Yuba River

Ecosystem Restoration Feasibility Study
California

Draft
Interim Feasibility Report
& Environmental Assessment

January 2018

YUBA COUNTY WATER AGENCY 1959

US Army Corps
of Engineers ®
Sacramento District

Cover Photo courtesy of the Sacramento District:

Yuba River at the Goldfields

Photos Below:
Downy Woodpecker, Winter –run Chinook Salmon, Yellow-billed Cuckoo



Table of Contents

Executive Summary ES-1
Purpose and Need ES-1
Study Authority ES-2
Consideration of Alternative Plans ES-4
Tentatively Selected Plan ES-5
Environmental Effects ES-7
Estimated Cost and Cost Sharing ES-7
Unresolved Issue ES-8
Chapter 1 – Introduction 1
1.1 Purpose and Need for the Study 1
1.2 Study Authority 3
1.3 Study Area Location 4
1.4 Study Sponsor and Participants 4
1.5 Existing, Projects, Studies, and Programs 7
1.5.1 Projects 7
1.5.2 Studies 12
1.5.3 Programs 14
1.6 Public and Agency Scoping 16
1.7 Report Organization 18
Chapter 2 – Need for Action 19
2.1 Purpose and Need for the Action 19
2.2 Problems and Opportunities 20
2.2.1 Problems 20
2.2.2 Opportunities 21
2.3 Federal and Non-Federal Objectives 21
2.4 Planning Goals and Objectives 22
2.5 Planning Constraints 23
2.6 Planning Considerations 23
Chapter 3 – Alternative Plans 25
3.1 Plan Formulation Process 25
3.2 Planning Criteria 25
3.3 Future Without-Project Conditions 26
3.4 Identification and Screening of Measures 29
3.4.1 Plan Formulation Rationale 29
3.4.2 Description of Initial Measures 29
3.4.3 Screening of Initial Measures 34
3.4.4 Screening Results 43
3.4.4 Unresolved Ecological Problem 43
3.5 Final Increments 43
3.5.1 Habitat Increment 1 49
3.5.2 Habitat Increment 2 50
3.5.3 Habitat Increment 3a 52

3.5.4 Habitat Increment 5a 54
3.5.5 Habitat Increment 5b 56
3.5.6 Construction Sequencing 57
3.6 Formulation of Final Array of Alternatives 58
3.7 Evaluation of Alternatives 59
3.8 Comparison of Alternatives 59
3.9 *Principles and Guidelines* Accounts 61
3.10 Tentatively Selected Plan 61
Chapter 4 – Affected Environment and Environmental Effects 63
4.1 Alternatives Not Evaluated in Detail 63
4.2 Resources Not Considered In Detail 63
4.2.1 Geology and Seismicity 63
4.2.2 Socioeconomics and Environmental Justice 65
4.2.3 Land Use and Agriculture 65
4.2.4 Hazardous, Toxic, and Radiological Waste 65
4.3 Resources Considered in Detail 65
4.3.1 Air Quality 65
4.3.2 Climate Change 75
4.3.3 Aesthetics 83
4.3.4 Hydrology and Hydraulics 86
4.3.5 Vegetation and Wildlife 93
4.3.6 Special Status Species 99
4.3.7 Water Quality 116
4.3.8 Transportation 122
4.3.9 Recreation 126
4.3.10 Cultural Resources 128
4.3.11 Noise 134
Chapter 5 - Cumulative Impacts 141
5.1 Methodology and Geographic Scope of the Analysis 141
5.1.1 Methodology 141
5.1.2 Geographic and Temporal Scope 141
5.2 Past, Present, and Reasonably Foreseeable Future Projects 142
5.3 Cumulative Impacts Analysis 143
5.3.1 Vegetation and Wildlife 143
5.3.2 Special Status Species 144
5.3.3 Water Quality 144
5.3.4 Air Quality 145
5.3.5 Aesthetics 145
5.3.6 Hydrology and Hydraulics 145
5.3.7 Noise 146
5.3.8 Climate Change 146
5.3.9 Transportation 146
5.3.10 Recreation 147
5.3.11 Cultural Resources 147
Chapter 6 – Compliance with Applicable Laws and Regulations 149
6.1 Federal Laws 149

6.2 Executive Orders 152
Chapter 7 – Public Agency Involvement and Review 155
7.1 List of Agencies and Persons Consulted 155
7.2 Public Meetings and Workshops 155
7.3 Scoping Comments 156
7.4 Public Review and Comments on the Draft Report 156
Chapter 8 – Tentatively Selected Plan 159
8.1 Tentatively Selected Plan 159
8.1.1 Features and Accomplishments 159
8.1.2 Federal Interest 162
8.1.3 Monitoring and Adaptive Management 163
8.1.4 Operation, Maintenance, Repair, Replacement, and Rehabilitation 163
8.1.5 Real Estate 164
8.1.6 Plan Economics 165
8.1.7 Cost Sharing 165
8.1.8 Risk and Uncertainty 166
8.2 Plan Implementation 167
8.2.1 Report Completion 167
8.2.2 Report Approval 167
8.2.3 Project Authorization and Construction 167
8.2.4 Division of Responsibilities 168
8.2.5 Schedule 169
8.2.6 Further Studies 169
Chapter 9 – Recommendations 171
Chapter 10 – List of Preparers 175
Chapter 11 – References 177

LIST OF APPENDICES

Appendix A: Plan Formulation
Appendix B: Cultural Resources
Appendix C: Engineering
Appendix D: Environmental
Appendix E: Real Estate

LIST OF FIGURES

Figure ES-1. Yuba River Watershed
Figure ES-2. Tentatively Selected Plan.

Figure 1-1. Hydraulic miner operates a water cannon.
Figure 1-2. Malakoff Mine, Nevada County,
Figure 1-3. The Yuba River flows through the Yuba Goldfields.
Figure 1-4. Sacramento River Basin.
Figure 1-5. Yuba River Watershed.
Figure 1-6. Daguerre Point Dam.

Figure 1-7. Englebright Dam.
Figure 1-8. New Bullards Bar Dam.

Figure 3-1. Proposed levees in the Yuba Goldfields.
Figure 3-2. Habitat Increments eliminated from the study.
Figure 3-3. Habitat Increment 1.
Figure 3-4. Habitat Increment 2
Figure 3-5. Habitat Increment 3a.
Figure 3-6. Habitat Increment 5a.
Figure 3-7. Habitat Increment 5b.
Figure 3-8. Incremental Costs and Outputs of Alternatives.
Figure 3-9. Tentatively Selected Plan.

Figure 8-1. Tentatively Selected Plan.
Figure 8-2. Yuba River Ecosystem Restoration TSP and AFRP Measures.

LIST OF TABLES

Table 1-1. USACE Planning and NEPA Process

Table 3-1. Measures to Achieve Study Objectives.
Table 3-2. Cost Ranking.
Table 3-3. Quantity Ranking.
Table 3-4. Quality Ranking.
Table 3-5. Efficiency of Measures.
Table 3-6. Risk Ranking.
Table 3-7. Screening Results.
Table 3-8. Habitat Increments.
Table 3-9. Riparian Planting Palette.
Table 3-10. Habitat Increment 1 details.
Table 3-11. Habitat Increment 2 Details.
Table 3-12. Habitat Increment 3a Details.
Table 3-13. Habitat Increment 5a Details.
Table 3-14. Habitat Increment 5b Details.
Table 3-15. Incremental Costs and Outputs of Alternatives.
Table 3-16. P&G Accounts Comparison of Alternative Plans.

Table 4-1. State and Federal Ambient Air Quality Standards
Table 4-2. Summary of Air Quality Monitoring Data in Yuba County (2008-2015).
Table 4-3. General Conformity *De Minimis* Thresholds.
Table 4-4. Emission Rates for Criteria Pollutants in Nonattainment Areas.
Table 4-5. Estimated Emissions from Alternative 5.
Table 4-6. Estimated Emissions from Alternative 6.
Table 4-7. Global, National, State, and Local GHG Emissions Inventories.
Table 4-8. Estimated GHG Emissions from Alternative 5.
Table 4-9. Estimated GHG Emissions from Alternative 6.
Table 4-10. Major dams in the Yuba River Watershed (CBEC 2010).

Table 4-11. Peak Discharge vs Annual Chance of Exceedance Estimates, USGS Gage Yuba River near Marysville, from USACE (2015).
Table 4-12. Estimates of Existing Cover of Riparian Vegetation.
Table 4-13. Summary of Potential Impacts to Vegetation
Table 4-14. Summary of special status species with potential to occur in the study area.
Table 4-15. Regulatory Criteria for Roadways and Intersections.
Table 4-16. Existing Conditions on Major Roadways in the Study Area.
Table 4-17. Cultural Resources Within the Project Area.
Table 4-18. Recommended Ambient Allowable Noise Level Objectives.
Table 4-19. Yuba County Noise Regulations.
Table 4-20. Population Density and Associated Ambient Noise Levels.
Table 4-21. Typical Noise Levels from Construction Equipment.

Table 5-1. Geographic Areas that Would Be Affected by the YRER Feasibility Study.
Table 5-2. Past, Present, and Reasonably Foreseeable Future Projects

Table 8-1. Estimated Costs of TSP.
Table 8-2. Economic Costs and Benefits of TSP.
Table 8-3. Summary of Cost-Sharing Responsibilities of the TSP.

Table 10-1. List of Preparers.

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DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

DRAFT FINDING OF NO SIGNIFICANT IMPACT
YUBA RIVER ECOSYSTEM RESTORATION PROJECT
YUBA COUNTY, CALIFORNIA

The U.S. Army Corps of Engineers, Sacramento District, has conducted an environmental analysis in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended. I determined that implementing the proposed Yuba River Ecosystem Restoration Project would have no significant effects on the quality of the human environment.

The proposed action as described in the Interim Feasibility Report/ Environmental Assessment (FR/EA) incorporated herein by reference, includes 178.6 acres of habitat restoration along the lower Yuba River consisting of (1) restoration of 42.5 acres of aquatic habitat including side channels, backwater areas, bank scallops, and (2) restoration of 136 acres of riparian habitat including of floodplain lowering and grading and riparian vegetation plantings channel stabilization. The possible consequences of the work described in the FR/EA have been studied with consideration given to environmental, cultural, social, and engineering feasibility. The views of other interested agencies, organizations, and individuals have also been considered.

In evaluating the effects of the proposed project, specific attention has been given to any environmental conditions that could potentially be affected. All construction would be implemented in compliance with applicable Federal laws, regulations and executive orders. Best management practices, avoidance protocols, and minimization and mitigation measures as summarized within this FR/EA, would be implemented. Cultural resource issues would follow the Programmatic Agreement and Historic Property Treatment Plan processes.

Based upon my review of the FR/EA, it is my determination that the proposed project would have no significant effects on environmental, social, or cultural resources. Based on these considerations, it is my determination that the proposed project does not constitute a major federal action that would significantly affect the human environment. Therefore, preparation of an Environmental Impact Statement is not required.

_____
Date

_____
David G. Ray, P.E.
Colonel, U.S. Army
District Commander

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Executive Summary

This report: (1) identifies problems and opportunities associated with ecosystem degradation in the Yuba River watershed; (2) develops and evaluates measures to solve identified problems; (3) formulates and compares alternatives for ecosystem restoration; and (4) identifies a Tentatively Selected Plan (TSP) for implementation. This integrated draft Feasibility Report/Environmental Assessment (FR/EA) describes the planning process followed to identify Federal interest in the TSP and serves as the environmental compliance document under the National Environmental Policy Act (NEPA). This draft FR/EA is being concurrently released for public review, internal policy review, and Agency Technical Review (ATR). Pending comments received during these reviews, the FR/EA will be finalized to present the recommended plan for potential authorization.

This feasibility report will be an interim response to the study authority because it will not address the entire scope of that authority.

Purpose and Need

Ecosystem restoration is one of the primary missions of the U.S. Army Corps of Engineers (USACE). Ecosystem restoration is the process of assisting in the recovery of ecosystems that have been degraded, damaged, or destroyed and focuses on establishing the ecological processes necessary to make ecosystems sustainable, resilient, and healthy. The focus of the USACE ecosystem restoration program is on water-related ecosystem projects, including wetland, riparian, and aquatic systems. The Yuba River ecosystem has been degraded by hydraulic mining and water resources development in the watershed, prompting investigation into restoration opportunities.

In 2015, USACE initiated the Yuba River Ecosystem Restoration Feasibility Study at the request of the Yuba County Water Agency (YCWA), the non-Federal sponsor for the study. USACE is the lead agency for the Feasibility Study and is also the lead under NEPA. YCWA, the lead agency under the California Environmental Quality Act (CEQA), is expected to complete a CEQA compliant environmental analysis after Congressional authorization. Numerous other agencies, organizations, and individuals have participated in the study including the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS).

The Yuba River watershed (Figure ES-1) is located on the western slope of the Sierra Nevada Mountain Range. The Yuba River is a source of life-sustaining water for communities, farmers, and ranchers, as well as fish and wildlife resources that the United States has pledged to conserve to the extent practicable. Nationally significant migratory birds stop along the Yuba River as they travel the Pacific Flyway. For example, the western yellow-billed cuckoo, a neotropical migratory bird, has been observed in the watershed. The cuckoo was once common throughout much of lowland California, but is now listed as threatened under the Endangered Species Act (ESA) primarily due to loss of riparian habitat. The river also supports populations of several special status fish species. Chinook salmon and steelhead were historically abundant

on the Yuba River. Now both species are listed as threatened under the ESA and the lower Yuba River has been designated as critical habitat. Other federally listed threatened species in the Yuba River watershed include green sturgeon, California red-legged frog, and Valley elderberry longhorn beetle.

Development in the watershed has disrupted the ecosystem structure, function, and processes that support fish and wildlife species. With the advent of the California gold rush in the mid-1800s, hydraulic mining washed away entire sections of the upper Yuba River watershed. The release of hundreds of millions of cubic yards of mining debris filled river channels, caused flooding of cities and farms, and obstructed navigation on the Sacramento River. The United States Congress established the Federal California Debris Commission (CDC) in 1893 to regulate hydraulic mining and protect navigation from damage due to mining debris. The CDC completed construction of Daguerre Point Dam in 1906 and Englebright Dam in 1941 to impound mining debris. These dams continue to contain this contaminated mining debris, with an estimated 28 million cubic yards (yd^3) impounded behind Englebright Dam and 4 million yd^3 behind Daguerre Point Dam. Upon Congressional decommissioning of the CDC in 1986, administration of Daguerre Point Dam and Englebright Dam and Lake was assumed by USACE.

However, much of the damage from hydraulic mining was inflicted before the construction of the debris dams. Vast amounts of sediment dislodged by hydraulic mining settled where the grade of the river flattened, suffocating stretches of riverbank under millions of cubic yards of cobble. Today, many sections of the lower Yuba River remain primarily composed of cobble and large gravel and the coarse substrate is unfavorable for the natural recruitment of riparian vegetation. Also, debris dams and additional water supply, flood control, and hydropower dams have further altered natural hydrologic and sediment transfer regimes. The altered geomorphic processes and conditions have diminished and degraded the Yuba River ecosystem and prompted the need for this feasibility study.

Study Authority

The authority to study the Sacramento River Basin for flood control and allied purposes, including ecosystem restoration, was granted in the Rivers and Harbors Act of 1962, P.L. 87-874, Section 209, which reads:

> *The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements…in drainage areas of the United States and its territorial possessions, which include the following named localities…Sacramento River Basin and streams in northern California draining into the Pacific Ocean for the purposes of developing, where feasible, multi-purpose water resource projects, particularly those which would be eligible under the provisions of Title III of Public Law 85-500.*
>
> (Title III of Public Law 85-500 concerns water supply.)

Figure ES-1. Yuba River Watershed.

On 28 April 2016, a Senate Committee Resolution clarified that ecosystem restoration is to be included in the investigation:

> *Resolved by the Committee on Environment and Public Works of the United States Senate, that the Secretary of the Army, pursuant to the Rivers and Harbors Act of 1962, Pub. L. 87-874 § 209, is requested to investigate ecosystem restoration opportunities in the Sacramento River Basin and streams in northern California draining into the Pacific Ocean, including the Yuba River watershed.*

Consideration of Alternative Plans

Planning for Federal water resources projects constructed by USACE, along with those of the U.S. Bureau of Reclamation, Natural Resource Conservation Service, and the Tennessee Valley Authority, is based on the economic and environmental *Principles and Guidelines* promulgated in 1983 by the U.S. Water Resources Council. Following the definition of ecosystem restoration problems and opportunities (see section 2.2), the following planning objectives were identified.

- Improve the quantity, quality, and complexity of aquatic habitat.
- Improve the quantity, quality, complexity, and connectivity of riparian habitat.
- Improve longitudinal river connectivity.
- Improve lateral connectivity of the river to its floodplain.

Various management measures were then identified to achieve planning objectives and avoid planning constraints. The range of measures included habitat restoration, dam modification, and fish passage measures. Management measures were screened based on acceptability, effectiveness, and efficiency as described in ER 1105-2-100, paragraph 2-3.c. Measures that passed the screening criteria were then evaluated and compared against more specific evaluation criteria (see section 3.4.2). Based on the screening results, conventional habitat restoration was carried forward for more detailed evaluation.

Habitat restoration is composed of channel, floodplain, and riparian habitat improvements along the lower Yuba River. Improvements include floodplain lowering and grading, side-channel and backwater creation, channel stabilization, riparian vegetation planting, and installation of woody material. In order to reasonably optimize the scale of the restoration plan, habitat restoration was divided into geographic increments. Class 4 cost estimates were prepared for each increment and a Habitat Evaluation Procedure was performed to quantify the ecosystem benefits of each increment (see section 3.7).

USACE Institute for Water Resources (IWR) Planning Suite was used to formulate the final array of alternatives based on the cost and benefits of each habitat restoration increment. IWR Planning Suite generated all possible combinations of increments and identified 5 Best Buy

Plans. In addition to the no action alternative, the Best Buy Plans became the final array of alternatives.

Tentatively Selected Plan

The National Environmental Restoration (NER) plan (Alternative 5) has been identified as the plan that reasonably maximizes ecosystem restoration benefits in the Yuba River watershed relative to costs, restoring about 178.6 acres at an estimated cost of $96.76 million. The NER plan has been designated as the Tentatively Selected Plan (TSP) (Figure ES-2) in accordance with the USACE objective for ecosystem restoration.

The principal features of the TSP include restoration of approximately 43 acres of aquatic habitat including side channels, backwater areas, bank scallops, and channel stabilization. These features will provide shallow, low velocity, rearing habitat and refugia for juvenile anadromous salmonids and potentially increase benthic macroinvertebrate producing habitat. Engineered log jams (ELJs) and placement of boulders and large woody material have been incorporated in the TSP at strategic locations. ELJs and boulders will be placed at actively eroding banks or sites with high velocities and shear stresses. These features will promote bank stabilization, add structural complexity, provide velocity refuge for juvenile fish, and modify local hydraulics and sediment transport.

The TSP also includes about 136 acres of riparian habitat restoration consisting of floodplain lowering and grading and riparian vegetation plantings, which will increase the quantity and quality of riparian habitat in the river corridor. The TSP addresses fragmentation of habitat by targeting areas adjacent to existing vegetation that have been unable to initiate revegetation through natural processes due to substrate composition and depth to groundwater. Floodplain lowering reconnects the river to its floodplain and makes planting feasible where it was not previously due to excessive groundwater depths. Four native species will be planted to provide species and structural diversity, including arroyo willow which is known to support neotropical bird habitat (RHJV 2004). When the restored riparian habitat is inundated by high flows, it will also function as aquatic habitat, providing additional feeding habitat and refugia for juvenile fish.

To various degrees, the TSP addresses all of the objectives of the feasibility study. Longitudinal river connectivity would be increased by improving approximately five river miles of aquatic habitat, improving refuge, rearing, and food production options for migrating fish along the lower Yuba River. The TSP will also reduce gaps between areas of suitable aquatic habitat, including other restoration projects such as the Hallwood Side Channel and Floodplain Restoration Project and the Hammon Bar Restoration Project.

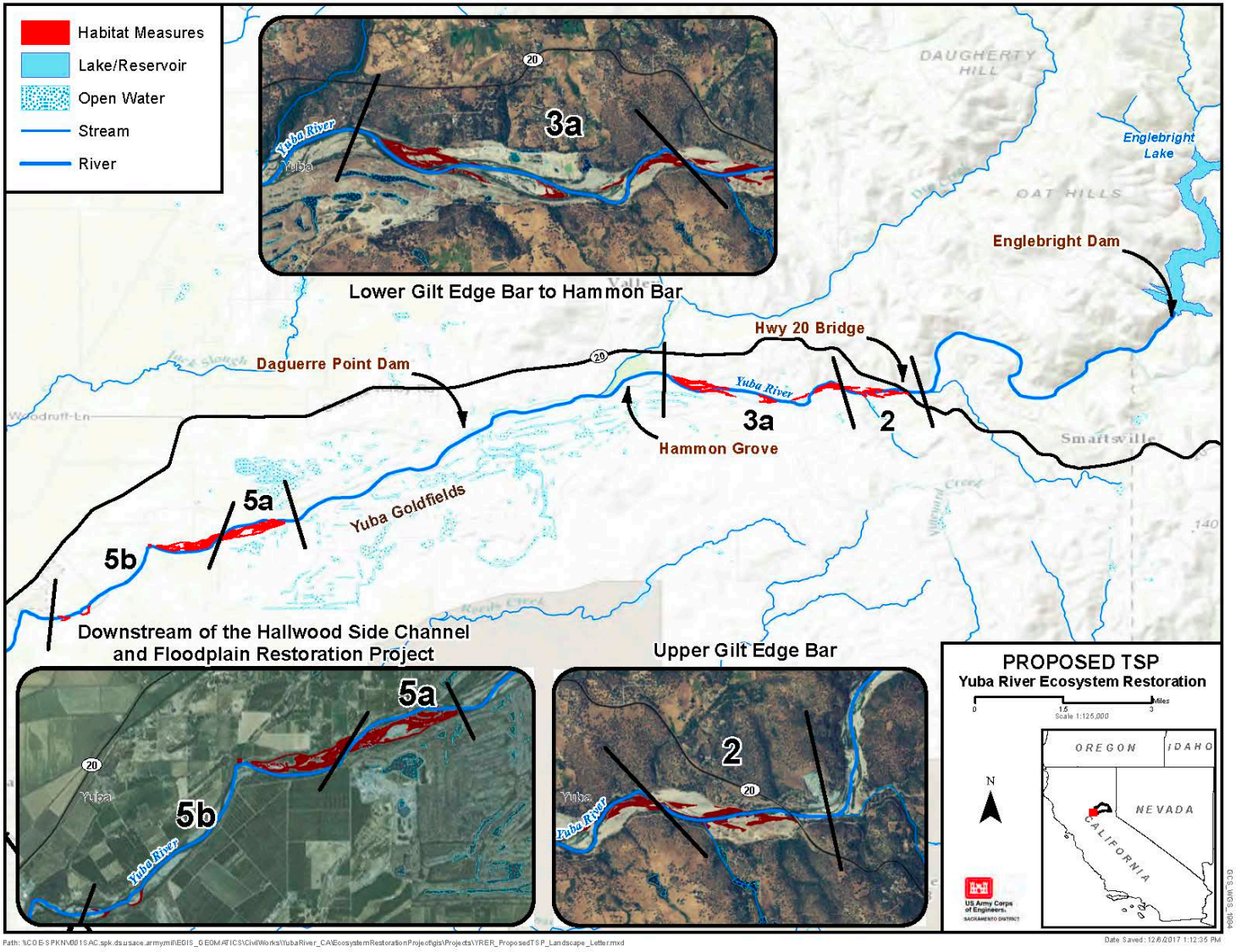

Figure ES-2. Tentatively Selected Plan.

Environmental Effects

The effects to the environment have been considered throughout the study and opportunities have been evaluated to provide ecosystem restoration, as described above. The proposed alternatives, while providing long-term benefits to the Yuba River watershed, would also have short-term effects on some resources. Various mitigation measures have been considered including construction timing, location of fill material placement, material source selection sites, and avoidance of certain areas.

In all cases, the potential adverse environmental effects would be reduced to a less-than-significant level through project design, construction practices, preconstruction surveys and analysis, regulatory requirements, and best management practices. No compensatory mitigation would be required. A geotechnical analysis of underlying substrates and water quality analysis of construction activities and methods would be conducted during the preconstruction, engineering, and design phase to further refine potential impact analysis. A National Pollutant Discharge Elimination System general construction permit would be required. A Storm Water Pollution Prevention Plan and Spill Prevention Control and Countermeasures Plan would be developed by the contractor prior to construction.

Estimated Cost and Cost Sharing

Investment cost accounts from the draft cost estimate for the TSP are displayed in Table ES-1 below.

Table ES-1. Estimated Costs of Tentatively Selected Plan.

