

CIVIL WORKS REVIEW BOARD

REPORT SUMMARY FOR SUTTER BASIN PILOT FEASIBILITY STUDY, CALIFORNIA

Schedule

Feasibility Scoping Meeting	19 JAN 2005
Pilot Study Selection	18 FEB 2011
Decision Point 1	23 AUG 2011
Decision Point 2	02 NOV 2012
Decision Point 3	18 SEP 2013
Decision Point 4	DEC 2013
Draft Report Guidance Memorandum:	13 AUG 2013
Division Engineer Transmittal:	20 AUG 2013
Received at CECW-PC:	21 AUG 2013
CWRB Briefing:	18 SEP 2013
30-Day S&A Review start:	OCT 2013
30-Day S&A Review end:	NOV 2013
FONSI Executed:	DEC 2013

STUDY INFORMATION

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.

The Sutter Basin Pilot Feasibility Study (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.

Study Sponsor.

The non-federal project sponsors are the State of California Central Valley Flood Protection Board (CVFPB), formerly the State Reclamation Board, and the Sutter Buttes 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.

Study Purpose and Scope.

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 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 tentatively selected plan (TSP) for implementation. This report constitutes both a draft Feasibility Report following the USACE "pilot" planning process to identify and evaluate alternatives, 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).

Project Location/Congressional District.

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 Figure 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. 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.

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, operated by the California Department of Fish and Wildlife, is primarily riparian woodland habitat along the Feather River and grasslands around the Thermalito Afterbay.

The study area is located in Congressional Districts CA-1 and CA-3 which are represented by Congressman Doug LaMalfa and Congressman John Garamendi, respectively.

