relationship between short-term uses of the environment and the impacts that such uses may have on the maintenance and enhancement of long-term productivity of the affected environment (40 CFR Section 1501.16). This section compares the short- and long-term environmental effects of the proposed project.

Short-term impacts caused by the project would be similar for any of the construction alternatives. These impacts would occur during and immediately after construction and would generally result in adverse effects. However, the long-term impacts that would occur over the life of the project would result in overall beneficial effects.

Implementation of either Alternative SB-7 or SB-8 would result in beneficial long-term impacts. The alternatives would address levee deficiencies that currently threaten property and public safety. Flooding in the event of a levee failure would result in extensive flooding and potential loss of life.

4.13.4.2 Significant Irreversible and Irretrievable Environmental Commitment of Resources

Construction of the levee improvements would result in an irretrievable and irreversible commitment of natural resources through the direct consumption of fossil fuels and use of materials. With completion of the project, that commitment of resources would end. The primary long-term, irreversible commitment of resources resulting from the project would be the conversion of farmland.

4.13.4.3 Unavoidable Significant Impacts

Unavoidable significant impacts are impacts that remain following the implementation of mitigation measures, or impacts for which there are no mitigation measures. This section lists the unavoidable significant impacts that could occur as a result of implementing the analyzed build alternatives, Alternatives SB-8 and SB-7. Nearly all potentially significant impacts could be reduced to less-than-significant levels by mitigation measures specified in this EIR/SEIS.

The effects that are significant and unavoidable or potentially significant and unavoidable are listed below.

- Air Quality

  - Effect AQ-2: Exceedance of Applicable Thresholds for Construction Emissions
- Noise
  - Effect NOI-1: Exposure of Sensitive Receptors to Temporary Construction-Related Noise
  - Effect NOI-2: Exposure of Sensitive Receptors to Temporary Construction-Related Vibration
- Vegetation
  - Effect VEG-1: Disturbance or Removal of Riparian Trees
  - Effect VEG-4: Potential Loss of Special-Status Plant Populations Caused by Habitat Loss Resulting from Project Construction
- Visual Resources
  - Effect VIS-1: Result in Temporary Visual Effects from Construction
  - Effect VIS-2: Adversely Affect a Scenic Vista
  - Effect VIS-3: Substantially Degrade the Existing Visual Character or Quality of the Site and its Surroundings
- Cultural Resources
  - Effect CR-1: Effects on Identified Archaeological Sites Resulting from Construction of Levee Improvements and Ancillary Features
  - Effect CR-2: Potential to Disturb Unidentified Archaeological Sites
  - Effect CR-3: Potential to Disturb Human Remains
  - Effect CR-4: Direct and Indirect Effects on Identified Historic Architectural/Built Environment Resources Resulting from Construction Activities

This chapter contains a summary of the consultation and coordination activities that have occurred in support of the Sutter Basin Pilot Feasibility Study (SBPFS).

5.1 Public Involvement

5.1.1 Public Scoping

On May 20, 2010, USACE published a notice of intent (NOI) in the Federal Register (Vol. 76, No. 98) to prepare an EIS and SBFCA published a notice of preparation for an EIR with the State Clearinghouse. The NOI was published as a combined NOI covering both the feasibility study EIS and the Feather River West Levee Project (FRWLP) EIS.

In June 2011, four scoping meetings were held jointly for the FRWLP and the SBPFS. Because the two projects would affect the same general area, have similar purposes, are related to each other, have the same lead agencies, and are being studied in close coordination, a joint scoping process was conducted to explain the relationship between the two efforts and obtain public input in a manner that was convenient, efficient, and integrated. The meetings were held to educate the public about each of the two efforts and to garner input on the proposed scope of each, in accordance with NEPA and CEQA.

The meetings were held at two different times over the course of two days. On June 27, 2011, meetings were conducted from 3:30 to 5:30 p.m. and from 6:30 to 8:30 p.m. Both were at the Yuba City Veterans Memorial Community Center. On June 28, 2011, meetings were conducted from 3:30 to 5:30 p.m. and from 6:30 to 8:30 p.m. Both were at the Gridley Veterans Memorial Hall.

The meeting locations were chosen because they are central to the region. The meeting times were chosen to accommodate both the workday schedules of public agency representatives and the general public, including residents and business owners.

The meetings were open-house style workshops in which attendees could read and view the information about the two projects and interact with project staff, including representatives of SBFCA, USACE, the California Department of Water Resources (DWR), and engineering and environmental consultants.

The views expressed in the scoping meeting are summarized as follows:

- Keep landowners apprised of associated activities occurring on their lands.
- Keep the Sutter Basin Feasibility Study on schedule so the state will be able to release early implementation program funding for the FRWLP.
- Coordinate with the Lower Feather River Corridor Management Project so that duplicative efforts pertaining to environmental studies are avoided.
- Put in a levee setback in the Nelson Slough area.
- Consider a perimeter levee around Yuba City or a J-levee on the south and west sides.

For more detail on comments received, information available at the meetings, and a summary of key issues that were raised, see Appendix D which contains a scoping report.

5.1.2 Public Review of Draft Report

The draft Integrated Feasibility Report and EIR/SEIS was circulated on June 14, 2013. An "All Interested Parties" notice was also sent out to a mailing list. A Notice of Availability was published in the Federal Register on June 14, 2013, and a public meeting was held by USACE and SBFCA on July 22, 2013 to receive comments on the report from agency representatives and other interested parties. The report was also made available for viewing and download from the USACE Sacramento District website. Meeting attendees included five members of the public.

USACE received six comment letters during the 45-day public review period, which ended on July 29, 2013 and two comments were submitted during the July 22, 2013 public meeting. Table 5-1 lists all parties who submitted comments. Appendix F contains the comments received and responses to the comments. Comments received on the Draft Report during the 45-day comment period were considered during preparation of this Final Report. Comments included issues such as induced flooding, availability of construction funding, consideration of a System Wide Improvement Framework to address vegetation and other levee deficiencies, evaluation of alternatives for compliance with Clean Water Act 404(b)(1) Guidelines, and mitigation monitoring.

Table 5-1. List of Commenters

Letter #	Commenter	Date of Comment
Federal Agencies (F)		
F1	Federal Emergency Management Agency	June 11, 2013
F2	U.S. Environmental Protection Agency	July 25, 2013
F3	U.S. Department of Interior, Office of Environmental Policy and Compliance	July 29, 2013
State Agencies (S)		
S1	Governor's Office of Planning and Research	July 30, 2013
Local Agencies (L)		
L1	Sacramento Area Flood Control Agency	July 25, 2013
Individuals (I)		
I1	Patrick Porgans	July 29 and 30, 2013
Public Meeting (PM)		
PM-1	Lawrence Mentz	July 22, 2013
PM-2	Patrick Porgans	July 22, 2013

5.1.3 Issues of Concern and Controversy

The following issues were identified as a result of public scoping, during the conduct of the feasibility study, and during preparation of the FRWLP EIS and EIR. While these issues were also addressed in the FRWLP EIS, these issues are of continuing concern to the public.

5.1.4 Construction-Related Effects

Because the levee system in the study area is in close proximity to residential areas and other developed land uses, flood improvements proposed under the SBPFS are likely to result in construction-related effects. These effects include those under the topics of public safety, noise, traffic, and air quality and are specifically described in Chapter 4, *Affected Environment and Environmental Consequences*.

5.1.5 Property Acquisition

A specific subset of construction-related effects involves potential conflicts with private property underlying or near proposed improvements. In some cases there may be temporary property use in the form of construction easements to build the project and permanent acquisition for operations and maintenance of the project. These effects are described in Chapter 4, *Affected Environment and Environmental Consequences*.

5.1.6 USACE Vegetation ETL Levee Safety Policy

Implementation of USACE national policy concerning restrictions on vegetation on and near flood control structures is controversial. Much of the remaining natural riparian habitats in the Central Valley are located along flood control levees. Levee inspections conducted by the USACE have identified vegetation that would need to be removed; otherwise a variance would need to be obtained for compliance with this policy. Effects on vegetation, recreation, and visual resources from project implementation are addressed in Chapter 4, *Affected Environment and Environmental Consequences*.

5.1.7 Climate Change and Sea-Level Rise

Global climate change and resultant sea-level rise are phenomena receiving international attention. These issues are further analyzed in the effects discussions in Chapter 4 under *Air Quality and Climate Change*.

5.1.8 River Access for Recreation

The Feather River is popular for recreation activities such as fishing, boating, walking, and wildlife viewing. There is demand to increase opportunities for public access to the river corridor.

5.2 Agency Consultation and Coordination

Beyond formal public scoping, USACE and SBFCA have been in communication with Federal, state, and local agencies in the course of project planning, design development, and preparation of this integrated report. These communications have taken the form of in-person meetings, telephone conversations, and written correspondence. The communications have addressed consistency with

other planning studies and projects in the region, pursuit of agency approvals, information to be considered in the document, and opportunities for partnership.

Since June 2012, numerous meetings have been held between staff from USACE Sacramento District, USFWS, and SBFCA to discuss various issues, including scope of service, the USFWS Coordination Act Report, Endangered Species Act Section 7 consultation, potential mitigation, and compliance strategy. USACE has also sent numerous electronic mail messages to the USFWS transmitting important information, including the USFWS Scope of Work, Civil Works project funding reports, and analysis of acreage impacts. An onsite field tour of the entire project area was conducted in July 2012 that was attended by USFWS staff and representatives of USACE, SBFCA, California Department of Water Resources, California Department of Fish and Wildlife, and Central Valley Flood Protection Board. The USFWS has provided USACE a final Fish and Wildlife Coordination Act Report that contains the USFWS analysis and recommendations concerning fish and wildlife impacts and mitigation (Appendix D). USFWS has also issued a biological opinion and incidental take statement covering the effects of the project on listed species within its jurisdiction under the Endangered Species Act. The National Marine Fisheries Service provided a letter concurring with USACE's "not likely to adversely affect" determination and recommendations to avoid and minimize effects to essential fish habitat (Appendix D).

5.3 Other Communication

Beyond agency coordination, USACE and SBFCA are in communication with Native Americans, environmental non-governmental organizations, and other interested stakeholders. Correspondence was received from United Auburn Indian Community, Mooretown Rancheria, and Enterprise Rancheria in response to a written inquiry from USACE based on Native American Heritage Commission coordination.

6.1 Federal Requirements

This final integrated pilot feasibility report and EIR/SEIS was prepared in accordance with the regulatory requirements found in statutes, regulations, executive orders, and various policy and guidance documents. This chapter contains a summary of the status of the proposed action in relation to each statutory and regulatory requirement. This section also discusses specific permitting activities and agency coordination for each statutory and regulatory requirement. Many of the requirements of the Federal government are codified under the United States Code (USC) as described below. Where a more common name for a law or regulation is typically used, the statute or regulation is listed by that name with a reference to the corresponding USC section.

6.1.1 National Environmental Policy Act

This final integrated pilot feasibility report and EIR/SEIS was prepared in accordance with the National Environmental Policy Act (NEPA) (42 USC Section 4321, et seq.), Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] Sections 1500–1508), and USACE NEPA implementing regulations (230 CFR Section 230.9). This report begins to fulfill requirements of NEPA. The draft report was circulated during a 45-day public comment. Appendix F contains the comments received and the responses to those comments. This final report incorporates public comments. Following circulation of the final report for 30 days, USACE will execute a Record of Decision in accordance with NEPA.

6.1.2 Federal Endangered Species Act

Section 7 of the Endangered Species Act (ESA) (16 USC Section 1536) requires Federal agencies, in consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), to ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of habitat of such species determined to be critical. Implementation of the Recommended Plan (RP) would result in direct and indirect effects on the valley elderberry longhorn beetle and the giant garter snake, both of which are listed as threatened under ESA. Therefore, a biological assessment was submitted to USFWS requesting initiation of formal consultation for adverse effects on these species. On September 19, 2013, the USFWS issued an amended biological opinion covering the additional effects of the project (Appendix D). A biological assessment was also submitted to NMFS requesting concurrence of the USACE determination that the RP may affect, but is not likely to adversely affect, listed fish species. In a letter dated September 26, 2013, the NMFS issued a letter concurring with USACE's determination (Appendix D). With receipt of an USFWS biological opinion and a NMFS letter of concurrence, USACE has complied with requirements under Section 7 of the ESA.

6.1.3 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 USC Section 661, et seq.) provides for consultation with USFWS and the California Department of Fish and Wildlife (CDFW) whenever the waters or channel of a body of water are modified by a department or agency of the United States. Under this act, the Federal department or agency shall consult with USFWS and the state agency with a view to the

conservation of wildlife resources. The act's purposes are to recognize the vital contribution of our wildlife resources to the nation, and their increasing public interest and significance, and to provide that wildlife conservation receive equal consideration and be coordinated with other features of water-resource development programs through planning, development, maintenance, and coordination of wildlife conservation and rehabilitation. A final Coordination Act Report (CAR) prepared by USFWS in coordination with CDFW was received from USFWS in April 2013 and can be found in Appendix D. The final CAR describes the existing environmental resources within the study area and the potential effects of the project on these resources, in addition to evaluating the proposed mitigation and monitoring plans. Recommendations developed by the USFWS contained in the final CAR have been considered in formulation of the RP. Table 6-1 more specifically demonstrates how each recommendation, opportunity, or problem identified in the CAR has been considered in plan formulation and mitigation plan development.

6.1.4 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) (16 USC Section 470f) requires Federal agencies to take into account the effects of Federal undertakings on historic properties. Section 106 of the NHPA describes the process for identifying and evaluating historic properties; for assessing the effects of Federal actions on historic properties; and for consulting to avoid, reduce, or minimize significant effects. The term *historic properties* refers to cultural resources that meet specific criteria for eligibility for listing on the National Register of Historic Places (NRHP). This process does not require historic properties to be preserved but does ensure that the decisions of Federal agencies concerning the treatment of historic properties result from meaningful consideration of cultural and historic values and the options available to protect the properties.

Under these requirements, the selected project's area of potential effects is inventoried and evaluated to identify historical, archeological, or traditional cultural properties that have been placed on the NRHP and those that the agency and the State Historic Preservation Officer (SHPO) agree are eligible for listing on the NRHP. If the project is determined to have an adverse effect on such properties, the agency must consult with SHPO and the Advisory Council on Historic Preservation (ACHP) to develop alternatives or mitigation measures to resolve adverse effects. Compliance with these and other provisions of the NHPA is required as a process separate from, but concurrent with, NEPA.

USACE and the SHPO have executed a programmatic agreement (PA) to provide guidelines for compliance with the Section 106 process when the effects on historic properties are unknown. The PA was executed on June 8, 2012 and has been transmitted to the Advisory Council on Historic Preservation.

Ongoing coordination and communication will be maintained by USACE with both the signatories and concurring parties to the PA, and other key stakeholders, as planned follow-on efforts are undertaken and the proposed project proceeds. By carrying out the terms of the PA, USACE will have fulfilled its responsibilities under Section 106 of the NHPA and ACHP regulations.