Construction Item	Cost[1] ($1,000s)
Lands and Damages	6,406
Relocations[2]	0
Construction (Fish and Wildlife Facilities[3])	71,079
Planning, Engineering, Design	11,756
Construction Management	3,563
Monitoring	739
Adaptive Management	3,012
Total First Cost	**96,755**

[1]Based on October 2017 price levels

[2]No relocations required in TSP.

[3]Fish and Wildlife Facilities account includes ecosystem restoration activities (excavation, grading, planting, etc.).

The TSP is a cost-effective and implementable alternative, is in the Federal interest, and would be fully compliant with all environmental laws prior to construction. The preliminary recommendation is that the report be finalized based on results of public review, internal policy review, and Agency Technical Review (ATR) of this draft FR/EA, and if warranted, recommend the TSP for authorization as a Federal project. The estimated first cost of the TSP is $96,755,000. The estimated annual OMRR&R cost is $1,470,000. The Federal portion of the

estimated first cost, based on October 2017 price levels, is $62,891,000. The non-Federal portion of the estimated first cost is $33,864,000.

Unresolved Issue

A significant ecosystem problem that was considered in this study would not be resolved by the TSP. Specifically, the TSP would not resolve the problem of blocked and impaired fish passage and altered hydrologic and sediment transport regimes caused by existing dams. Additional investigation of this unresolved problem could be addressed in a future study under the same authority.

Chapter 1 – Introduction

This report documents the planning process for ecosystem restoration in the Yuba River watershed, California, to demonstrate consistency with U.S. Army Corps of Engineers (USACE) planning policy and to meet the regulations that implement the National Environmental Policy Act (NEPA) of 1969, as amended. The following sections provide background information regarding the basis for this study.

1.1 Purpose and Need for the Study

The Yuba River ecosystem has been degraded by hydraulic mining and water resources development in the watershed, prompting investigation into restoration opportunities. The purpose of the Yuba River Ecosystem Restoration Feasibility Study is to identify problems and opportunities associated with ecosystem degradation in the Yuba River watershed; to formulate, evaluate, and screen potential solutions to these problems; and to recommend a project in the Federal interest[1] that is supported by a local entity willing to provide the necessary items of local cooperation. This report presents the analysis and findings of the Feasibility Study and integrates documentation of the plan formulation process with documentation of environmental effects.

The current state of riparian and aquatic ecosystems in the Yuba River watershed was largely shaped by extensive hydraulic mining that occurred from 1853 to 1884. Early descriptions of the Yuba River before the onset of hydraulic mining are limited. However, available field, documentary, and cartographic evidence suggests that the Yuba channel near Marysville was characterized by a distinct riparian zone along the stream banks. This zone was vegetated by tall trees, brush, and vines (James, 2013). The floodplain along the lower Yuba River was described as an extended strip of bottom-lands with rich, black alluvial soil, on an average a mile and a half wide on each side of the river (Sawyer, 1884). The upper watershed was free of dams and an estimated 300,000 fish returned to the Yuba River each year (Yoshiyama et al. 2001; CDFG 1993).

The California Gold Rush of 1849 enticed settlement in the watershed and ingenious methods for resource extraction. Modern hydraulic mining techniques, which includes the use of high pressure water cannons to dislodge rock material or move sediment (Figure 1-1), were developed in mining camps of the northern Sierra Nevada. Miners directed the water-sediment slurry through sluice boxes to separate gold or other desirable minerals. Entire mountainsides were washed away as hydraulic technology evolved and the industry boomed (Figure 1-2).

[1] A project is said to be in the Federal interest if it is consistent with the mission of the Corps of Engineers and the project benefits are in excess of the project costs.

Figure 1-1. Hydraulic miner operates a water cannon.

Figure 1-2. Malakoff Mine, Nevada County, Yuba River

Hydraulic mining resulted in torrents of sediment transported downslope, causing rapid aggradation and exacerbating flooding along the lower Yuba River (James and Singer 2008). The sediment deposited in the channel raised the channel bed to the point that in 1868 it was higher than the streets in Marysville. It is estimated that 684 million cubic yards of gravel and debris from hydraulic mining washed into the Yuba River from 1849 -1909 (Yoshiyama et al. 2001). This is more than triple the sediment volume of the Panama Canal excavations (Yoshiyama et al. 2001).

Much of the sediment dislodged by hydraulic mining settled where the grade of the river flattened, suffocating stretches of riverbank under millions of cubic yards of cobble, but also creating another opportunity for extraction. Gold dredging operations re-mined the vast hydraulic mining sediment deposits along the lower Yuba River. Dredging began in 1902, and by 1910, 15 dredges were operating in the lower Yuba River. In coordination with the Federal California Debris Commission (CDC), dredge operators created enormous "training walls" to contain the river in a single channel and mitigate sediment problems. Gravel berms 20 to 75 feet high were constructed between 1910 and 1935 to promote scouring and formation of a permanent, stable river channel (Adler 1980). This section of the river, known as the Yuba Goldfields, is currently dominated by 20,000 acres of dredger tailings (Figure 1-3). The altered landscape is discernible from orbital space even today.

In addition to training walls in the Yuba Goldfields, several structures were built on the Yuba River to control flooding and sedimentation. Specifically, two major debris dams were constructed by the CDC (i.e., Daguerre Point Dam in 1906 and Englebright Dam in 1941) to prevent further movement of finer sediment into the Feather and Sacramento Rivers, and ultimately the Sacramento and San Joaquin River Delta and San Francisco Bay. The dams sequestered sediment and also trapped the chemicals that were used in hydraulic mining processes. Mercury was used to separate gold from sand and gravel in the sluice box. In the Sierra Nevada Mountains, up to 9 million pounds of mercury were added to the environment (Churchill 2000). Mercury and other heavy metals remain as contaminants in the sediment loads

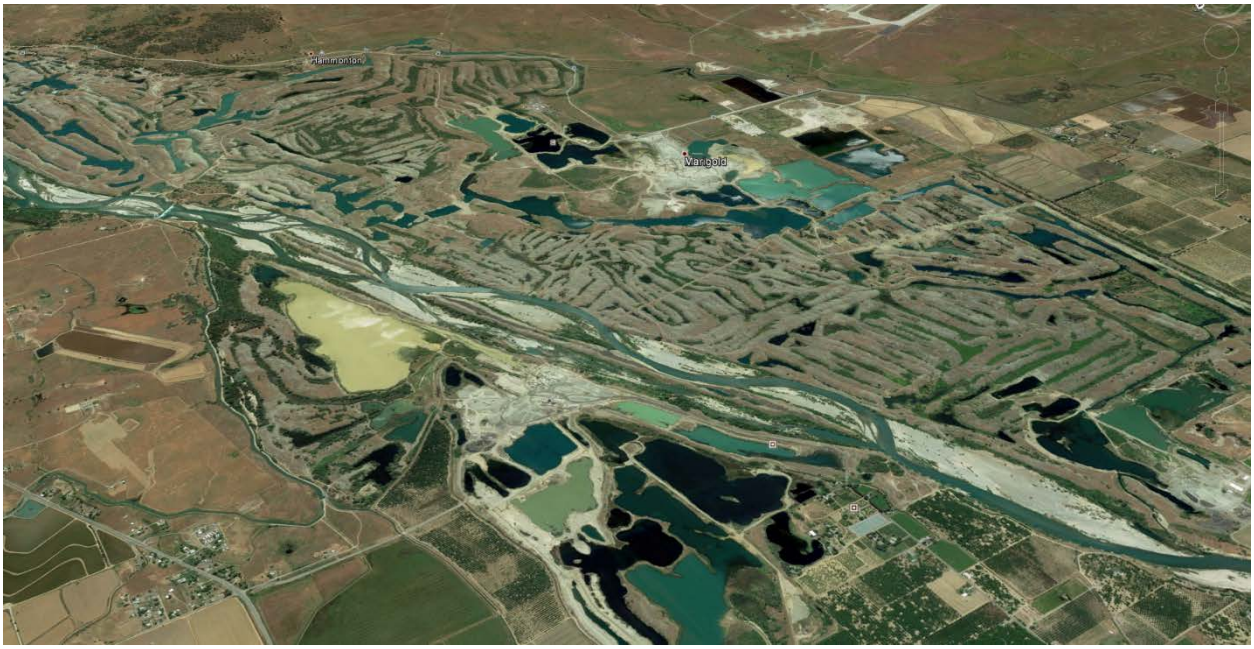

Figure 1-3. The Yuba River flows through the Yuba Goldfields.

behind Daguerre Point and Englebright Dams causing present day safe-eating advisories from the California Office of Environmental Health Hazard Assessment. Guidelines advise women ages 18-45 and children ages 1-17 to avoid eating largemouth, smallmouth, or spotted bass from Englebright reservoir.

The upper Yuba River watershed was also developed for hydropower and water supply during the early 20th century. Most of the dams and diversions that were used primarily for gold mining were in place during this period, but they were replaced or removed as developmental emphasis in the watershed shifted from gold mining to flood management, water supply, and hydropower generation.

The purpose of this study is to address the degradation of this ecosystem, as described above, and to determine the National Ecosystem Restoration (NER) plan. This report analyzes potential NER benefits associated with restoring the natural structure, functions, and processes of the Yuba River and concludes with a tentative recommendation for Congressional authorization of the Tentatively Selected Plan (TSP), pending public, technical, and policy reviews, and subsequent revisions. This report will serve as an interim response to the study authority.

1.2 Study Authority

The authority to study the Sacramento River Basin for flood control and allied purposes, including ecosystem restoration, was granted in the Rivers and Harbors Act of 1962, P.L. 87-874, Section 209, which reads:

The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements…in drainage areas of the United States and its territorial possessions, which include the following named localities…Sacramento River Basin and streams in northern California draining into the Pacific Ocean for the purposes of developing, where feasible, multi-purpose water resource projects, particularly those which would be eligible under the provisions of Title III of Public Law 85-500.

(Title III of Public Law 85-500 concerns water supply.)

On 28 April 2016, a Senate Committee Resolution clarified that ecosystem restoration is to be included in the investigation:

Resolved by the Committee on Environment and Public Works of the United States Senate, that the Secretary of the Army, pursuant to the Rivers and Harbors Act of 1962, Pub. L. 87-874 § 209, is requested to investigate ecosystem restoration opportunities in the Sacramento River Basin and streams in northern California draining into the Pacific Ocean, including the Yuba River watershed.

1.3 Study Area Location

Located within the Sacramento River Basin (Figure 1-4), the Yuba River watershed (Figure 1-5) encompasses 1,340 square miles on the western slopes of the Sierra Nevada Mountain Range. The river flows east to west through forest, foothill chaparral, and agricultural lands to the confluence of the Feather River.

The watershed is located in portions of Sierra, Placer, Yuba, and Nevada counties. There are a total of 32 dams and 11 powerhouses in the watershed. For most of its course, levees are absent from the river, except for near the confluence with the Feather River. At that point, the Yuba River is confined by setback levees for six miles.

1.4 Study Sponsor and Participants

USACE and the Yuba County Water Agency (YCWA) are the lead agencies in the Feasibility Study and share the cost of the study equally, pursuant to the Feasibility Cost Sharing Agreement executed by the parties on June 2, 2015 and amended July 31, 2017.

Figure 1-4. Sacramento River Basin.

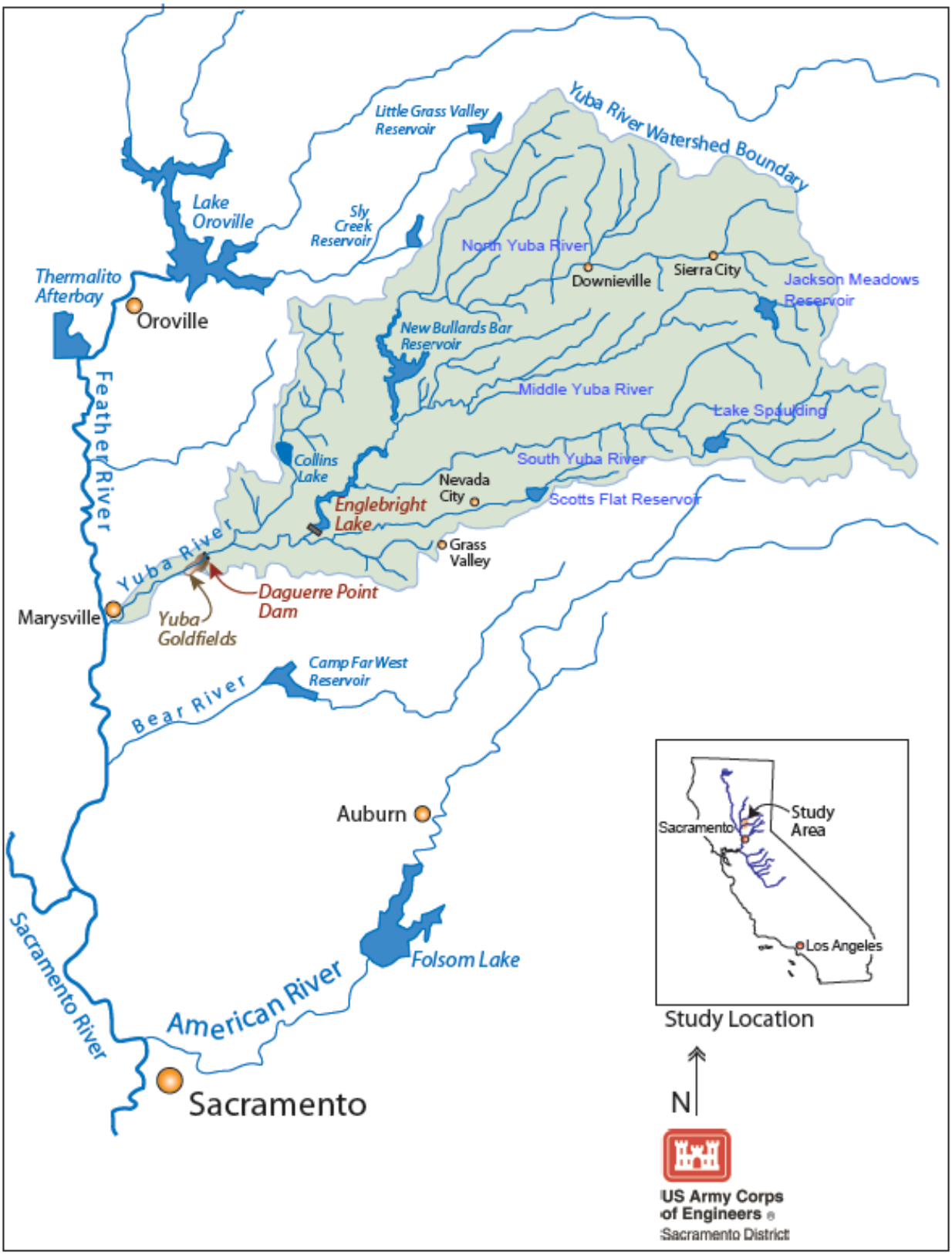

Figure 1-5. Yuba River Watershed.

Affected agencies and stakeholders include but are not limited to: the National Marine and Fisheries Service, U.S. Fish and Wildlife Service (USFWS), California Department of Fish & Wildlife, Tahoe National Forest, public recreation groups, mining companies, irrigation districts, South Yuba River Citizen's League, and Trout Unlimited. USACE has also consulted with the Native American Tribes in the area.

1.5 Existing, Projects, Studies, and Programs

There are several ongoing water resources related projects, studies, and programs that could affect ecosystem conditions in the study area. Those efforts that pertain directly to this feasibility study are summarized below.

1.5.1 Projects

There are many water resources development projects on the Yuba River from sediment retention structures, hydropower generation, water supply for irrigation, municipal, and industrial purposes, to fish and wildlife mitigation and restoration projects. The following list is not exhaustive, but highlights the projects most relevant to this study, such as the dams that are the first barriers to fish passage, hydropower projects with controlled water releases, and other habitat restoration efforts.

Yuba River Restraining Barriers

The Rivers and Harbors Acts of 1893 and 1896 authorized the construction of restraining barriers to control movement of hydraulic mining debris as recommended by the California Debris Commission (CDC). The Yuba River Restraining Barriers project consists of Daguerre Point Dam, which forms a storage basin for debris, and about 15 miles of large berms or training walls. The berms confine flows to narrow channels to prevent stream meander and downstream movement of old debris deposits from floodplain areas.

Congress established the CDC in 1893 to provide for: resumption of hydraulic mining without injury to navigation or damage to overflow; to restore, as nearly as practicable, navigation conditions as of 1860; and to afford relief in flood time and to provide sufficient water to maintain scouring force in summer to restore channel capacities. Members of the CDC were USACE officers appointed by the President of the United States. The CDC did not discover a satisfactory method to allow resumption of hydraulic mining, but was effective in debris management.

Daguerre Point Dam

Daguerre Point Dam (Figure 1-6) is located on the Yuba River approximately 11.5 miles upstream of Marysville. The CDC recommended the dam to prevent hydraulic mining debris from washing into navigable waters of the Sacramento and Feather Rivers. Congress authorized the dam's construction in the 1902 Rivers and Harbors Act (P.L. 57-154). Although the dam was completed in May of 1906, the river was not diverted over the dam until 1910. The dam rapidly

filled to capacity with sediment and debris that moved downstream during flooding in 1911. Daguerre Point Dam was damaged and breached by floods in 1963 and 1964, then rebuilt in 1965. The area behind the dam is almost entirely filled with up to 4 million cubic yards of sediment that has accumulated since it was rebuilt.

The Water Resources Development Act of 1986 (P.L. 99-662) eliminated the CDC and transferred Daguerre Point Dam to USACE. USACE is responsible for operation and maintenance of the dam.

As documented in the 2013 Biological Assessment (BA) on Daguerre Point Dam, USACE implemented protective and voluntary conservation measures for listed species under its obligation to Section 7(a)(1) of the Endangered Species Act and several voluntary conservation measures in accordance with USACE's Environmental Stewardship and Maintenance Guidance and Procedures, respectively. USACE is in compliance with the Endangered Species Act.

Daguerre Point Dam's key details include the following:

- Overflow concrete ogee ("s-shaped") spillway with concrete apron and abutments.
- Ogee spillway section is 575 feet wide and 25 feet tall.
- Originally designed to retain hydraulic mining debris.
- Currently used to facilitate water diversion for irrigation purposes.
- Not operated for flood control or recreation.
- No storage capacity – reservoir filled with hydraulic mining debris and sediments.

Figure 1-6. Daguerre Point Dam.

There are three water diversions associated with Daguerre Point Dam which utilize the elevated head[2], or pressure, created by the dam, or the influence of the dam in the prevention of additional river channel incision, to gravity-feed their canals. The three diversions are the Hallwood-Cordua diversion, the South Yuba/Brophy diversion, and the Browns Valley Irrigation District diversion, which have a combined capacity of 1,085 cubic feet per second (cfs).

In addition to the dam structure, there are two fish ladders, each with a control gate. The purpose of these two fish ladders is to permit salmon and steelhead access upriver to the seasonal spawning areas. Other native species, including pikeminnow and suckers, have also been observed using the ladders. However, the ladders do not meet modern fish passage design standards, and are not effective in passing all species over a full range of flows (NMFS 2014a).

[2] The "elevated head" at Daguerre Point Dam is created by the hydraulic conditions associated with water being impounded behind (i.e., upstream) of the dam. USACE has no control over the in-river flows, and has no discretionary control over the "head" for local water users in the vicinity of Daguerre Point Dam.

Englebright Dam

Originally known as Upper Narrows Reservoir, the Harry L. Englebright Dam and Lake is on the main stem of the Yuba River (RM 23.9) approximately 20 miles northeast of Marysville. The concrete arch dam and reservoir was authorized by the Rivers and Harbors Act of 1935 (P.L. 74-409) as part of the Sacramento River and Tributaries Project. Completed by the CDC in 1941, the project was authorized primarily to contain hydraulic mining sediments originating in upstream areas (USACE 2013).

Englebright Dam (Figure 1-7) is 260 feet high, and the storage capacity of the reservoir was 69,700 AF at the time of construction (Childs et al. 2003). However, due to sediment buildup, the gross storage capacity was more recently estimated at 50,000 AF (USGS 2003). The volume of sediment in Englebright Lake is significant and was estimated at approximately 28 million cubic yards in 2003 by the U.S. Geological Survey (USGS). Additional details regarding Englebright Dam and Lake are provided below.

- Englebright Dam is a concrete constant angle arch structure.
- Dam crest length of 1,142 feet and the dam top crest width is 21 feet.
- Dam spillway crest elevation is 527 feet mean sea level (msl).
- Maximum spillway design capacity is 108,000 cfs.
- Reservoir water surface elevation generally fluctuates between 517 feet to 525 feet msl on a daily and weekly basis.
- Dam is not operated for flood control.
- Englebright Reservoir is used as an afterbay for releases from New Bullards Bar Reservoir through the New Colgate Powerhouse and is used as a regulating reservoir to meet recreation and power generation needs and to capture uncontrolled flows from the Middle and South Yuba rivers to manage downstream releases to the lower Yuba River.
- Englebright Lake is approximately 9 miles long.
- Englebright Dam provides the hydraulic head for approximately 67 megawatts (MW) of electric generation at the Narrows 1 and 2 powerhouses.

Figure 1-7. Englebright Dam.

Water in the reservoir provides for recreational opportunities as well as hydroelectric power generation. The reservoir does not have any dedicated flood storage space and only provides incidental flood control benefits. Since the reservoir was constructed for mining debris retention and not for flood control purposes, it does not have a low-level outlet. In fact, the design of the dam allows unregulated flood flows to spill over the top of the dam during

flood events. Since around 1941, controlled releases into the lower Yuba River have been made from the Pacific Gas and Electric (PG&E) Narrows 1 Power Plant, and since 1970 from the YCWA Narrows 2 Power Plant, both Federal Energy Regulatory Commission (FERC) licensed facilities. These power plants are just downstream of the dam.

Englebright Dam typically represents the delineation between the upper and lower Yuba River. Englebright Dam and its associated hydropower facilities are impassable in the upstream direction, and therefore is the upstream limit of anadromous fish migration in the Yuba River.

Yuba River Development Project

The Yuba River Development Project serves multiple uses, including hydropower, flood control, water supply, and environmental resources. The project as described in YCWA's December 2, 2013, Draft License Application consists of: 1) New Bullards Bar Dam and Reservoir; 2) Our House Diversion Dam; 3) Log Cabin Diversion Dam; 4) Lohman Ridge Diversion Tunnel; 5) Camptonville Diversion Tunnel; 6) New Colegate Powerhouse; 7) Narrows 2 Powerhouse; and 8) several recreational facilities. The project currently operates under a FERC license issued May 16, 1963 and amended May 6, 1966. The project has an energy generation capacity of 361 megawatts.

The Yuba River Development Project releases water into the lower Yuba River in order to meet flow requirements specified in their water rights, as described in Revised Water Right Decision 1644 and Corrected Water Right Order 2008-0014. Corrected Water Right Order 2008-0014 allows implementation of the lower Yuba River Accord (Yuba Accord). Portions of the Project are on Federal lands managed by the U.S. Forest Service and USACE.

New Bullards Bar Dam

The largest structure on the river, New Bullards Bar Dam, is on the North Yuba River, 18 miles upstream from Englebright Dam. Construction was completed in 1970 by YCWA as part of FERC Project No. 2246 to provide water for power generation, irrigation, water supply, flood control, and recreation. USACE contributed $12 million to the construction of the dam in exchange for flood control space the reservoir would provide. The reservoir is used heavily for recreation, and it powers two hydroelectric plants.

The USACE Flood Control Manual for New Bullards Bar Reservoir (1972) specifies flood releases in a major flood event. Releases from New Bullards Bar Reservoir are made through the New Colgate Powerhouse, through the dam's low-level outlet, or through the gated spillway. Figure 1-8 displays New Bullards Bar Dam.

Additional details about New Bullards Bar Dam and Reservoir are (YCWA 2010):

- 1,110-foot long radius, double curvature, concrete arch dam.
- Dam height is 645 feet.
- Overflow-type spillway with a width of 106 feet.

- Spillway crest elevation of 1,902 feet msl.
- Three 30-foot wide and 54-foot tall tainter gates on the spillway.
- Maximum spillway design capacity of 160,000 cfs.
- Provides hydraulic head for 340 MW of hydroelectric peaking power at the Colgate powerhouse.
- The reservoir extends approximately 8.5 miles upstream at the normal maximum water surface elevation (1,956 feet).
- Estimated reservoir storage capacity is 966,103 acre-feet.
- Reservoir maximum depth is 645 feet.
- Normal water level fluctuations of 150 feet.

Figure 1-8. New Bullards Bar Dam.

1.5.1.1 Other Existing Water Projects

Other dams have been constructed in the Yuba River watershed for irrigation and drinking water supplies. Many of the earlier dams have been retrofitted to supply hydropower in addition to newer dams constructed with hydropower as a purpose. Other hydroelectric projects within the Yuba River watershed are the Yuba-Bear Project managed by the Nevada Irrigation District (a water agency based in Grass Valley, California), and the Drum-Spaulding Project overseen by PG&E.