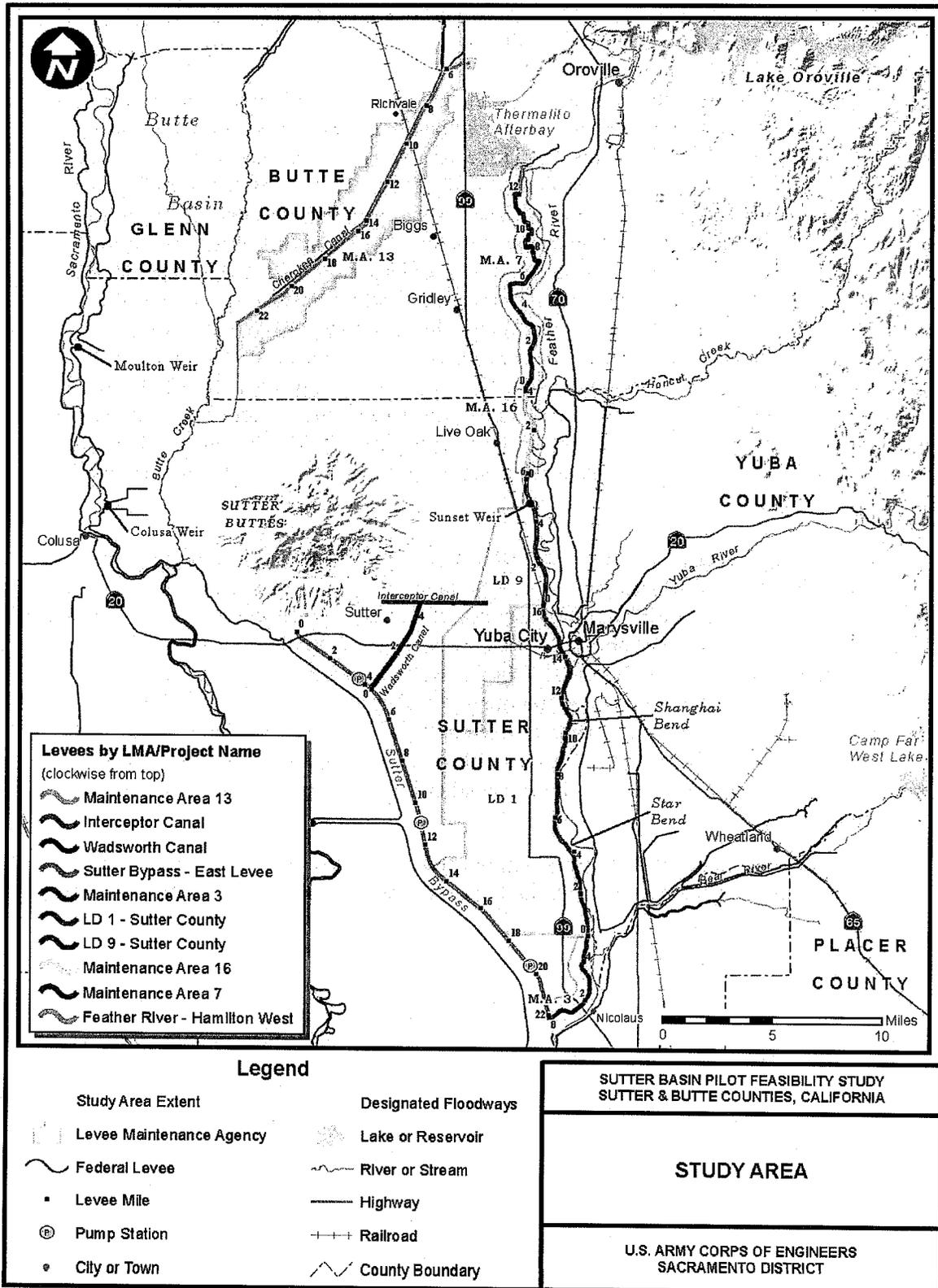


Figure 1. Study Area

Prior Reports and Existing Water Projects

The Sacramento River Flood Control Project (SRFCS). The history of the SRFCS 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 which 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 SRFCS 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.

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 California State Water Plan for development and utilization of water resources of California. 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. It was built for multi-purpose functions: water supply, flood control, power generation, recreation, and conservation. It 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 of need 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 flood plain.

New Bullards Bar, built in 1969 and operated by the Yuba County Water Agency, located on the Yuba River, provides a 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) requires Feather River flows to not exceed 150,000 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 the Corps, has invested heavily in coordinating operations, including developing models, establishing off-site data servers, and holding annual mock operations scenarios.

Advanced Work by Local Interests. 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.

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 Early Implementation Program (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 underseepage, 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.

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 underseepage 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 19 July 2013. In accordance with the requirements of ER 1165-2-208, an In-Kind MOU was executed on 14 June 2013, after identification of the Tentatively Selected Plan (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.

Central Valley Flood Protection Plan. California Senate Bill 5 (SB 5) 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 ten 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 the California Department of Water Resources (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 Central Valley Flood Protection Board adopt, a Central Valley Flood Protection Plan 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 Board did adopt the Central Valley Flood Protection Plan 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 non-structural 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.

Even before adoption of the Central Valley Flood Protection Plan, DWR, the Central Valley Flood Protection Board, and local agencies understood the importance of specific structural improvements to protect high risk urban areas. As a result, DWR created the Early Implementation Project (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 Sutter Butte's Feather River West Levee Project and construction of urgently needed reaches, the Three Rivers Levee Improvement Program, and the 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 Central Valley Flood Protection Plan, 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 requirements for urban areas. In addition, the California Legislature also enacted new laws giving the Central Valley Flood Protection Board new authorities for managing and enforcing encroachment standards on Federally-authorized levees, and is currently considering legislation that would further streamline that process.

STUDY OBJECTIVES

Problems and Opportunities.

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 is still at a high risk of flooding. From 1950 to 2011 extensive flood fighting occurred in the study area during 19 flood events. The flood of 1955 resulted from a nighttime 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.

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 performance during past flood events have resulted in a greater understanding of underseepage and 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 are found 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 underseepage. 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 underseepage 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.

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

The topographic surface elevations (excluding the high ground of Sutter Buttes) range from 110 feet NAVD88 in the northeast to 30 feet NAVD88 in the southwest, creating deep floodplain pooling in the southern basin.

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. 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 impact the northern half of the basin.

The following opportunities have been identified:

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

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

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

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

Planning Objectives.

The policy of the United States, as set forth in Section 2031 of the Water Resources Development Act 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 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.

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 without and with-project future 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 Order 11988.
- Section 308 of Water Resources Development Act (WRDA) 1990 prohibits the inclusion of damages to structures built in the FEMA regulated floodplain after 01 July 1991 in the economic analysis.

ALTERNATIVES

Plan Formulation Rationale.

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. The plan formulation process followed a multi-criteria method based upon risk-informed decision making, existing data and available information, and coordinated professional judgment.

Management Measures and Alternative Plans.