Table 6-1. Consideration of USFWS Recommendations

Recommendations	Response
1. Mitigate the loss of any natural habitat types (riparian forest, riparian scrub-shrub, oak woodland, wetland, pond, canal, stream) at a ratio of at least 2:1.	Concur. The proposed mitigation and monitoring plan (Appendix D) proposes 2:1 compensation for impacts on natural habitats.
2. Should the feasibility study move forward, USACE should work with DWR and SBFCA to develop a variance to allow vegetation within the USACE vegetation-free zone to remain in place.	Concur. As part of the recommended RP, USACE proposes to investigate during the design phase the applicability of a variance to lessen loss of riparian vegetation.
3. Work with USFWS on development of the mitigation area.	Concur. USACE and SBFCA will coordinate implementation of mitigation features.
4. Lands disturbed by construction activities, including the staging areas, should be reseeded with native grasses and forbs. Reseeding should be conducted just prior to the rainy season to enhance germination and plant establishment.	Concur. Site restoration following construction will include the seeding of native grasses in areas of disturbance prior to the rainy season to enhance germination and establishment.
5. Conduct pre-construction surveys for breeding birds, including state-listed Swainson's hawk and burrowing owl.	Concur. Preconstruction surveys would be conducted as recommended.
6. Develop and implement a vegetation monitoring program as part of the project. Monitoring the riparian restoration effort should focus on (a) recording tree survival rates, (b) the quantification of improved habitat values for wildlife (primarily bird species) by measuring percentage of tree and shrub cover, average height of overstory trees, canopy layering, and total woody riparian vegetation, and (c) developing recommendations for alternative methods of riparian restoration should initial efforts fail. A vegetation monitoring report should be submitted annually for the first 5 years after planting activities, and on the 10th, 15th, and 20th years after planting. The monitoring reports should also identify any shortcomings in the restoration effort and include remedial actions on how to improve restoration efforts. All phases of the revegetation and monitoring programs should be coordinated with, and approved by, USFWS, CDFW, and NMFS.	Concur. The proposed mitigation and monitoring plan (MMP) includes monitoring as part of the project (Appendix D). The details of the monitoring plan (periodicity, standards, and remedial actions) and the contents of the monitoring reports will be coordinated with USFWS, CDFW and NMFS to obtain their approval.
7. Comply with Conservation Measures and Terms and Conditions in the Biological Opinion.	Concur. Requirements of the Biological Opinion and Incidental Take Statement issued by USFWS will be met.
8. Complete the appropriate consultation with CDFW regarding impacts on state-listed species, and with NMFS, as required under Section 7 of the Endangered Species Act, for potential impacts on anadromous fish under NMFS jurisdiction.	Concur. USACE has completed consultation with NMFS on listed fish species. The results of consultation are included in this Final EIR/SEIS (Appendix D).
9. SB-7 and SB-8 (depending on the alternative selected) should mitigate for the loss of upland habitat due to erosion protection. Effects resulting from this action should be discussed both under the Fish and Wildlife Coordination Act as well as under the Federal and state endangered species acts.	Concur. The effects of levee landside slope erosion protection on upland habitats used by giant garter snake and the western borrowing owl were included in the Biological Opinion issued by the USFWS.
10. Initiate Section 7 consultation with USFWS on the effects of O&M activities on listed species.	Concur. Per the USFWS biological opinion, O&M activities will be consulted on when an O&M manual is prepared by USACE.

6.1.5 Farmland Protection Policy Act

The Farmland Protection Policy Act (FPPA) (7 USC Section 4201, et seq.) is implemented by the Natural Resources Conservation Service (NRCS). The purpose of this act is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to ensure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with state and local government, and private programs and policies to protect farmland. NRCS is authorized to review Federal projects to determine whether a project is regulated under the act and establish the farmland conversion impact rating for the project. As described in the FRWLP Final EIS, USACE provided NRCS with project information on Form NRCS-CPA-106 ("Farmland Conversion Impact Rating for Corridor Type Projects") to determine a Farmland Conversion Impact Rating for the FRWLP Preferred Alternative, Alternative 3. Projects are scored on a scale of 260 points, and under the FPPA, projects receiving a total score of less than 160 need not be given further consideration for protection and no alternative sites need to be evaluated (FPPA Rule 401.24, Section 658.4). The completed forms accompany the FRWLP Final EIS. The total score for the Butte County portion of Alternative 3 is 124 points, and the total score for the Sutter County portion of Alternative 3 is 118 points. Because the score was less than 160 points, no further consideration for protection and additional alternatives must be evaluated. This conclusion is applicable to the Sutter Basin Pilot Feasibility Study because the same general project area is being assessed and the amount of farmland permanently impacted by Alternative SB-8 would be less than under the FRWLP (Section 4.6, *Agriculture, Land Use, and Socioeconomics*).

6.1.6 Clean Water Act

Construction of the RP would require compliance with Sections 404, 401, and 402 of the Clean Water Act (CWA) (33 USC Sections 1344, 1341, and 1342). Some placement of fill within jurisdictional wetlands and waters of the United States is required for the project, which is detailed in Section 4.7, *Vegetation and Wetlands*. USACE has responsibility for issuing permits pursuant to Section 404. However, by regulation, a USACE Section 404 permit is not required for USACE Civil Works projects (33 CFR Sections 323.3(b) and 322.3(c)). The RP must be evaluated pursuant to Section 404(b)(1) of the Clean Water Act in accordance with the guidelines promulgated by the Environmental Protection Agency (EPA) (40 CFR Section 230) for evaluation of the discharge of dredged or fill material into waters of the United States. The proposed discharge must represent the least environmentally damaging practicable alternative and would include all appropriate and practicable measures necessary to minimize adverse effects on the aquatic environment. The work would not result in the unacceptable degradation of the aquatic environment. A Section 404 (b)(1) evaluation has been prepared for the RP and is included in Appendix D.

Unavoidable effects on approximately 5.79 acres of waters of the United States would result from RP implementation. Relocation of the Sutter Butte Canal has been minimized to the extent feasible to avoid effects on CWA Section 404 jurisdictional waters. Onsite replacement of 4.07 acres would occur in conjunction with relocation of the canal. Remaining acreage impacts would be mitigated at a mitigation bank.

A Section 401 State Water Quality Certification for activities associated with implementation of the RP would be required. Prior to construction, USACE would submit a 401 certification application to the Central Valley Regional Water Quality Control Board (Central Valley RWQCB). Pursuant to Section 402 of the CWA, the project would also require a National Pollutant Discharge Elimination

System permit, through the development of a Stormwater Pollution Prevention Plan, because the RP would disturb more than 1 acre of ground.

6.1.7 Clean Air Act

The Clean Air Act (CAA) (42 USC Section 7401, et seq.) mandates the establishment of national ambient air quality standards and regulations to reduce air pollutants. These air pollutants are also known as criteria pollutants. RP construction falls under the jurisdiction of the Butte County Air Quality Management District (BCAQMD) and the Feather River Air Quality Management District (FRAQMD). The districts determine whether project emission levels significantly affect air quality, based on Federal standards established by EPA and the California Air Resources Board (CARB). The districts would first issue a *permit to construct*, followed by a *permit to operate*, which would be evaluated to determine whether all facilities have been constructed in accordance with the permit to construct. Construction of the RP would result in the temporary increase in criteria pollutant emissions that is unavoidable and significant. Mitigation measures will be implemented in accordance with requirements determined by BCAQMD and FRAQMD. In addition, the proposed project is subject to the General Conformity Rule (42 USC Section 7596(c) (Section 176(c)) and its implementing regulation (40 CFR Section 93). The air quality analysis has concluded that a general conformity determination is not required because de minimis thresholds for nonattainment pollutants would not be exceeded (see Section 4.5.4.2). Implementation of the RP would not trigger a formal conformity determination under Section 176(c) of the CAA. Therefore, analyses in this integrated report indicate that the RP would comply with the CAA.

6.1.8 Executive Order 11988, Floodplain Management

This Executive Order (EO) requires USACE to provide leadership and take action to (1) avoid development in the base (1-in-100 annual event) floodplain, unless such development is the only practicable alternative; (2) reduce the hazards and risk associated with floods; (3) minimize the effect of floods on human safety, health, and welfare; and (4) restore and preserve the natural and beneficial values of the base floodplain. To comply with EO 11988, the policy of USACE is to formulate projects which, to the extent possible, avoid or minimize significant effects associated with use of the without-project floodplain, and avoid inducing development in the existing floodplain unless there is no practicable alternative. Compliance with the executive order is addressed in Chapter 7, *Recommended Plan*.

6.1.9 Executive Order 11990, Protection of Wetlands

This order directs USACE to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in implementing Civil Works projects. Wetlands have been avoided to the extent possible through design and siting of the RP. Unavoidable effects on approximately 9.59 acres of wetlands would result from implementing the RP. Wetland effects would be mitigated. Relocation of the Sutter Butte Canal has been minimized to the extent feasible to avoid effects on CWA Section 404 jurisdictional waters.

6.1.10 Executive Order 12898, Environmental Justice

The order requires all Federal agencies to identify and address, as appropriate, disproportionately high and significant human health or environmental effects of their programs, policies, and activities

on minority and low-income populations. Anticipated effects resulting from the RP were reviewed to determine whether low-income or minority neighborhoods would be disproportionately affected by the RP. No effects associated with environmental justice or social equity are anticipated as a result of the RP.

6.1.11 Executive Order 13514, Environmental, Energy, and Economic Performance

EO 13514 requires Federal agencies to set a 2020 greenhouse gas emissions reduction target; increase energy efficiency, reduce fleet petroleum consumption, conserve water, and reduce waste; support sustainable communities; and leverage Federal purchasing power to promote environmentally responsible products and technologies. USACE is requiring use of construction equipment that produces lower emissions and electricity-powered batch plants.

6.1.12 Executive Order 13112, Invasive Species

This order directs Federal agencies not to authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species. To avoid introduction or spread of invasive species, USACE would ensure that appropriate control measures are implemented during project construction that would comply with applicable state and county invasive species control regulations.

6.1.13 Wild and Scenic Rivers Act

The RP complies with this act (16 USC Section 1271, et seq.) because no river segments designated as wild and scenic exist in the project area.

6.1.14 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC Section 703, et seq.) states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, young, feather, or egg in part or in whole without a Federal permit issued in accordance within the MBTA's policies and regulations. Several special-status bird species are known to forage in the project area and vicinity, and there is a possibility that one or more could establish a nest in or near the project area. The nest would be protected under the MBTA. To avoid possible disturbance to nesting birds, tree and brush removal should preferably take place during the non-nesting season. In the event that migratory birds are encountered onsite during project construction, every effort would be made to avoid take of protected birds, active nests, eggs, and young. Most effects resulting from the RP are anticipated to be short-term direct disturbances to migratory birds, which would likely temporarily avoid the construction area.

6.1.15 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act (16 USC Section 1801, et seq.) establishes a management system for national marine and estuarine fishery resources. This legislation requires that all Federal agencies consult with NMFS regarding all actions or proposed actions that may adversely affect Essential Fish Habitat (EFH). Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered. Consultation conducted with the NMFS determined that the proposed action would adversely affect EFH for Federally managed fisheries.

Pursuant to the Magnuson-Stevens Act, the NMFS, in their Section 7 ESA concurrence letter, provided conservation recommendations to avoid or further minimize adverse effects to EFH. The NMFS recommended that USACE strongly consider in the future design phase revising the proposed alignment of levees near the Sutter Butte Canal to avoid or further minimize waterside construction and that other options be considered in-lieu of strict adherence to the Vegetation ETL, including a variance, to allow existing waterside vegetation to remain. The NMFS EFH recommendations have been adopted by USACE.

6.1.16 Noise Control Act of 1972

Section 4(b) of the Noise Control Act (42 USC Section 4903(b)) directs Federal agencies to comply with applicable Federal, state, and local noise requirements with respect to the control and abatement of environmental noise. Construction equipment and vehicles would create localized, temporary noise effects. However, once construction is completed, background noise levels would return to usual levels. While most construction activities would occur in nonurban setting, analyses reveal that construction-generated noise would exceed regulatory noise thresholds and would result in significant effects on sensitive receptors that are not amenable to mitigation to a level of insignificance. Prior to construction, nearby local residents would be notified of the construction schedule. Staging areas would be sited to minimize effects on surrounding areas.

6.2 State Requirements

Many of the requirements of the State of California are codified under the Public Resources Code (PRC) as described below. Where a more common name for a law or regulation is typically used, the statute or regulation is listed by that name with a reference to the corresponding code section.

6.2.1 California Environmental Quality Act

CEQA (PRC Section 21000, et. seq.) requires disclosure of environmental effects, alternatives, potential mitigation, and environmental compliance of the proposed project. To comply with CEQA, SBFCA will finalize this EIR/SEIS and file a Notice of Determination.

6.2.2 California Fish and Game Code

Under Sections 1600–1616 of the California Fish and Game Code, CDFW 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 that falls under CDFW jurisdiction. Federal projects are not subject to California Fish and Game Code.

6.2.3 California Endangered Species Act

CDFW administers the California Endangered Species Act (CESA), which requires non-federal lead agencies to prepare documentation if a project may significantly affect one or more state-listed endangered species. Federal agencies are not subject to CESA. However, SBFCA is coordinating with CDFW in compliance with CESA.

6.2.4 Porter-Cologne Water Quality Control Act

Porter-Cologne (Water Code Section 13000, et seq.) designates RWQCBs as the primary state agencies with regulatory authority over California water quality and appropriative surface water rights allocations. Under Porter-Cologne and the CWA, the State is required to adopt water quality standards and waste discharge requirements to be implemented by the State Water Resources Control Board and the nine RWQCBs. The study area is within the Central Valley RWQCB's jurisdiction. Pursuant to Porter-Cologne, the Central Valley RWQCB establishes water quality standards and reviews individual projects for compliance with the standards. USACE will submit a CWA Section 401 State Water Quality Certification application as described under Section 6.1.6, *Clean Water Act*.

6.2.5 California Streets and Highways Code

The California Department of Transportation (Caltrans) is responsible for ensuring the safety and integrity of the state's highway system. Under California Streets and Highways Code Section 660, any encroachment on a state route must be approved by Caltrans. USACE would coordinate with Caltrans for any construction permitting.

6.2.6 California Clean Air Act

As discussed above under Section 6.1.7, BCAQMD and FRAQMD determine whether project emission sources and emission levels would significantly affect air quality based on Federal standards established by EPA and state standards set by CARB. The RP would be in compliance with all provisions of Federal and state Clean Air Acts.

6.2.7 California Land Conservation Act (Williamson Act) and Farmland Security Zone Act

The California Land Conservation Act of 1965, commonly referred to as the Williamson Act (Government Code Section 51200, et seq.), is a state policy administered at the local government level. The Williamson Act is intended to preserve agricultural and open space lands through contracts with private landowners. By entering into a Williamson Act contract, the landowner foregoes the possibility of converting agricultural land to nonagricultural use for a rolling period of 10 years in return for lower property taxes. No lands under Williamson Act protection would be affected in Sutter County and no further action is required. SBFCA will be responsible for addressing any Williamson Act issues in Butte County and is in the process of determining any Williamson Act triggers.

The Williamson Act was amended in 1998 to establish Farmland Security Zones. In return for a 20-year contract commitment, property owners are granted greater tax reductions. Neither Sutter County nor Butte County currently participates in the Farmland Security Zone program.

6.2.8 Administration and Control of Swamp, Overflowed, Tide, or Submerged Lands

Under PRC Section 6301, the State Lands Commission has exclusive jurisdiction over all ungranted tidelands and submerged lands owned by the State and the beds of navigable rivers, sloughs, and lakes. State ownership extends to lands lying below the ordinary high-water mark of tidal

waterways and below the low-water mark of nontidal waterways (Civil Code Section 830). The area between the ordinary high and low water on nontidal waterways is subject to a *public trust easement*. Projects such as bridges, transmission lines, and pipelines fall into this category. A proposed project cannot use these state lands unless a lease is first obtained from the State Lands Commission. The Commission also issues separate permits for dredging. For the RP, no state lands have been identified that require State Lands Commission review and approval.