Marysville and Yuba City, the communities at the downstream end of the Yuba River, receive flood risk reduction benefits from a system of levees, bypasses, and reservoirs, including USACE's Sacramento River Flood Control Project authorized in 1917, Yuba River Basin Project authorized in 1999, and Sutter Basin Project authorized in 2014. The Three Rivers Levee Improvement Authority (TRLIA) and Sutter Butte Flood Control Agency have constructed projects, including portions of the two recently authorized USACE projects, to address critical flood risk issues. USACE is currently constructing the Marysville Ring Levee element of the Yuba River Basin Project and is initiating design of the unconstructed portion of the Sutter Basin Project.

Hammon Bar Riparian Restoration Project

In 2011 and 2012 the South Yuba River Citizens League (SYRCL) planted 6,800 riparian cuttings on five acres of Hammon Bar on the lower Yuba River. Hammon Bar, like other sections of the lower Yuba River, is primarily composed of cobble and large gravel with small and varying composition of small gravel or sand. The course substrate, a result of the altered sediment regime, may be unfavorable for natural recruitment of riparian trees. This project demonstrates the feasibility of establishing riparian hardwood forests on open bar surfaces of the lower Yuba River by targeting areas with appropriate groundwater depths and utilizing specific

planting techniques. Plantings can influence conditions for natural riparian recruitment, increase biomass and structural complexity, encourage additional hydraulic interactions, and benefits to habitat (SYRCL 2013).

Storm events over the winter of 2016-2017 realigned the Yuba River, testing the sustainability of the restoration project. In July 2017, U.S. Fish and Wildlife Service biologists reported that hundreds of plantings survived.

1.5.2 Studies

The Yuba River downstream of Englebright Dam is one of the more thoroughly studied rivers in the Central Valley of California. Much of the research is connected to the FERC relicensing process of YCWA's Yuba River Development Project. Additional key prior studies and reports are described below.

Biological Opinion (BO) for Operation and Maintenance of Daguerre Point Dam and Fish Ladders. National Marine Fisheries Service (NMFS), May 2014.

Responded to the 2013 Daguerre Point Dam BA and concluded that implementation of the proposed action is not likely to jeopardize the threatened and endangered species, or adversely modify their designated critical habitat. NMFS included Reasonable and Prudent Measures and discretionary terms and conditions that are intended to minimize incidental take associated with the proposed action. The BO superseded the February 2012 BO for Operation and Maintenance of Englebright and Daguerre Point Dams.

Letter of Concurrence for Operation and Maintenance for Englebright Reservoir on the Yuba River. NMFS, May 2014.

Response to the 2013 USACE BA for Operation and Maintenance for Englebright Reservoir. In the letter, NMFS concurs with USACE's determination that the project proposed is not likely to adversely affect Central Valley spring-run Chinook salmon and steelhead or green sturgeon or the species' designated critical habitats.

BA for the Application for New FERC License Draft. YCWA, April 2014.

Identified and evaluated potential effects on threatened and endangered species from YCWA's power generating activities. The assessment was required as part of the FERC relicensing process.

Yuba Salmon Forum Summary Habitat Analysis, Prepared by Cardno ENTRIX for the Yuba Salmon Forum. September 2013.

This report provides a summary assessment of potential anadromous spring-run Chinook salmon and steelhead habitat in the Yuba River watershed. The summary assessment was designed to provide habitat information that can be used to review potential actions that warrant

further investigation regarding introduction of Central Valley spring-run Chinook salmon and Central Valley steelhead into the North, Middle, and/or South Yuba Rivers and/or portions of the Yuba River. The summary assessment includes a synthesis of data from various sources that includes hydrology, water temperature, upstream migration barriers, and a quantification of migration, holding, spawning, incubation, rearing, and smolt emigration habitat.

Interim Monitoring & Evaluation Report Draft, Lower Yuba River Accord, River Management Team. April 2013.

Served as both a 'report card' on the lower Yuba River Accord's River Management Team's monitoring and evaluation program results regarding the implementation of the Yuba Accord for regulators, stakeholders and the broader scientific community, and to help inform the FERC relicensing process.

Assessment of Infrastructure and Related Items to Support Anadromous Fish Passage to the Yuba River Watershed, Prepared by MWH for the Yuba Salmon Forum. March 2013.

Provides an assessment of infrastructure to support anadromous fish passage to the Yuba River watershed, including an engineering assessment of the facilities, appurtenances, costs, permitting, and changes to the infrastructure and operations of existing facilities required for the implementation and operations and maintenance of an Anadromous Fish Passage Program to locations in the upper Yuba River watershed, including the North, Middle, and South Yuba Rivers.

Yuba River Basin Post Authorization Documentation Report, USACE. December 2012.

Reaffirmed that there is Federal interest in project improvements within the Linda/Olivehurst area of the authorized Yuba River Basin Project. The project, as authorized, includes improvements to strengthen existing levees to reduce flood risk to the City of Marysville and to Reclamation District 784.

Upper Yuba River Watershed Chinook Salmon and Steelhead Habitat Assessment. DWR, 2007.

The California Department of Water Resources (DWR) Upper Yuba River Studies Program conducted this study to determine whether the re- introduction of wild Chinook salmon and steelhead to the upper Yuba River Watershed is biologically feasible. The study concluded that the Middle Yuba River could support a small salmon run.

Yuba River, California, Daguerre Point Dam Initial Appraisal Report. USACE, August 2005.

Under Section 216 authority, the USACE prepared an Initial Appraisal Report (IAR) in 2005. The report recommended a cost-shared feasibility study to determine the Federal interest in fish passage improvement, restoration of fisheries, restoration of aquatic habitat, and flood damage reduction associated with Daguerre Point Dam. A Continuing Authorities Program (CAP) Section 1135 study was not recommended because alternative costs to address aquatic ecosystem problems along the Yuba River were expected to exceed the CAP funding limit.

Daguerre Point Dam Fish Passage Improvement Project Alternative Concepts Evaluation, Wood Rodgers, Inc., Sacramento, CA. September 2003.

This evaluation described the potential solutions (and limitations of each) for fish passage improvements at Daguerre Point Dam as recommended by the California Department of Fish and Game (now the Department of Fish and Wildlife). It provided costs for each solution and compared the impacts to fish passage, water supply interests, and downstream flood protection relative to the cost for implementation.

Preliminary Fish Passage Improvement Study. USACE, August 2001.

Identified potential alternatives for fish passage improvement at Daguerre Point Dam on the Yuba River. It included preliminary plans to reduce fisheries resource problems in the study area. It provided the project status and planned future efforts needed to conduct a feasibility study.

1.5.3 Programs

Sacramento River Basin Habitat Expansion Agreement

The Habitat Expansion Agreement provides a framework for the DWR and PG&E to jointly identify, evaluate, and select the most promising and cost-effective action(s) to expand spawning, rearing, and adult holding habitat for spring-run Chinook salmon and steelhead in the Sacramento River Basin. Habitat expansion is intended to mitigate for any presently unmitigated impacts due to the blockage of passage of all fish species caused by Feather River Hydroelectric Projects.

Because the Yuba River was historically a major contributor of spring-run Chinook salmon to the Sacramento River System, DWR and PG&E, in consultation with resource agencies, identified actions to expand spawning habitat on the lower Yuba River, specifically the *Yuba River Canyon Salmon Restoration Project*. An additional, optional action to support segregation of spring-run and fall-run Chinook salmon using a seasonally operated segregation weir was also identified.

Anadromous Fish Restoration Program

Under the authority of the Central Valley Project Improvement Act, the USFWS Anadromous Fish Restoration Program (AFRP) has the broad goal of doubling natural production of anadromous fish in the river and streams of the Central Valley of California. One of the high priority actions of the AFRP is to evaluate the benefits of restoring stream channel and riparian habitats of the Yuba River, including the creation of side channels for spawning and rearing habitat for salmonids. In keeping with AFRP goals, USFWS and partner agencies have proposed and funded the *Hallwood Side Channel and Floodplain Restoration Project*, *Yuba River Canyon Salmon Habitat Restoration Project* and the *Hammon Bar Restoration Project*.

Lower Yuba River Accord

The Yuba Accord is a consensus-based, comprehensive program designed to protect and enhance 24 miles of the lower Yuba River extending from Englebright Dam downstream to Yuba River's confluence with the Feather River. The Yuba Accord was put into place to address water management in the lower Yuba River until a new FERC license is issued for the Yuba River Development Project. The Yuba Accord is composed of three interrelated agreements: 1) the Lower Yuba River Fisheries Agreement, which specifies lower Yuba River minimum stream flows and creates a detailed fisheries monitoring and evaluation program; 2) the Water Purchase Agreement, under which YCWA provides annual water supplies for fish and wildlife purposes in the Bay-Delta, CALFED's Environmental Water Account, the State Water Project, and the Central Valley Project; and 3) the Conjunctive Use Agreements which specify the terms of the Yuba Accord's conjunctive use program.

Yuba Salmon Forum

The Yuba Salmon Forum is a collaborative process that began in 2011. The forum is comprised of a diverse group of stakeholders including State and Federal agencies, municipalities, and environmental groups. The purpose of the Forum is to identify, evaluate, recommend, and seek to achieve implementation of effective near-term and long-term actions that achieve viable salmonid populations in the Yuba River Watershed to contribute to recovery goals.

Yuba Salmon Partnership Initiative

The Yuba Salmon Partnership Initiative (YSPI) is a collaborative, science-based initiative to contribute to the recovery of Central Valley spring-run Chinook salmon and Central Valley steelhead by enhancing habitat in the Yuba River downstream of Englebright Dam and reintroducing salmon (and possibly steelhead) into their historic habitat in the North Yuba River upstream of New Bullards Bar Dam.

1.6 Public and Agency Scoping

Scoping began on October 9, 2015, when USACE published a Notice of Intent in the Federal Register (Vol. 80, No. 196) to prepare an Environmental Impact Statement. Following publication of the notice, input was solicited from Federal, State, and local agencies, non-governmental organizations, and the general public. USACE and YCWA hosted four public meetings throughout the watershed. The meetings were held to educate the public about the study efforts and to garner input on the proposed scope, in accordance with the National Environmental Policy Act (NEPA). Table 1-1 displays the USACE planning and NEPA processes. YCWA, the lead agency under the California Environmental Quality Act (CEQA), is expected to complete a CEQA compliant environmental analysis after Congressional authorization of a Federal project and will ensure full compliance with all applicable state environmental laws.

Over 150 comments were received through email, mail, and at public scoping meetings (written and verbal). Comments ranged from general support of or opposition to the study, to requests for specific measures. The key comments included:

- General support for study.
- General support for reintroduction of salmonids into upper watershed.
- Interest in volitional or voluntary fish passage past Daguerre Point Dam and Englebright Dam.
- Support for a watershed scope of study.
- An interest in preserving existing and developing new recreation opportunities, including: fishing, boating, hiking, wildlife, and gold panning.
- Interest in communication and transparency throughout the study process – make information available to public including public scoping information, public comments, and screening criteria.
- Concern regarding the sponsor, YCWA, and USACE partnership.
- Concern for impacts to existing water resources.

The health of the native salmon and steelhead fisheries has been at the center of extensive study and debate. The overall awareness of and interest in issues in the Yuba River watershed is high. Participation in public meetings and submission of comments reflects an engaged public. There is a general expectation for this feasibility study to recommend a plan that achieves progress in the ongoing debate over natural resource management in the watershed.

During the plan formulation process, certain measures were screened from further consideration as more information was gathered and more analyses completed. This lead to identification of a final array of reasonable alternatives that, following an analysis of environmental effects, were determined to have no significant impacts on environmental

resources with the implementation of appropriate mitigation measures. Due to these findings, it was decided that the appropriate NEPA documentation to be made available for public review was a draft environmental assessment (EA) with an associated draft finding of no significant impact (FONSI).

For more detail on comments received, information available at meetings, and a summary of key issues that were raised, see Chapter 7, Public Agency Involvement and Review. A similar open-house format will be used when this draft integrated feasibility report and EA are made available for public review and comment. USACE will ensure all agencies, organizations, and individuals who provide comments will be provided a digital copy of the final integrated feasibility report and EA.

Table 1-1. USACE Planning and NEPA Process

USACE Planning Process	Yuba River Ecosystem Restoration Feasibility Study	NEPA Process
Step 1. Identify Problems and Opportunities	Scoping Charrette: 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 conditions and affected environment
Step 3. Formulate Alternatives	**Milestone 1:** Alternatives	Identify reasonable alternatives
Step 4. Evaluate Alternatives		
Step 5. Compare Alternatives		Evaluate impacts and potential mitigation
		Compare alternatives
Step 6. Select Alternative	**Milestone 2:** Tentatively Selected Plan	Draft EA: public notice and 30-day public review
	Milestone 3: Agency Decision	Final EA: respond to public comments
	Milestone 4: Senior Leader Briefing State and Agency Review	
	Milestone 5: USACE Chief's Report ASA(CW) Transmits Chief's Report to OMB ASA(CW) Transmits Chief's Report to Congress Congressional Authorization	Record of Decision (ROD)

[a] On October 9, 2015 USACE published a NOI in the *Federal Register* (Vol. 80, No. 196).

[b] Public Scoping Meetings were held on October 28, 29 and November 4, 5, 2015.

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

OMB = Office of Management and Budget.

1.7 Report Organization

The planning process 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 recommended plan based upon the comparison of the alternative plans.

This report documents the study process. It also serves as the EA for compliance with NEPA. The chapter headings and analysis presented in this report generally follow the outline of an EA. The report chapters relate to the six steps of the planning process as follows:

- The second chapter of this report, Need for Action, covers the first step in the planning process (specification of water and related land resources problems and opportunities).
- The third chapter of this report, Alternative Plans, 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 in the planning process (comparison of alternative plans), and the sixth step of the planning process (selection of the recommended plan based upon the comparison of the alternative plans). In addition, at the end of the chapter, a project description is provided for the purposes of the NEPA analysis.
- The fourth chapter of this report, Affected Environment and Environmental Consequences, covers the second and fourth step of the planning process (Inventory, forecast and analysis of water and related land resources in the study area and evaluation of the effects of the alternative plans). This chapter is the majority of the NEPA analysis for the study.
- The remaining chapters of the report discuss: cumulative effects (Chapter 5); compliance with Federal laws and regulations (Chapter 6); public and agency involvement and review (Chapter 7); the tentatively selected plan (Chapter 8); recommendations (Chapter 9); the list of preparers (Chapter 10); and references (Chapter 11).

Chapter 2 – Need for Action

This chapter presents results of the first step of the planning process, the specification of water and related land resources problems and opportunities in the study area, and establishes the purpose and need for action within the NEPA framework. The chapter also establishes the planning objectives and planning constraints, which are the basis for formulation of alternative plans.

2.1 Purpose and Need for the Action

The purpose of the project is to improve degraded ecosystem form, functions, and processes in the Yuba River watershed including the quality, quantity, and connectivity of aquatic and riparian habitats.

The Yuba River watershed contains a diverse array of environments and conditions, from the snow-covered crest of the Sierra Nevada Mountain Range to the agricultural fields of the Sacramento Valley below. The variety of ecological communities support a multitude of significant resources, such as the Federally listed threatened Western yellow-billed cuckoo, valley elderberry longhorn beetle, and California red-legged frog. The lower Yuba River is designated critical habitat for federally listed threatened Chinook salmon, steelhead trout, and green sturgeon. However, many of the watershed's ecological communities, especially riparian and aquatic communities, are under stress.

According to the National Marine Fisheries Service (NMFS) and numerous studies, at least 80% of historic riparian habitat has been lost in the western United States. In the Central Valley of California, less than 5% of historic riparian forests remain (Hunter et al. 1999). Degraded and diminished riparian habitat affects the quality and quantity of aquatic habitat as well. The lack of riparian vegetation translates to scarce shade, shelter, nutrients, and food for aquatic species. Additionally, in the Central Valley of California, 72% of the historical Chinook salmon spawning and holding habitat is no longer available (Yoshiyama et al. 2001). Parallel to regional and national trends, riparian and aquatic habitat along the Yuba River has been drastically degraded by human activities, limiting the productiveness of the ecosystem.

Historic and ongoing alterations to the watershed have degraded the aquatic and riparian habitat on the lower Yuba River and degraded the processes that sustain these habitats. Hundreds of millions of cubic yards of hydraulic mining debris eliminated much of the Yuba River's riparian corridor and aquatic habitat in the mid to late 1800s. Subsequent dredger mining altered the character of the lower Yuba River including realigning and constricting the channel and reworking and coarsening substrate. Large amounts of mining debris persist to this day retarding the regeneration of riparian vegetation and preventing the recovery of fish species. The construction of dams and other water resource infrastructure has altered the natural transport of sediment and water in the watershed. The need for ecosystem restoration in the Yuba River watershed is to reverse degradation and reduce stressors to nationally significant resources (Section 8.1.2) including critical riparian and aquatic habitats and the Federally listed species that depend on them.

2.2 Problems and Opportunities

Identification and specification of the problems and opportunities to be addressed is an important step in the planning process. A problem is an existing undesirable condition to be changed. An opportunity is a chance to create a future condition that is desirable. Within the context of solving the problems, opportunities contribute to the overall beneficial outcome of the project. The difference between problems and opportunities is often indistinct, but in both cases a changed future condition is preferred. The purpose of this feasibility study is to develop an implementable and acceptable plan to change the future condition and address specific water and related land resources problems and opportunities in the Yuba River watershed.

2.2.1 Problems

Modifications along the main stem and three forks of the Yuba River for resource extraction (hydraulic mining, dredging), initial mitigation of resource extraction effects (sediment dams, training walls), and water resource development (hydropower, water supply, flood control dams, irrigation diversions) have resulted in the following problems:

- The quality of aquatic habitat has been degraded by reduced water volume; altered depth, velocity, temperature, substrate, and oxygen levels; and introduced heavy metals.
- Riparian habitats have been diminished in quantity, degraded in quality, and fragmented by conversion to agricultural fields and reservoirs; accumulation of mining deposits; and reduced fine sediments.
- Longitudinal river connectivity has been reduced by altered hydroperiods and sediment transport as well as blocked and impaired passage of migrating fish.
- Lateral river connectivity has been reduced by aggradation of the floodplain and channelization of the river.

Climate change is further exacerbating habitat degradation, fragmentation, and subsequent impacts to wildlife. For example, the Western yellow-billed cuckoo breeds in low- to moderate-elevation native forests lining the rivers and streams of the western United States. They require relatively large, contiguous patches of multilayered riparian habitat for nesting. The loss and degradation of native riparian habitat throughout their range have played a major role in the bird's decline. Climate change has the potential to be an additional stressor to the cuckoo. The warmer temperatures already occurring in the southwestern United States may alter the plant species composition of riparian forests over time (NPS 2015). In the Central Valley, low species richness, poor vital rates, and low abundance of songbirds reflect the loss of riparian habitat integrity (CVJV 2006). In fact, riparian habitat loss may be the most important cause of population declines among songbird species in western North America (DeSante and George 1994) and climate change scenarios predict further changes in vegetation.

Another example of risk from climate change is to the cold-water fish species. The Yuba River watershed is historical habitat for threatened Central Valley spring-run Chinook salmon,

threatened Central Valley steelhead, and threatened North American green sturgeon. These anadromous fish species rely on appropriate habitat and cold, clean water to survive. Climate change is likely to reduce availability and access to cold water through increasing average air temperatures and decreasing precipitation. Reduced snow packs will cause prolonged periods of low streamflows during summer and early fall. Climate change will aggravate existing impacts to anadromous fish species in the Yuba River. A May 2017 report from biologists at the University of California, Davis, Center for Watershed Sciences and California Trout states that nearly 75 percent of California's salmon, trout, and steelhead will be extinct in 100 years unless critical habitat is protected and restored. If present trends continue, 45 percent of species are likely to be extinct in the next 50 years (Moyle et al, 2017).

2.2.2 Opportunities

In addition to the problems identified above, the following opportunities that could potentially be addressed in the feasibility study were also identified:

- Provide compatible recreation in conjunction with ecosystem restoration features.
- Conserve Evolutionary Significant Units of Chinook Salmon in the Yuba River watershed, including genetic isolation of seasonal runs.

Unlike many other Sierra Nevada rivers, there are no fish hatcheries on the Yuba River. In fact, the Yuba supports one of the last remaining wild salmon runs in California, providing a unique opportunity to preserve genetic integrity of independent salmonid populations. Improving opportunities for reproductive isolation would reduce interbreeding between Chinook salmon fall and spring runs and result in increased species productivity, resiliency to changing conditions, and survival.

2.3 Federal and Non-Federal Objectives

The Federal (USACE) objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER). Contributions to national ecosystem restoration (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units).

YCWA's primary mission is flood protection, water supply, fisheries protection and enhancement, hydroelectric generation, and recreation. The YCWA objective for the study is to identify opportunities for construction of sustainable ecological habitat improvements to the Yuba River watershed to restore the Yuba River ecosystem degraded by hydraulic mining and other anthropogenic impacts.

2.4 Planning Goals and Objectives

The overall goal of the study is to restore degraded ecosystem structure, function, and dynamic processes of the Yuba River watershed to a less degraded, more natural condition. The planning objectives, which are developed specifically for this study, are statements of the intended steps toward achieving the goals. An objective is developed to address each of the identified problems and opportunities. Planning objectives represent desired positive changes in the future without-project conditions.

All of the planning objectives focus on activities to be conducted within the study area over a 50-year period of analysis. Based upon the problems and opportunity identified in the study area, planning objectives include the following.

- **Improve the quantity, quality, and complexity of aquatic habitats.**

This objective addresses the improvement of aquatic habitats and the functions those habitats provide for all life stages of anadromous fish, water birds, amphibians, and other wildlife within the watershed.

- **Improve the quantity, quality, complexity, and connectivity of riparian habitats.**

This objective addresses the improvement of riparian habitats and migratory corridors and the functions those habitats provide for waterfowl, water birds, riparian songbirds, amphibians, and other wildlife within the watershed.

- **Improve longitudinal river connectivity.**

This objective addresses the improvement of hydrologic and aquatic habitat connectivity. Critical components of connectivity include the longitudinal, or downstream, movement of water and sediment, and the upstream movement of anadromous fish and the oceanic nutrients they provide. Connectivity is improved when areas of suitable habitat are joined or gaps between areas of suitable habitat are reduced.

- **Improve lateral connectivity of the river to its floodplain.**

This objective addresses the improvement of hydrologic connectivity within and between aquatic and floodplain habitats. Critical components of connectivity include the lateral, or horizontal movement of water within the channel and onto the floodplain, and the vertical, or downward movement of water into the ground.

The feasibility study presents a range of alternative plans that balance objectives and avoid conflicts or, where necessary, demonstrate the tradeoffs between conflicting objectives,

enabling decisions to be made. The Federal objective is to maximize net benefits. Because of this, it is not appropriate to identify targets within objectives. For example, no target of minimum acreage of restored habitat was identified for the project. Rather, the planning process includes formulation of alternative plans to maximize NER benefits relative to cost.

2.5 Planning Constraints

A constraint is a restriction that limits the extent of the planning process. It is a statement of aspects of the study area the alternative plans should avoid. In the development of alternatives, the following constraints were identified:

- The recommended plan will not recommend any action that is legally required of another entity or is included as O&M of an existing USACE project, *e.g.*, mitigation requirements of FERC licenses or NMFS May 2014 Biological Opinion.
- Removal of any Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulated wastes would be a responsibility of the non-Federal sponsor, *e.g.*, contaminated sediment.

An example situation in which the constraint would apply is pollution abatement. According to the ER 1105-2-100, paragraph E-30.g., USACE will not propose any restoration projects or features that would result in treating or otherwise abating pollution problems caused by other parties where the other parties have, or are likely to have, a legal responsibility for remediation or other compliance responsibility. Any such actions will become part of the future without-project condition. Also, a USACE restoration project cannot implement fish and wildlife mitigation that is required for another project or be used as a mitigation credit.

2.6 Planning Considerations

In addition to the planning constraints, the following key planning considerations were recognized. Key considerations are based on identified study or implementation risks. The feasibility study will seek to identify measures and alternatives that address these considerations to the extent practicable.

- Do not increase flood risk or reduce flood management capabilities.
- Do not have a significant negative effect on Federal ESA-listed species or impair existing habitat for listed species in the future.
- Avoid or minimize, where practicable, providing upstream passage for non-native fish.
- Avoid or minimize adverse effects on the downstream water users' diversions at Daguerre Point Dam.
- Avoid or minimize, where practicable, adverse effects to groundwater recharge.
- Avoid or minimize, where practicable, impeding green sturgeon recovery efforts.

- Avoid or minimize, where practicable, impeding public access or recreational opportunities as currently allowed.