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. Then various management measures were identified to achieve the planning objectives and avoid the planning constraints.

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 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, since 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 will 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 this 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:

Alternative SB-1: No Action

Under this No Action Alternative, or the future without-project condition, the Federal government would take no action toward implementing a specific flood risk-management plan. 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 2.

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 2.

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 2.

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 2.

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.

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

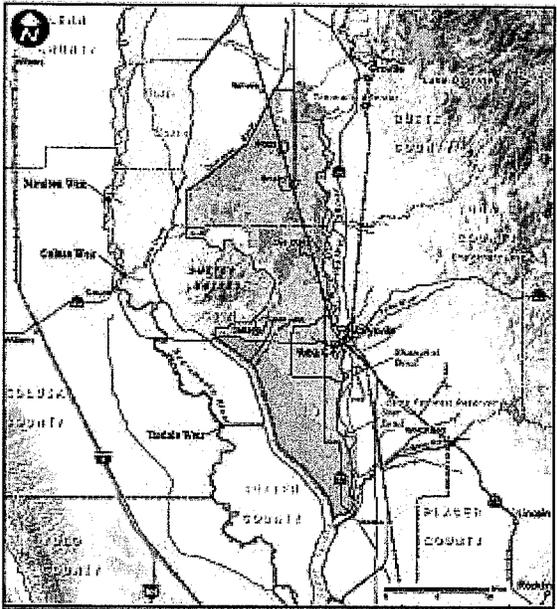
This alternative consists of fix-in-place improvements to the Sutter Bypass and Wadsworth Canal Levees and the Feather River Levees from Thermalito Afterbay to Laurel Avenue. Alternative SB-6 includes fix-in-place levee structural measures and nonstructural measures. Flood risk would be reduced most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

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

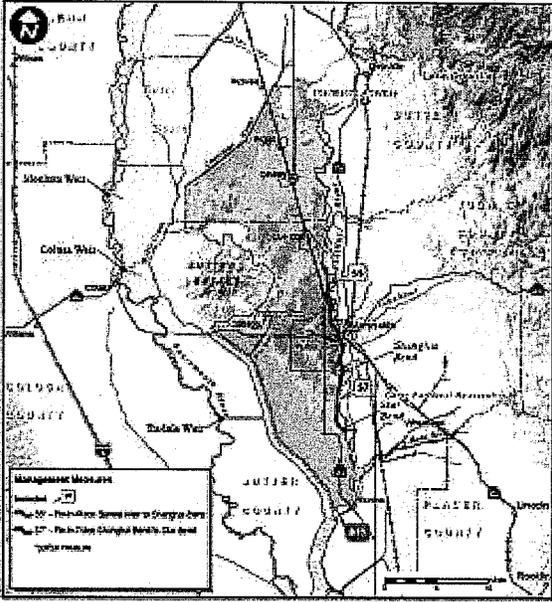
This alternative includes Alternative SB-2 but extends Feather River fix-in-place levee improvements south of Yuba City to a point 2,250 linear feet downstream of Laurel Avenue. Alternative SB-7 includes fix-in-place levee structural measures and nonstructural measures. The additional increment of levee 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.

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

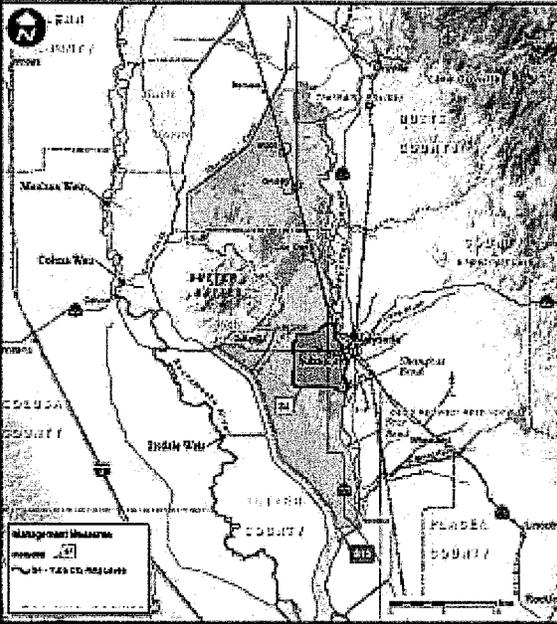
This alternative includes Alternative SB-7 but extends Feather River levee improvements north to Thermalito. Alternative SB-8 includes fix-in-place levee structural measures and nonstructural measures. Alternative SB-8 includes all the flood risk benefits of all of Alternative SB-7. However, Alternative 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.