6.3 Local Plans and Policies

Evaluating the level of compliance with locally adopted plans can be complicated due to the following: (1) the intentionally broad and unspecific goals articulated in local general plans; (2) the potential of a Federal project to influence the location, density, and rate of development in ways that differ from existing local plans and policies; and (3) the currency of local plans. The RP is located within the jurisdiction of the general plans of Sutter and Butte Counties and the Cities of Yuba City, Live Oak, and Gridley. As the non-federal sponsor representing Sutter and Butte Counties, SBFCA would ensure, to the extent practicable, that the RP complies with the provisions of all relevant local plans.

This chapter describes the Recommended Plan (RP), as well as the procedures and cost sharing required to implement the plan. A schedule and a list of further studies are also included.

7.1 Recommended Plan Identification

The plan identified as the RP is the Locally Preferred Plan (LPP), Alternative SB-8. This plan is justified and has a benefit to cost ratio of 2.6 to 1.0. Further, the LPP will comply with criteria of the California Government Code requirements for a 200-year level of protection for urban and urbanizing areas by 2025. This results in the northern urban areas achieving the State requirements, but not the southern portion of the basin Refer to Appendix C1b. Hydraulic Design and Analysis.

The Assistant Secretary of the Army for Civil Works (ASA[CW]), by Memorandum dated May 7, 2013, has approved an exception to National Economic Development (NED) policy for the Federal government to recommend a LPP over the NED Plan as the RP at NED level of Federal participation cost share. The estimated total project cost of the RP is $688,930,000; the estimated Federal cost share is $255,270,000, and the estimated non-federal cost share is $433,660,000, as shown in Table 7-2. The RP is described briefly below, including the specific cost share requirements associated with the approved policy exception. For more detailed information, refer to Chapter 3, *Plan Formation*, and to the appendices and supporting documentation.

7.1.1 Features and Accomplishments

The RP is a fix-in-place design to the existing Feather River West Levees divided into 41 levee reaches beginning near Thermalito Afterbay (Station 2368+00) and extending south to near Laurel Avenue (Station 180+00). The primary method of strengthening the existing levee would be the construction of soil-bentonite cutoff walls of various depths. The specific design features for the RP are listed in Table 7-1 and shown in Plate 7-1.

Table 7-1. Design Features of Recommended Plan

	Feature Description	Quantity
Alternative SB-8 Reach 2A-North to 41 180+00 to 2638+00 2013–2019	No Rehabilitation Required	28,220 LF
	Cutoff Wall Only	158,780 LF
	Jet Grouting Cutoff Wall Only	960 LF
	Seepage Berm Only	5,350 LF
	Cutoff Wall with Full Levee Degrade	600 LF
	Cutoff Wall with Existing Relief Wells	2,500 LF
	Cutoff Wall with Seepage Berm	7,670 LF
	Cutoff Wall with Levee Relocation	11,600 LF
	Cutoff Wall with Sutter Butte Canal Relocation	1,540 LF
	Cutoff Wall with Landside Toe Fill	1,870 LF
	Erosion Protection	7,660 LF
	Utility Improvements	142
	Utility Relocations	109
	Land Acquisition	2,196 acres
	Number of Effected Parcels	468
	Number of Potential Structural Demolition	34
	Closure Structure (stop log)	1

LF = linear feet.

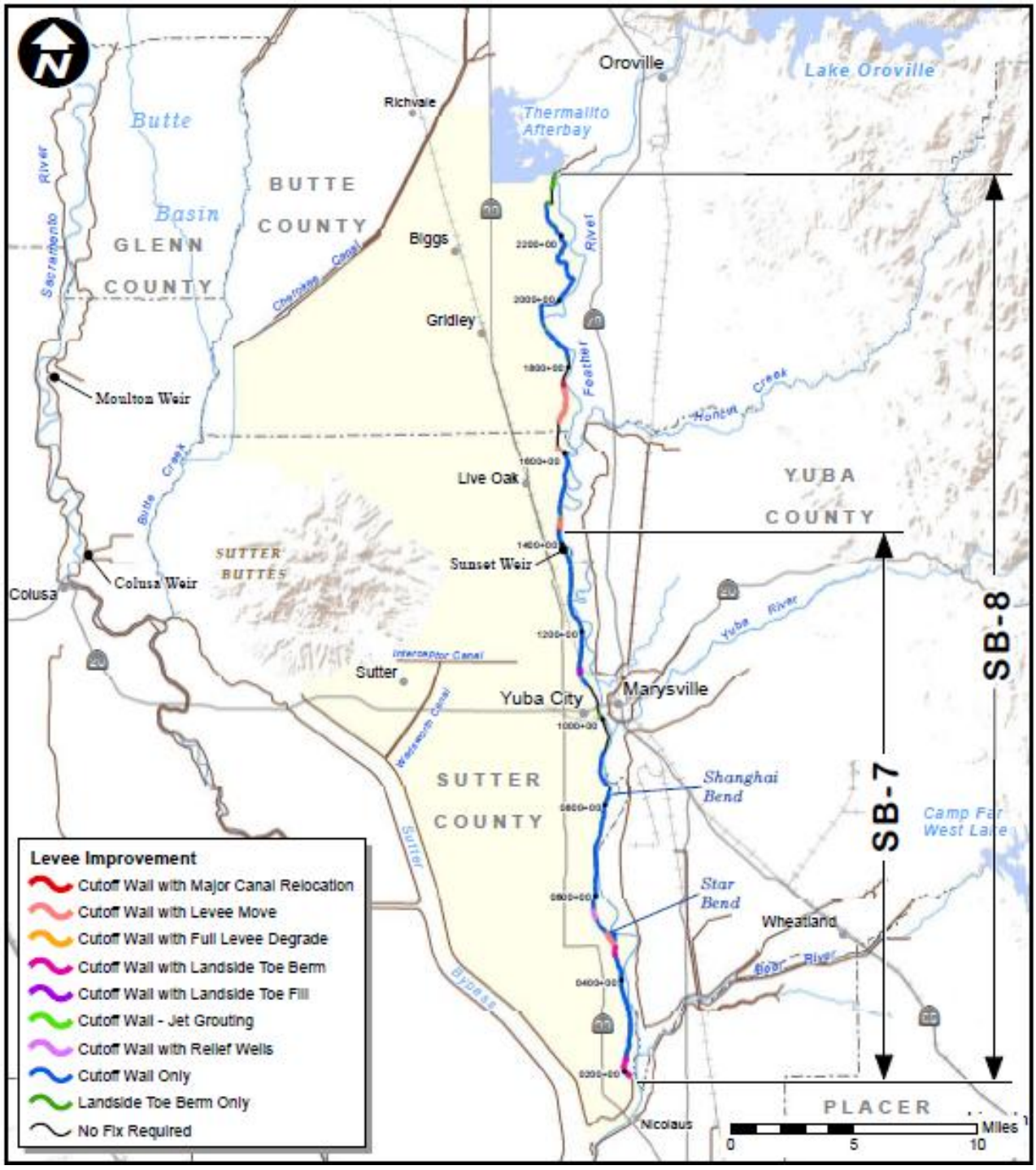


Plate 7-1. RP (SB-8) Levee Improvement and Proposed Design Feature

Table 7-2. Summary of Cost Sharing Responsibilities for the RP ($1,000)[a, b]

MCACES Account[c]	Account	Federal	Non-Federal	Total[d]
	NED Plan			
1	Land and Damages	$0	$42,390	$42,390
2	Relocations	$0	$28,542	$28,542
6	Fish and Wildlife	$4,797	$1,241	$6,038
11	Levees and Floodwalls	$190,596	$49,326	$239,922
18	Cultural Resources	$493	$127	$620
30	Preconstruction, Engineering, and Design	$43,086	$8,633	$51,719
31	Construction Management	$16,664	$4,312	$20,976
	Add Data Recovery	$1,633	$0	$1,633
	Percentage	65%	35%	100%
	Total First Cost (NED)	$255,270	$136,570	$391,840
	Recommended Plan: LPP Increment from NED to LPP			
1	Land and Damages	$0	$11,156	$11,156
2	Relocations	$0	$58,917	$58,917
6	Fish and Wildlife	$0	$1557	$1,557
11	Levees and Floodwalls	$0	$172,933	$172,933
18	Cultural Resources / Data Recovery	$0	$1,853	$1,853
30	Preconstruction, Engineering, and Design	$0	$35,831	$35,831
31	Construction Management	$0	$14,843	$14,843
	Total Incremental Increase	$0	$297,090	$297,090
	Total First Cost (LPP)	**$255,270**	**$433,660**	**$688,930**

Notes:

[a] Based on October 2013 price levels.

[b] Planning, Engineering, and Design costs incurred after completion of the Feasibility Report will be cost shared between the Government and the project sponsors in accordance with a Design Agreement. Upon initiation of project construction, all costs incurred under the Design Agreement will be included as part of the total project costs and subject to the project cost sharing requirements in accordance with the Project Partnership Agreement which will be executed prior to award of the first construction contract.

[c] Micro Computer-Aided Cost Engineering System (MCACES) is the software program and assorted format used by USACE in developing cost estimates. Costs are divided into various categories identified as "accounts." Detailed costs estimates are presented in Appendix C, part 4, Cost Engineering.

[d] Relocations estimate includes construction cost, design cost, and construction management cost associated with required relocations.

Required borrow materials for project construction are available within the Sutter Basin or close to the basin, and suitable borrow areas have been generally identified for the RP. Excavated materials from levee degradation are expected to be reusable. Haul routes are expected to consist primarily of existing public roads.

The RP includes additional risk reduction through levee superiority to allow for a more controlled failure of the levee due to prolonged overtopping. Two levee reach locations have been identified where levee overtopping could potentially first occur for large flood events. Because the RP is based upon an existing levee profile, the design top of levee was reviewed relative to the modeled mean water

surface profiles to determine the likely initial overtopping locations, which are located between Station 547+00 to 604+60, south of Yuba City, and between Station 1528+00 to 1601+00, north of Yuba City. Both locations are located in nonurbanized areas and the initial overtopping is estimated to occur between the mean 0.5% (1/200) Annual Chance Exceedance (ACE) and 0.2% (1/500) ACE flood events. At each location the landward side of the levee would be covered with anchored High Performance Turf Reinforced Mat (HPTRM). This design element would increase the erosion resistance of the levee slope and allow for a more controlled failure of the levee in the event of prolonged overtopping.

A number of known prehistoric and historic resources exist in the project area and more may be encountered in the course of further inventory work. Pursuant to a programmatic agreement between the USACE and the California State Historic Preservation Officer (SHPO), the USACE, in consultation with SHPO and interested Native American Tribes, would determine the specific area of potential effects for the project, inventory that area thoroughly for significant cultural resources, and resolve adverse effects to all significant resources identified. This work would entail subsurface prospection, test excavation, data recovery excavations, other alternative mitigations, and extensive open consultation.

Nonstructural measures to be implemented in conjunction with the RP are preparation of an emergency evacuation plan, identification of flood fight pre-staging areas, updates to the floodplain management plan, and flood risk–awareness communication.

Project performance statistics for the without- and with-project condition are shown on Tables 7-3 and 7-4, respectively. Figure 7-1 shows the residual 1% (1/100 year) ACE composite floodplain for the with-project condition. As shown, The RP provides significant flood risk management reduction to the urban areas of Yuba City, Live Oak, Gridley and Biggs, as well as to the rural agricultural areas east and north of Yuba City. The RP does not include measures to strengthen the existing levees along the Feather River south of Laurel Avenue or along the Sutter Bypass between Sutter Buttes and the Feather River. Plate 4-14 in Chapter 4, *Affected Environment and Environmental Consequences*, shows the residual 1% (1/100 year) ACE composite floodplain for the without-project condition.

A sensitivity analysis was performed on the effects of climate change on the economic analysis and is documented in the Hydrology Appendix. The hydrologic and economic analysis for estimating the impact of climate change in the selection of draft alternatives for the Sutter Basin Pilot Feasibility Study (SBPFS) indicates that the identification of the NED Alternative (SB-7) is not sensitive to the climate change scenarios. Further, the rationale for selection of the LPP (SB-8) would not be affected by climate change scenarios. The RP would significantly reduce residual flood risk to public and life safety over the NED Plan, as discussed in Chapter 3, *Plan Formation*.

Table 7-3. Project Performance by Economic Impact Area: Without-Project Condition

		Annual Exceedance Probability		Long-Term Risk			Assurance by Event			
Economic Impact	Breach Location	Median	Expected	10-yr Period	30-yr Period	50-yr Period	10%	2%	1%	0.20%
Biggs	F9.0R	0.07	0.08	55%	91%	98%	82%	61%	58%	32%
Gridley	F9.0R	0.07	0.08	55%	91%	98%	82%	61%	58%	32%
Live Oak	F9.0R	0.07	0.08	55%	91%	98%	82%	61%	58%	32%
Yuba City	F9.0R	0.04	0.04	33%	70%	86%	85%	67%	60%	22%
Rural Butte	F9.0R	0.07	0.08	55%	91%	98%	82%	61%	58%	32%
Rural Sutter	S4.0L	0.45	0.52	99%	100%	100%	33%	30%	22%	6%

Table 7-4. Project Performance by Economic Impact Area: With-Project Condition

Economic Impact	Breach Location	Annual Exceedance Probability		Long-Term Risk			Assurance by Event			
		Median	Expected	10-yr Period	30-yr Period	50-yr Period	10%	2%	1%	0.20%
Biggs	F9.0R	0.02	0.02	2%	7%	11%	99%	99%	97%	64%
Gridley	F9.0R	0.02	0.02	2%	7%	11%	99%	99%	97%	64%
Live Oak	F9.0R	0.02	0.02	2%	7%	11%	99%	99%	97%	64%
Yuba City	F9.0R	0.02	0.03	3%	8%	13%	99%	99%	99%	55%
Rural Butte	F9.0R	0.02	0.02	2%	7%	11%	99%	99%	97%	64%
Rural Sutter	S4.0L	0.45	0.52	99%	99%	99%	33%	30%	22%	6%