An outstanding challenge is, and will remain, the presence of toxic sediments behind Englebright and Daguerre Point dams (including mercury, arsenic, chromium, copper, and nickel) deposited from past mining activities (USGS, 2004 and 2006). Responsibilities for any remedial action would be determined in accordance with applicable laws, regulations, and policies.

Chapter 3 – Alternative Plans

3.1 Plan Formulation Process

The formulation, evaluation, and comparison of alternative plans comprise the third, fourth, and fifth steps of the USACE planning process. These steps are often referred to collectively as plan formulation. Plan formulation is an iterative process that involves cycling through the formulation, evaluation, and comparison steps several times to develop a reasonable range of alternative plans and then narrow those plans down to a final array of feasible plans from which a single plan can be identified for implementation.

3.2 Planning Criteria

Planning criteria are used to formulate, screen, evaluate, and compare measures and alternative plans. Four specific formulation criteria are required in USACE water resource studies, as described in ER 1105-2-100, paragraph 2-3.c: completeness, effectiveness, efficiency, and acceptability. These criteria are generally subjective and are useful in narrowing down the array of possible alternative plans. With the exception of completeness, these criteria are also useful in screening potential measures. The four planning criteria are:

- **Completeness.** Completeness 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. It is an indication of the degree to which the planned outputs are dependent upon the actions of others. All alternative plans were formulated to be complete.
- **Effectiveness.** Effectiveness is the extent to which a measure or alternative plan contributes to achieving the planning objectives. Measures that clearly make little or no contribution to the planning objectives were dropped from consideration.
- **Efficiency.** Efficiency is the extent to which a measure or alternative plan is the most cost effective means of achieving the planning objectives. Benefits can be both monetary and non-monetary. Measures that provide little benefit relative to cost were dropped from consideration.
- **Acceptability.** Acceptability is the extent to which a measure or alternative plan is acceptable in terms of applicable laws, regulations and public policies. Unpopular plans are not necessarily unacceptable, just unpopular. Measures that were clearly not acceptable were dropped from consideration.

Measures and plans that pass the screening criteria are evaluated and compared against more specific evaluation criteria, which are described later in this chapter. Evaluation criteria can include costs, outputs, or effects and reflect the planning objectives or constraints. Some or all of the evaluation criteria may be used at various stages in the plan formulation process to

compare alternative plans. Effective evaluation criteria must be measurable and reveal differences or trade-offs between alternative plans.

3.3 Future Without-Project Conditions

Alternative plans are formulated and evaluated based on the future without-project condition. The future without-project condition is forecasted from the base year (the year when the proposed project is expected to be operational) to the end of the 50-year period of analysis. Forecasts should consider all other actions, plans, and programs that are most likely to be implemented in the future to address the problems and opportunities in the study area in absence of a USACE project.

If no Federal action is taken, the Yuba River ecosystem-related problems existing today are expected to continue, and stressors will persist and potentially become exacerbated. Populations of Chinook salmon, steelhead, and waterbirds will continue to be significantly reduced from historic conditions. Connectivity of the riverine aquatic habitat will continue to be curtailed by the presence of large dams in the watershed. Regeneration of riparian habitat will continue to be impeded by coarse substrate conditions. Incremental improvements to currently accessible habitat may be made by other entities. However, the cost of large scale excavation is likely a barrier to other entities and the sites requiring minimal excavation have already been addressed, leaving the most problematic and expensive sites in the current state of degradation.

Under the Englebright Dam project authority, USACE is responsible for various discretionary and non-discretionary functions. The discretionary functions include activities related to the manner and frequency of maintaining the recreational facilities on the reservoir. Non-discretionary functions include the inspection and maintenance of the dam structure to ensure it remains in good repair. USACE does not conduct any water control operations or releases for the debris dam.

Under the Daguerre Point Dam project authority, USACE is responsible for various discretionary and non-discretionary functions. The discretionary functions include, but are not limited to, the timing and frequency of monitoring and clearing debris from the existing fish passage facilities, and managing sediment buildup across the upstream face of the dam. Future gravel injections and the Large Woody Material Management Plan are anticipated as components of USACE's voluntary conservation measures associated with the recent ESA consultation. USACE's Gravel Augmentation Implementation Plan contains guidance for a long-term gravel injection program to provide spring-run Chinook salmon spawning habitat in the bedrock canyon downstream of Englebright Dam. Non-discretionary functions include the inspection and maintenance of the dam structure and fishways to ensure they remain in good repair.

Mining will continue in the Yuba Goldfields, and the tailings will remain. Restoration opportunities may be present in the Yuba Goldfields, however, due to the tremendous volume of gravel tailings and the inability of those tailings to support much vegetation, the future without-project condition does not include any restoration projects in the Yuba Goldfields.

Flood Risk Management structures will continue to be constructed and maintained in the lowest portion of the watershed. Three River Levee Improvement Authority (TRLIA) plans to construct a levee within the Yuba Goldfields and along the southern edge, about three miles southwest of Daguerre Point Dam and one mile south of the river (Figure 3-1).

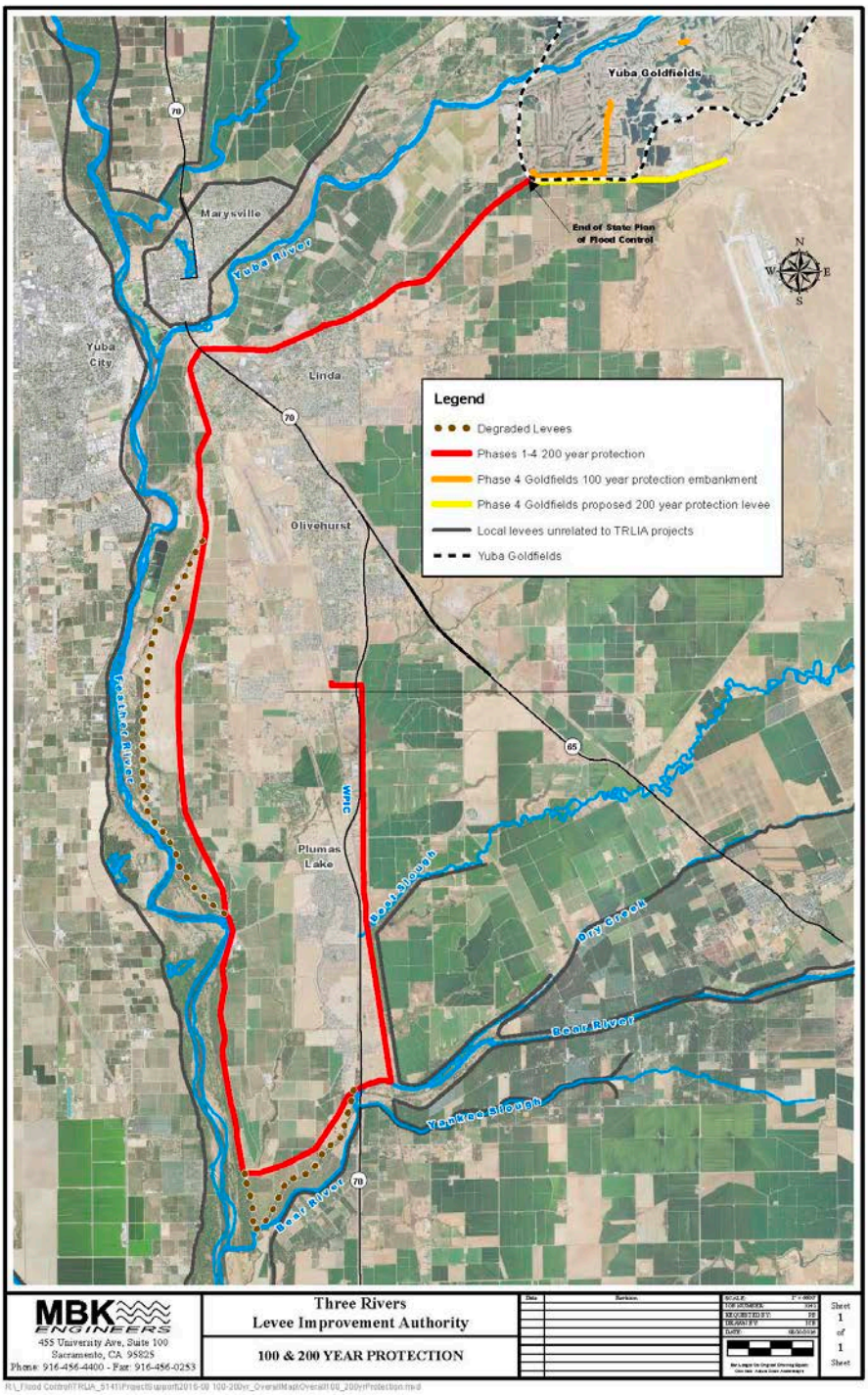

Figure 3-1. Proposed levees in the Yuba Goldfields.

Implementation of lower Yuba River restoration actions by other entities is expected to continue. The USFWS Anadromous Fish Restoration Program (AFRP) has four projects in the planning phase. 1) The Yuba River Canyon Salmon Habitat Restoration Project would restore up to 0.5 miles of in-channel spawning habitat by restoring and replenishing gravel and removing shot rock debris from the Narrows Reach, which is below Englebright Dam. 2) The Hallwood Side Channel and Floodplain Restoration Project has the potential to enhance or create up to 170 acres of seasonally-inundated riparian floodplain habitats, more than 3 miles of perennial side channels and alcoves, and more than 4 miles of seasonal side channels. 3) The Long Bar Restoration Project would restore floodplain habitat at the downstream end of Long Bar which will include floodplain lowering, side channel enhancement, riparian planting, and placement of large woody debris. 4) The Upper Rose Bar Enhancement Project seeks to enhance salmonid spawning habitat by fixing a degraded gully and adding spawning gravels to the river. Figure 8-2 displays how the habitat increments proposed in this study build upon AFRP projects.

Over the next 50 years, climate change is expected to be a stressor for anadromous salmonids in the Yuba River, and climate change in general poses an additional risk to the survival of salmonids in the Central Valley (NMFS 2014). According to National Oceanic and Atmospheric Administration (NOAA) research, under the expected warming of around 5°C, substantial habitat in the Central Valley would be lost, although significant amounts of habitat could remain, primarily in the Feather and Yuba Rivers (Lindley et al. 2007). Literature suggests that by the year 2100, mean summer temperatures in the Central Valley may increase by 2 to 8°C. Precipitation will likely shift to more rain and less snow, with significant declines in total precipitation possible. Hydrographs will likely change, and Chinook salmon and steelhead will be more thermally stressed by stream warming at the southern ends of their ranges (NMFS 2014).

NMFS (2014) has prioritized the upper Yuba River (upstream of Englebright Dam) as a primary area to re-establish viable populations of spring-run Chinook salmon and steelhead. Recent studies conducted by Yuba Salmon Forum (YSF) (2013) demonstrate that of all rivers/reaches in the Yuba River watershed, the North Yuba River upstream of New Bullards Bar Reservoir and the lower Yuba River downstream of Englebright Dam provide the most thermally suitable amounts of habitat in the watershed. The North Yuba River, because of the lack of storage reservoirs and water management infrastructure, most closely approximates unimpaired conditions. According to YCWA (2010), because of specific physical factors, hydrologic factors, and flows negotiated under the Yuba Accord, the lower Yuba River is expected to continue to provide the most suitable water temperature conditions for anadromous salmonids of all Central Valley floor rivers, even if there are long-term climate changes. This is because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample cold water pool reserves that will continue to be available to provide sustained, relatively cold flows of water into the lower Yuba River during the late spring, summer, and fall of each year (YCWA 2010).

Public lands along the South Yuba River will continue to be managed under the South Yuba River Comprehensive Management Plan. The plan is the result of a multi-agency effort to develop a shared vision for lands along the river.

Urban development along the Yuba River will be negligible. Most of the upper watershed is National Forest land. The towns along the upper portions of the Yuba River are over an hour's drive from job centers, so they are not expected to grow significantly. Areas along the lower Yuba River are expected to remain rural; indeed, Yuba County's current general plan, from 2011, states that, "Rural residential areas will be preserved, recognizing the need to provide for a variety of lifestyles. On the valley floor, lands that are the least productive for agricultural purposes will be committed to development while higher value agricultural land will be protected from encroachment and preserved for future generations of farmers."

Other programs currently in early planning phases could also potentially influence the study area in the future, but are not assumed to be part of the future without-project conditions. They include the Yuba Salmon Partnership Initiative, which is investigating collection and transport and the Yuba County Integrated Regional Water Management Plan. They are not assumed to be part of the future without-project conditions because they are not funded and approved. Also, no new actions associated with FERC relicensing are assumed, as the new licenses are not in effect.

3.4 Identification and Screening of Measures

Preliminary measures were compiled from several source documents including the Central Valley Recovery Plan (NMFS 2014), Yuba River Ecosystem Restoration Section 905(b) Analysis (USACE 2014), Habitat Expansion Plan (DWR and PG&E 2010), Habitat Expansion for Spring-run Chinook Salmon and Steelhead (RMT 2009), Daguerre Alley Habitat Enhancement Measures (cbec 2014), Rehabilitation Concepts for the Parks Bar to Hammon Bar Reach (cbec et al. 2010), and Rehabilitation Planning from Parks Bar to Marysville (cbec 2013). Additional preliminary measures were suggested at the YRER Planning Charette held in Marysville, California from September 22 – 25, 2015. The compiled preliminary measures were screened and, in some cases, combined to form initial measures with identifiable ecosystem outputs that would address the planning objectives.

3.4.1 Plan Formulation Rationale.

Measures were developed to address study objectives, as shown below in Table 3-1.

3.4.2 Description of Initial Measures

The four general types of initial measures that were developed were riverine habitat restoration, connectivity at Daguerre Point Dam, connectivity at Englebright Dam, and connectivity at New Bullards Bar Dam.

Lower Yuba Habitat Restoration. This measure represents approximately 40 habitat restoration site concepts along the lower Yuba River which include channel, floodplain, and riparian habitat improvements, such as floodplain grading, side-channel and backwater creation, riparian vegetation planting, and installation of woody material. After the screening process described below, the site concepts were divided into multiple geographic increments for further evaluation.

Table 3-1. Measures to Achieve Study Objectives.

Measures	Objective: Improve the quantity, quality, complexity of aquatic habitats	Objective: Improve the quantity, quality, complexity, and connectivity of riparian habitats	Objective: Improve longitudinal river connectivity	Objective: Improve lateral connectivity of the river to its floodplain habitat
Lower Yuba River Habitat Restoration – *Floodplain grading*	X	X	X	X
Lower Yuba River Habitat Restoration – *Floodplain lowering*	X	X	X	X
Lower Yuba River Habitat Restoration – *Riparian vegetation planting*	X	X		
Lower Yuba River Habitat Restoration – *Side channel creation*	X		X	
Lower Yuba River Habitat Restoration – *Bank scalloping*	X			X
Lower Yuba River Habitat Restoration – *Large woody material or engineered log jams*	X			
Daguerre Point Dam Step Pools			X	
Daguerre Point Dam 10% bypass			X	
Daguerre Point Dam Removal	X	X	X	X
Englebright Dam Fish Ladder			X	
Englebright Dam Fish Tram			X	
Englebright Dam Bypass			X	
Englebright Dam Removal	X	X	X	X
Collect and Transport Above Englebright Dam			X	
Collect and Transport Above New Bullards Bar Dam			X	

Daguerre Point Dam Step Pools. This measure involves constructing a series of low-head weirs, also known as step pools, across the river downstream of the dam. This measure addresses upstream and downstream fish passage. Existing irrigation diversions would not be affected.

Daguerre Point Dam 10% Bypass. This measure includes a fishway/bypass around Daguerre Point Dam, which would redirect up to 10% of the flows around the dam in order to facilitate fish passage. National Marine Fisheries Service and California Department of Fish and Wildlife generally accept a fishway design flow of 10% of the fish passage flow (related to flows during the upstream migration period). Flow for fish passage releases would be controlled by a headworks structure by regulating flow in the bypass channel in proportion to flow in the Yuba River. A concrete floodwall or levee along the proposed channel boundary would be required to protect the bypass channel from high river flows. Additionally, this measure could affect at least one irrigation diversion.

Daguerre Point Dam Removal. This measure includes blasting and demolishing the existing 575-foot-wide by 25-foot-high by 50-foot-thick ogee-type concrete debris control dam, the 575-foot-wide by 65-foot-long concrete apron, retaining walls, abutments, and the two existing fish ladders. Potentially over four million cubic yards of stored sediment would need to be addressed, as well as effects to the existing irrigation diversions.

Englebright Dam Fish Ladder. This measure includes the installation of a fish ladder at Englebright Dam. The ladder would likely be constructed along the northern side of the Yuba River, with its entrance near the existing Narrows 2 Powerhouse. A juvenile collection facility consisting of a floating surface collector or screen system would be required within Englebright Reservoir to collect juvenile salmon, and juvenile and adult steelhead. Juveniles would be returned to the lower Yuba River via truck, piping, or tramway.

Englebright Dam Fish Tram. This measure involves the construction of a mechanical tramway or elevator to transport adult fish (upstream) and juvenile fish (downstream) over the existing Englebright Dam. The tramway would be constructed along the northern side of the Yuba River, with its entrance near the existing Narrows 2 Powerhouse. The tramway system would include an attraction and crowding system for adult fish, large bins to carry fish, and a rail or cable system to hoist the live fish boxes up and over the dam. The same hoist and box system could be used to return juveniles to the lower Yuba River. A juvenile collection facility consisting of a floating surface collector or screen system would be required within Englebright Reservoir to collect juvenile salmon, and juvenile and adult steelhead. Juveniles would be returned to the lower Yuba River via tramway.

Englebright Dam Bypass. This measure uses Deer Creek and a newly constructed canal to provide a low-gradient, rock-bedded channel for adult migration. Modifications to the existing Deer Creek channel would need to be undertaken, such as re-contouring and removal of natural barriers, to ensure the potential for successful fish passage at a range of flows. The new canal would be several miles long. A headworks structure and short fish ladder would be required to control flows into the canal, since reservoir elevations vary by 10 to 15 feet. A juvenile collection facility, consisting of a floating surface collector or screen system, would be required within Englebright Reservoir to collect juvenile salmon, and juvenile and adult steelhead. Juveniles would be returned to the lower Yuba River via truck, piping, tramway, or through the bypass.

Englebright Dam Removal. This measure includes the complete removal of Englebright Dam. The large volume of sediment deposited behind Englebright Dam cannot be released due to water quality concerns. The sediment would either need to be completely or partially removed or secured in place in such a manner that the sediment would not be mobilized and released downstream. Due to upstream fish passage concerns, this measure also includes a fish ladder and juvenile return bypass on the Middle Yuba River, and improvements to the New Bullards Bar Dam outlet, tailrace, and habitat downstream of New Bullards Bar Dam.

Collect and Transport above Englebright Dam and Reservoir. This measure includes the upstream collection and transport of adult spring-run Chinook salmon from the lower Yuba

River at Daguerre Point Dam to above Englebright Reservoir (to the Middle and/or South Yuba Rivers) and the downstream collection and transport of juvenile spring-run Chinook salmon from Englebright Reservoir to the lower Yuba River. Fish would be transported via tanker truck to historic spawning habitat in the upper watershed.

Collect and Transport above New Bullards Bar Dam and Reservoir. This measure includes the upstream collection and transport of adult spring-run Chinook salmon from the lower Yuba River at Daguerre Point Dam to above New Bullards Bar Reservoir and the downstream collection and transport of juvenile spring-run Chinook salmon from the North Yuba River to the lower Yuba River. Fish would be transported via tanker truck to historic spawning habitat in the upper watershed.

3.4.2.1 Measures Not Considered in Detail

Daguerre Point Dam Fish Ladder. This measure consists of two new fish ladders to replace existing fish ladders. This would primarily serve to improve upstream migration but fails to improve downstream fish passage. Based on currently available information, it is not possible to demonstrate that new fish ladders would be a cost-effective method providing quantifiable ecosystem restoration benefits compared to the other measures considered. Available data indicate that most fish attempting to migrate upstream are currently able to do so successfully. Although the effectiveness of the fish ladders might be improved based on current design criteria, it is not possible to accurately quantify that improvement in terms of ecosystem outputs because (1) there is insufficient quantitative information on the degree to which upstream migration remains impeded despite the existing fish ladders, (2) the degree to which a new ladder would improve upstream migration is not known, and (3) there is no existing USACE-approved ecosystem model that would quantify ecosystem outputs from improved fish migration for direct comparison to ecosystem outputs from the other restoration measures considered, including aquatic and riparian habitat restoration. This measure was not carried forward for further consideration because it cannot be shown to be effective or efficient based on information that can be obtained within the scope of this study.

Lower Englebright Dam and Installing Fish Ladder. The normal water surface elevation immediately downstream of Englebright Dam is approximately 287 feet and the existing dam crest elevation is 527 feet, for a height difference of approximately 240 feet. According to research and anecdotal information, it is not clear that a fish ladder has been successfully implemented over a dam of this height. This measure includes lowering Englebright Dam by about 100 feet so that it could accommodate a fish ladder within both the length and height of previously constructed successful fish ladders. Construction of a juvenile collection and transport system near Englebright Dam would be necessary to collect and concentrate juveniles, and convey the juveniles safely downstream through use of a bypass pipe or other arrangement. Similar to a complete removal of Englebright Dam, a modification of this nature would require at least a partial removal of sediment behind Englebright Dam because it is deposited at a relatively high elevation in the upper reservoir. This measure retains high technical complexity, high operations and maintenance costs, and high technical and cost uncertainty with minimal

additional habitat restored; therefore, it is not carried forward for further consideration because it would not be efficient.

Construct a second dam as a step to Englebright Dam. This measure would generally include construction of a second dam and reservoir downstream of Englebright Dam, and construction of two fish ladders, one from the river to the top of the first dam, the second from the first reservoir to the top of Englebright Dam. There are currently no conceptual evaluations of this concept. Construction of a second dam would result in additional impacts compared to other measures, including impacts to existing power facilities and the inundation of existing riverine habitat. This measure would not result in additional benefits and therefore is not carried forward for further consideration because it would be less efficient than other measures.

Construct a segregation weir downstream of Englebright Dam. This measure would include establishing a barrier across the width of the river, potentially comprised of a fixed sill or base, with weir pickets installed seasonally to provide positive distinction between Chinook salmon runs. The design would need to accommodate a range of flow levels, as well as consider recreational and safety issues. This measure would require annual operation and maintenance. This measure is limited to single species management, which would not be consistent with policy regarding USACE participation in ecosystem restoration.

Habitat restoration in the Yuba Goldfields. Because of the Yuba Goldfields are covered by extensive deposits of large cobbles from previous mining, and continue to be actively mined, this measure would be less efficient than other potential restoration measures.

Additional measures were suggested during the study scoping process, but were not considered in detail because they would not be consistent with USACE ecosystem restoration policy and, therefore, would not be acceptable. Under USACE policy, the objective of ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition, rather than to manage particular species (ER 1105-2-100 and EP 1165-2-502). Generally, restoration lands must be acquired in fee title by the non-Federal sponsor; however, restoration cannot consist primarily of land acquisition. Clean up of hazardous or toxic materials is not an ecosystem restoration purpose. Regulation of land use is a non-Federal responsibility. Operation of existing water supply and hydropower facilities is the responsibility of the operating and regulating agencies. The following measures were not considered in detail because they would not be consistent with these general policies regarding USACE participation in ecosystem restoration. These measures could be implemented by other agencies or organizations in addition to the plan recommended by this study.

- Rice field rearing of fish.
- Build a hatchery.
- Conduct mining to remove mercury.
- Mine remediation.
- Mercury clean-up.

- Zoning restrictions and other government planning processes to curtail further development in active floodplains of the Yuba River.
- Permanently protect riparian and floodplain habitat through easements and/or land acquisition.
- Implement programs and measures to minimize predation by non-native fish.
- Monitor and evaluate sport fishing regulations to ensure they are consistent with recovery of listed salmonids.
- Evaluate whether adult anadromous salmonids straying between the Feather and Yuba Rivers can be minimized through flow management.
- Implement flow fluctuation and ramping rates found to be protective of anadromous salmonid embryos and juveniles.
- Modify the Hallwood-Cordua diversion facility to decrease mortality of out-migrating juvenile anadromous salmonids.
- Modify the South Yuba/Brophy diversion facility to decrease mortality of out-migrating juvenile anadromous salmonids.
- Install new security features or reconstruct existing barriers to limit public access at Daguerre Point Dam to reduce poaching of indicator fish species.
- Removal or realignment of Hammonton Road between Lower Gilt Edge Bar and First Island.
- Relocate the riverside motocross recreation area, located in the Marysville Reach, outside of the active floodplain.