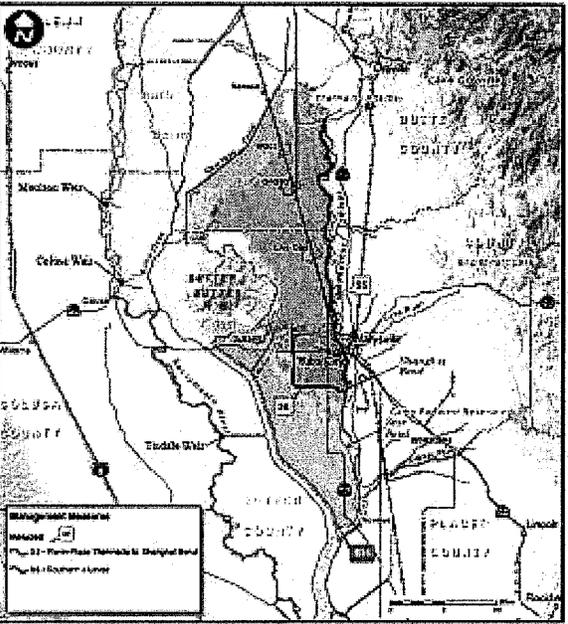
Alternative SB-1



Alternative SB-2

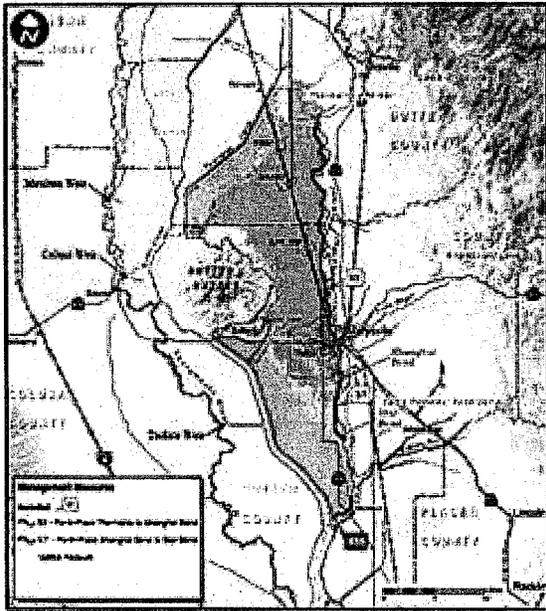


Alternative SB-3

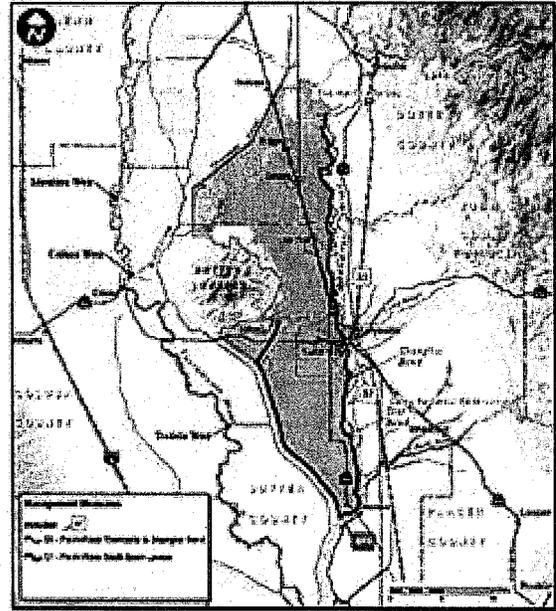


Alternative SB-4

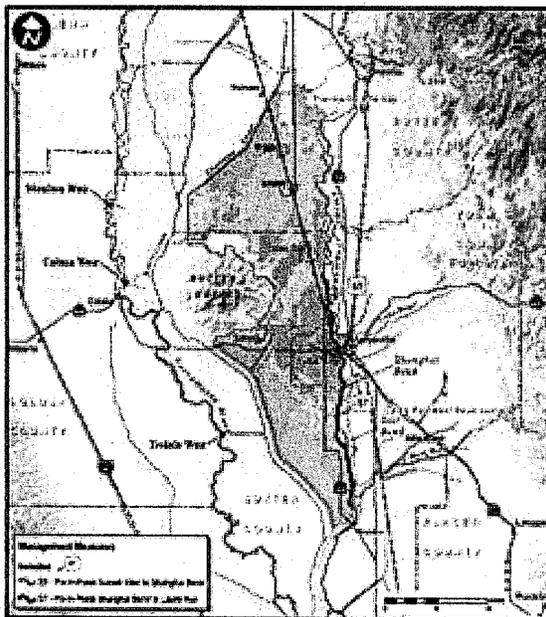
Figure 2 – Alternatives SB-1, SB-2, SB-3, and SB-4