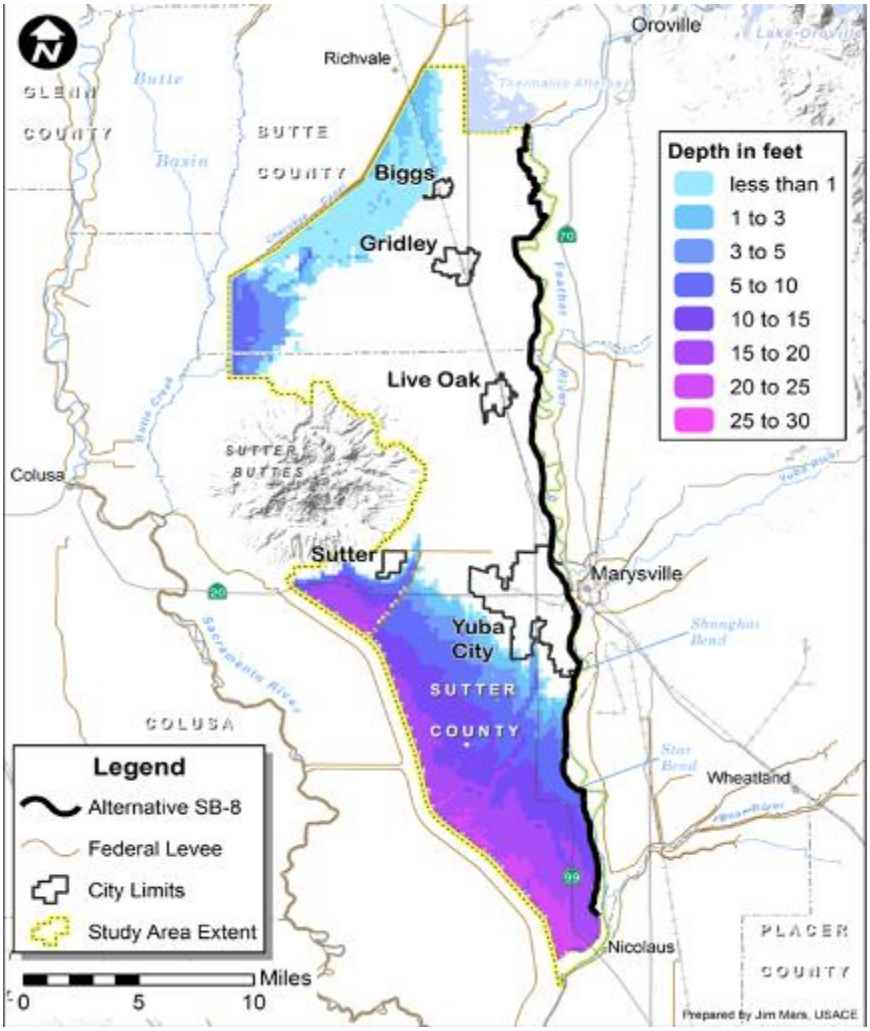


Figure 7-1. Recommended Plan: Residual 1% ACE Composite Floodplain under Alternative SB-8

7.1.2 Compliance with Engineering Technical Letter 1110-2-571

The RP is in full compliance with the Vegetation ETL, and maximum potential effects have been disclosed in this report. Environmental effects resulting from the RP construction have been identified in Chapter 4, *Affected Environment and Environmental Consequences*. Some direct effects on some riparian habitat and elderberry shrubs cannot be avoided, requiring the development of a mitigation and monitoring plan in consultation with appropriate resource agencies. During the preconstruction engineering and design (PED) phase, all options then available for compliance with the Vegetation ETL, including but not limited to the application and issuance of a variance to permit woody vegetation on the lower two-thirds of the waterside slope of the levee, will be considered.

Maintenance deficiencies for the Sutter Basin levees were identified in USACE's 2010 Periodic Inspection Report (PIR). A number of identified deficiencies have been addressed or repaired by the local levee maintaining agencies. Unwanted woody vegetation growth is one of the most significant remaining deficiencies. By letter dated March 28, 2013, the Central Valley Flood Protection Board indicated that the local levee maintaining agencies within the Sutter Basin, led by SBFCA, intend to develop and implement a System-Wide Improvement Framework (SWIF) plan to address deficiencies in order for the levee systems to regain eligibility for rehabilitation assistance under Public Law 84-99. A 2-year period was requested to develop the SWIF.

Based upon the letter of intent to develop a SWIF plan to achieve compliance with existing Operations and Maintenance (O&M) requirements, including vegetation removal, the SBPFS has assumed that there will be no deferred maintenance; i.e., the without-project condition will be fully compliant with existing O&M requirements. During construction, any unacceptable inspections items and deficiencies that have not been addressed in accordance with the SWIF, would be included in the government construction contract as a non-federal expense.

7.1.3 Hydraulic Mitigation

The only potential hydraulic effects would be project-induced increases in flood risk in adjacent or downstream areas. No identifiable hydraulic effects would be caused by the RP. Therefore, no hydraulic mitigation is required.

The RP includes the proposed realignment of 11,600 linear feet of existing levee where it lies directly adjacent to the Sutter Butte Canal. The modification would move the levee about 20 feet waterward to provide a 10-foot maintenance road between the canal and the project levee. To evaluate whether moving the levee waterward would affect water surface elevations and increase the potential risk of flooding, changes to flow, depth, duration, and velocity were estimated using a hydraulic model. The hydraulic model results were also used to perform a transfer of risk analysis using Risk and Uncertainty based methods.

The hydraulic model results indicated no measureable change in flow, depth, duration, and velocity within the Feather River (stage change less than 0.005 feet). The 20-foot realignment would be located where the levee toe is higher than the 0.5% (1/200) ACE water surface elevation. Therefore, any change in water surface elevation would only occur for flood events more rare than 0.5% (1/200) ACE. In addition, this study area reach of river is more than 5,000 feet wide, and the 20-foot realignment of the levee would be a small change in the overall hydraulic cross section of the river.

Transfer of flood risk was evaluated by comparing with-project and without-project levee performance values at index points throughout the study area. For purposes of evaluating system impacts, the risk

analysis is limited to hydrologic and hydraulic parameters and their uncertainties. This approach is consistent with Section 3.b (2) of the memorandum *Clarification Guidance on the Policy and Procedural Guidance for the Approval of Modifications and Alterations of Corps of Engineers Projects* (U.S. Army Corps of Engineers 2008). The analysis is described in detail in Appendix C1b, *Hydraulic Design and Analysis*.

Analysis of the RP (Alternative SB-8) found no transfer of flood risk. As described above, the hydraulic model created for Alternative SB-8 computed the same water surface elevations as Alternative SB-1 (No Action Alternative). Because the water surface elevations are the input to the Risk and Uncertainty model, and they did not change, there would be no change in the project performance and no transfer of flood risk.

7.1.4 Local Advanced Work

The RP includes the construction of a slurry wall to strengthen 3,400 feet of existing levee from station 478+68 to station 512+00 in the vicinity of Star Bend. In 2010, SBFCA constructed a setback levee in the same location to address historic under-seepage problems while providing for habitat enhancement opportunities. One of the non-federal project sponsors, SBFCA, requested credit consideration under Section 104 of the Water Resources Development Act (WRDA) of 1986 for this work to be applied toward the required non-federal cost share of any future Federal Sutter Basin project. By memorandum dated June 10, 2009, ASA(CW) approved the request for credit consideration.

In accordance with Engineer Regulation 1165-2-29: *Water Resources Policies and Authorities—General Credit for Flood Control* (1987), Section 104 crediting is limited to that part of the local work directly related to a flood risk management purpose. The local project is compatible with the RP as an acceptable substitute strategy. The locally constructed setback levee provides FRM improvements that are identical to those that would be provided by the RP's proposed work and will eliminate the need to construct the fix-in-place slurry wall section in the vicinity of Star Bend, as part of the RP. Section 104 credit will be the actual local cost associated with constructing the FRM features of the setback levee or the savings to the government by not having to construct the fix-in-place slurry wall, whichever is less, and will be evaluated in a crediting report to be prepared prior to execution of the Project Partnership Agreement (PPA).

Further local advance work includes SBFCA initiating construction of the local Feather River West Levee Project (FRWLP) that provides flood risk management benefits to the people and property within the Sutter Basin in advance of a Federal Sutter Basin project. The sponsor's intent is to seek Section 221 credit under WRDA 1986 to be applied toward the non-federal cost share of a Sutter Basin project. A Section 221 Memorandum of Understanding (MOU) was executed in advance of local construction as required by Engineer Regulation 1165-2-208: *Water Resources Policies and Authorities; In-Kind Contribution Provisions of Section 221 of the Flood Control Act of 1970* (as Amended 2012). Section 221 provides that credit may be afforded only if ASA(CW) determines that a material or service provided as in-kind contribution by a non-federal sponsor is integral to the project. To be integral to the project, the material or service must be part of the work that the Federal Government would otherwise have undertaken for construction of what is ultimately determined to be the Federal project. During the PED phase an Integral Determination Report will be prepared prior to execution of the PPA. Section 104 and Section 221 credit will be afforded only in accordance with the provisions of the PPA.

7.1.5 Operation and Maintenance, Repair, Replacement, and Rehabilitation

Existing project levees have continuing OMRR&R obligations, manuals, and agreements. The local sponsors have coordinated with the responsible OMRR&R districts and agencies of the RP levees. Annual operation and maintenance, repair, replacement, and rehabilitation (OMRR&R) cost is estimated to be $454,000, an increase of $22,000 over existing costs from existing OMRR&R commitments of the existing levees. Some primary OMRR&R responsibilities and factors evaluated are enumerated below.

- Slurry wall will not change long term maintenance or replacement costs.
- Wet penetration encroachments will be improved or replaced along the entire levee reaches.
- Dry encroachments such as power poles and vegetation will be reduced.
- Relief wells north of Shanghai Bend will be converted to observation wells.
- Right-of-way will be increased, so maintenance costs will increase to cover a larger vegetation management footprint. However, these costs will be offset by reduction in the need for periodic levee toe re-grading formerly caused by adjacent farming operations.
- Life cycle vegetation management maintenance costs will increase.

Once project construction is complete, the project levees would again be turned over to the non-federal sponsors (SBFCA and the Central Valley Flood Protection Board (CVFPB)), with an amended OMRR&R manual and a revised agreement. The non-federal sponsors would then be responsible for the continued OMRR&R of the levees with any amendments in accordance with the amended OMRR&R manuals and new signed agreements.

The annual cost for OMRR&R of the RP is estimated to be about $454,000. Additional detail on the OMRR&R can be found in the Civil Design Appendix C.

7.1.6 Real Estate

Acquisition of an estimated 402 acres in permanent levee easements, maintenance road easements, and temporary work area easements, 1,772 acres of potential borrow sites, and 71 acres of potential mitigation sites would be required for RP implementation, as discussed in the Real Estate Appendix. The non-federal sponsor would acquire these lands as part of the project. The project is estimated to require permanent and temporary easements on approximately 468 parcels. Approximately two to four parcels would need to be acquired in fee for onsite mitigation. The majority of the disposal material would be recycled at the potential borrow sites. Approximately 18,000 cubic yards of structural debris could be disposed of at the local landfills. The RP may require relocations of a total of 34 residential, 5 businesses, and 10 agricultural buildings. The majority of the relocations are located in Yuba City and the remaining relocations are located north of Yuba City. These relocations would comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act. The Uniform Act provides for fair and equitable treatment of persons whose property will be acquired or who will be displaced because of programs or projects financed with Federal funds. The total lands and damages real estate costs for the RP are estimated at $53,546,000. The total utility facility relocation costs are estimated at $87,459,000.

7.1.7 Plan Economics and Cost Sharing

The project first cost, estimated on the basis of October 2013 price levels, is $688,930,000. Estimated average annual costs are $33 million based on a 3.5% interest rate, a period of analysis of 50 years, and construction ending in 2023. The total average annual flood damage reduction benefits would be $87,000,000 with a benefit-cost ratio of 2.6 to 1.

The ASA(CW) has approved an exception to the policy that requires decision documents to recommend the NED Plan. The LPP would cost $297,090,000 more than the NED Plan. The non-federal sponsors would be responsible for the entire extra cost, which increased the non-federal cost share from $136,570,000 for the NED Plan to $433,660,000 for the LPP. The Federal cost share of $255,270,000 is the same for both the NED Plan and the LPP. A summary of cost sharing responsibilities is presented in Table 7-2.

Local interests have completed construction of the Star Bend setback levee to replace a section of the right bank of the Feather River levee to address critical under-seepage, and flow constriction issues. Prior to initiation of construction, local interests requested and by letter dated June 10, 2009, the ASA(CW) approved Section 104 credit consideration for the setback levee construction. In accordance with ER 1162-2-29, *General Credit for Flood Control*, in order to receive credit under Section 104, the local construction must be completed prior to project authorization. Construction of the setback levee was completed in 2010 at an estimated cost of $20,776,349. The Section 104 approval would allow design and construction dollars invested by the local sponsor to be considered for use as credit towards meeting the non-federal cost-share requirements for the project recommended by this feasibility study, if authorized. A determination of the actual value of the eligible work and amount of credit afforded will be made in accordance with the terms and conditions of the PPA for the project authorized by Congress.

7.1.8 Risk and Uncertainty

Risk and uncertainty is fundamental to all water resource planning and communication. As a pilot project, this study incorporated risk management framework principles and risk-informed planning into its plan formulation process.

- Risk analysis and communication was used following ER 1105-2-101, *Risk Analysis for Flood Damage Reduction Studies*, and EM 1110-2-1619, *Risk-Base Analysis for Flood Risk Management Studies*.
- Workshops were held for the project delivery team (PDT) at the start of the pilot study to institute risk-informed decision making into the planning process. An internal document called the risk register is a pilot study planning document developed and used to document and carry forward those risk management concepts.
- Uncertainty was captured through cost engineering's mandatory center of expertise risk assessment process to establish cost contingencies. The economic analysis developed ranges of economic outputs with mid and mean number ranges to best capture uncertainties and identify risks in the risk register.
- Risk and uncertainty ranges were further refined for costs and economics when the final array of alternatives was designed and evaluated to a feasibility level analysis (35%). This analysis confirmed the conceptual numbers were still within the established ranges of uncertainty, validating assumptions and risk decisions.

- The planning strategy addressed residual risk in the development of multi-objective evaluation metrics to assist in assessing alternatives in terms of critical infrastructure and life safety.

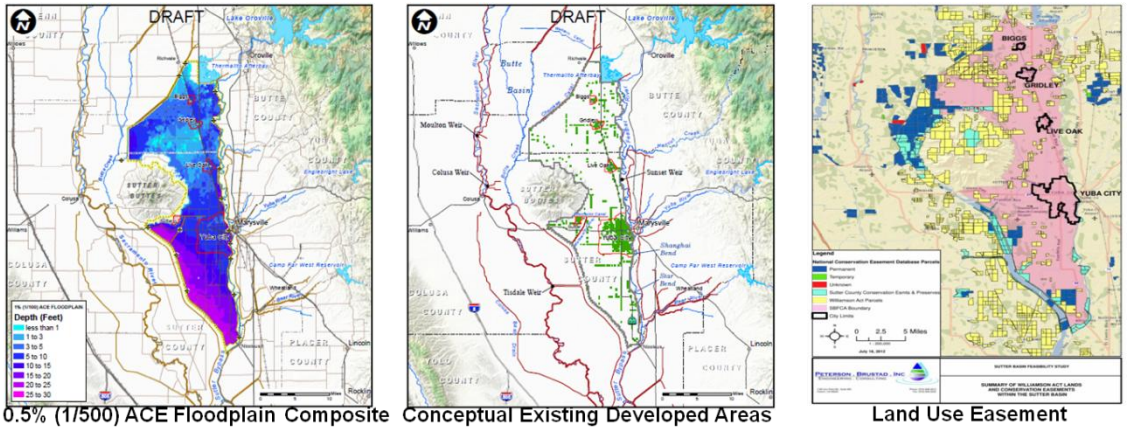
7.1.9 Executive Order 11988

Executive Order (EO) 11988 (May 24, 1977) requires a Federal agency, when taking an action, to avoid short- and long-term adverse effects associated with the occupancy and the modification of a floodplain. The agency must avoid direct and indirect support of floodplain development whenever floodplain siting is involved. In addition, the agency must minimize potential harm to or in the floodplain and explain why the action is proposed. Additional floodplain management guidelines for EO 11988 were provided in 1978 by the Water Resources Council.