3.4.3 Screening of Initial Measures

In order to ensure that only implementable measures with a reasonable chance of achieving a significant increase in habitat value at a reasonable cost (i.e., efficient measures) were included in the final array of alternatives, criteria were established to further screen measures. The criteria used to screen measures are efficiency (cost, habitat quantity, and habitat quality) and risk to efficiency. These criteria are further described below:

Efficiency. For the purposes of screening measures, relative efficiency was calculated for each measure based on estimated cost, quantity of habitat restored, and quality of habitat restored, as described below:

- ***Estimated Cost.*** In order to compare the relative costs of measures, cost categories were established to rank measures as Low-Medium-High cost. Cost categories with $200 million ranges were used because of the high degree of uncertainty in the rough order of magnitude cost estimates used in the screening process. For efficiency calculations, associated ranking factors were also assigned. Cost ranking categories and associated ranking factors shown in Table 3-2 are as follows:

- Low (Ranking Factor 1) = $0 to $200 million
- Low-Medium (Ranking Factor 2) = $200 to $400 million
- Medium (Ranking Factor 3) = $400 to $600 million
- Medium-High (Ranking Factor 4) = $600 to $800 million
- High (Ranking Factor 5) = $800 to $1,000 million
- Very High (Ranking Factor 6) = $1,000 to $1,200 million
- Very High (Ranking Factor 7) = $1,200 to $1,400 million
- Very High (Ranking Factor 8) = $1,400 to $1,600 million
- Very High (Ranking Factor 9) = $1,600 to $1,800 million
- Very High (Ranking Factor 10) = over $1,800 million

Table 3-2. Cost Ranking.

Measure	Cost	Ranking Factor
Lower Yuba Habitat Restoration	Low	1
Daguerre Point Dam Step Pools	Low	1
Daguerre Point Dam 10% Bypass	Low	1
Daguerre Point Dam Removal	Med	3
Englebright Dam Fish Ladder	High	5
Englebright Dam Fish Tram	Very High	6
Englebright Dam Bypass	Very High	6
Englebright Dam Removal	Very High	10
Collect and Transport above New Bullards Bar Dam and Reservoir	Low-Med	2
Collect and Transport above Englebright Dam and Reservoir	Med	3

Quantity of Habitat Restored.

- The quantity of habitat restoration by the various measures was compared in terms of both (1) the size of the area within which habitat quality would be improved and (2) the degree to which unrestricted ecological connectivity between existing areas of habitat would be restored. Translating these two factors into a single common unit of measure for the comparison of diverse measures is a difficult problem for which there is no generally accepted solution. After considering various potential approaches, USACE decided to use the conversion method presented in the USACE Fiscal Year 2016 Budget Development Guidance, Engineer Circular 11-2-206, Appendix C, 31 Mar 2014 (EC 11-2-206). Although the EC method was intended only for prioritizing projects for budget purposes, the EC provides an unbiased and logical approach to converting area and connectivity factors into a single metric. The EC method is an excellent fit because it was developed to compare aquatic habitat improvements, dam removals, and fish passage improvements, which are the same categories as the types of measures being considered in this study. The EC method measures the quantity of habitat restoration in terms of equivalence to acres of habitat restored.
  - Formulas described in EC 11-2-206 were applied as follows:

- Direct alterations of habitat in a channel = bank to bank stream width multiplied by the length of the reach within which the restoration measures are located.
- Dam removal = [length of the impoundment created by the dam under normal flow conditions multiplied by the width of the river immediately upstream of the impoundment] plus [length of the mainstem river up to the next fish passage impediment multiplied by the width of the river immediately upstream of the impoundment multiplied by a factor of 0.25] *Per EC 11-2-206, the 0.25 multiplier represents the fact that fish are restored to the reach, but that fish only represent one component of the habitat.*
- Fish passage project other than complete dam removal = length of the mainstem river up to the next fish passage impediment multiplied by the width of the river immediately upstream of the impoundment multiplied by a factor of 0.25, as described above. Additionally, this product is then multiplied by an efficiency factor of 0.9 for nature-like bypass channels, 0.8 for rock ramp, and 0.6 for fish ladders. An efficiency factor of 0.6 was also applied for collect and transport measures.

o Based on the formulas described above, quantity ranking categories shown in Table 3-3 are as follows:

- Low (Ranking Factor 1) = 0 to 100 acres
- Low-Medium (Ranking Factor 2) = 101 to 200 acres
- Medium (Ranking Factor 3) = 201 to 300 acres
- Medium-High (Ranking Factor 4) = 301 to 400 acres
- High (Ranking Factor 5) = 401 to 500 acres

Table 3-3. Quantity Ranking.

Measure	Quantity of Habitat Restored	Ranking Factor
Lower Yuba Habitat Restoration	Med	3
Daguerre Point Dam Step Pools	Low	1
Daguerre Point Dam 10% Bypass	Low	1
Daguerre Point Dam Removal	Med	3
Englebright Dam Fish Ladder	Low-Med	2
Englebright Dam Fish Tram	Low-Med	2
Englebright Dam Bypass	Low-Med	2
Englebright Dam Removal	Med-High	4
Collect and Transport above New Bullards Bar Dam and Reservoir	Low	1
Collect and Transport above Englebright Dam and Reservoir	Low-Med	2

Quality and Significance of Habitat Restored.

- In order to compare the quality of habitat restored, the following significance criteria derived from ER 1105-2-100, Appendix E, paragraph E-37 and ranking criteria from EC 11-2-206 were applied to the measures, as shown in Table 3-4:

  - *Habitat Scarcity.* This ranking represents the scarcity of the type of habitat from a national and regional context:
    - High (Ranking Factor 5) indicates the measures would restore nationally scarce habitat;
    - Medium-High (Ranking Factor 4) indicates the measure would restore regionally scarce habitat;
    - Medium (Ranking Factor 3) indicates the measure would restore a broad type of habitat (e.g., wetlands) that is recognized nationally as declining;
    - Low-Medium (Ranking Factor 2) indicates the measure would restore other declining habitat types; and
    - Low (Ranking Factor 1) indicates the measure would restore a habitat type that is abundant, stable at natural levels, or improving beyond natural levels.

  - *Connectivity.* This ranking represents the extent to which the measure facilitates the movements of native species. For Daguerre Point Dam, the existing and future without-project condition assumes the existing fish ladders remain in place; therefore, scores for measures at Daguerre Point Dam were reduced in order to represent the net improvement from existing conditions. Rankings are as follows:
    - High (Ranking Factor 5) indicates the measure would fully restore a critical direct physical connection between existing habitat areas within a corridor (e.g., removing a dam);
    - Medium-High (Ranking Factor 4) indicates the measure would create a nodal connection between existing habitat areas within a corridor (e.g., ramps or by-pass channels);
    - Medium (Ranking Factor 3) indicates the measure would restore suitability of an existing connection or corridor (e.g., fish ladders [existing condition at Daguerre Point Dam]);
    - Low-Medium (Ranking Factor 2) indicates the measure would provide a large expansion to an existing habitat; and
    - Low (Ranking Factor 1) indicates the measure is an isolated unit.

  - *Special Status Species.* This ranking represents the extent to which a significant contribution would be made to some key life requisite within the potential range of a special status species. Rankings are as follows:

- High (Ranking Factor 5) indicates the measures restore habitat for Federally listed or candidate threatened or endangered species;
- Medium (Ranking Factor 3) indicates the measures restore habitat for species covered by international treaty, such as International Migratory Birds; and
- Low (Ranking Factor 1) indicates the measures restore habitat for State listed or candidate species.

o *Hydrologic Character*. This ranking represents the degree to which appropriate hydrology is restored in order to maintain the ecological functions of aquatic, wetland, and/or riparian systems. Rankings are as follows:

- High (Ranking Factor 5) indicates the measures fully restore the natural hydrology to the system or site;
- Medium-High (Ranking Factor 4) indicates the measures partially restore the natural hydrology to the system or site;
- Medium (Ranking Factor 3) indicates hydrologic impairment does not exist at the site or the hydrology is restored to the best attainable condition, but remains a limiting factor in ecosystem health;
- Low-Medium (Ranking Factor 2) indicates some elements of the system or site hydrology are restored but most conditions necessary for a more natural hydrology are not attained; and
- Low (Ranking Factor 1) indicates the measures do not address hydrologic restoration, although hydrologic impairments exist on the system or critical goals are not attained.

o *Geomorphic Character*. This ranking relates to the establishment of suitable structure and physical processes for successful restoration. Rankings are as follows:

- High (Ranking Factor 5) indicates the measures fully restore the natural or attainable geomorphic processes and form to the system or site;
- Medium-High (Ranking Factor 4) indicates the measures restore the key geomorphic processes to the system or site;
- Medium (Ranking Factor 3) indicates geomorphic impairment does not exist at the site or the geomorphology is restored to the best attainable condition, but remains a limiting factor in ecosystem health;
- Low-Medium (Ranking Factor 2) indicates the form of the site or system is restored, but some key system processes remain degraded or non-functional (e.g., restoration of an oxbow on a stream that is not allowed to meander naturally); and
- Low (Ranking Factor 1) indicates the measures do not address geomorphic restoration, although impairments exist on the system or critical goals are not met.

- *Self-Sustaining.* This ranking represents the extent to which the measures restore a self-sustaining ecosystem consisting of natural processes. Rankings, based on relative operations and maintenance costs, are as follows:
  - High (Ranking Factor 5) indicates low relative operations and maintenance costs;
  - Medium (Ranking Factor 3) indicates medium relative operations and maintenance costs; and
  - Low (Ranking Factor 1) indicates high relative operations and maintenance costs.

Efficiency Ranking

In order to compare the overall efficiency of each measure, the following formula was used:

Efficiency Ranking Factor = (Quality Factor X Quantity Factor) / Cost Factor

Overall efficiency ranking factors range from 1 (least efficient) through 12 (most efficient) and are shown below in Table 3-5 in order of efficiency. Efficiency ranking categories are as follows:

- Very High = Ranking Factor above 10
- High = Ranking Factor of 9 to 10
- Medium-High = Ranking Factor of 7 to 8
- Medium = Ranking Factor of 5 to 6
- Low-Medium = Ranking Factor of 3 to 4
  Low = Ranking Factor of 1 to 2

Risk and Uncertainty Regarding Efficiency Ranking. Certain critical drivers exist that could affect the efficiency ranking described above. These risk and uncertainty factors, described below, were qualitatively ranked as Low, Low-Medium, Medium, Medium-High, or High based on professional judgment. Risk and uncertainty rankings are shown below in Table 3-6.

- ***Cost Risk/Uncertainty Due to Potential for Mercury Contamination.*** As a result of historic hydraulic gold mining in the region, sediments throughout the watershed are highly contaminated with mercury. Due to uncertainty regarding concentration and location of mercury contamination, as well as uncertainty regarding regulatory requirements that could result, a risk ranking was applied for potential impacts to cost estimates due to mercury contamination. Lower Yuba River Habitat Restoration and dam removal measures both involve excavation of large amounts of material potentially contaminated with mercury. However, cost risks of dealing with potential mercury are low for restoration measures and high for dam removal measures. This is because the principal risk from mercury contamination is the potential for methylation, which is the process that makes mercury bio-available in the environment. Sediments sequestered

behind dams are more likely prone to both anaerobic conditions and a greater fine sediment fraction (less than 74 microns) than in-river sediments. Anaerobic conditions increase the likelihood of methylated mercury, and fine grain sediments more favorably partition methylated mercury for transport and deposition downstream, if disturbed. Materials that would be excavated for Lower Yuba River Habitat Restoration are coarser, thus trapping less mercury, and permeable, thus likely already stripped of mercury contaminants. Excavated restoration material will need to be tested during the design and construction phases, although the level of contamination is expected to be below CERCLA thresholds. Additionally, restoration excavation quantities are a fraction of the quantities stored behind either dam.

- ***Cost Risk/Uncertainty Due to Distance to Sediment Disposal.*** In addition to general uncertainty regarding mercury, a specific cost driver could be uncertainty regarding distance to disposal of excavated material. For example, mercury contamination could be significant enough to warrant disposal as hazardous waste or low enough that material could be placed on adjacent lands. Due to this uncertainty, a relative risk ranking was applied to each measure.
- ***Potential Effects to Water Diversions and/or Water Rights.*** There are many water diversions and associated water rights throughout the watershed. Some measures have the potential to alter hydrology in a manner that could impact current diversions, which would require further analysis and could potentially increase costs beyond current estimates. For this reason, a risk ranking was assigned to each measure based on the potential for that measure to affect water diversions and/or water rights.
- ***Risk of Design Complexity.*** Some measures under consideration are extremely complex from a design perspective. In order to capture this complexity, which could increase costs, a risk ranking was applied as follows: "low" indicates that no unique design is required (common action with documented success); "medium" indicates that some unique design is required (approximately less than 25% of the action requires some unique design); and "high" indicates that unique or unproven design features are needed for the majority of the action (experimental).
- ***Risk of Construction Complexity.*** Some measures under consideration are extremely complex from a construction perspective. In order to capture this complexity, which could increase costs, a risk ranking was applied as follows: "low" indicates that the measures requires standard techniques and locally available equipment and skills; "medium" indicates that the measure requires proven techniques and regionally available equipment and skills; and "high" indicates that the measure requires unique or unproven techniques and specialized equipment and skills. For this category, some measures were ranked as "low-medium" or "medium-high" to indicate that measure fell between categories, based on professional judgment.

Table 3-4. Quality Ranking.

Measure	Habitat Scarcity		Connectivity		Special Status Species		Hydrologic Character		Geomorphic Condition		Self-Sustaining		Quality Score (Total)	Average Quality Ranking	
Lower Yuba Habitat Restoration	Med-High	4	Low-Med	2	High	5	Low	1	Med-High	4	High	5	21	Med-High	4
Daguerre Point Dam Step Pools	Med-High	4	Low	1	High	5	Low	1	Low	1	Med	3	15	Med	3
Daguerre Point Dam 10% Bypass	Med-High	4	Low	1	High	5	Low	1	Low	1	Low	1	13	Low-Med	2
Daguerre Point Dam Removal	Med-High	4	Low-Med	2	High	5	High	5	High	5	High	5	26	Med-High	4
Englebright Dam Fish Ladder	Med-High	4	Med	3	High	5	Low	1	Low	1	Low	1	15	Med	3
Englebright Dam Fish Tram	Med-High	4	Med-High	4	High	5	Low	1	Low	1	Low	1	16	Med	3
Englebright Dam Bypass	Med-High	4	Med-High	4	High	5	Low	1	Low	1	Low	1	16	Med	3
Englebright Dam Removal	Med-High	4	High	5	High	5	High	5	High	5	High	5	29	High	5
Collect and Transport above New Bullards Bar Dam and Reservoir	Med-High	4	Med	3	High	5	Low	1	Low	1	Low	1	15	Med	3
Collect and Transport above Englebright Dam and Reservoir	Med-High	4	Med	3	High	5	Low	1	Low	1	Low	1	15	Med	3

Table 3-5. Efficiency of Measures

Measure	Quantity Factor		Quality Factor		Cost Factor		Efficiency Ranking Factor = (Quantity × Quality) ÷ Cost	Efficiency Ranking
Lower Yuba Habitat Restoration	3	×	4	÷	1	=	12	Very High
Daguerre Point Dam Removal	3	×	4	÷	3	=	4	Low-Med
Daguerre Point Dam Step Pools	1	×	3	÷	1	=	3	Low-Med
Englebright Dam Removal	4	×	5	÷	10	=	2	Low
Daguerre Point Dam 10% Bypass	1	×	2	÷	1	=	2	Low
Collect and Transport above Englebright Dam and Reservoir	2	×	3	÷	3	=	2	Low
Collect and Transport above New Bullards Bar Dam and Reservoir	1	×	3	÷	2	=	2	Low
Englebright Dam Fish Ladder	2	×	3	÷	5	=	1	Low
Englebright Dam Fish Tram	2	×	3	÷	6	=	1	Low
Englebright Dam Bypass	2	×	3	÷	6	=	1	Low

3.4.4 Screening Results

Upon applying screening criteria and ranking measures based on how well they achieved those criteria, measures were screened based on these results. A definitive breakpoint exists in the overall efficiency ranking. As shown in Table 3-7 below, Lower Yuba River Habitat Restoration was the most efficient measure by a factor of 3: the Lower Yuba Habitat Restoration ranking factor was 12, while the next most efficient measure (Daguerre Point Dam Removal) ranking factor was 4. The Lower Yuba Habitat Restoration measure was also the only measure to rank as low risk in all risk categories. For these reasons, the Lower Yuba Habitat Restoration measure was retained for further evaluation and all other measures were screened from further consideration under this study. The Lower Yuba Habitat Restoration measure, as defined for screening purposes, contains dozens of site concepts throughout the lower Yuba River which are further defined and refined in subsequent chapters.

3.4.4 Unresolved Ecological Problem

An ecosystem related problem was identified through this study which is not being fully addressed through measures included in the final array of alternatives. Specifically, longitudinal river connectivity has been reduced by altered hydroperiods and sediment transport as well as blocked and impaired passage of migrating fish.

While some measures in the final array of alternatives would address this problem on a small scale (i.e., restoration areas which could create a habitat corridor), the overarching connectivity problem caused by the presence of dams across the river remains unresolved.

At Daguerre Point Dam, the extent to which the presence of the dam creates ecological problems is at present poorly defined. While there are perceived problems with fish passage at Daguerre Point Dam, existing fish ladders at the dam currently facilitate upstream passage of salmonids. Downstream passage of juvenile salmonids appears to be potentially impacted to some extent, based on limited screw trap data. In order to quantify ecological outputs that could result from any action at Daguerre Point Dam (i.e., fish bypass, step pools, rock riffle, dam removal, etc.), existing conditions must first be better defined and quantified. Additional study would be required to:

- Better define and quantify specific ecological problems associated with longitudinal river connectivity within the study area;
- Better define specific measures to address these specific ecological problems; and
- Develop a methodology to quantify ecological outputs of specific measures.

3.5 Final Increments

For more detailed evaluation, the initial Lower Yuba Habitat Restoration measure was divided into multiple Habitat Increments based on geographic locations that take advantage of

cost-efficiencies of scale, including shared access routes for construction. Habitat restoration sites that are likely to be completed by other organizations were eliminated from the study. Habitat Increments that would be impacted by potential future actions at Daguerre Point Dam were also eliminated, as shown below in Table 3-8 and Figure 3-2.

Alternative plans will be composed of an increment or any combination of the increments. The increments are on the lower Yuba River downstream of Englebright Dam and are composed of various features that are described below. The design details are planning assumptions that are subject to refinement during feasibility-level design and pre-construction design.

Increment Features

Riparian Planting. Planting will occur with a stinger planting method that uses a specialized planting devise mounted on an excavator to quickly plant cuttings one or two at a time. The stinger device can plant to a maximum depth of nearly 7 feet and the cutting of maximum diameter of approximately 2 inches. A combination of four native species will be planted, including Fremont cottonwood, black willow, red willow, and arroyo willow. The planting design is intended to promote hard wood structure (i.e. forest and large wood production) while also providing species and structural diversity. Although arroyo willow is not a tree type willow it is included in the design to create structural diversity known to support neotropical bird habitat. Furthermore, arroyo willow, is underrepresented on the lower Yuba River compared to other shrubby willows (WSI 2012; SYRCL 2013). The planting density for this feature would be 1500 plants per acre (PPA) with two plants per stinger planting pit.

Backwater Area. In addition to enhancing juvenile anadromous salmonid rearing habitat, creation of a backwater area (a part of the river not reached by the current, where the water is still) of the lower Yuba River is anticipated to provide enhanced habitat for use by waterfowl, amphibians and other wildlife species. These areas will be at a depth of 7 to 10 feet.

Floodplain Lowering. This feature is the excavation of the floodplain in areas where the depth to the water table is greater than 10 feet to facilitate riparian planting and survival or shallow water habitat. This would be conducted with the goal of providing water depths with 50 to 100 percent of juvenile spring run Chinook salmon optimal water depth suitability approximately 80 percent of the time during the over-summer juvenile rearing period. The slope of the floodplain grading generally follows a linear extrapolation between the water side and land side limits of the grading area.

Floodplain Grading. Grading of the floodplain will consist of shaping the terrain appropriately to create shallow water habitat and/or to decrease the surface distance to groundwater.

Table 3-6. Risk Ranking.

Measure	Cost Risks of Mercury Contamination		Cost Risk of Distance to Sediment Disposal		Potential Effects to Water Rights		Risk of Design Complexity		Risk of Construction Complexity		Risk Ranking (Total)
Lower Yuba Habitat Restoration	Low	1	Low	1	Low	1	Low	1	Low	1	5
Daguerre Point Dam Step Pools	Med	3	Low	1	Low	1	Med	3	Low-Med	2	10
Daguerre Point Dam 10% Bypass	Low	1	Med	3	Low	1	Med	3	Med	3	11
Daguerre Point Dam Removal	High	5	High	5	High	5	Med	3	Med-High	4	22
Englebright Dam Fish Ladder	Low	1	Low	1	Low	1	High	5	High	5	13
Englebright Dam Fish Tram	Low	1	Low	1	Low	1	High	5	High	5	13
Englebright Dam Bypass	Low	1	Low	1	Low	1	High	5	High	5	13
Englebright Dam Removal	High	5	High	5	High	5	High	5	High	5	25
Collect and Transport above New Bullards Bar Dam and Reservoir	Low	1	Low	1	Low	1	High	5	High	5	13
Collect and Transport above Englebright Dam and Reservoir	Low	1	Low	1	Low	1	High	5	High	5	13

Table 3-7. Screening Results.

Measure	Efficiency		Cost Risks of Mercury Contamination		Cost Risk of Distance to Sediment Disposal		Potential Effects to Water Rights		Risk of Design Complexity		Risk of Construction Complexity	
Lower Yuba Habitat Restoration	Very High	12	Low	1	Low	1	Low	1	Low	1	Low	1
<----------*Screening Break*---------->												
Daguerre Point Dam Removal	Low-Med	4	High	5	High	5	High	5	Med	3	Med-High	4
Daguerre Point Dam Step Pools	Low-Med	3	Med	3	Low	1	Low	1	Med	3	Low-Med	2
Englebright Dam Removal	Low	2	High	5	High	5	High	5	High	5	High	5
Daguerre Point Dam 10% Bypass	Low	2	Low	1	Med	3	Low	1	Med	3	Med	3
Collect and Transport above Englebright Dam and Reservoir	Low	2	Low	1	Low	1	Low	1	High	5	High	5
Collect and Transport above New Bullards Bar Dam and Reservoir	Low	2	Low	1	Low	1	Low	1	High	5	High	5
Englebright Dam Fish Ladder	Low	1	Low	1	Low	1	Low	1	High	5	High	5
Englebright Dam Fish Tram	Low	1	Low	1	Low	1	Low	1	High	5	High	5
Englebright Dam Bypass	Low	1	Low	1	Low	1	Low	1	High	5	High	5

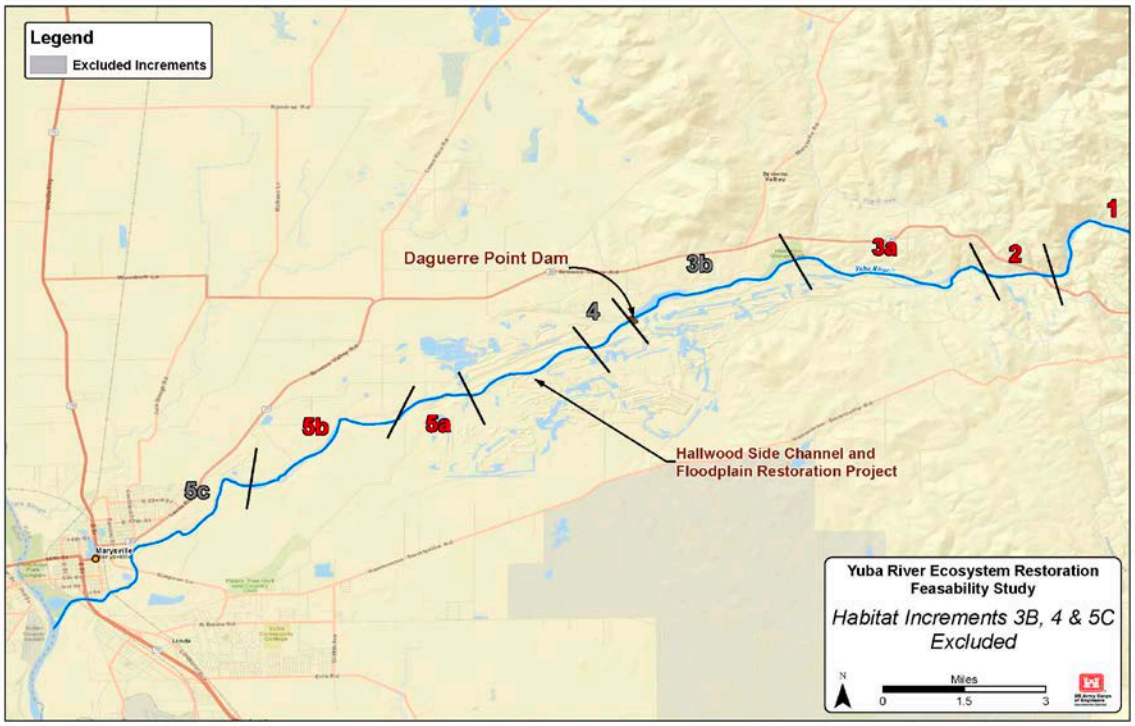

Figure 3-2. Habitat Increments eliminated from the study.