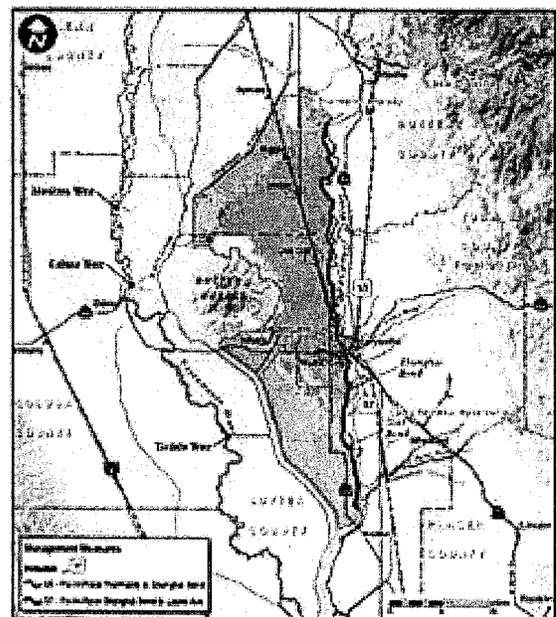
Alternative SB-5



Alternative SB-6



Alternative SB-7



Alternative SB-8

Figure 3 – Alternatives SB-5, SB-6, SB-7, SB-8

Identification of Final Array of Alternatives.

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.

Alternative SB-7, which 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 . 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.

Table 1. Net Benefits (Mean, Standard USACE Practice) – Final Array of Alternatives Using October 2013 Prices (\$1,000) and 3.75% Discount Rate

Economic Category	Alternative SB-1: No Action	Alternative SB-7: NED Plan	Alternative SB-8: LPP
Total First Cost		388,607	691,029
IDC		41,000	102,000
OMRR&R		277	454
Annual Cost		19,000	36,000
Annual Benefits		79,000	87,000
Annual Net Benefits		60,000	51,000
Benefit to Cost Ratio		4.2:1	2.4:1

NED = National Economic Development.

TSP = Tentatively Selected Plan.

IDC = Interest during construction.

OMRR&R = Operations and maintenance, repair, replacement and rehabilitation.

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.

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 \$692 million. The LPP would provide annual net benefits of \$51 million.

SB-1 (No Action)

SB-7 (NED)

SB-8 (LPP)

Figure 4. Final Array of Alternatives Comparison (Residual 1% ACE Floodplains).

The additional investment of \$303 million 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 2, and Figure 4).

Table 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 net benefits and a positive 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 TSP.

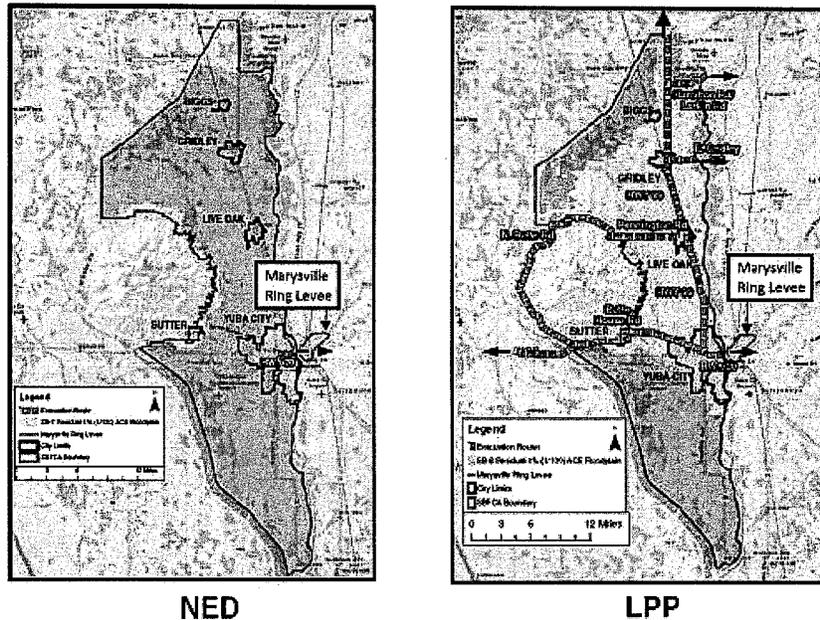


Figure 5. Evacuation Routes Comparison of NED and LPP.