The wise use of floodplains concept, as described in EO 11988, was incorporated as a life safety metric for this study. The metric "potentially developable floodplains" was used in the pilot study multi-objective planning process for evaluation and screening. This metric approach was based on pilot study objectives of applying qualitative rather than quantitative analysis; use of existing data/inventory; and professional team judgment. In calculating the potentially developable land metric for the Sutter Basin, the following areas were excluded.

- Areas that are currently developed.
- Areas that are owned in fee by governments or nonprofit organizations and that are protected for open space purposes.
- Areas with flood depths greater than 3 feet for the FEMA 1% (1/100) ACE base flood event because constructing buildings to meet FEMA floodplain management requirements is assumed to be cost prohibitive.
- Areas outside the 0.2% (1/500) ACE floodplain boundary. This prevents high topographic areas along Sutter Buttes from being included.

The 0.2% (1/500) ACE maximum floodplain was determined as the base floodplain. This area covers essentially the entire Sutter Basin outside the Sutter Buttes (Figure 7-2). Also, for baseline reference use only, a map of currently developed areas and a compilation map of existing easements were created (Figure 7-2).



0.5% (1/500) ACE Floodplain Composite Base Flood Plain

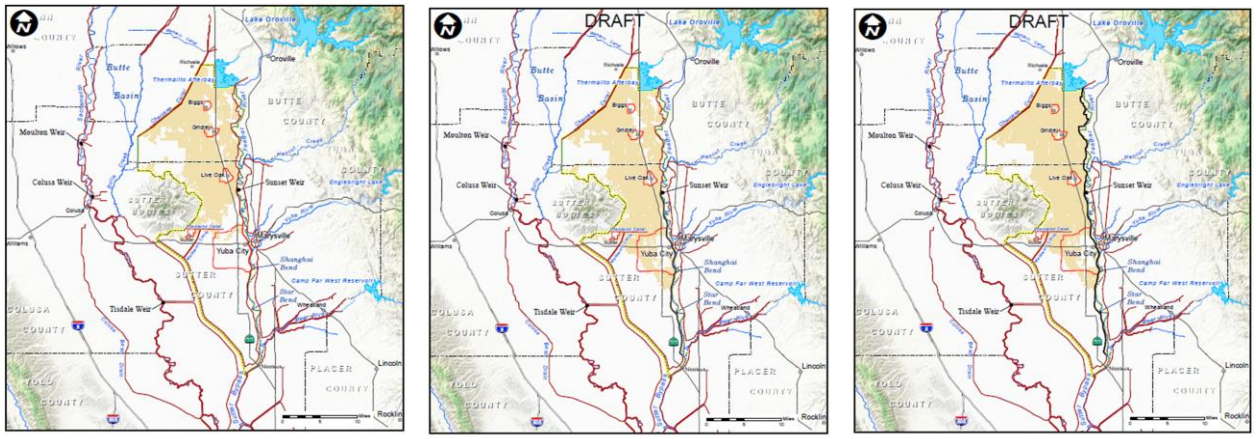
Conceptual Existing Developed Areas Source: USDA NASS 2010

Land Use Easement Compilation Map

(See the *Figures* folder on the CD for full-sized images.)

Figure 7-2. Baseline Information Maps

Using the criteria and assumptions listed above for determining potentially developable floodplain, maps were prepared and acreages were calculated for the No Action, NED Plan, and RP (Figure 7-3). These maps do not forecast future growth. Tables 7-5, 7-6, and 7-7 show the potentially developable land by economic impact area for the No Action Alternative, NED Plan and RP, respectively.



(See the *Figures* folder on the CD for full-sized images.)

Figure 7-3. Potentially Developable Floodplain Comparison Maps

Table 7-5. Potentially Developable Land, Alternative SB-1 No Action

Economic Evaluation Area	Total Acres	Protected Acres	Developed Acres	Unprotected and Undeveloped Acres	Potentially Developable Acres			
					Total	Acres by Residual 1/500 ACE Depth		
						< 2 feet	2 to 15 Feet	>15 Feet
Town of Sutter	115	0	23	92	92	92	0	0
Yuba City Urban	15,748	46	8,379	7,323	872	0	872	0
Biggs Urban	758	0	298	459	230	0	230	0
Gridley Urban	1,286	0	643	643	620	69	551	0
Live Oak Urban	1,377	23	735	620	436	0	436	0
Sutter County Rural	95,914	1,148	5,188	89,578	25,298	2,870	22,429	0
Butte County Rural	68,526	8,838	3,145	56,543	44,284	12,420	31,864	0
Total	**183,724**	**10,055**	**18,411**	**155,257**	**71,832**	**15,450**	**56,382**	**0**

Table 7-6. Potentially Developable Land, Alternative SB-7: Fix In Place Feather River Levees: Sunset Weir to Laurel Avenue

Economic Evaluation Area	Total Acres	Protected Acres	Developed Acres	Unprotected and Undeveloped Acres	Potentially Developable Acres			
					Total	Acres by Residual 1/500 ACE Depth		
						< 2 feet	2 to 15 Feet	>15 Feet
Town of Sutter	115	0	23	92	92	92	0	0
Yuba City Urban	15,748	46	8,379	7,323	6,175	0	6,084	92
Biggs Urban	758	0	298	459	230	0	230	0
Gridley Urban	1,286	0	643	643	620	69	551	0
Live Oak Urban	1,377	23	735	620	436	0	436	0
Sutter County Rural	95,914	1,148	5,188	89,578	36,387	2,870	33,402	115
Butte County Rural	68,526	8,838	3,145	56,543	44,284	12,420	31,864	0
Total	**183,724**	**10,055**	**18,411**	**155,257**	**88,223**	**15,450**	**72,567**	**207**

Table 7-7. Potentially Developable Land, Alternative SB-8: Fix In Place Feather River Levees: Thermalito to Laurel Avenue

Economic Evaluation Area	Total Acres	Protected Acres	Developed Acres	Unprotected and Undeveloped Acres	Potentially Developable Acres			
					Total	Acres by Residual 1/500 ACE Depth		
						< 2 feet	2 to 15 Feet	>15 Feet
Town of Sutter	115	0	23	92	92	92	0	0
Yuba City Urban	15,748	46	8,379	7,323	6,221	0	6,129	92
Biggs Urban	758	0	298	459	459	0	459	0
Gridley Urban	1,286	0	643	643	643	69	574	0
Live Oak Urban	1,377	23	735	620	620	0	620	0
Sutter County Rural	95,914	1,148	5,188	89,578	39,118	2,870	35,583	666
Butte County Rural	68,526	8,838	3,145	56,543	53,076	12,420	40,634	23
Total	**183,724**	**10,055**	**18,411**	**155,257**	**100,230**	**15,450**	**83,999**	**781**

The NED Plan would result in an additional 16,000 acres of potentially developable floodplain consisting of 5,000 acres in the Yuba City urban area and 11,000 acres in the Sutter County rural area outside of Yuba City. The additional increment to implement the RP would result in an additional 12,000 acres of potentially developable floodplain consisting of 500 acres in the urban areas of Yuba City, Biggs, Gridley, and Live Oak; 2,700 acres in the Sutter County rural area; and 8,800 acres in the Butte County rural area.

Development does not occur in the absence of demand. Land use in the basin is primarily dominated by a strong agricultural-based economy and uses. This type of land use and economy does not support rapid, urbanized growth or demand. The necessary basin wide public infrastructure (i.e. roadways, water and sewer systems, and utilities) do not exist for urban growth, and would require a substantial investment from the State, local governments, and the development community. This

type of future investment is unlikely due to the lack of demand from consumers within and outside the basin.

The cities of Biggs, Gridley, Live Oak, and Yuba City are not currently mapped within the FEMA 100-year floodplain. Despite the lack of floodplain development restrictions, development in Biggs, Gridley, Live Oak, and Yuba City has been modest, even during the building boom of the early 2000s. The addition of FRM improvements this study will provide would not change the fundamental drivers of urban growth demand within the Sutter Basin. Lack of economic drivers and development restrictions in place at the local, state, and Federal level, will continue to control and limit urbanized development, even with implementation of the improvements to reduce the risk of flooding, such as the local FRWLP and the Sutter Basin project recommended by this report.

Table 7-8 presents 2070 population estimates for the Sutter Basin using growth rates developed by the Sacramento Area Council of Governments (SACOG). The population figures do not relate directly to demand for developable acreage. In order to estimate the demand for developable land necessary to accommodate the projected population presented in Table 7-8, the population growth rates were applied to existing developed acreage in each jurisdiction. The projected urban development within each city's Sphere of Influence (SOI) as shown in each General Plan is shown in the Tables 7-9 and 7-10.

Table 7-8. Population Projection within the Sutter Basin

		Projected Population (Year 2070) [b]	
Jurisdiction	**2010 Population [a]**	**Median Growth Rate**	**Est. Population**
Yuba City	64,925	2.5%	285,656
Live Oak	8,392	2.6% [c]	39,148
Biggs	1,707	5.2%	35,742
Gridley	6,584	3.5%	51,869
Sutter County	94,737	1.7%	260,482
Butte County	220,000	1.1%	424,123

[a] According to 2010 Census.

[b] Based on Sacramento Area Council of Governments (SACOG) growth rates.

[c] City of Live Oak Growth Rate used because SACOG estimate was not available for Live Oak.

Table 7-9. Projected Sutter County Developed Areas

Sutter County Growth Areas[a]	Existing Developed Acreage[b]	Projected New Urban Acreage from 2010–2030[c]	Projected New Urban Acreage from 2010–2070[d]
Yuba City SOI & Employment Corridor	8,965	12,019	30,479
Live Oak SOI	1,165	6,511	11,667 [e]
Other (Sutter & Tudor)	2,037	2,939	7,465
Subtotal Sutter County	**12,167**	**21,469**	**49,611**

[a] As indicated in the Sutter County General Plan Draft EIR.

[b] Acreage within the City limits is assumed to be fully developed.

[c] As indicated in the Sutter County General Plan Draft EIR. Does not subtract out existing development in the SOI.

[d] Assumes population projected growth rate of 2.6% also applies to urbanized development.

[e] Growth rate of 2.6% applied to new acreage in 2030 (6,511 acres)

SOI = Sphere of Influence.

Table 7-10 Projected Butte County Developed Areas

Butte County Growth Areas	Existing Developed Acreage	Projected New Urban Acreage from 2010-2030[a]	Projected New Urban Acreage from 2010-2070[d]
Biggs SOI	414[b]	541[b]	8,524
Gridley SOI	1,300[c]	2,900[c]	8,941
Subtotal Butte County	5,155	3,441	17,465
Total for Sutter & Butte County	**17,322**	**24,910**	**67,076**

[a] Does not subtract out existing development in the SOI

[b] As indicated in the City of Biggs General Plan

[c] Acreage values not included. Gross acreage scaled off map in Gridley General Plan

[d] Assumes projected growth rate of 5.2% and 3.5% for Biggs and Gridley, respectively. Same growth rates also apply to urbanized development.

The data presented in Tables 7-9 and 7-10 indicate that only about 67,000 new acres are projected to be developed by 2070 within the basin, assuming SACOG projected growth rates are maintained beyond 2030. Furthermore, Yuba City accounts for about half of the demand for developable acreage (approximately 30,000 acres). This estimated projected new urban acreage is far less than the Potentially Developable Land under the No Action, NED, and RP alternatives. This data indicate the estimated demand by 2070 for approximately 67,000 acres of developable land—far less than the 71,800 acres of Potentially Developable Land to be available in the basin under the No Action Alternative.

The developable acreage shown in Table 7-5 is primary located in the northern basin, where current flooding depths are relatively shallow. Land located in the deep floodplain in the southern portion of the basin would not be removed from the floodplain under any alternative, and is, therefore, not included in the potentially developable acreage. The eight-step EO 11988–Floodplain Management

evaluation process is outlined below with discussion of the RP formulation process to demonstrate coordination and compliance with the EO.

Step 1: Determine if a proposed action is in the base floodplain (1/100 year floodplain or 1% ACE).

The proposed RP is within the defined base floodplain. The RP proposes to improve the structural integrity of existing Feather River Federal levees in the Sutter Basin to the authorized levee design elevation, reducing flood risk and addressing residual risk to public and life safety. These levees are part of the overall SRFCP.

Step 2: If the action is in the floodplain, identify and evaluate practicable alternatives to locating in the base floodplain.

The study evaluated all practicable measures and alternatives by following the six-step planning process and evaluating a wide range of measures and alternatives using pilot initiatives of available information, professional judgment, and risk-informed decision making. Practicable alternatives and measures (structural and nonstructural) that were considered included those listed below.

- Construction of Marysville Reservoir: This was screened out because of foundation conditions.
- Improvement of Butte Bypass: This was screened out because of high cost and because it did not address geotechnical levee failure modes.
- Removal of existing development: This was not considered a practicable alternative.
- Ring levees: They were determined not cost effective because of high environmental effects.
- Flood proofing and raising existing structures and infrastructure: This was determined not cost effective.
- Reservoir reoperation: This alternative was screened out because of potential systemwide effects, and because it did not address geotechnical levee failure modes.
- Fix geotechnical issues of existing Federal levees: These measures were retained.

Step 3: Provide public review.

The public has been advised through the integrated NEPA/CEQA process and proposed outreach program. The NEPA/CEQA process requires and provides for public disclosure through various means, such as scoping meetings, public notices, websites, direct mailing, and presentations to various agencies and small groups.

A more detailed accounting of the scoping process is provided in Chapter 5, *Consultation and Coordination*.

Step 4: Identify the impacts of the proposed action and any expected losses of natural and beneficial floodplain values.

The proposed fix-in-place levee improvements under the NED Plan and the LPP minimize the direct impact on the floodplain by confining levee improvements to the existing Feather River West Levees. Because the existing levees are set back from the active channel of the Feather River for the majority of the study area, the wide riparian floodplain waterside of the levees would largely remain unaffected by the project. The total area of floodplain along the right bank of the Feather River adjoining the study area is about 7,650 acres. In its current setback condition, the river will continue to provide opportunity for natural processes that enhance fish and wildlife habitat.

Project construction would cause some loss of floodplain riparian vegetation but would not significantly diminish existing floodplain natural values. Only where existing riparian vegetation abuts the levee toes and is within the Vegetation ETL vegetation-free zone would vegetation be impacted by the project. To compensate for vegetation losses, both the NED Plan and LPP propose revegetation of the floodplain restoration area created at the Star Bend levee setback. This proposal has received strong conceptual support from the fish and wildlife resource agencies. Mitigation at Star Bend represents biodiversity and ecological structure and patch size that far outweigh the individual trees for which the mitigation compensates.

Natural floodplain values located landward of the project levees could be affected by future growth in the Sutter Basin study area. However, any future growth is expected to come from conversion of agricultural land or urban infill rather than from conversion of natural areas. The majority of the land within the study area is in agricultural use. Much of the natural habitat that existed historically has been lost to agriculture and urban development. Only about 12.4% of the land is in natural habitat and these lands are located in State and Federal refuges and other permanently protected areas.

Beneficial impacts of the proposed RP are listed below.

- The probability of flooding of existing infrastructure and agricultural land will be reduced.
- Annualized economic losses to existing infrastructure and agricultural land will be reduced.
- Annualized potential hazardous waste and toxic releases due to flooding of storage areas and infrastructure will be reduced.
- Annualized flood recovery cleanup and disposal tonnage will be reduced.
- Risk to public and life safety due to flooding will be reduced.