Table 3-8. Habitat Increments.

Increments	Description	Notes
Habitat Increment 1	19.2 acres - Restoration measures upstream of Highway 20	No anticipated effects from potential future action at Daguerre Point Dam
Habitat Increment 2	23.3 acres - Restoration measures between Highway 20 and Lower Gilt Edge Bar	No anticipated effects from potential future action at Daguerre Point Dam
Habitat Increment 3a	56.4 acres - Restoration measures between Lower Gilt Edge Bar and Hammon Bar	Split from increment 3 based on proximity to Daguerre Point Dam; no anticipated effects from potential future action at Daguerre Point Dam
Habitat Increment 3b	58.1 acres - Restoration measures between Hammon Bar and Daguerre Point Dam	Screened from analysis due to proximity to Daguerre Point Dam and relative uncertainty regarding future conditions
Habitat Increment 4	17.0 acres - Restoration measures between Daguerre Point Dam and Hallwood	Screened from analysis due to proximity to Daguerre Point Dam and relative uncertainty regarding future conditions
Habitat Increment 5a	49.3 acres - Restoration measures downstream of Hallwood at Bar C	No anticipated effects from potential future action at Daguerre Point Dam
Habitat Increment 5b	49.5 acres - Restoration measures at Narrow Bar downstream to Island B	No anticipated effects from potential future action at Daguerre Point Dam
Habitat Increment 5c	18.0 acres – Restoration measures downstream of Island B	Screened from analysis due to changed conditions during winter floods of 2016

Table 3-9. Riparian Planting Palette.

Scientific Name	Common Name	Plants Per Acre	Cutting / Container Size	Planting Method
Populus fremontii	Fremont cottonwood	450	Pole cutting /Deepot 40	Stinger / Hand Pit
Salix gooddingii	Black Willow	300	Pole cutting	Stinger
Salix laevigata	Red willow	250	Pole cutting	Stinger
Salix lasiolepis	Arroyo willow	250	Pole cutting	Stinger
Associate plants	To be determined (TBD)	250	Deepot 40	Hand Pit / Auger
Total		**1,500**		

Side Channel. Side channels will be created to a water depth of 0.5 feet associated with the base flow conditions. Above Daguerre Dam flows are expected to be 730 cfs and downstream of the dam 530 cfs.

Bank Scalloping. Side channel criteria is applied to this feature as appropriate. This feature would involve excavating small scallops into the tall and steam banks to increase local topographic diversity and wetted edge. The steeps slopes surrounding the alcoves would be feathered to a 10 to 1 slope to provide additional shallow inundated areas with desirable depth-velocity combinations over a range of flows.

Large Woody Material (LWM). Where woody material is described as an addition to bankline, assume woody features are 25 feet in length and 2 feet in diameter. The material will be anchored in the bankline at a 45 degree angle downstream and protrude one third of its total length beyond the bankline into the channel. The floodplain application is where woody material is placed on a floodplain or seasonally inundated area, the woody material will be placed parallel with the flow, anchored with cables boulders and pins (also known as Engineered Log Jams or ELJs).

Boulders. Boulders weighing 5 tons each will be used to slow velocities in certain areas. Number of boulders needed per site will be determined using a hydraulic model.

Access and Staging Areas. Proposed staging areas and access roads are located on existing roadways (dirt and/or paved) and previously disturbed areas. Potential staging areas have been identified for each increment or group of increments. Each staging area would be half an acre to an acre, depending on the amount of work to be completed. These areas will be the sole locations used for staging of vehicles, materials, and other associated construction equipment. The staging areas have been subject to the same environmental review as the project footprint to ensure that any potential resources will not be adversely affected.

From the proposed staging areas, vehicles accessing the restoration sites would haul primarily on the sand bars along the river. In some cases, temporary haul roads may need to be constructed in order to provide better access to the sites. Occasionally, rather than hauling on sand bars, vehicles would have access to farm roads. In some cases, access to the restoration sites could only be provided through temporary river crossings. These would consist of 10 foot

wide by 10 foot long railroad flatcar bridge that would be placed over the river channel for temporary access, when needed.

Disposal. A large quantity of earth materials is expected to be hauled away during project construction. Disposal of this material is assumed to occur at a licensed disposal facility at a distance of approximately 20 to 25 miles away. If the project is authorized and funded, detailed evaluation of excavated material requirements, identification and detailed technical evaluation of routes would be completed during PED. For a detailed analysis of access and staging, including temporary bridges see Real Estate Appendix E and Engineering Appendix B - Attachment D.

3.5.1 Habitat Increment 1

Upstream of Highway 20. In the Timbuctoo Bend area of the lower Yuba River, a side channel would be created to increase aquatic habitat. The side channel would be constructed with native cobble or armored stone. Along the southern bank of the side channel, the floodplain would be graded and planted with riparian vegetation extending across the existing bar to the lower Yuba River. This action would reconnect the river to its floodplain and increase aquatic and riparian habitat.

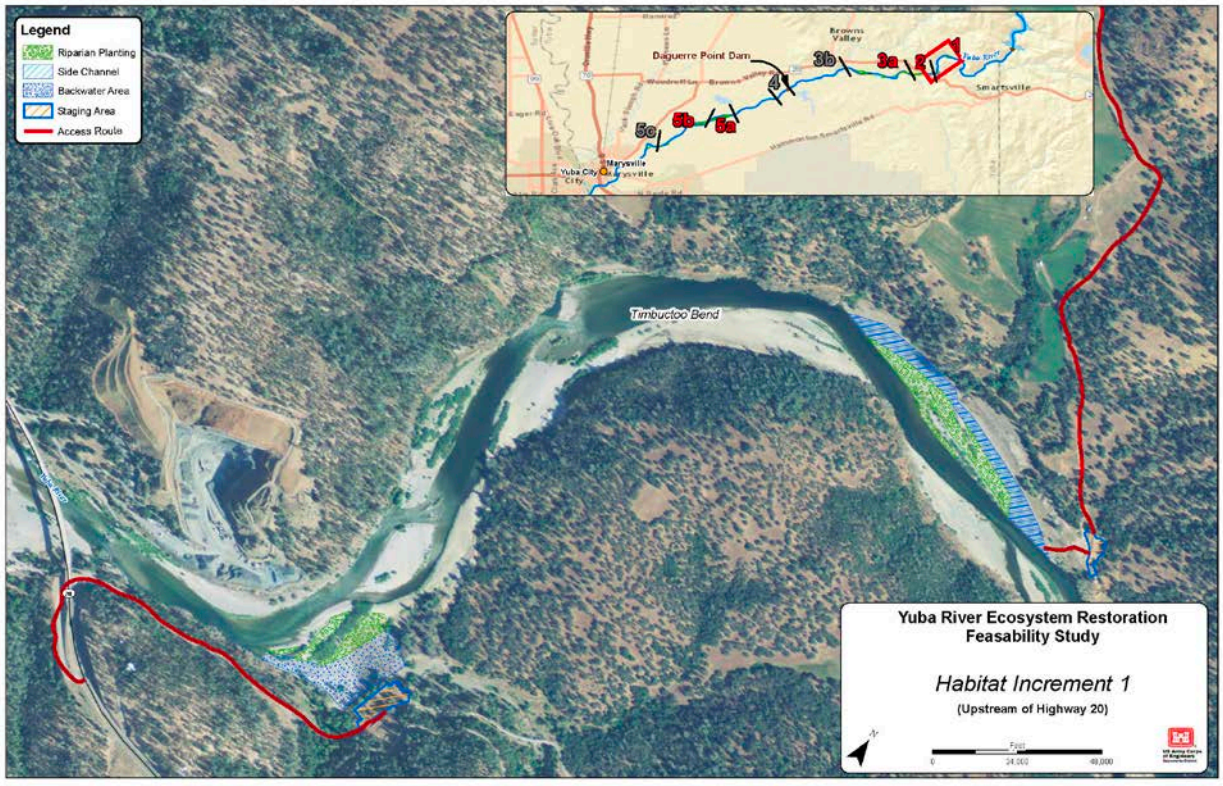

Figure 3-3. Habitat Increment 1.

East of Parks Bar, near Big Ravine, the near-shore area and adjacent floodplain on the south bank of the lower Yuba River would be graded and planted with riparian vegetation adjacent to the Yuba River. Near the confluence of Big Ravine creek, a large backwater area would be created for use by waterfowl, amphibians, and other wildlife species.

There are two staging areas identified for Increment 1. The staging area at the upstream end of Increment 1 is located on an approximately 1 acre previously disturbed gravel parking lot on the north side of the Yuba River. This staging area would be accessed via Highway 20 to Peoria Road. Peoria Road turns into Scott Forbes Road/Long Bar Road. From Scott Forbes Road/Long Bar Road, the staging area is accessed via a privately owned gravel road. A temporary haul road would be constructed from the staging area to the proposed habitat restoration area.

The downstream staging area is located on approximately 1 acre of grassland adjacent to a private river access road. This staging area would be accessed via Highway 20 to Timbuctoo Place. Vehicles would continue about 0.5 mile east on Timbuctoo Place to the private access road.

The high ratio of material excavated to acreage restored makes Increment 1 the most expensive increment per unit of ecosystem output.

Habitat Increment 1 includes 7.4 acres of riparian planting, 5.8 acres of side channel creation, and 6.1 acres of restored backwater area. Table 3-10 shows details for features of the Upstream of Highway 20 increment.

Table 3-10. Habitat Increment 1 details.

Feature Type	Acres	Volume (Cubic Feet)	Length (feet)	Width (feet)
Riparian Planting	7.4			
Side Channel	5.8	3,892,400	2,200	150
Backwater Area	6.1	2,332,700	570	295
Total	**19.2**	**6,225,100**	**2,770**	**445**

3.5.2 Habitat Increment 2

Upper Gilt Edge Bar. Just downstream of the Highway 20 bridge at Upper Gilt Edge Bar, the floodplain would be lowered to facilitate inundation at 3,000 cubic feet per second (cfs). This flow magnitude was selected to guide the initial design of floodplain elevations as it would be shallowly inundated by a flow that persisted for a 21 day duration in 1 in 2 years during the March-June period (cbec, 2013). Riparian vegetation would be planted along the channel edge.

On the southern bank of Upper Guilt Edge Bar, where the bank is 8-15 feet high, and the edge of the channel is relatively monotonous with little habitat complexity, small scallops would

be excavated into the tall and steep banks to increase local topographic diversity and wetted edge. These scallops are designed to create an inundated alcove at all discharges with the steep slopes surrounding the alcoves feathered to at least a 10:1 slope, providing additional shallow inundated areas with desirable depth/velocity combinations. Initially, these scallops would provide year round rearing habitat to juvenile salmonids. Over time, it is expected that fine sediment may deposit in the scallops creating nursery sites where natural woody vegetation recruitment could occur. The scallops would further facilitate natural recruitment of riparian vegetation, due to shallow access to the water table, and the fine texture of deposited sediments.

In addition, Large Woody Material (LWM) would be placed within and protruding from the scallops. An existing backwater area would be restored allowing for inundation in a typical 50% to 100% Annual Chance of Exceedance (ACE) flood. Riparian vegetation would be planted to increase the structural diversity and extent of existing riparian vegetation. Additional fine material would be introduced to the upper 3 feet of the soil column in excavated areas to increase soil absorption and the amount of soil moisture available to riparian vegetation. LWM would be placed within the backwater to provide aquatic structure.

Unnamed Bar. At the unnamed bar on the north side of the river near River Mile (RM) 17, riparian vegetation would be planted. The site would be restored by lowering areas to increase lateral floodplain connectivity and provide additional opportunity to plant riparian vegetation.

The staging area on the south side of the river is located on approximately 1 acre of disturbed sand bar land approximately 0.20 mile downstream of the Highway 20 bridge. Access to the Increment 2 staging area would be via Highway 20 to Timbuctoo Place. Vehicles would then loop around back under the Highway 20 bridge to Old Bonanza Ranch Road to the staging area.

The staging area on the north side would be located on a gravel parking lot at the end of a private gravel road adjacent to the river. Access to this staging area would be via Highway 20 to the private gravel road. A temporary haul road may need to be constructed from the end of the gravel road to connect vehicles to the sand bar and its proposed restoration site.

Habitat Increment 2 includes; 8.7 acres of riparian planting, 14 acres of floodplain lowering, 0.3 acres of restored backwater area, 0.3 acres of bank scalloping. Table 3-11 shows details for features on Upper Gilt Edge Bar and the unnamed bar.

Table 3-11. Habitat Increment 2 Details.

Feature Type	Acres	Volume (Cubic Feet)	Length (feet)	Width (feet)
Floodplain Lowering	14.0	828,100	3,480	770
Riparian Planting	8.7			
Bank Scalloping	0.3			
Backwater Area	0.3	67,200	240	150
Total	**23.3**	**895,300**	**3,720**	**920**

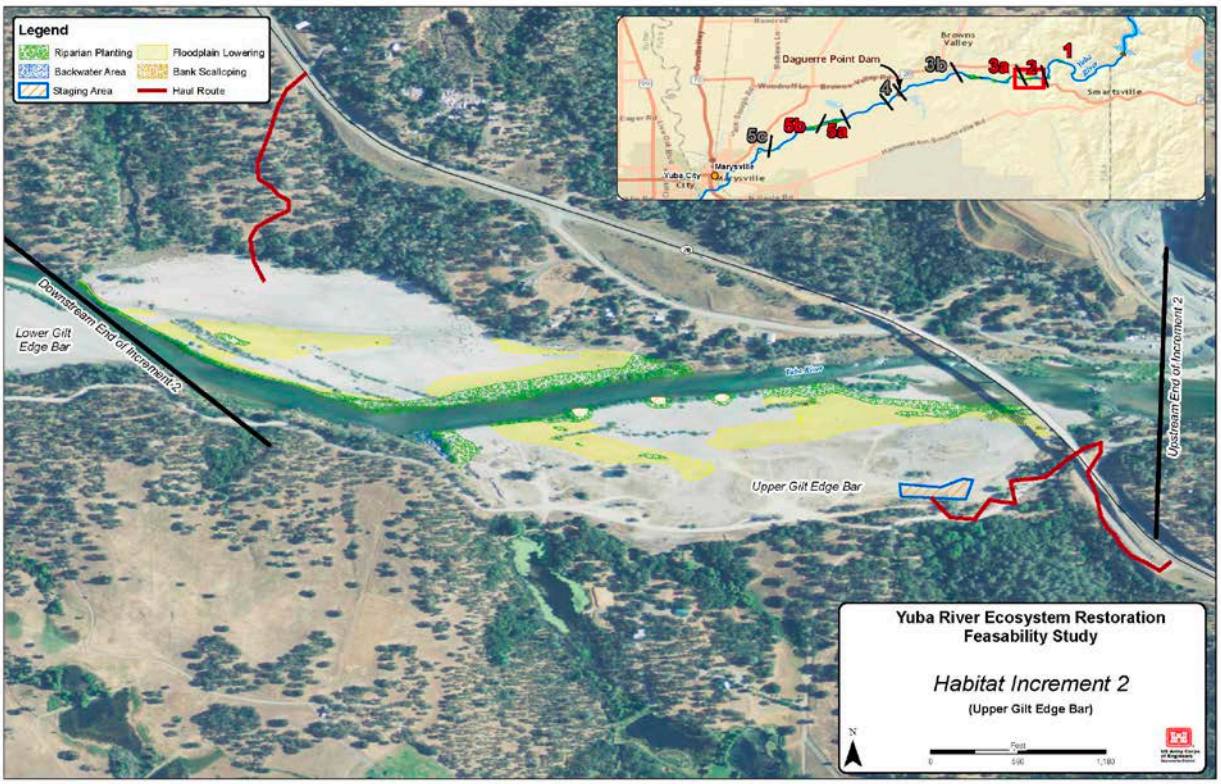

Figure 3-4. Habitat Increment 2

3.5.3 Habitat Increment 3a

Lower Gilt Edge Bar. At Lower Gilt Edge Bar, an existing swale feature (at upstream end of Lower Gilt Edge Bar) would be lowered and connected to the channel to become inundated at 3,000 cfs. A patchwork floodplain network of LWM surrounding the restored groundwater-fed swale would be constructed to encourage fine sediment deposition and riparian recruitment, as well as provide edgewater refugia at flows above baseflow.

Hidden Island. Downstream of Lower Gilt Edge Bar, on the alluvial bar on the north side of the river, riparian vegetation would be planted.

First Island. First Island has large expanses of floodplain and high floodplain, and a side channel on the left bank provides spawning and rearing habitat. This area may provide immediate benefit to emerging salmonid fry if allowed access to larger expanses of shallow habitat with riparian cover. To encourage sediment deposition and riparian vegetation recruitment, Engineered Log Jams (ELJs) would be installed in a patchwork configuration, particularly along the apex of First Island just above bankfull elevation.

Silica Bar. Rock and sediment would be deposited along the left bank of Silica Bar, and ELJs would be placed to aid constriction at this location and prevent erosion at a downstream site

with potential flood management concerns (cbec, 2013). LWM would be placed along the margins of the downstream terminus of the existing side channel/backwater that is surrounded by an existing stand of diverse, mature, native riparian vegetation, in areas that would not disrupt existing riparian vegetation along the banks of the side channel/backwater area. Floodplain areas would be lowered to facilitate more frequent inundation and riparian vegetation would be planted.

Bar A. Located on the right bank of the river just downstream of First Island, floodplain surfaces would be lowered and riparian vegetation would be planted to facilitate more frequent inundation between 3,000 and 5,000 cfs. Inundation between 3,000 and 5,000 cfs was identified in the cbec (2013) conceptual report to avoid prolonged inundation and potential to induce mortality of riparian vegetation seedlings. Rock and sediment would be deposited along the left bank of Silica Bar, coupled with placement of ELJs to aid river constriction at this location.

A side channel would be created that activates above 3,000 cfs and connects to the low lying area downstream, providing beneficial off-channel habitat with established riparian vegetation. This would create an anabranching side channel (stable multiple-thread channels) in an existing swale within a stand of relatively dense vegetation that includes willows and cottonwoods.

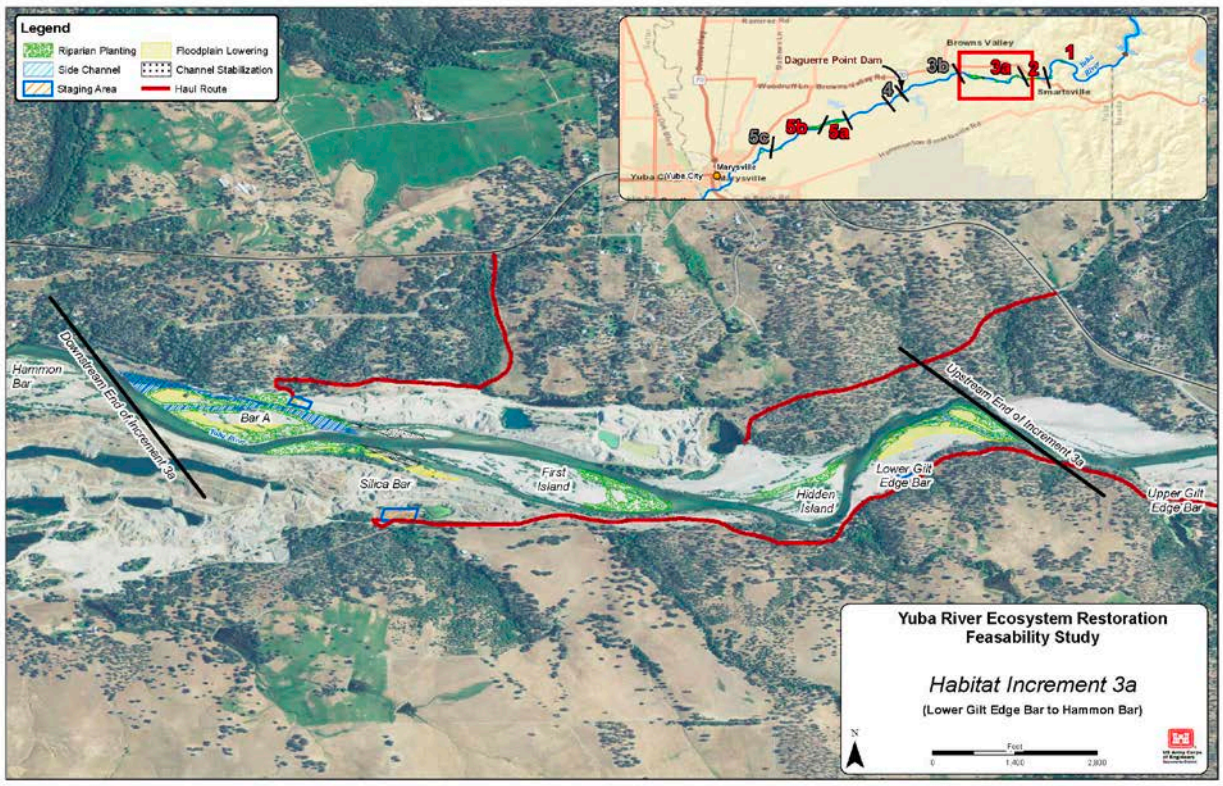

Figure 3-5. Habitat Increment 3a.

There are three staging areas identified for Increment 3a. The upstream staging area on the south side of the river is located on approximately 1 acre of disturbed sand bar land. Access to this staging area would be via Highway 20 to Timbucktoo Place. Vehicles would then loop around back under the Highway 20 bridge to Old Bonanza Ranch Road to the staging area. This staging area is approximately 1 mile west of the Increment 2 staging area.

The downstream staging area on the south side of the river is approximately 2 acres located entirely on disturbed land on the edge of a sand bar. Access to this staging area would be via Highway 20 to Timbucktoo Place. Vehicles would then loop around back under the Highway 20 bridge to Old Bonanza Ranch Road to the staging area. This staging area is approximately 2.5 miles west of the Increment 2 staging area.

The staging area on the north side of the river is approximately 1 acre located entirely on disturbed sand bar land. Access to this staging area would be via Highway 20 to a previously disturbed gravel access road owned and operated by SRI Sand and Gravel Co. Vehicles would then proceed westward along a dirt/gravel road for approximately 0.5 mile to the staging area.

Habitat Increment 3a would increase habitat connectivity between Habitat Increment 2 and SYRCL's Long Bar Restoration Project and Hammon Bar Restoration Project. Increment 3a includes 28.7 acres of riparian planting, 13 acres of floodplain lowering, and 11.3 acres of side channel creation. Table 3-12 shows details for features on Lower Gilt Edge Bar, Hidden Island, First Island, Silica Bar, and Bar A.

Table 3-12. Habitat Increment 3a Details.

Feature Type	Acres	Volume (Cubic Feet)	Length (feet)	Width (feet)
Floodplain Lowering	13.0	752,500	4,160	1,290
Riparian Planting	28.7			
Side Channel	11.3	5,040,600	4,557	267
Channel Stabilization	3.5			
Total	**56.4**	**5,793,100**	**8,717**	**1,557**

3.5.4 Habitat Increment 5a

Bar C. Immediately downstream of the Hallwood Side Channel and Floodplain Restoration Project, a historical channel alignment on the north side of Bar C would be restored to inundate at 3,000 cfs and function as swale habitat. The side channel and adjacent floodplain would be lowered and graded. Additionally, riparian vegetation would be planted on each side of the restored swale/side channel. ELJs would be placed in a patchwork configuration at the inflow of the swale, at the upstream end of Bar C. In addition, LWM would be placed in the backwater area at the downstream end of Bar C to increase structural and habitat complexity in the area.

A historical channel alignment on the south side of the bar would be restored by lowering

and grading a side channel within a stand of riparian vegetation. The side channel would extend into an existing backwater habitat located at the downstream edge of the Yuba Goldfields. The floodplain on the north side of the side channel would be lowered and planted with riparian vegetation. Boulder structures would be placed to provide hydraulic stability at the inflow section of the side channel at the upstream end of Bar C.

There is one staging area identified for Increment 5a. Located on the south side of the river, the staging area is approximately 1.5 acres of previously disturbed land on the edge of a sand bar. Access to this staging area would be via Highway 70 to Feather River Boulevard. Vehicles would travel northeast on Feather River Boulevard to North Beale Road and turn right. Vehicles would proceed down North Beale road for approximately 1 mile and turn left onto Hammonton Smartsville Road. Approximately 1 mile down Hammonton Smartsville Road, vehicles would turn left onto Simpson Lane, and then take an immediate right onto Simpson Dantoni Road. Simpson Dantoni Road will become Dantoni Road. In approximately 8 miles, vehicles would arrive at the staging area.