Strengthening the existing levees from Thermalito Afterbay to Laurel Avenue will 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 five days in advance. A more accurate warning of potential levee overtopping would likely be made 24 to 36 hours in advance.

Table 3. 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 to Laurel Avenue.
2. MULTI-OBJECTIVE PLANNING ASSESSMENT			
A. National Economic Development (NED) – mean or mid-range numbers			
1. Project Cost (First Cost)	\$0	\$388,607,000	\$691,029,000
2. Annual Cost	\$0	\$19,000,000	\$36,000,000
3. Total Annual Benefit	\$0	\$79,000,000	\$87,000,000
4. Annual Net Benefits	\$0	\$60,000,000	\$51,000,000
5. Benefit – Cost Ratio	N/A	4.2:1	2.4:1
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 SB-8.
1b. Loss of Life	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

No Action (SB-1)	NED Plan (SB-7)	LPP (SB-8)
<p>1c. Critical Infrastructure – Public Safety</p>	<p>28 structures deemed as critical from a national perspective are at risk from floods.</p>	<p>1 structure would be at risk from floods.</p>
<p>1d. Evacuation Routes</p>	<p>In the event of a flood, no evacuation route is available out of the basin.</p>	<p>Five evacuation routes would be available in the event of a flood. A flood warning and evacuation plan would have more robustness and redundancy.</p>
<p>1e. Potential Developable Floodplains Note: fix-in-place measures are only bringing levees up to authorized elevation and performance.</p>	<p>Currently, 71,800 acres of land are potentially available for future development.</p>	<p>100,200 acres of land would be potentially available for future development.</p>
<p>2. Social Vulnerability (Study Area Resiliency)</p>	<p>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.</p>	<p>The four existing communities would be provided flood risk reduction, and social vulnerability would be minimized due to a decrease in the probability of flood hazards occurring.</p>
<p>3. Residual</p>	<p>Residual flood risk would remain high throughout the study area.</p>	<p>Residual flood risk for public and life safety would be reduced in the high-risk communities of Yuba City, Live Oak, Gridley, and Biggs.</p>
<p>E. Federal Planning Criteria</p>		
<p>Acceptability</p>	<p>N/A</p>	<p>The local sponsors and public support levee fixes and improvements.</p>

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

Recommended Plan.

The plan identified as the TSP is the Locally Preferred Plan (LPP), Alternative SB-8. This plan is justified and has a benefit to cost ratio of 2.4 to 1.0. Further, the LPP will comply with California Government Code requirements for a 200-year level of protection for urban and urbanizing areas by 2025.

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 TSP at NED level Federal participation cost share. The TSP 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.

The TSP 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 is the construction of soil-bentonite cutoff walls of various depths. The specific design features for the TSP are listed in [Table 4](#).

Table 4. Design Features of Tentatively Selected 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.

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 TSP.

Excavated materials from levee degradation are expected to be reusable. Haul routes are expected to consist primarily of existing public roads.

Environmental effects resulting from the TSP construction have been identified in Chapter 4, Affected Environment and Environmental Consequences. Some direct effects on riparian habitat and elderberry shrubs cannot be avoided, requiring the development of a mitigation and monitoring plan that would be coordinated with appropriate resource agencies. The TSP would be in full compliance with the vegetation guidelines of Engineering Technical Letter 1110-2-571, Guidelines for Landscape Plantings and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures (Vegetation ETL), and maximum potential effects have been disclosed. During the preconstruction engineering and design (PED) phase, all options then available for compliance with the Vegetation ETL will be considered.

Cultural resource effects have been identified and coordinated with consideration of historical sites and structures in the Yuba City area and some prehistoric sites near the existing levee areas.

Nonstructural measures to be implemented in conjunction with the TSP 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.