Adverse impacts of the proposed RP are listed here.

- Potential for increased development within the areas removed from the currently defined base floodplain. These areas are on the landside of the existing levee system and consist of areas with existing urban communities and agriculture areas in current production.
- Short-term environmental impacts due to construction activities within the project footprint. Impacts are expected to be greatest at the location of seepage berms and lowest where slurry walls would be constructed.

Step 5: Minimize threats to life and property and to natural and beneficial floodplain values. Restore and preserve natural and beneficial floodplain values.

Addressing the geotechnical issues by fixing-in-place the existing Federal levees was determined to be the most effective and cost-efficient measure. No existing floodplain values were changed.

A wide range of measures and alternatives was evaluated that would cost effectively lower flood risk and reduce residual risk to life safety in the northern basin and the towns of Biggs, Gridley, Live Oak, and parts of Yuba City with minimal additional environmental short- and long term-impacts. Chapter 3, *Plan Formation*, compares these alternatives with the RP. Some potential mitigation measures to minimize threats and risk are listed below.

- A flood warning and evacuation plan would be incorporated into the alternative.

- A proposed strategy to control development in the potentially developable land that becomes available due to SB-8.
- A flood risk–awareness program.

Further, in conjunction with the FRWLP project, SBFCA has entered into an MOU with the American Rivers and other parties, as documented in the FRWLP EIS. The signatories to the MOU have agreed to work jointly to seek funding for and to pursue additional elements of a multi-objective approach for the Feather River watershed beyond the FRWLP to further reduce flood risk to the Sutter Basin, mitigate for past degradation of the Feather River ecosystem from facilities of the State Plan of Flood Control, and to advance the objectives of the Central Valley Flood Protection Plan. Such activities would include the following measures.

- In partnership with the Three Rivers Levee Improvement Authority, enhancing and expanding restoration as part of a levee setback area on the east side of the Feather River to serve as habitat mitigation as a near-term component of the FRWLP and other projects as described in the preliminary approved California Department of Water Resources FloodSAFE Environmental Stewardship and Statewide Resources Office grant application signed by SBFCA.
- Developing and implementing a multi-benefit project in the Oroville Wildlife Area to decrease water surface elevations in the Feather River, restore and improve floodplain habitat, improve flood operations, and reduce maintenance costs.
- Creation of approximately 20 acres of riparian habitat by SBFCA in addition to the approximately 20 acres already created by Levee District 1.
- A multi-benefit project at Abbott Lake that would provide levee borrow material to support levee reconstruction while modifying the floodplain surface to be beneficial to fish and wildlife.
- The potential for a setback levee south of Laurel Avenue if there is a willing seller and local support. The project would achieve 100-year flood protection for the southern portion of the basin and help to create a mosaic of riparian floodplain habitat and agriculturally productive land that produces flood management benefits for the Sutter Basin.
- An environmental restoration project located at Nelson Slough as identified by the Lower Feather River Corridor Management Plan.
- A State funded program to purchase agricultural easements from willing sellers to promote agriculture and to meet ecosystem restoration goals identified in the Central Valley Flood Protection Plan and as a public safety strategy to manage long-term risk in the floodplain.

Step 6: Reevaluate alternatives.

A full range of alternatives was analyzed and evaluated using planning criteria of acceptability, effectiveness, efficiency (NED), and completeness. Evaluation metrics framed around life safety were developed with one metric, potentially developable floodplains, developed specifically to address EO 11988. Multi-objective planning looked beyond cost effectiveness and into residual risk and life safety. See Chapter 3, *Plan Formation*, for a comparison of the RP with other alternatives.

Step 7: Issue findings and a public explanation.

The public has been kept advised through the NEPA/CEQA process. To conclude the NEPA process, a record of decision for the early implementation programs (EIPs) will be publically issued following approval of the Final EIS. To conclude the CEQA process, findings will be publically issued following

certification of the Final EIR. A public workshop will be conducted during the Draft EIS/SEIR stage, and a public hearing will be held to decide on project adoption by SBFCA as an action under CEQA.

Step 8: Implement the action.

Alternative SB-8 is the proposed RP.

7.1.10 Natural Floodplain Values

The Sutter Basin study area consists of a natural basin bounded by the Sutter Buttes and a series of mostly Federal levees that are part of the SRFCP (See Plate 1-2) that was completed and documented in 1957. The two main levee elements that define the Sutter Basin are the Sutter Bypass on the west side and the Feather River on Sutter Basin's eastern boundary. The Sutter Bypass is a primary bypass flood structure of the SRFCP during high-water events. The bypass has no defined natural floodplain but has within its boundaries high-value agricultural areas for wintering waterfowl.

Unlike on the Sacramento River, the levees of the Feather River are mostly set back hundreds of feet from the main river channel and bank. Within these waterside setback areas are agricultural and significant remnant riparian areas that are still considered connected to the natural river floodplain with high habitat values. Several wildlife conservations areas are located within these setback areas.

The landside of the leveed basin is primarily agricultural. The natural floodplains were redefined when Sutter Basin was leveed in the early 20th century to reduce risk of flooding to agricultural and urban areas. Remnant but disconnected natural floodplain areas or habitats within the Basin are mostly now in conservation easements or preserve areas that are secured from future development. These conservation easements in conjunction with rice production fields provide high-value stop over areas for the Pacific Flyway migration. (For land use easement compilation map, see Figure 7-2 and associated figures appendix).

The RP effect of induced development in the Sutter Basin's remnant and isolated natural floodplain and habitat areas would be minimal. As stated, the natural floodplains are already disconnected by the existing levee while the majority of natural riverine connected areas remains landside. Other natural floodplain values of groundwater recharging and water quality would be minimally affected by induced development.

7.1.11 Residual Risk

The RP would strengthen approximately 41 miles of existing Feather River levees from Thermalito Afterbay to Laurel Avenue, just south of Yuba City. The RP would provide FRM benefits to the urban areas of Yuba City, Live Oak, Gridley and Biggs, as well as to the rural agricultural areas around the urban areas. The RP incorporates levee superiority by providing landward erosion protection at two initial overflow locations to allow for a more controlled failure and increased evacuation time in the event of hydraulic capacity exceedance. To further increase the resiliency, initial overtopping locations were selected both upstream and downstream of the Yuba River to account for the hydrologic possibility of storms centered over the Feather River or Yuba River watersheds (or both). The remaining 3.3 miles of Feather River levee downstream of Laurel Avenue to the Sutter Bypass, and 18 miles of Sutter Bypass levee will not be strengthened in the RP. Levee assurance within these reaches will continue to be limited by geotechnical conditions.

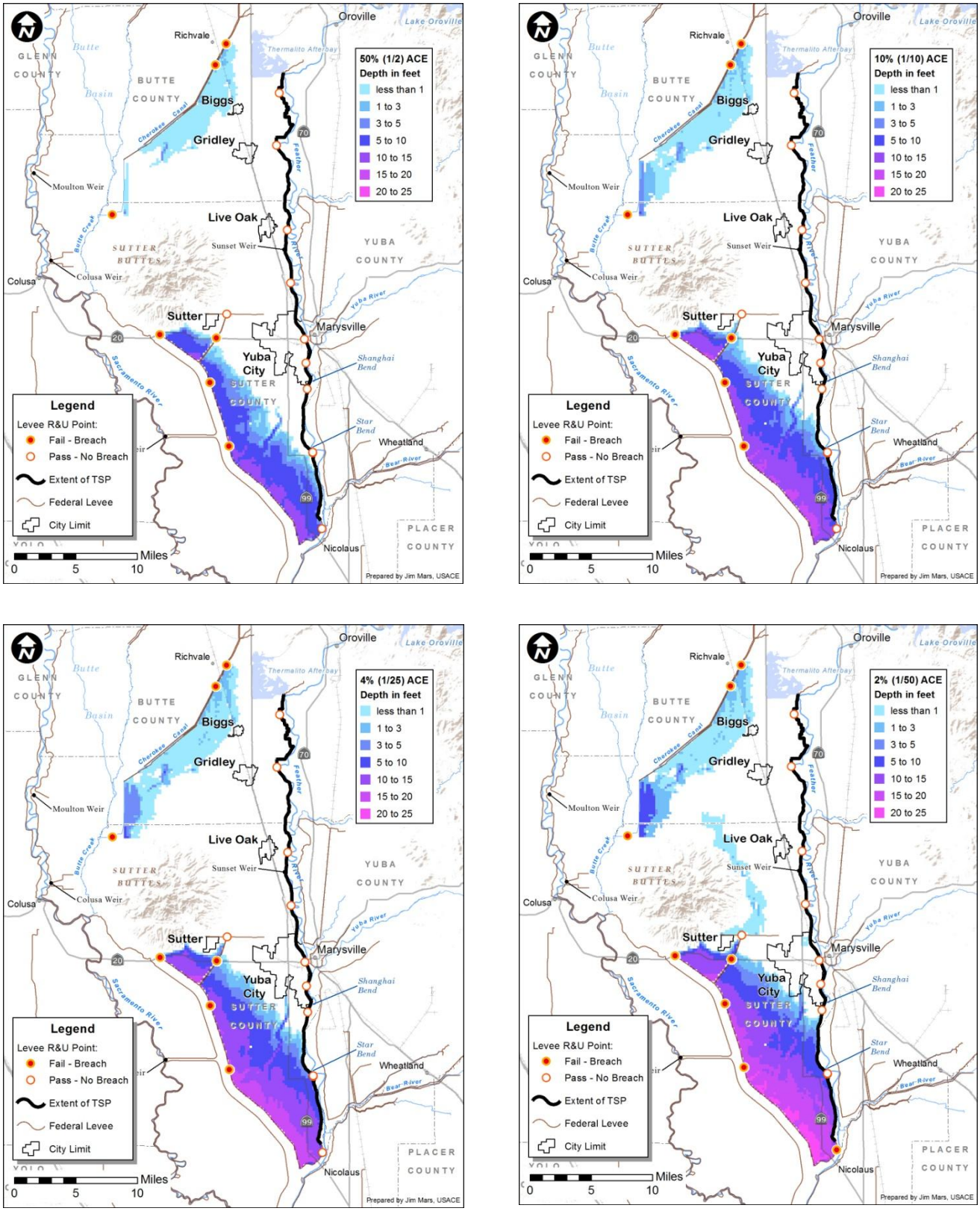
Residual flood risk related to the strengthened levee reaches will be primarily related to overtopping type levee breaches which are forecasted in advance. In comparison, the remaining reaches will have a significantly higher probability of an unforecasted geotechnical-related levee breach prior to overtopping.

Residual flood risk after completion of the RP would vary throughout the study area. Figures 7-4 and 7-5 depict the composite floodplains for flood magnitudes ranging from 50% (1/2) ACE to 0.2% (1/500) ACE. The maps show that the probability of flooding in the northern and Yuba City portions of the study area would be substantially less than in the southern portion of the study area. The following provides a narrative description of residual flood risk within the study area. Flood stages and geotechnical performance are uncertain and actual flood scenarios are highly variable.

The primary source of residual flood risk for the northern urban areas Live Oak, Gridley, and Biggs would be from infrequent large flood events that overtop the existing Feather River levees. As discussed in Appendix C1a, *Hydrology*, and summarized in Section 4.2.2.5.2, an overtopping flood event would likely be preceded by flood warning and river guidance issued by the National Weather Service (NWS) and CNRFC five days in advance. A more accurate warning would likely be made 24 to 36 hours in advance. Initial overtopping would likely start to occur in the superiority reaches with landward erosion protection described above followed by a breach of the levee. The populated areas are located 1 to 2 miles away from the Feather River and evacuation of the northern area would likely occur prior to the overtopping levee breach.

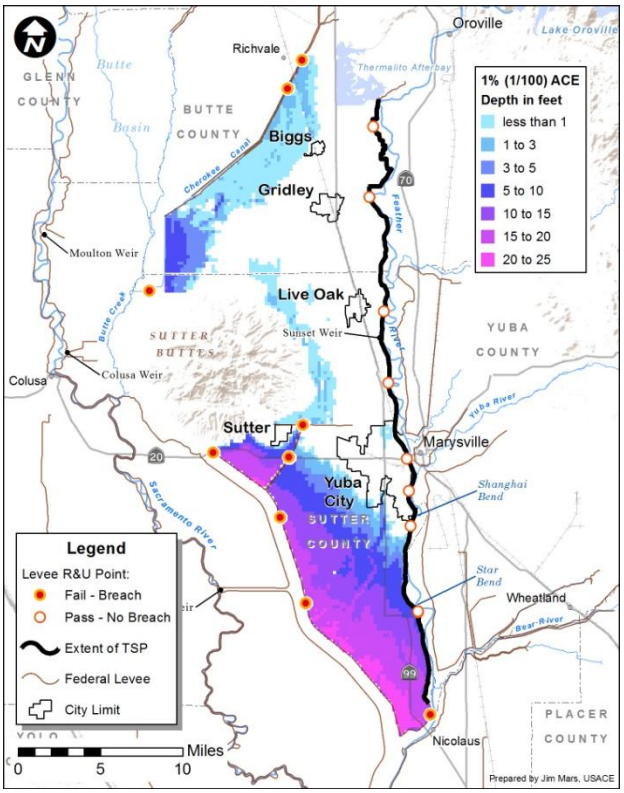
The primary source of residual flood risk for the Yuba City area will also be from infrequent large flood events that overtop the existing Feather River levees. An overtopping flood event would likely be preceded by flood warning and river guidance issued by the NWS and California Nevada River Forecast Center (CNRFC) 5 days in advance. A more accurate warning would likely be made 24 to 36 hours in advance. Initial overtopping would likely start to occur in the levee superiority reaches with landward erosion protection followed by a breach of the levee. A breach to the north of Yuba City would result in flood flow southwest, flanking most of the urban area. A breach to the south of Yuba City would also result in flood flow southwest and which would fill the southern portion of the Basin, then back up into the southern outskirts of Yuba City. Yuba City is located adjacent to the Feather River levees at the confluence of the Yuba River. As a result, the consequences of a levee breach along this reach would be the largest of the three areas described.