Habitat Increment 5a would connect riparian and aquatic habitat corridors to the Hallwood Side Channel and Floodplain Restoration Project. Increment 5a includes 21.3 acres of riparian planting, 13 acres of floodplain lowering, and 15.1 acres of side channel creation. Table 3-13 shows details for features on Bar C.

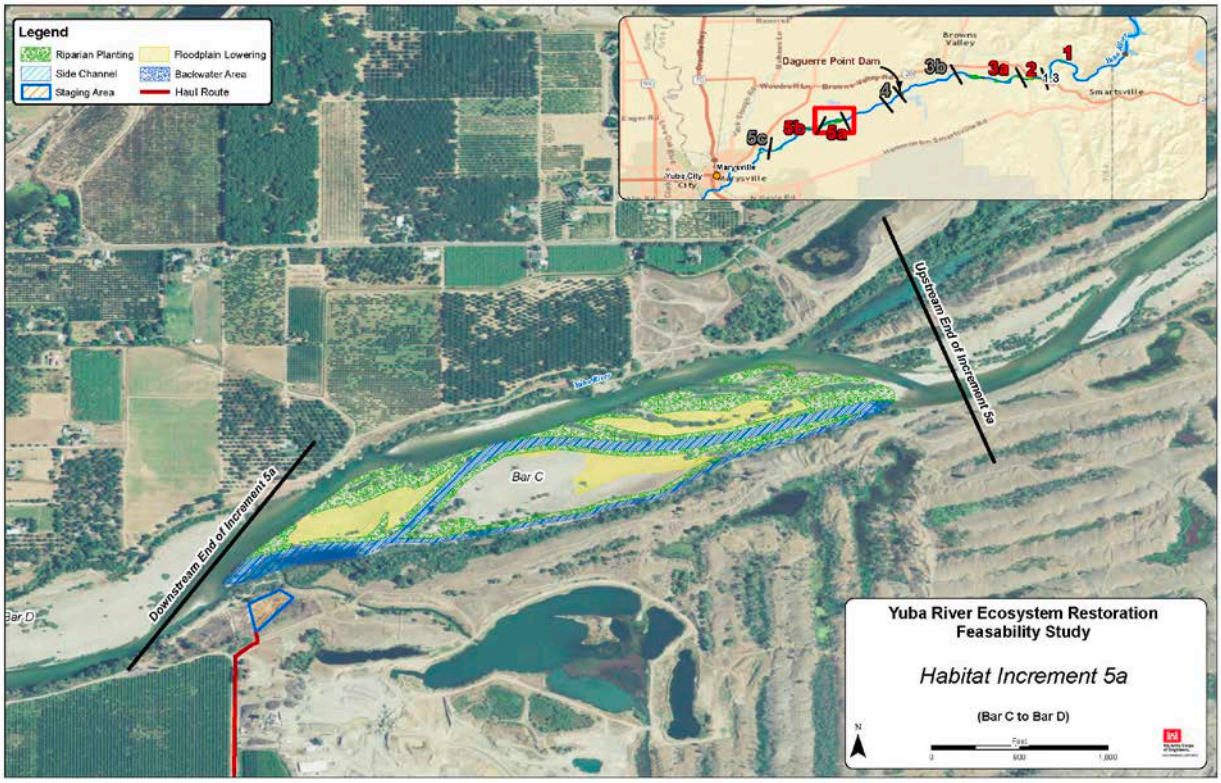

Figure 3-6. Habitat Increment 5a.

Table 3-13. Habitat Increment 5a Details.

Feature Type	Acres	Volume (Cubic Feet)	Length (feet)	Width (feet)
Floodplain Lowering	13.0	905,700	3,350	306
Riparian Planting	21.3			
Side Channel	15.1	5,246,100	10,135	140
Total	**49.3**	**6,151,800**	**13,485**	**446**

3.5.5 Habitat Increment 5b

Narrow Bar. A side channel would be constructed at Narrow Bar that would connect to an existing swale at the downstream end of the bar. Existing riparian vegetation would border the created side channel. Another side channel would be created, splitting off from the other side channel through the middle of the bar in the southwest direction. Boulders would be placed to maintain stable hydraulic conditions at the inflow. There is a large expanse of shallow depth to groundwater on Narrow Bar, with some areas of high floodplain. The high floodplain areas would be graded and planted with riparian vegetation. Additionally, floodplain along the main channel would be graded to increase inundation duration and frequency at 3,000 cfs. ELJs would be placed in a patchwork configuration to facilitate riparian recruitment and to restore swale habitat. At the terminus of the anabranching side channel, a backwater area would be created.

River Mile 6.5. A backwater area would be created on the right bank of the river to provide shallow water refugia for salmonids.

Bar E. Riparian vegetation would be planted in the downstream portion of Bar E surrounding a historical channel alignment to restore species and structural diversity. LWM would be placed in the swale/backwater downstream from the existing diversion channel.

Island B. Riparian vegetation would be planted along the upstream portion of this island to create species and structural diversity. ELJs would be placed in a patchwork configuration to encourage native plant recruitment and improve survivability of plantings.

There is one staging area for Increment 5b. Located on the north side of the river, the staging area is approximately 1.5 acres of previously disturbed land adjacent to a sand bar. Access to this staging area would be via Highway 20/Browns Valley Road to Hallwood Boulevard. Vehicles would proceed east on Hallwood Boulevard for approximately 2 miles to the end of the road. At the dead-end, vehicles would take a right turn onto a dirt farm road alongside an orchard. The staging area would be located approximately 0.25 mile down the farm road.

Habitat Increment 5b includes 29.7 acres of riparian planting, 7.7 acres of floodplain lowering, 9.2 acres of side channel creation, and 2.9 acres of restored backwater area. Table 3-

14 shows details for features on Narrow Bar, River Mile 6.5, Bar E, and Island B.

Table 3-14. Habitat Increment 5b Details.

Feature Type	Acres	Volume (Cubic Feet)	Length (feet)	Width (feet)
Side Channel	9.2	3,445,900	3,939	103
Floodplain Lowering	7.7	262,600	2,433	441
Riparian Planting	29.7			
Backwater Area	2.9	360,300	1,004	392
Total	**49.5**	**4,068,800**	**7,376**	**936**

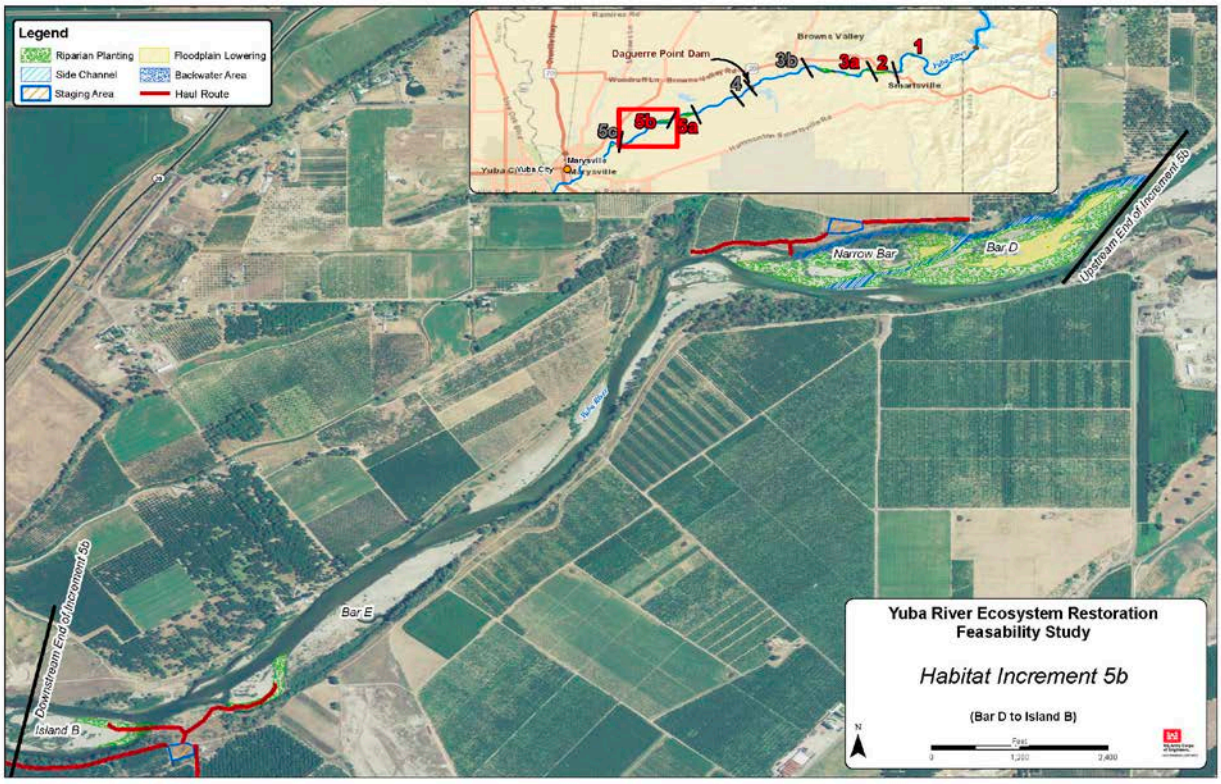

Figure 3-7. Habitat Increment 5b.

3.5.6 Construction Sequencing

Construction duration would depend upon the overall scale of the selected plan, with a set of increments being completed each year. To avoid and minimize impacts to nesting birds, work would not begin until June of each year. To avoid and minimize impacts to fish species (especially special status anadromous salmonids), in water work would be limited to July 1st to October 30th. In general, construction each year would begin with establishment of access and

staging of equipment/materials in June. Excavation would begin in July and continue through October. Installation of woody features and boulders would also occur during this time. Preparation for riparian planting, including identification of donor trees would be completed in September. Harvest and planting by stinger of riparian plantings would occur in October and November each year. The Yuba River has a number of sensitive species considerations that affect work window, and no single period of time exists that would completely avoid the presence of sensitive species. This proposed construction sequence represents a conservative estimate of work windows and work windows may be revisited during the PED phase and expanded or reduced as site specific considerations are made.

3.6 Formulation of Final Array of Alternatives

USACE Institute for Water Resources (IWR) Planning Suite was used to formulate the final array of alternatives based on the final increments. IWR Planning Suite generated all possible alternatives by combining the increments. Class 4 cost estimates and Average Annual Habitat Units (described in Sections 3.7 and 3.8) were used as variables to perform a cost effectiveness and incremental cost analysis (CE/ICA). Class 4 cost estimates are based on early concept technical information resulting in major estimate assumptions in technical information and quantities, heavy reliance on cost engineering judgment, and a great deal of uncertainty relative to major construction components (ER 1110-2-1302). IWR Planning Suite generated 5 Best Buy Plans (alternatives) in addition to the no action alternative:

Alternative 1 is the no action plan and assumes no action is taken as the result of this study.

Alternative 2 includes only Increment 2 at Upper Gilt Edge Bar and Unnamed Bar, which would result in 23.3 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation, as described above. The total cost of this alternative is $9.2 million.

Alternative 3 includes Increments 2 and 5b at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, and Island B, which would result in 72.8 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation, as described above. The total cost of this alternative is $32.8 million.

Alternative 4 includes Increments 2, 5b, and 5a at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, Island B, and Bar C, which would result in 122.2 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation, as described above. The total cost of this alternative is $57.8 million.

Alternative 5 includes Increments 2, 5b, 5a, and 3a at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, Island B, Bar C, Lower Gilt Edge Bar, Hidden Island, First Island, Silica Bar, and Bar A, which would result in 178.6 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation, as described above. The total cost of this alternative is $89.4 million.

Alternative 6 includes Increments 2, 5b, 5a, 3a, and 1 at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, Island B, Bar C, Lower Gilt Edge Bar, Hidden Island, First Island, Silica Bar, Bar A, and Upstream of Highway 20, which would result in 197.8 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation, as described above. The total cost of this alternative is $109.6 million.

3.7 Evaluation of Alternatives

A standard Habitat Evaluation Procedure (HEP) was used to quantify ecosystem outputs for the CE/ICA. Three key habitat types were identified to represent anticipated ecosystem outputs of the final array of alternatives: in-channel habitat, inundated floodplain habitat, and riparian habitat. Evaluation species were selected for each habitat type based on several criteria: (1) species known to be sensitive to specific land and water use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with important resource problems, such as anadromous fish and migratory birds. The species identified to evaluate habitat were steelhead, downy woodpecker, and yellow warbler.

The "blue book" Habitat Suitability Models for the woodpecker and the warbler have been approved by the National Ecosystem Restoration Planning Center of Expertise (Eco-PCX). The models have been used in other projects in the area, are focused on the target habitat types, and have been coordinated with the USFWS. The steelhead Habitat Suitability Model was developed based on information specific to the Yuba River. YCWA and the Yuba River Development Project Relicensing Participants collaborated in the development of habitat suitability criteria for fish species and life stages to be used in the lower Yuba River instream flow model. These criteria were used to develop the Juvenile Steelhead Habitat Suitability Index (HSI) Model, which has been reviewed by the Eco-PCX and recommended to USACE Headquarters for approval for one time use.

Habitat suitability criteria for each species and habitat type were analyzed under a range of river flow conditions. Ecosystem outputs were calculated based on the difference between future without project conditions and future with project conditions. Refer to Appendix D, Attachment 8 for further detail on assessing ecosystem outputs.

3.8 Comparison of Alternatives

Alternatives were compared based on costs and outputs, as well as other criteria such as contribution to planning objectives, environmental factors, completeness, effectiveness, efficiency, and acceptability. All of the other criteria were relatively consistent between increments. The alternatives comparison was made using the results of the Cost Effectiveness/Incremental Cost Analysis (CE/ICA) which displays incremental costs (dollars) and outputs (Average Annual Habitat Units - AAHUs). Incremental costs per unit of output were used to identify major breakpoints in cost efficiency among the alternatives. This analysis is shown in Table 3-15 and Figure 3-8.

Table 3-15. Incremental Costs and Outputs of Alternatives.

Alternatives	Total Costs[1]	Annualized Costs	Acres	Average Annual Habitat Units (AAHU)	Incremental Annual Cost per AAHU	Total Annual Cost per AAHU
1 (No Action)	0	0	0	0	0	0
2 (Increment 2)	$9,194,000	$348,895	23.3	14.32	$24,364	$24,364
3 (Increments 2, 5b)	$32,802,000	$1,244,773	72.8	35.67	$41,905	$34,898
4 (Increments 2, 5b, 5a)	$57,789,000	$2,192,982	122.2	55.06	$48,980	$39,830
5 (Increments 2, 5b, 5a, 3a)	$89,399,000	$3,395,521	178.6	72.86	$67,386	$46,563
6 (Increments 2, 5b, 5a, 3a, 1)	$109,640,000	$4,160,628	197.8	76.48	$212,126	$54,402

[1] Total costs in this table do not include Monitoring and Adaptive Management or Operation, Maintenance, Repair, Replacement, and Rehabilitation costs. The absence of these costs does not affect plan selection because they would be proportional to each alternative.

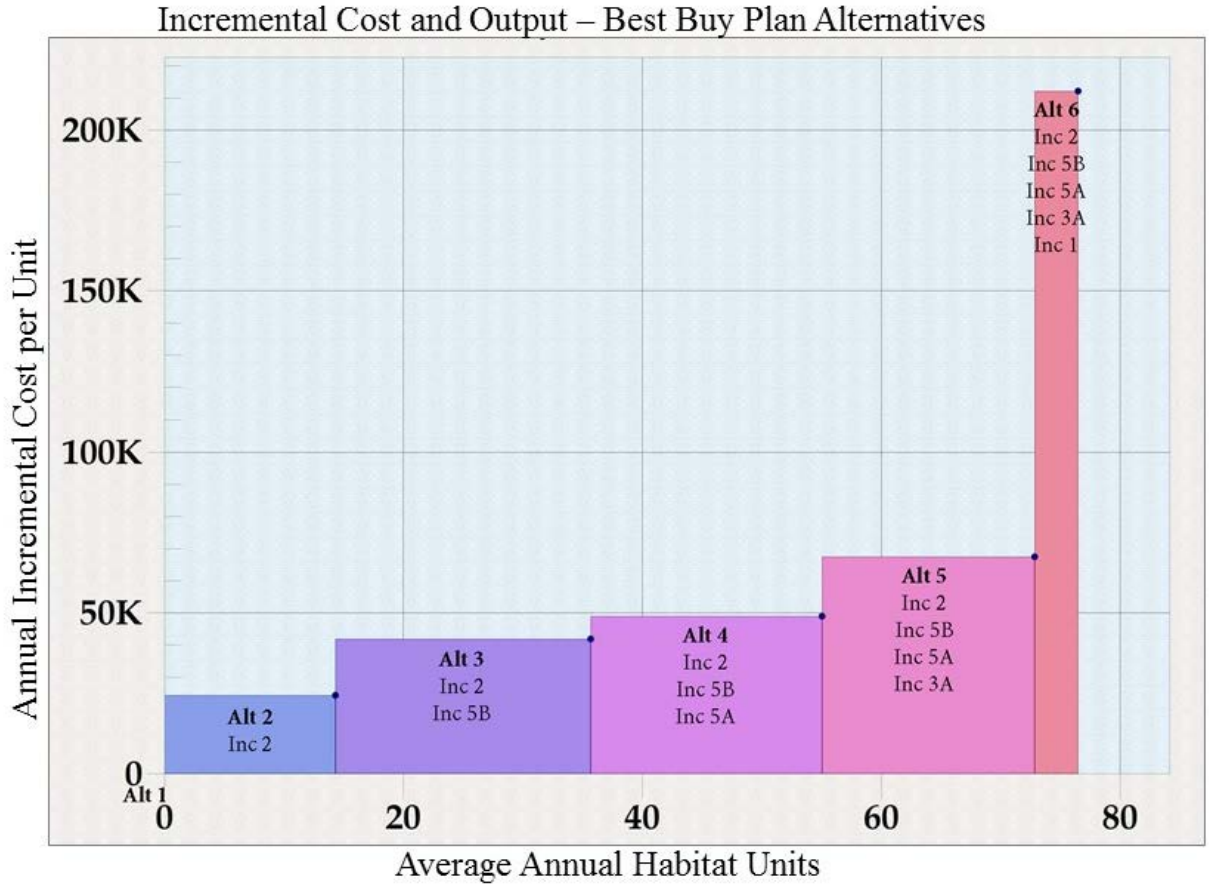

Figure 3-8. Incremental Costs and Outputs of Alternatives.

3.9 *Principles and Guidelines* Accounts

The 1983 *Principles and Guidelines* (P&G) establishes four accounts to facilitate evaluation and display of effects of alternative plans. The national economic development (NED) account displays changes in the economic value of the national output of goods and services. The environmental quality (EQ) account displays non-monetary effects on ecological, cultural, and aesthetic resources including the positive and adverse effects of ecosystem restoration plans. The regional economic development (RED) account displays changes in the distribution of regional economic activity (e.g., income and employment). The other social effects (OSE) account displays plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts (e.g., community impacts, health and safety, displacement, and energy conservation).

Table 3-16. P&G Accounts Comparison of Alternative Plans.

	NED	EQ	RED	OSE
Alternative 1	No change	No change	No change	No change
Alternative 2	$348,895 annual cost	23.3 acres restored The following impacts are proportional to the scale of each alternative: increased fish and wildlife populations; improved aesthetics; temporary impacts to water quality, air quality and traffic.	The following impacts are proportional to the scale of each alternative: temporary increase in employment and economic activity due to construction expenditures; potential long term reduction in mining or other economic activity on project lands.	The following impacts are proportional to the scale of each alternative: improved outdoor activities based on increased fish and wildlife populations such as fishing, hunting, and bird watching.
Alternative 3	$1,244,773 annual cost	72.8 acres restored		
Alternative 4	$2,192,982 annual cost	122.2 acres restored		
Alternative 5	$3,395,521 annual cost	178.6 acres restored		
Alternative 6	$4,160,628 annual cost	197.8 acres restored		

Effects of each alternative would be similar and proportional to the scale of the alternative. Based on this comparison, there is no basis for an exception to the NER plan.

3.10 Tentatively Selected Plan

Alternative 1, the no action alternative, would not contribute to project objectives from a national perspective. Ecosystem-related problems existing today would continue and stressors would persist and potentially become exacerbated. Alternative 2, while the lowest cost per

AAHU, is very small in scale, would not significantly contribute to the project objectives from a national perspective, and would not maximize benefits relative to costs. Alternatives 3, 4, and 5, the next lowest cost per AAHU, are very similar in efficiency. Alternative 6 includes Increment 1, which is more than three times the cost per AAHU of the other increments. Alternative 5 maximizes benefits relative to costs and is therefore the NER Plan and the Tentatively Selected Plan.

The inclusion of appropriate recreation features in the TSP was considered by USACE; however, a non-Federal sponsor willing to provide the required 50% cost-share and OMRR&R for recreation features has not been identified. Therefore, no recreation features are proposed. Any proposal for recreation features on lands acquired for the TSP would require public access and safety to be addressed, as well as consideration of potential adverse effects on the primary ecosystem restoration purposes of the plan.

Alternative 5, the TSP, restores significant ecosystem function, structure, and dynamic processes on 178.6 acres of riverine, riparian, and related habitats in the highly degraded Yuba River System. Alternative 5 is shown below in Figure 3-9.

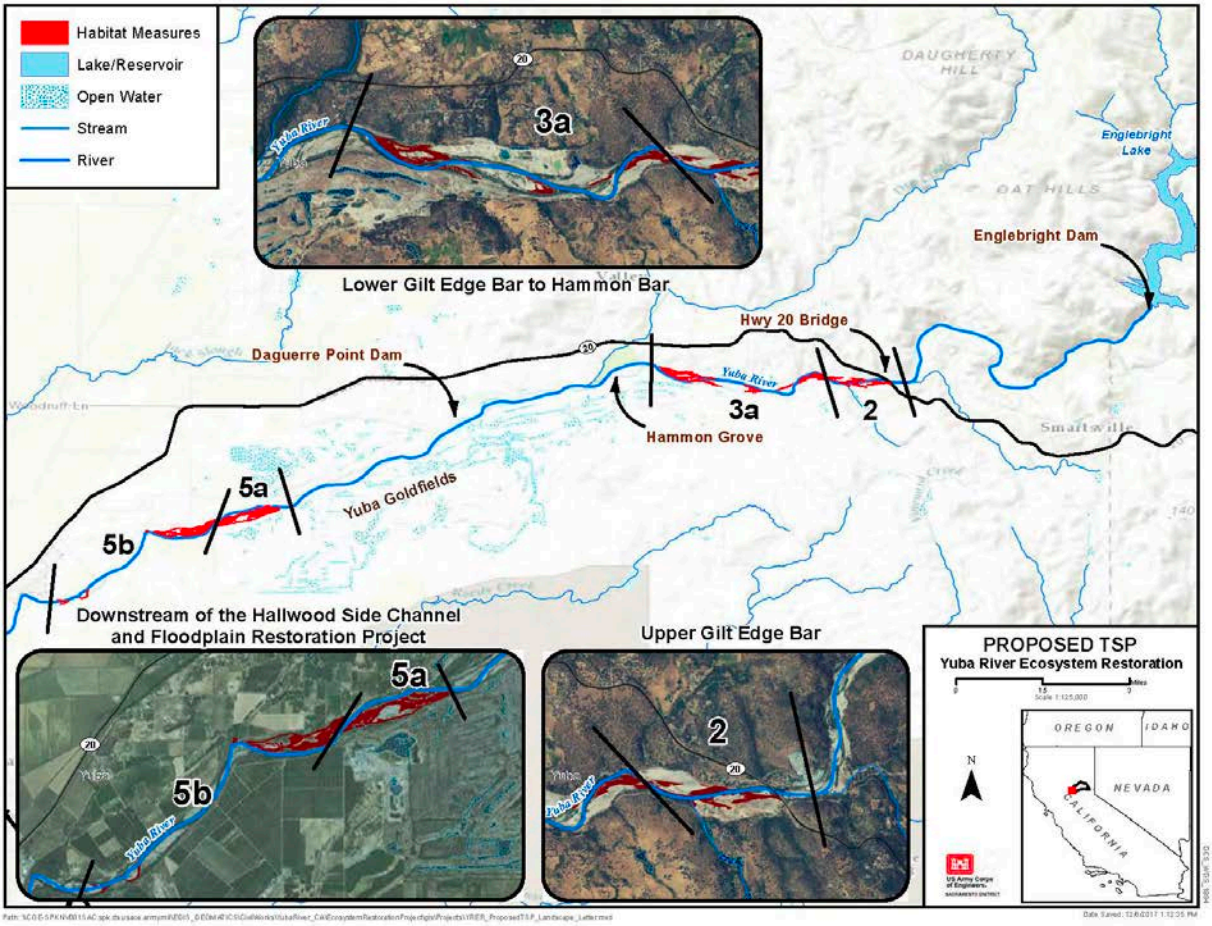

Figure 3-9. Tentatively Selected Plan.