The TSP would significantly reduce residual flood risk to public and life safety over the NED Plan.

Systems/Watershed Context.

The Sutter Basin study area is situated within the Sacramento River watershed. 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 River and Bear Rivers. These watersheds drain the eastern 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.

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.

Peer Review.

ATR was conducted by a qualified interdisciplinary team of Corps of Engineers personnel from the New Orleans (MVN), St. Louis (MVS), Alaska (POA), Institute for Water Resources (IWR), and Walla Walla (NWW) Districts with the ATR lead being assigned to the Alaska District.

ATR of the Draft GRR was certified on 2 August 2013. The HQUSACE Policy Review comments via the Policy Guidance Memorandum were addressed and responses incorporated into the report.

Independent External Peer Review of the final report was coordinated by a representative of the Corps Flood Risk Management Center of Expertise (FRM-PCX) via a contract with Battelle, Inc, and conducted by appropriate outside resources familiar with the study area and its resources. Comments made by the IEPR team and responses to those comments, are documented in the IEPR package which will be completed in September 2013.

EXPECTED PROJECT PERFORMANCE

Project Costs.

The project first cost, estimated on the basis of October 2013 price levels, is \$691,029,000. Estimated average annual costs are \$36,000,000 based on a 3.75% 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 2.4 to 1.

Equivalent Annual Costs and Benefits.

Cost Sharing.

The ASA(CW) has approved an exception to the policy that requires decision documents to recommend the NED. The LPP costs \$302,422,000 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 \$136,252,000 for the NED Plan to \$438,674,000 for the LPP. The Federal cost share of \$252,355,000 is the same for both the NED Plan and the LPP. A summary of cost sharing responsibilities is presented in Table 5.

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 underseepage, 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 will 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 determined in accordance with the terms and conditions of the Project Partnership Agreement for the project authorized by Congress.

Table 5. Summary of Cost Sharing Responsibilities for the TSP (\$1,000)^{a b}

MCACES Account ^c	Account	Federal	Non-Federal	Total
	NED Plan			
1	Land and Damages	\$0	\$41,083	\$41,083
2	Relocations ^d	\$0	\$30,793	\$30,793
6	Fish and Wildlife	\$4,811	\$1,227	\$6,038
11	Levees and Floodwalls	\$189,556	\$48,356	\$237,912
18	Cultural Resources ^e	\$498	\$126	\$620
30	Preconstruction, Engineering, and Design	\$40,918	\$10,438	\$51,356
31	Construction Management	\$16,576	\$4,229	\$20,805
	Total First Cost (NED)	\$252,355	\$136,252	\$388,607
	Percentage	65%	35%	100%
	LPP Increment from NED to LPP			
1	Land and Damages	\$0	\$11,391	\$11,391
2	Relocations	\$0	\$66,223	\$66,223
6	Fish and Wildlife	\$0	\$1,557	\$1,557
11	Levees and Floodwalls	\$0	\$172,253	\$172,253
18	Cultural Resources ^e	\$0	\$505	\$505
30	Preconstruction, Engineering, and Design	\$0	\$35,708	\$35,708
31	Construction Management	\$0	\$14,785	\$14,785
	Total Incremental Increase	\$0	\$302,422	\$302,422
	Total First Cost (LPP)	\$252,355	\$438,674	\$691,029

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
- ^e Includes cultural resources investigations and required mitigation; excludes estimated cost for data recovery estimated to be \$1,633 for the NED Plan and an additional \$1,348 for the increment from NED to LPP

Project Implementation.

After 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.

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 Project Partnership Agreement can be signed by USACE and the sponsor and project construction can proceed.

USACE would complete PED studies. Once the project is authorized and funds are appropriated, a Project Partnership Agreement 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.

Specific items of local cooperation are identified in Chapter 8, Recommendations. The total estimated non-federal first cost of the project is \$438,674,000, 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. The total estimated value for the project lands, including LERRDs, is \$149,490,000.

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 Project Partnership Agreement. 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.

If the project is authorized in 2014, construction activities could start as early as 2017 subject to authorization and appropriation. Table 6 contains a schedule showing the approval and construction phases of the project.

Table 6. 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	NA ¹
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

Note: 1. As discussed in Section 1.7.2.1, the local sponsor has completed construction of a setback levee at Star Bend. The ASA (CW) had 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 (TSP) will not be constructed, but will be the basis upon which Section 104 credit is evaluated in accordance with ER 1165-2-29.

Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R).

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 TSP 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 TSP is estimated to be about \$454,000. Additional detail on the OMRR&R can be found in the Civil Design Appendix C.

Key Social and Environmental Factors.

Impacts to the environment from the recommended plan will be minimized by the construction of fix-in-place levee improvements which minimize environmental impacts to existing levee footprint.

A significant impact of the recommended plan is the loss of about 44 acres of riparian woodland and oak woodland from construction and compliance with Engineer Technical Letter 1110-2-571 (Vegetation ETL). The acreage of estimated vegetation loss is based on complete removal of vegetation within the Vegetation ETL vegetation-free zone. During the Preconstruction and Engineering Design (PED) phase, the existing levee system will be evaluated using current criteria for a possible variance to retain vegetation on the lower 2/3rds of the waterside slope of the levee and within 15 feet of the waterside levee toe. Additional options for compliance with the Vegetation ETL, or variance consideration, may be established in the future. During the PED phase, all available options and means for achieving Vegetation ETL compliance will be considered.

Fish and wildlife mitigation needs for the project have been coordinated with U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the California Department of Fish and Wildlife. Implementation of the Mitigation and Monitoring Plan will compensate for impacts by the restoration of about 88 acres of riparian floodplain habitat. Monitoring and contingency plans are included in the recommended plan. Periodic monitoring to determine mitigation success will continue until the Division Commander determines that mitigation success criteria have been met. Effects on the federally-listed giant garter snake and jurisdictional waters of the U.S. will be compensated and deemed satisfied through the purchase of mitigation credits from commercial mitigation banks.

The recommended plan is not anticipated to have significant social impacts or disproportionately affect minority or low-income populations. 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. Implementation of the plan would require permanent or temporary displacement of some residences. 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.

Due to the large volume of borrow material that must be delivered and the operation of a wide range of construction equipment, short-term emissions of reactive organic gases during construction will result in significant and unavoidable air quality effects. Implementation of mitigation measures would greatly reduce project-generated construction emissions, but will not reduce emissions to below local air quality management standards for reactive organic gases. To compensate for any emissions above air quality thresholds, including nitrogen oxides (NO_x) and particulate matter less than 10 microns in diameter (PM₁₀), payment will be made into the applicable air quality mitigation fee program.

The project could result in effects in identified archaeological sites as a result from levee construction ground-disturbing excavation that could inadvertently disturb human remains during this excavation. This construction work could have direct and indirect effects on built environment resources (historical buildings) through demolition or damage from vibration. These impacts will be minimized to the extent possible through avoidance where feasible, recovery and preservation of resources where disturbance is unavoidable and close coordination with representatives of the tribal communities that historically occupied the area.

Stakeholder Perspectives and Differences.

The non-federal sponsors, SBFCA and CVFPB, support the TSP 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.

Environmental Compliance.

NEPA compliance is being accomplished by the integration of a Supplemental Environmental Impact Statement into the feasibility report. The Draft FR/EIR/SEIS was released for public review on 14 June 2013, the public review comment period ended on 29 July 2013.

In compliance with Section 7 of the Endangered Species Act and ER 1105-2-100, Biological Assessments have been prepared and coordinated with the USFWS and NMFS. The District anticipates receiving an amended Biological Opinion from the USFWS and a Letter of Concurrence of "not likely to adversely affect" from the NMFS. Section 7 consultation will be completed prior to the signing of the Record of Decision.

USACE and the State Historic Preservation Officer have executed a programmatic agreement (PA) to provide guidelines for compliance with the Section 106 process. The PA was executed on June 8, 2012 and has been transmitted to the Advisory Council on Historic Preservation.

State and Agency Review.

(To be inserted by HQUSACE after the S&A Review ends.)

Certification of Peer and Legal Review.

Agency Technical Review (ATR) was certified on 02 August 2013 with all review comments satisfactorily addressed. Final legal review was completed 08 August July 2013 by Sacramento District Council. The Cost Engineering Center of Expertise (CX) Review was completed by the Walla Walla District CX and certified 08 August 2013.

Policy Compliance Review.

The Policy Compliance Review conducted to date is documented in the Policy Guidance Memorandum dated 13 August 2013. All comments have been incorporated into the final Feasibility Report/EIR/SEIS and appendices as appropriate. The final policy review findings will be documented herein when completed by HQUSACE.