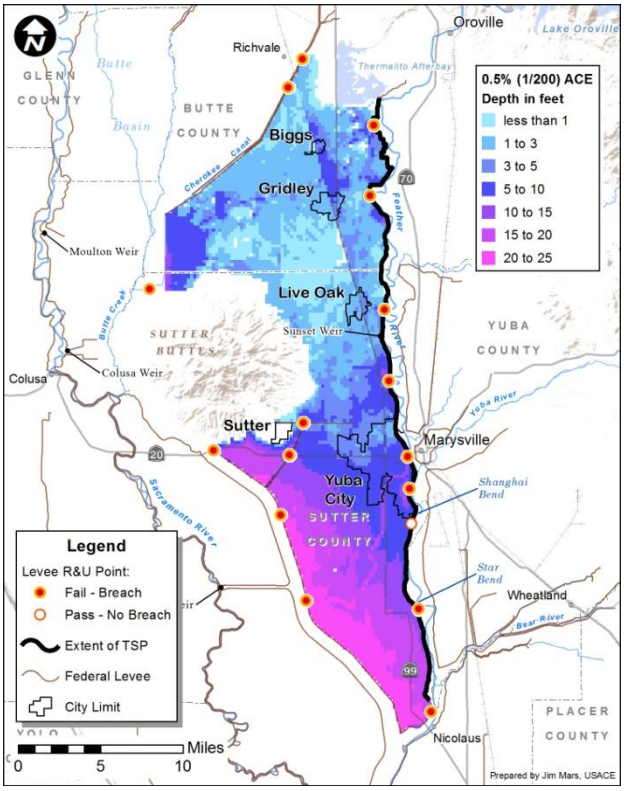
The primary source of residual flood risk for the southern rural agricultural area of the Sutter Basin would continue to be from unforecasted geotechnical failure of the levees on the Feather River south of Laurel Road and along the Sutter Bypass. This southern area is at the lowest elevation within the Sutter Basin. Geotechnical levee breeches often occur with little advance warning. A breach in the southern portion of the Sutter Basin would result in a flood flow that would extend along the levee at lower elevations and then spread slowly north and up to the Yuba City area. The areas of highest life safety risk would be near the levee breach, where velocities and inundation times would be the fastest. Evacuation would be directed to the north in advance of the expanding floodwaters. However, this would area would pose an extremely high life safety risk for anyone trapped while evacuating. The floodwaters along the southern portion of this area could achieve depths as great as 25 feet, well above the roof tops of most structures.

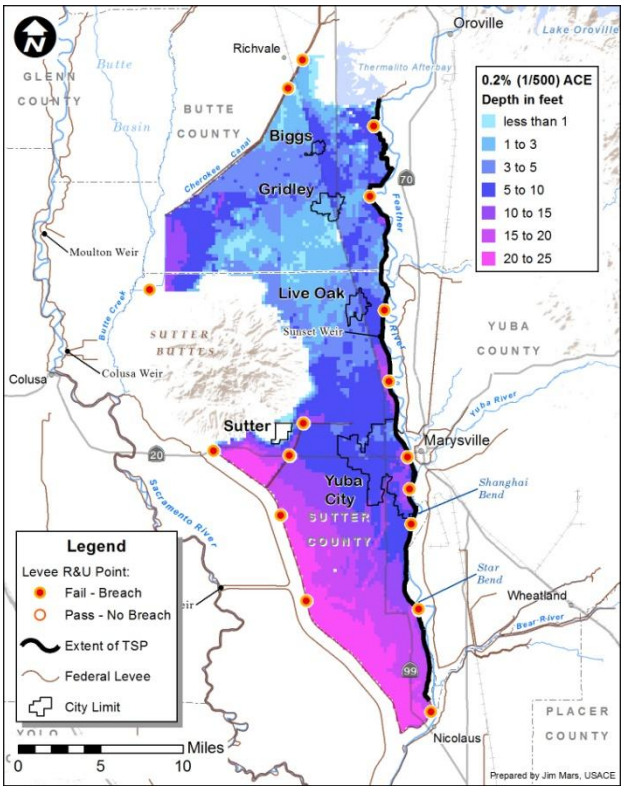


(See the *Figures* folder on the CD for a full-sized image.)

Figure 7-4. 50% ACE, 10% ACE, 4% ACE, and 2 % ACE Composite Floodplains







(See the *Figures* folder on the CD for a full-sized image.)

Figure 7-5. 1% ACE, .05% ACE, and .02 % ACE Composite Floodplains

7.1.11.1 Floodplain Population

The estimated 2010 population within the residual composite floodplains of the No Action Alternative and RP are provided Tables 7-11 and 7-12, respectively. The estimates were made by comparing the population within 2010 census blocks to the composite floodplains. The estimates are made for all floodplain depths greater than zero feet.

Table 7-11. Population within No Action Alternative Residual Composite Floodplains

	People within Floodplain depths greater than 0 feet						
Economic Evaluation Area	50% (1/2) ACE	10% (1/10) ACE	4% (1/25) ACE	2% (1/50) ACE	1% (1/100) ACE	0.5% (1/200) ACE	0.2% (1/500) ACE
Biggs Urban	0	1,452	1,452	1,452	1,452	1,452	1,763
Gridley Urban	0	6,379	6,379	6,379	6,379	6,379	6,379
Live Oak Urban	0	4,408	8,362	8,362	8,362	8,362	8,362
Yuba City Urban	0	67,351	67,368	67,368	67,368	67,368	67,368
Butte County Rural	0	4,338	4,776	4,788	4,788	4,793	4,899
Sutter County Rural	1,089	5,346	6,260	6,260	6,269	6,300	6,344
Total	**1,089**	**89,274**	**94,597**	**94,609**	**94,618**	**94,654**	**95,115**

Table 7-12. Population within RP Residual Composite Floodplains

	People within Floodplain depths greater than 0 feet						
Economic Evaluation Area	50% (1/2) ACE	10% (1/10) ACE	4% (1/25) ACE	2% (1/50) ACE	1% (1/100) ACE	0.5% (1/200) ACE	0.2% (1/500) ACE
Biggs Urban	0	19	19	19	19	1,452	1763
Gridley Urban	0	0	0	0	0	6,379	6379
Live Oak Urban	0	0	0	0	0	8,362	8362
Yuba City Urban	0	43	255	2,756	3,467	37,115	67,368
Butte County Rural	0	9	9	9	18	4,793	4,899
Sutter County Rural	1,089	1,718	2,110	2,938	3144	6,293	6,344
Total	**1,089**	**1,789**	**2,393**	**5,722**	**6,648**	**64,394**	**95,115**

7.1.11.2 Life Safety

Population within floodplains with high life loss potential was defined as the population of grid elements with flood depths greater than 15 feet, as rooftops of single story houses would be underwater. The estimated 2010 populations within residual composite floodplains with depths greater than 15 feet are provided in Tables 7-13 and 7-14 respectively. The estimates were made by comparing the population within 2010 census blocks to the composite floodplains. The estimates are made for all floodplain depths greater than 15 feet.

Table 7-13. Population within No Action Alternative Residual Composite Floodplains Depths Greater Than 15 Feet

	People within Floodplain depths greater than 15 feet						
Economic Evaluation Area	50% (1/2) ACE	10% (1/10) ACE	4% (1/25) ACE	2% (1/50) ACE	1% (1/100) ACE	0.5% (1/200) ACE	0.2% (1/500) ACE
Biggs Urban	0	0	0	0	0	0	0
Gridley Urban	0	0	0	0	0	0	0
Live Oak Urban	0	0	0	0	0	0	0
Yuba City Urban	0	0	137	137	137	303	934
Butte County Rural	0	0	0	0	0	0	0
Sutter County Rural	0	499	774	944	958	1,059	1,183
Total	**0**	**499**	**911**	**1,081**	**1,095**	**1,362**	**2,117**

Table 7-14. Population within RP Residual Composite Floodplain Depths Greater Than 15 Feet

	People within floodplain depths greater than 15 feet						
Economic Evaluation Area	50% (1/2) ACE	10% (1/10) ACE	4% (1/25) ACE	2% (1/50) ACE	1% (1/100) ACE	0.5% (1/200) ACE	0.2% (1/500) ACE
Biggs Urban	0	0	0	0	0	0	0
Gridley Urban	0	0	0	0	0	0	0
Live Oak Urban	0	0	0	0	0	0	0
Yuba City Urban	0	0	0	0	0	0	934
Butte County Rural	0	0	0	0	0	0	0
Sutter County Rural	0	0	4	231	303	774	1,183
Total	**0**	**0**	**4**	**231**	**303**	**774**	**2,117**

The USACE Levee Screening Tool (LST) was used to provide an initial quantitative life safety risk. The LST is intended to assist local, state, and Federal stakeholders in identification and prioritization of funding needs for levees of concern. The resulting Life loss estimates for a levee breach in an un-strengthened reach during a flood event near the top-of-levee (approximately a 0.5%, 1/200 ACE event) after construction of the RP are provided in Table 7-15.

Table 7-15. Life Loss Estimate

	No Action		RP	
Community	Day	Night	Day	Night
Biggs	6	8	0	0
Gridley	26	33	0	0
Live Oak	34	43	0	0
Yuba City	276	348	14	18
Rural Butte	20	25	0	0
Rural Sutter	26	32	13	16
Total	**388**	**489**	**27**	**34**

7.1.11.3 Critical Infrastructure

Critical infrastructure is a term used by governments to describe assets that are essential for the functioning of a society and economy from a national perspective. Most commonly associated with the term are facilities for fire stations, police stations, hospitals, senior living facilities, and prisons. Table 7-16 provides an estimate of the numbers of critical infrastructure that would remain within the 1% (1/100) ACE residual floodplains of the No Action Alternative and RP.

Table 7-16. Critical Infrastructure in Floodplain

	Number of Critical Infrastructure Facilities	
Community	No Action	RP
Biggs	1	0
Gridley	3	0
Live Oak	4	0
Yuba City	19	0
Rural Butte	0	0
Rural Sutter	1	1
Total	**28**	**1**

7.1.11.4 Economic Damages

The residual estimated annual damages after completion of the RP are described in Table 7-17.

Table 7-17. Residual Expected Annual Damages, October 2013 Prices (Values in $1,000s), 3.5% Discount Rate

	Expected Annual Damages ($1,000)	
Community	No Action	RP
Biggs	951	352
Gridley	3,052	452
Live Oak	3,293	529
Yuba City	70,929	10,483
Rural Butte	34,75	1,558
Rural Sutter	54,841	36,141
Total	**136,541**	**49,515**

7.2 Environmental Operating Principles

The USACE Environmental Operating Principles (EOP) are an integral part of the guidance and philosophy for the planning process. They are:

- Foster Sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

The EOP were incorporated into Sutter Basin Pilot planning process and recommendation through its basis of multi-objective analysis and evaluation using the system of accounts. The system of accounts (national economic development, environmental quality, regional economic development, and other social effects (See Section 3.4.2)) provides a framework for considering the broad array of effects of the alternative plans beyond what is normally considered in the NED analysis. The EOPs were essential in identifying a plan formulation strategy that balanced urban, rural, agricultural, and natural elements within the Sutter Basin. Avoidance of adverse environmental impacts, followed by minimization and then compensation of unavoidable, significant adverse impacts, is the formulation direction that that was followed in accordance NEPA and other environmental laws.

The Pilot Process incorporated all the principles, but was particularly effective with environmental and economic consequences, risk management, collaboration, and an open, transparent process to the public, local sponsors, and the USACE teams.

7.3 USACE Campaign Plan

The mission of USACE is to provide vital public engineering services in peace and war to strengthen the nation's security, energize the economy, and reduce risks from disasters. In order to meet this mission, the agency has developed the USACE Campaign Plan as a component of the corporate strategic management process to establish priorities, focus on the transformation initiatives, measure and guide progress, and adapt to the needs of the future. The goals and supporting objectives of the Campaign Plan are:

- **Ready for all Contingencies**
  - Ready, responsive and reliable
  - USACE supports combat, stability and disaster operations
  - Human resources and family support to promote readiness
  - Institutionalize USACE capabilities in interagency policy and doctrine
- **Transform Civil Works (Engineering Sustainable Water Resources Solutions)**
  - Deliver enduring and essential water resources solutions.
  - Collaborates with partners and stakeholders to find holistic and sustainable solutions.
  - Improve water resources policies and stream line regulatory processes.
  - Enable Gulf Coast recovery
- **Building Effective, Innovative, Sustainable Solutions**
  - Use innovative tools to efficiently and effectively deliver high quality facilities
  - Improve reliability and resiliency of critical infrastructure and reduce risks related to water resources and other DOD infrastructure
  - Use risk-informed asset management
  - Innovative approaches to delivering quality infrastructure
- **Recruiting and Retaining Strong Teams**
  - Build and cultivate a competent, disciplined and resilient team
  - Strengthen critical core technical competencies
  - Communicate strategically with stakeholders and the public
  - Use standardized processes

The Sutter Basin Feasibility Study and the pilot study program have been responsive to these goals and objectives by:

- Transform Civil Works (Engineering Sustainable Water Resources Solutions)
  - The Sutter Basin Feasibility Study was one of a small handful of studies selected as a Pilot Study as part of the USACE National Pilot Program that led the SMART planning groundwork in the transforming of the study process.
- Deliver enduring and essential water resources solutions:

- Designing a project which avoids or minimizes environmental impacts through fix-in-place levee alternatives while reducing flood risk and reducing the residual flood risk for public safety the Sutter Basin.
- The Recommended Plan has minimal impact to existing waterside riparian areas and habitat while maintaining minimal impacts to agriculture and urban areas.

- Improve water resources policies and stream line regulatory processes:
  - For the Pilot Study, the team led the way in development of new SMART planning processes and ways of plan formulation and feasibility study procedures to improve water resource policies and processes.
  - A LPP policy exception request was granted by ASA(CW) allowing recommendation of a Recommended Plan that addresses residual risk.
- Collaborate with partners and stakeholders to find holistic and sustainable solutions.
  - The Feasibility Study team as part of the Pilot development and study process, organized and participated in various Vertical Team and stakeholder meetings, charettes, and public workshops throughout the process and worked with local groups and sponsors to achieve a timely balance of project goals and public concerns.
- Build and cultivate a competent, disciplined and resilient team
  - The study successfully employed the use of Vertical Team coordination, Risk Assessment and Analysis, Charette & VE workshops, District Quality Control (DQC), Agency Technical Review (ATR), and Independent External Peer Review (IEPR) to assist in the review of the development of a technically and policy sound recommendation of Federal Interest.

7.4 Plan Implementation

This section describes the remaining steps to potential authorization of the project by Congress.

7.4.1 Report Approval

After review by Headquarters USACE, the Final Feasibility Report and EIR/SEIS will be circulated for 30 days to all appropriate Federal, state, and local government agencies, and the public. After its review of the final Feasibility Report and EIR/SEIS, including consideration of public comments, USACE Headquarters will prepare the Chief of Engineers' Report. This report will be submitted to ASA(CW), who will coordinate with the Office of Management and Budget and submit the report to Congress.

7.4.2 Project Authorization and Construction

Once the final report is approved by the Chief of Engineers and the project is authorized by Congress, construction funds must be appropriated by Congress before a PPA can be signed by USACE and the sponsor and project construction can proceed.

7.4.2.1 Federal Responsibilities

USACE would complete PED studies. Once the project is authorized and funds are appropriated, a PPA would be signed with the State of California as the non-federal sponsor. After the sponsor

provides the cash contribution, lands, easements, rights-of-way, relocations, and disposal areas, as well as assurances, the Federal Government would begin construction of the project.

7.4.2.2 Non-Federal Responsibilities

Specific items of local cooperation are identified in Chapter 8, *Recommendations*.

7.4.2.2.1 Views of Non-Federal Sponsor

The non-federal sponsors, SBFCA and CVFPB, support the RP and accept responsibility for the additional cost increment beyond the Federal cost share of the NED Plan. Local interests have been supportive of the study and project. Throughout development of this feasibility report, there has been significant coordination with SBFCA, the State of California, and private landowners.

7.4.2.2.2 Financial Capability of Sponsor

The total estimated non-federal first cost of the project is $433,660,000, including lands, easements, rights-of-way, relocations, and disposal areas (LERRDs) using October 2013 price levels. Actual costs may be slightly greater at the time of construction due to inflation.

7.4.2.3 Project Cost-Sharing Agreements

A Design Agreement must be executed between USACE and the non-federal sponsor in order to cost share the development of detailed plans and specifications. Before construction is started, the Federal Government and the non-federal sponsor would execute a PPA. This agreement would define responsibilities of the non-federal sponsor for project construction as well as operation and maintenance, repair, replacement, and rehabilitation and other assurances.

7.5 Schedule

If the project is authorized in 2014, construction activities could start as early as 2017 subject to authorization and appropriation. Table 7-18 contains a schedule showing the approval and construction phases of the project. The construction sequencing strategy addresses high flood risk urban areas first. The construction schedule is not constrained by assumptions of limited appropriations of funds to the government, but is based upon limited window of construction to non-flood months and time required for local acquisition of required LERRDs for each contract.

As discussed in Section 1.7.3.2, the project sponsors propose to initiate construction of the local FRWLP and to request in-kind credit for this work to be applied toward the non-federal cost share of the Sutter Basin project (RP). A Section 221 MOU was executed on June 14, 2013, and construction of the local FRWP was initiated in July 2013.

The construction sequencing of the local FRWLP is aligned with the proposed Federal project phasing. During the PED phase the construction schedule for the Federal project will be adjusted based upon an evaluation of how much of the local FRWLP has been completed and a determination of the Federal project remaining to be constructed.

During the PED phase, minimal additional studies would be conducted as part of developing detailed designs for the project. These potential studies may include the following.

- Additional geotechnical analysis of underlying substrates.

- Topographic surveys for project design.
- Preconstruction surveys to avoid direct effects on nesting birds and other sensitive species.
- Water quality analysis of construction activities and methods.
- Analysis of a Southern Levee Relief Structure for flood waters release in the southern basin (local sponsor initiative).

Table 7-18. Project Schedule

Phases	Scheduled Dates
Division Commander's Notice	2014
Chief of Engineers Report	2014
Potential Authorization	2015
USACE and Sponsor Sign Design Agreement	2015
Preconstruction Engineering and Design	2015–2016
Initiate Construction	2017
Contract A Station 180+00 to 478+68	2022–2023
Contract SBFIP Station 478+68 to 512+00	Not applicable[a]
Contract B Station 512+00 to 845+00	2021–2022
Contract C1 Station 845+00 to 1213+85	2017–2018
Contract C2 Station 1213+85 to 1674+37	2018–2019
Contract D1 Station 1674+37 to 2122+00	2019–2020
Contract D2 Station 2122+00 to 2638+00	2020–2021
Complete Physical Construction	2023

[a] As discussed in Section 1.7.3.1, the local sponsor has completed construction of a setback levee at Star Bend. The ASA(CW) approved credit consideration for this local work in 2010 and in accordance with the provisions of Section 104 WRDA 1998. The fix-in-place component of the Star Bend reach of the Federal plan (RP) will not be constructed, but will be the basis upon which Section 104 credit is evaluated in accordance with ER 1165-2-29.

Embedded Figures

Chapter 8
Recommendations

This chapter describes the Items of Cooperation for a Structural Flood Risk Management (Single Purpose) Project that will be specifically authorized.

I recommend that the Recommended Plan (Alternative SB-8) be authorized for implementation as a Federal project with such modifications thereof as in the discretion of the Commander, U.S. Army Corps of Engineers, may be advisable. The estimated first cost of the Recommended Plan (RP) is $688,930,000. The estimated Federal cost is $255,270,000 and the estimated non-federal cost is $433,660,000 at October 2013 price levels. Federal cost participation is limited to the Federal cost of the NED Plan (Alternative SB-7). Annual operations and maintenance, repair, replacement, and rehabilitation cost is estimated to be $454,000 (October 2013 price levels).

The RP is a Locally Preferred Plan (LPP) that differs from the National Economic Development (NED) Plan. The LPP would reduce the vulnerability of a larger population and additional critical infrastructure, reduce economic flood risks to a greater extent, and provide more evacuation routes relative to the NED Plan. The LPP would cost about $297,090,000 more than the NED Plan. The non-federal sponsors would be responsible for the entire extra cost, which would increase the non-federal cost share from about $136,570,000 for the NED Plan to about $433,660,000 for the LPP. The Federal cost share of initial construction, estimated at $255,270,000, would remain the same for the NED Plan and the LPP.

Section 104 credit consideration has been approved for the advanced work performed by the project sponsor in construction of the Star Bend setback levee. The advanced work is compatible with the RP as an acceptable substitute to providing FRM benefits and will be incorporated into the Federal plan. The amount of Section 104 credit to be afforded will be the actual costs incurred by the sponsor to provide the substitute FRM measure or the cost of the savings to be realized by the Government in not constructing the fix-in-place slurry wall. The affording of Section 104 credit will not increase the total project cost of the RP.

Federal implementation of the Recommended Plan would be subject to the non-federal sponsors agreeing to pay the full incremental cost between the NED Plan and LPP, estimated to be $297,090,000, and to comply with applicable Federal laws and policies, including but not limited to:

1. Provide a minimum of 35 percent, but not to exceed 50 percent, of total project costs of the NED plan as further specified below:
    a. Provide 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;
    b. Provide, during construction, a contribution of funds equal to 5 percent of total project costs;

c. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operations and maintenance of the project;

d. Provide, during construction, any additional funds necessary to make its total contribution equal to at least 35 percent of total project costs for the NED alternative;

2. Shall not use funds from other Federal programs, including any non-federal contribution required as a matching share therefore, to meet any of the non-federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;

3. Not less than once each year, inform affected interests of the extent of protection afforded by the project after construction completion;

4. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

5. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 United States Code (USC) 701b-12), which requires a non-federal interest to prepare a floodplain management plan within one year after the date of signing a project cooperation agreement, and to implement such plan not later than one year after completion of construction of the project;

6. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

7. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the project affords, hinder operations and maintenance of the project, or interfere with the project's proper function;

8. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 USC 4601-4655), and the Uniform Regulations contained in 49 Code of Federal Regulations (CFR) Part 24, in acquiring lands, easements, and right-of-way required for construction, operations and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

9. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

10. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;
11. Hold and save the United States free from all damages arising from the construction, operations and maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;
12. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 CFR Section 33.20;
13. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 USC 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, titled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 USC 3141–3148 and 40 USC 3701–3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 USC 276a et seq.)), the Contract Work Hours and Safety Standards Act (formerly 40 USC 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 USC 276c et seq.);
14. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 USC 9601–9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operations and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-federal sponsor with prior specific written direction, in which case the non-federal sponsor shall perform such investigations in accordance with such written direction;
15. Assume, as between the Federal Government and the non-federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operations and maintenance of the project;
16. Agree, as between the Federal Government and the non-federal sponsor, that the non-federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA; and

17. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 USC 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 USC 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

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Michael Farrell
Colonel, U.S. Army
District Engineer

This following individuals participated in the preparation of this document.

9.1 U.S. Army Corps of Engineers

Name	Education/Experience	Contribution
Matthew Davis	M.S. Biological Sciences; 28 years' experience	Environmental analysis
Miki Fujitsubo	B.S. Environmental Planning – Landscape Architecture, California Licensed Landscape Architect; 34 years' experience	Plan formulation and evaluation
W. Scott Parker	M.S. Engineering, M.B.A., California Licensed Civil Engineer; 43 years' experience	Plan formulation and evaluation
Brad Johnson	B.A. Landscape Architecture; 18 years' experience	Environmental analysis
Nick Applegate	M.B.A. 12 years' experience	Economic analysis
Destani Hobbs Szarkowski	B.A. Geography & Environmental Studies, MASc Environmental Policy and Management; 5 years' experience	Mapping and graphics
Jim Green	B.A. Geography, Certified General Real Estate Appraiser-State of California; 17 years' experience	Real estate appraisal
Laurie Parker	B.A. Geography; 21 years' experience	Real estate inventory and evaluation
Steve Carey	B.A. Geography, B.S. Geology; 15 years' experience	Mapping and graphics
James Mars	B.A. Geography; 20 years' experience	Mapping and graphics
Richard C. Kristof	B.S. M.S. Civil Engineering; 44 years' experience	Engineering analysis
Tung Le	B.S. Civil Engineering; 5 years' experience	Engineering analysis
Jane M. Bolton	M.S. Civil Engineering; 24 years' experience	Geotechnical analysis
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9.2 ICF International

Name	Education/Experience	Contribution/Role
Christopher Elliott	B.S. Landscape Architecture, California Licensed Landscape Architect, Certified Arborist; 17 years' experience	Project Director
Ingrid Norgaard	B.A. Political Science (emphasis on public service); 14 years' experience	Internal/External Project Co-Manager
Gregory Ellis	B.A. Geography; 18 years' experience	Internal Project Co-Manager
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Jennifer L. Rogers	B.A Journalism; 7 years' experience	Project Coordinator
Bill Mitchell	M.S. Fisheries Biology; 24+ years' experience	Fisheries and Aquatics Specialist
Paul Shigley	B.A. Government-Journalism; 25 years' experience	Technical Editor of Report
Deborah Jew	A.A. General Education, C.A. Graphic Communication; 25 years' experience	Publication Specialist
Alan Barnard	17 years' experience in graphic design, web design, multimedia design, and cartography	Cover Graphics

10.1 Elected Officials and Representatives

Honorable Barbara Boxer, U.S. Senator

Honorable Dianne Feinstein, U.S. Senator

Honorable Doug LaMalfa, U.S. Representative, California District 1

Honorable Jim Nielsen, California State Senator, District 4

Honorable Dan Logue, California Assembly Member, District 3

10.2 U.S. Government Departments and Agencies

Bureau of Indian Affairs, Pacific Regional Office, Sacramento, CA

Bureau of Land Management, Sacramento, CA

Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA

Department of Agriculture, Animal and Plant Health and Inspection Service, Sacramento, CA

Department of Agriculture, Farm Service Agency, Washington, DC

Department of Agriculture, National Institute of Food and Agriculture, Washington, DC

Department of Agriculture, Natural Resources Conservation Service, Oroville, CA

Department of Agriculture, Natural Resources Conservation Service, Washington, DC

Department of Agriculture, Natural Resources Conservation Service, Yuba City, CA

Department of Defense, Navy, Washington, DC

Department of Defense, U.S. Marine Corps, Washington, DC

Department of Energy, Washington, DC

Department of Health and Human Services, Americans with Disabilities Act, Washington, DC

Department of Health and Human Services, Centers for Disease Control and Prevention, Atlanta, GA

Department of Health and Human Services, Office of the Secretary, Washington, DC

Department of Homeland Security, Washington, DC

Department of Housing and Urban Development, Region IX, San Francisco, CA

Department of the Interior, Washington, DC

Department of the Treasury, Washington, DC

Department of Veterans Affairs, Washington, DC

Environmental Protection Agency (via e-filing)

Environmental Protection Agency Region 9, San Francisco, CA

Federal Aviation Administration, Flight Standards District Office, Sacramento, CA

Federal Emergency Management Agency, Region IX, Oakland, CA

Federal Highway Administration, California Division, Sacramento, CA

Fish and Wildlife Service, Sacramento Fish and Wildlife Office – Sacramento, CA

Fish and Wildlife Service, Sacramento River National Wildlife Refuge Complex-Willows, CA

General Services Administration, Washington, DC

Geological Survey, Menlo Park, CA

National Marine Fisheries Service, Central Valley Office-Sacramento, CA

National Marine Fisheries Service, Southwest Regional Office-Long Beach, CA

National Park Service, San Francisco, CA

National Science Foundation, Arlington, VA

10.3 State of California Government Agencies

California Air Resources Board

California Department of Conservation

California Department of Fish and Game, North Central Region

California Department of Parks and Recreation, Northern Butte District

California Department of Transportation, District 3

California Department of Water Resources

California Environmental Protection Agency

California Natural Resources Agency

Central Valley Flood Protection Board

Central Valley Regional Water Quality Control Board

Office of Historic Preservation

Office of Planning and Research

State Lands Commission, Environmental Management Division

10.4 Local and Regional Government Agencies

Butte County Air Quality Management District

Butte County Board of Supervisors

Butte County Clerk/Recorder

Butte County Department of Development Services

Butte County Library—Main Branch, Oroville

Butte Environmental Council

City of Biggs Branch Library

City of Biggs City Council

City of Biggs Planning Department

City of Gridley City Council

City of Gridley Planning Department

City of Live Oak City Council

City of Live Oak Planning Department

City of Marysville City Council

City of Marysville Planning Department

City of Yuba City City Council

City of Yuba City Community Development

Feather River Air Quality Management District

Gridley Branch Library

Levee District 1

Levee District 3

Levee District 9

Maintenance Area 16

Maintenance Area 7

Sacramento Area Flood Control Agency

Sutter Butte Flood Control Agency

Sutter Butte Flood Control Agency Board of Directors

Sutter County Board of Supervisors

Sutter County Clerk/Recorder

Sutter County Library—Main Branch, Yuba City

Sutter County Planning Services

Sutter County Public Works Department

Sutter County Resource Conservation District

Three Rivers Levee Improvement Authority

West Sacramento Area Flood Control Agency

Yuba County Planning Department

10.5 Other Interested Parties

Alliance for Nuclear Accountability

American Bird Conservancy

American Federation of Labor and Congress of Industrial Organizations

American Lung Association

American Recreation Coalition

American Rivers

California Farm Bureau Federation

Center for Biological Diversity

Central Valley Flood Control Association

Clean Water Action

Ducks Unlimited

Earth Justice

Edison Electric Institute

Environment America

Environmental Council of the States

Environmental Defense Fund

Environmental Defense Institute

Family Water Alliance

Friends of the Earth

GRACE

Institute for Science and International Security

League of Women Voters

Local Media Representatives

National Association of Attorneys General

National Audubon Society

National Conference of State Legislatures

National Wildlife Federation

Natural Resources Defense Council

Northern California Water Association

Pacific Gas & Electric Company

Partners in Flight

Responsible Environmental Action League

Sacramento River Preservation Trust

Sacramento Valley Landowners Association

Sierra Club

The Nature Conservancy

The Partnership Project

The Wilderness Society

Trout Unlimited

Yuba-Sutter Farm Bureau

10.6 Native American Contacts

Berry Creek Rancheria of Maidu Indians

Butte Tribal Council

Cachil DeHe Band of Wintun Indians (Colusa Rancheria)

Cortina Indian Rancheria of Wintun Indians

Enterprise Rancheria of Maidu Indians

Greenville Rancheria of Maidu Indians

KonKow Valley Band of Maidu

Maidu Cultural and Development Group

Maidu Nation

Maidu/Konkow

Mechoopda Indian Tribe of Chico Rancheria

Mooretown Rancheria of Maidu Indians

National Congress of American Indians

National Tribal Environmental Council

Paskenta Band of Nomlaki Indians of California

Strawberry Valley Rancheria

Tsi-Akim Maidu

United Auburn Indian Community of the Auburn Rancheria

10.7 Members of the Public

All members of the general public who requested a copy of the Draft Report, or who provided comments on the Draft Report, will be mailed either an electronic version (on CD) or a hard copy of this document. Additionally, those who submitted comments during the scoping process, spoke or provided comment cards at the public meeting, and provided complete mailing addresses and those who may be affected by the proposed project will also receive a copy of the Final Report. Comments received on the Draft Report are reproduced in Appendix F.

Chapter 11
Index

12.1 Executive Summary

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None.

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12.6 Chapter 5. Consultation and Coordination

None

12.7 Chapter 6. Compliance with Environmental Laws and Regulations

None.

12.8 Chapter 7. Tentatively Selected Plan

None.

12.9 Chapter 8. Recommendations

None.