Chapter 4 – Affected Environment and Environmental Effects

This section describes the pre-project conditions of the environmental resources in the study area and compares them to the effects of the proposed alternatives. Resources less likely to be adversely affected by the project alternatives are described first, followed by the resources that may be affected by the alternatives. Initial evaluation of the effects of the project indicated that there would likely be little to no effect on several resources. These resources are discussed in Sections 4.2.1 through 4.2.4 to add to the overall understanding of the area. Sections 4.3.1 through 4.3.11 describe existing conditions for those resources that are more likely to be affected by implementation of the proposed alternatives. An assessment of the potential impacts and proposed mitigation measures is also included in Sections 4.3.1 through 4.3.11.

4.1 Alternatives Not Evaluated in Detail

Alternatives 1 – 6 were developed following the USACE plan formulation process described in Chapter 3. These alternatives are similar in the types of proposed actions, environmental effects, and expected outcomes and differ primarily in scope. Alternative 1 is the No Action alternative and will be evaluated in further detail in this chapter. Alternative 5 reasonably maximizes ecosystem output and therefore was identified as the NER and TSP. Alternative 5 will be evaluated in further detail in this chapter. Alternative 6 represents an incremental increase in proposed implementation at which efficiency in ecosystem output decreases. Alternative 6 will be evaluated in further detail in this chapter. Alternatives 2, 3, and 4 represent subsets of Alternative 5, with proportionally lower anticipated ecosystem output and environmental impacts. Alternatives 2, 3, and 4 do not warrant further consideration and will not be evaluated in this chapter.

4.2 Resources Not Considered In Detail

4.2.1 Geology and Seismicity

4.2.1.1 Geology

The major physiographic feature within the project vicinity is the Sierra Nevada Range, which is about 400 miles long and runs south-southeast to north-northwest in the eastern portion of California. The Sierra Nevada crest forms the eastern limit of the Yuba and Bear River Basins and trends north-northwest. Drainage within the Yuba and Bear River Basins is west to southwest from the Sierra Crest to the adjacent floor of the Sacramento Valley. To the east of the basins, down faulting of the eastern Sierra face has affected drainage evolution by creating channels that now have their headwaters facing east.

Uplifting and tilting of the Sierra Block reorganized drainage networks and initiated a period of sustained channel incision, and many of the modern river channels have elevations below Tertiary-age river channels. The ancestral (Tertiary Period) Yuba River had cut about 1,000 feet below a surface defined by San Juan, Washington, and Harmony ridges. These

ancestral deep channels drained north-northwest across the strike of the modern drainages. The south branch of the ancestral Yuba River flowed north from Gold Run to Badger Hill, then southwest to Smartsville and Marysville. The ancestral channels were filled first by very coarse, boulder material rich in gold, followed by finer gravel and sand deposits, also rich in gold. These Tertiary gravel deposits are the source of the gold extensively mined in the late 1800s.

The modern Yuba and Bear River Basins drain the northwestern Sierra Nevada via a series of deep canyons separated by high, steep-sided ridges and a parallel drainage network. The parallel drainage network results in narrow ridges between small tributaries, small tributary watersheds, and low tributary sediment loads under natural conditions; prehistoric debris fans at tributary junctions were not common. Stratigraphic evidence indicates the presence of stepped, Quaternary Period terraces similar to piedmont channels flowing out of the Sierra Nevada, but these terraces were generally buried by debris and sediment associated with mining activities. Downcutting, as noted specifically in the Bear River, through the relatively soft Paleozoic metamorphic rock (Shoofly Complex) has created a deep, v-shaped canyon where short, steep-sided tributary drainages are typical. Distinctive v-shaped inner gorge areas are common in all of the major drainages in the vicinity of the projects (FERC 2014).

The proposed alternatives are small-scale ecosystem restoration projects that would restore the proposed locations to historic conditions. As a result, the project would have no effect on the geologic features in the project area.

4.2.1.2 Seismicity

The study is characterized by low to moderate seismicity, with most seismic activity concentrated east and southeast of the project areas near Lake Tahoe and to the northwest of the project areas, south of Lake Oroville. Expected seismic shaking intensities within the projects area from these nearby faults are considered to be low.

A number of north-to-northwest trending faults cross the projects, most of which are associated with the Foothills Fault System. Among the more significant faults are the Grass Valley Fault, the Melones Fault Zone, the Big Bend/Wolf Creek Fault Zone, the Giant Gap Fault, and the Camel Peak Fault Zone. None of the mapped faults within the project areas has been active in Quaternary time. A portion of the Giant Gap fault south of the projects is designated as having been active in Quaternary time. The nearest active fault (defined by the California Geological Survey as movement within the past 11,400 years) is the Cleveland Hill Fault located to the northwest of the projects near Lake Oroville; that fault had recorded movement in 1975. Other active faults are located to the east and southeast of the projects near Lake Tahoe (FERC 2014).There are no project features that would be sensitive to seismic conditions. As a result, the proposed alternatives would not be impacted by seismicity within the project area.

4.2.2 Socioeconomics and Environmental Justice

The proposed alternatives are located in rural Yuba County, in an area that is designated for natural resources and rural communities. While there are rural farm populations near the study area, any impacts associated with the alternatives would be temporary impacts limited to the construction period. Long-term, residents would benefit from the improved ecosystem along the river. There would be no disproportionately high adverse effects to low-income or minority populations or communities, and the project would not result in population growth or increased population density.

4.2.3 Land Use and Agriculture

Land use in the study area is zoned for natural resources and rural communities. Primarily, the existing land uses in the study area include natural resources and mineral mining adjacent to the river, with farm fields and rural residences present beyond the river channel. All of the proposed restoration increments are located within the active river channel adjacent to the river. Conversion of these lands to habitat features would not significantly change or impact the current land use designations. The project would require the acquisition of land and associated mineral rights to restored areas to ensure that restored areas are protected in perpetuity; however, no operating permitted mining activities would be permanently impacted (Appendix E - Real Estate Plan). Furthermore the preservation of restored areas as open space is compatible with current land use designations. While agricultural fields are present adjacent to the river corridor, no agricultural lands would be impacted by the construction of these restoration features.

4.2.4 Hazardous, Toxic, and Radiological Waste

A Phase I Environmental Site Assessment was performed in conformance with the scope and limitations of ASTM Practice E 1527-13 for the Yuba River Ecosystem Restoration Feasibility Study (Engineering Appendix B – Section 9 – Hazardous and Toxic Materials). The records research report and site visit indicates that there are no Recognized Environmental Conditions within or adjacent to the proposed study area. Adjacent properties surrounding the study area appeared well maintained and clean during a site visit. Although the equipment necessary for the proposed alternative (including material removal, transport, and placement) require fuel, oil and equivalent substances to operate, it is assumed that the BMPs described in the water quality section 4.2.7 would avoid, minimize, and or mitigate any potential impacts to a less than significant level.

4.3 Resources Considered in Detail

4.3.1 Air Quality

This air quality section describes the pre-project air quality conditions in the project vicinity and compares them to potential effects of the proposed alternatives on air quality in the project vicinity.

4.3.1.1 Affected Environment

The study area is located in Yuba County and is subject to the regulations and attainment goals and standards of the Northern Sacramento Valley Air Basin (NSVAB) and the Feather River Air Quality Management District (FRAQMD). The topographic features of the NSVAB are the Coast Range to the west, the Sierra Nevada to the east, and the Cascade Range to the north. These mountain ranges channel winds through the basin but also inhibit the dispersion of pollutant emissions.

The predominant annual and summer wind pattern is a full sea breeze, commonly referred to as a Delta breeze. The cool winds of the Delta breeze originate from the Pacific Ocean and flow through a sea-level gap in the Coast Range called the Carquinez Strait. In the winter (December to February), northerly winds predominate. Wind directions in the Sacramento Valley are influenced by the predominant wind flow pattern associated with each season. During about half the days from July through September, the Schultz Eddy prevents the Delta breeze from transporting pollutants north and out of the Sacramento Valley by causing the wind pattern to circle back south and keep air pollutants in the valley.

4.3.1.2 Criteria Pollutants

The 1970 Federal Clean Air Act (CAA) authorized the establishment of national health-based air quality standards, known as National Ambient Air Quality Standards (NAAQS) and also set deadlines for their attainment. Under the CAA, state and local agencies in areas that exceed the NAAQS are required to develop state implementation plans (SIPs) to show how they will achieve the NAAQS for nonattainment criteria pollutants by specific dates. SIPs are not single documents; rather, they are a compilation of new and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), district rules, state regulations and Federal controls. The US Environmental Protection Agency (USEPA) is responsible for enforcing the NAAQS primarily through reviewing SIPs that are prepared by each state.

As required by the Federal CAA, the USEPA has established and continues to update the NAAQS for specific criteria air pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), inhalable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead (Pb). The NAAQS for these pollutants are listed under "Federal Standards" in Table 4-1 and represent the upper-bound levels of pollutant concentrations deemed necessary by the USEPA to protect the public health and welfare with an adequate margin of safety.

Pursuant to CAA Section 176(c) requirements, USEPA promulgated the General Conformity Rule (GCR), which applies to most Federal actions, including the proposed alternatives. The GCR is used to determine if Federal actions meet the requirements of the CAA and the applicable SIP by ensuring that pollutant emissions related to the action do not:

Table 4-1. State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	Federal Standard[a]	California Standard[b]	Violation Criteria	
				National	California
CO	8 hour	9 ppm	9 ppm	Not to be exceeded more than once per year	Not to be exceeded
	1 hour	35 ppm	20 ppm	Not to be exceeded more than once per year	Not to be exceeded
NO_2	Annual	0.053 ppm	0.030 ppm	If exceeded	Not to be exceeded
	1 hour	0.100 ppm	0.18 ppm	The 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.100 ppm.	Not to be exceeded
O_3	8 hour	0.075 ppm	0.070 ppm	The ozone standard is attained when the 4th highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal to or less than the standard.	Not to be exceeded
	1 hour	N/A	0.09 ppm	N/A	Not to be exceeded
PM_{10}	Annual	N/A	20 µg/m3	N/A	Not to be exceeded
	24 hour	150 µg/m3	50 µg/m3	The 24 hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m3 is equal to or less than one.	Not to be exceeded
$PM_{2.5}$	Annual	12 µg/m3	12 µg/m3	The 3-year average of the weighted annual mean must not exceed	Not to be exceeded
	24 hour	35 µg/m3	N/A	The 24 hour standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or less than the standard	N/A
SO_2	24 hour	0.14 ppm	0.04 ppm	Not to be exceeded more than once per year	Not to be exceeded
	3 hour	N/A[c]	N/A	N/A	N/A
	1 hour	0.075 ppm	0.25 ppm	The 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.075 ppm.	Not to be exceeded
Pb	30 day	N/A	1.5 µg/m3	N/A	Not to be exceeded or equaled
	Quarter	1.5 µg/m3	N/A	Not to be exceeded more than once per year	N/A
	3 month	0.15 µg/m3	N/A	Not to be exceeded more than once per year	N/A

Source: CARB, 2016a

[a] 40 CFR 50.4 through 50.13

[b] California Code of Regulations, Table of Standards, Section 70200 of Title 17

[c] No National Primary 3 hour standard for SO_2. National Secondary 3 hour standard for SO_2 is 0.5 ppm.

µg/m3 micrograms per cubic meter

ppm parts per million

N/A Not Applicable; State and Federal Standards do not exist.

- Cause or contribute to new violations of a NAAQS.
- Increase the frequency or severity of any existing violation of a NAAQS.
- Delay timely attainment of a NAAQS or interim emission reduction.

A conformity determination under the GCR is required if the Federal agency determines: the action will occur in a nonattainment or maintenance area; that one or more specific exemptions do not apply to the action; the action is not included in the Federal agency's "presumed to conform" list; the emissions from the proposed action are not within the approved emissions budget for an applicable facility; and the total direct and indirect emissions of a pollutant (or its precursors), are at or above the *de minimis* levels established in the General Conformity regulations.

An action will be determined to conform to the applicable SIP if the action meets the requirements of 40 CFR 93.158(c). In addition, Federal activities may not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with timely attainment or required interim emissions reductions toward attainment.

The primary pollutants in Yuba County are vehicular emissions and agricultural activities. Light industry and aircraft emissions from Beale Air Force Base also contribute to reduce air quality in the region. The closest air quality monitoring station is located on Almond Street in Yuba City. This station monitors CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, and several weather parameters (CARB 2015). Data is no longer being collected at the Sutter County Fairgrounds Agricultural Building mentioned in the 1998 EIS/EIR. Table 4-2 summarizes air quality data between 2008 and 2015 (any data after 2015 is considered preliminary at this time).

4.3.1.3 Toxic Air Contaminants

Air quality regulations in California also focus on toxic air contaminants (TACs), known as hazardous air pollutants (HAPs) in Federal regulations. A TAC is an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health (California Office of Environmental Health Hazard Assessment, 2017). TACs are usually present in minute quantities in the ambient air, however, their high toxicity or health risk may pose a threat to the public even at very low concentrations. Unlike criteria air pollutants, for which there are acceptable levels of exposure, there is no safe level of exposure to TACs, as there is no concentration that does not present some risk. TACs are regulated by the USEPA and CARB through regulations that generally require the utilization of best available technology to limit emissions.

Table 4-2. Summary of Air Quality Monitoring Data in Yuba County (2008-2015).[1]

Pollutant	Year	Average Period (hr.)	Maximum Concentration	No. of Violations of State Standard
Ozone	2008	1	0.092 ppm	0
	2009	1	0.089 ppm	0
	2010	1	0.089 ppm	0
	2011	1	0.074 ppm	0
	2012	1	0.083 ppm	0
	2013	1	0.095 ppm	1
	2014	1	0.103 ppm	1
	2015	1	0.080 ppm	0
PM10	2008	24	66.9 µg/m^3	–[2]
	2009	24	50.1 µg/m3	0
	2010	24	43.3 µg/m3	0
	2011	24	57.8 µg/m3	13
	2012	24	63.0 µg/m3	6
	2013	24	58.4 µg/m^3	–
	2014	24	77.6 µg/m^3	–
	2015	24	67.2 µg/m^3	6

[1]Almond Street Monitoring Station

[2]Data not available for State Standard Violations of PM10 in Yuba City from 2008, 2013, and 2014.
Source: CARB 2016a

The majority of TACs can be attributed to relatively few compounds (CARB, 2011). Of the TACs for which data is available in California, diesel PM, benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride and percholorethylene are the most hazardous to health. Of these, diesel PM presents the greatest health risk (CARB, 2016b). The PM from diesel-fueled engines is composed of a complex mixture of hundreds of substances and is the most important of the TACs. Diesel fueled internal combustion engines emit diesel PM, but the composition of the emissions varies by many factors, including fuel consumption, operating conditions, engine type, etc. Diesel PM, unlike other TACs has no ambient monitoring data available, as there is no routine measurement currently in existence.

4.3.1.4 Sensitive Receptors

Some locations are considered more sensitive to adverse effects from air pollution than others. These locations are called sensitive receptors. A sensitive receptor is generally a location where human populations, particularly children, seniors and the sick are found, and where there is a reasonable expectation of continuous human exposure according to appropriate

standards (e.g., 24-hour, 8-hour, and 1-hour). Sensitive land uses and sensitive receptors generally include residences, hospitals, rehabilitation centers and convalescent centers, retirement homes, and schools, playgrounds and childcare centers. Sensitive receptors in the study area include rural residences.

4.3.1.5 Environmental Consequences

4.3.1.5.1 Methodology

The methods for evaluating impacts are intended to satisfy the Federal air quality requirements, including the Federal General Conformity Rule, and to disclose effects to fulfill requirements set forth in accordance with NEPA.

To complete the analysis, information was collected on projected construction activities, duration, and timing, equipment use, and activities for each construction year using SMAQMD's Road Construction Emission Model Version 8.1.0. Construction equipment usage from similar projects was analyzed to estimate daily and annual exhaust emissions. Emissions are considered significant if emissions exceed the thresholds established by the applicable air quality agencies. Modeling was conducted using a worst case scenario approach; annual emissions were modelled for a single year of construction representative of the maximum amount of work that could be performed. Modeling assumptions for each project alternative and methodology are provided in the Environmental Appendix D – Attachment 10. The following construction sources and activities were analyzed for emissions:

- On site construction off-road equipment emissions (all criteria pollutants)
- On site pickup trucks, onsite haul trucks, and off site haul trucks emissions (all criteria pollutants)
- Off-site worker vehicle emissions (all criteria pollutants)
- On site pickup trucks, on site haul trucks, off site haul truck, and off site worker vehicles entrained fugitive dust emissions for paved and unpaved road entrained dust (PM_{10} and $PM_{2.5}$)
- On site excavation (cut/fill) fugitive dust (PM_{10} and $PM_{2.5}$)

Disposal sites have not yet been identified at the time of this writing, but are assumed to be located within a 20 mile radius from the study area. Emissions associated with material activities would fall within the FRAQMD.

4.3.1.5.2 Basis of Significance

Adverse effects on air quality were considered significant if implementation of an alternative plan would:

- Violate any Federal ambient air quality standard.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project is in nonattainment under applicable Federal 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.

4.3.1.5.3 State Implementation Plan and General Conformity De Minimis Thresholds

Federal actions need to demonstrate conformity to any SIPs of the regional air basin. Each action must be reviewed to determine whether it: 1) qualifies for an exemption listed in the General Conformity Rule (GCR); 2) results in emissions that are below GCR *de minimis* emissions thresholds; or 3) would produce emissions above the GCR *de minimis* thresholds applicable to the specific area. The General Conformity *de minimis* levels for this project are shown below (Table 4-3). These thresholds were applied to the project's estimated emissions and used to determine effect significance as detailed below.

Table 4-3. General Conformity *De Minimis* Thresholds.

Pollutant	Federal Attainment Status	Threshold Values (tons/yr.)[1]
Ozone precursor (ROG)	Unclassifiable/Attainment	25
Ozone precursor (NO_X)	Unclassifiable/Attainment	25
CO	Attainment	100
SO_2	Attainment	100
$PM_{2.5}$	Nonattainment	100
PM_{10}	Attainment	100
Pb	Attainment	25

Source: USEPA 2014

[1] Thresholds from 40 CFR Parts 51 and 93.

4.3.1.5.4 Federal General Conformity Criteria

The USEPA developed the General Conformity Rule, which became effective on January 31, 1994, to implement Section 176c of the Federal CCA. The underlying principle of the

General Conformity Rule is that Federal actions must not cause or contribute to any violation of a 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 could exceed *de minimis* threshold levels listed in the General Conformity Rule (40 CFR 93.153). If the total direct emissions associated with the project are below the *de minimis* levels indicated in Table 4-3, general conformity requirements do not apply, and the project is considered in conformity and would not result in an adverse effect.

Although the project region is in attainment for the majority of criteria pollutants indicated in Table 4-4, the region was in non-attainment for $PM_{2.5}$ (U.S. Environmental Protection Agency, 2017); therefore, a conformity assessment for $PM_{2.5}$ must be completed. That assessment will evaluate whether the project's construction emissions would exceed 100 tons per year of $PM_{2.5}$.

Table 4-4. Emission Rates for Criteria Pollutants in Nonattainment Areas.

Pollutant	Emission Rate (tons per year)
Ozone (Volatile organic compounds or NO_X)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
Other ozone nonattainment areas outside an ozone transport region	100
Marginal and moderate nonattainment areas inside an ozone transport region	
Volatile organic compounds	50
NO_X	100
CO: All nonattainment areas	100
SO_2 or NO_2: All nonattainment areas	100
PM_{10}	
Moderate nonattainment areas	100
Serious nonattainment areas	70
$PM_{2.5}$	
Moderate nonattainment areas	100
Serious nonattainment areas	70
Pb: All nonattainment areas	25

Note: *De minimis* threshold levels for conformity applicability analysis.
Source: 40 CFR 51.853

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba

River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. Air quality in the area would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Construction of this alternative would result in a short-term, temporary increase in the generation of ROG, CO, NO_X, PM_{10}, $PM_{2.5}$, and CO_2 emissions from the earthwork operations, motor vehicle exhaust associated with construction equipment, employee commute trips, material transport, material handling, and other construction activities. Annual emissions were calculated based on assumptions of the type of construction equipment required for each construction phase (Environmental Appendix D).

Maximum daily emissions (lbs/day) and total construction emissions (tons/year) were calculated from the SMAQMD's Road Construction Emission Model Version 8.1.0 for ROG, NOX, SO_x, PM10, and $PM_{2.5}$ to evaluate emissions against the FRAQMD thresholds. Table 4-5 summarizes the total emissions for ROG, NOX, SO_x, PM10, and $PM_{2.5}$ estimated for Alternative 5.

Impacts to air quality from construction and establishment related activities would be temporary in nature. These impacts would include localized and regional increases in fugitive dust and emissions. BMPs listed below, including use of water trucks during construction and restoration of impacted areas, would be implemented to reduce the short-term construction related impacts of this alternative to air quality. Emissions modeling indicate that no Federal thresholds for construction related emissions would be exceeded due to the implementation of Alternative 5 and therefore no mitigation would be required with regards to Federal standards. State and local thresholds for construction related emissions would be evaluated under a CEQA analysis and appropriate mitigation would be implemented to reduce potential impacts to air quality to a less than significant level. Alternative 5 has no significant O&M requirements and no long-term impacts on air quality are anticipated. Given these considerations, implementation of Alternative 5 would result in a less than significant impact to air quality.

Table 4-5. Estimated Emissions from Alternative 5.

Site Preparation & Construction	**ROG**	**CO**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Total emissions (tons/year) in 2022	0.15	2.35	1.50	1.03	0.24
Federal Threshold (tons/year)	25	100	25	100	100

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Alternative 6 includes all elements of Alternative 5 plus the addition of Increment 1. With the addition of Increment 1, additional aquatic habitats would be created through the excavation of a side channel and back water area in Timbuctoo Bend upstream of Highway 20. Alternative 6 would have similar, but incrementally greater, construction related effects to Alternative 5, including short-term, temporary increase in the generation of the previously discussed emissions from earthwork operations, motor vehicle exhaust associated with

construction equipment, employee commute trips, material transport, material handling, and other construction activities. The emissions for this alternative were also calculated on assumptions on the type of construction equipment required for each construction phase. Therefore, the effects to air quality from Alternative 6 would be expected to be proportionally greater than Alternative 5. Given these considerations, Alternative 6 would result in less than significant impacts to air quality.

Table 4-6. Estimated Emissions from Alternative 6.

Site Preparation & Construction	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$
Total emissions (tons/year) in 2022	0.20	2.99	2.01	1.07	0.26
Federal Threshold (tons/year)	25	100	25	100	100

4.3.1.6 Avoidance, Minimization, and Mitigation Measures

The following avoidance, minimization, and mitigation measures would be implemented to reduce potential air quality impacts to a less than significant level:

- Minimize idling time by either shutting equipment off when not in use or reduce the idling time to five minutes (as required by the state airborne toxics control measure [Title 13, Sections 249(d)(3) and 2485 of the California Code of Regulations]). Clear signage that posts this requirement at the entrances to the site would be required.
- Maintain all construction equipment in proper working conditions according to the manufacturer's specifications. The equipment must be checked by a certified mechanic and determined to be running in proper condition before it is operated.
- At least 48 hours prior to the use of heavy-duty, off-road equipment, the contractor would provide FRAQMD with the anticipated construction timeline, including start date, and the names and phone numbers of the project manager and onsite foreman.
- Restrict vehicle speeds of any vehicle or equipment traveling across unpaved areas to no higher than 15-mph.
- Prior to any ground disturbance, including grading, excavating and land clearing, sufficient water would be applied to the area to be disturbed to prevent emitting dust exceeding Ringlemann scale 2 and to minimize visible emissions from crossing the boundary line..
- No trucks would be allowed to transport excavated material off-site unless the trucks are maintained such that no spillage can occur from holes or other openings in cargo compartments.
- Water all exposed surfaces at least twice daily. Exposed surfaces include, but are not limited to soil piles, graded areas, unpaved parking areas, staging areas and access roads.
- Cover or maintain a minimum of two feet of free board space on haul trucks transporting soil, sand, or other loose material on the site. Any haul trucks that would be traveling along freeways or major roadways would be covered.

4.3.2 Climate Change

This section establishes the existing conditions for climate change in the study area. The basis of significance for impacts to climate change are established, including specific emissions standards, thresholds, or other measurements for the various pollutants. The potential effects of the proposed alternatives are discussed, and, as necessary, applicable mitigation measures are described.

4.3.2.1 Affected Environment

This section addresses the impacts of greenhouse gas (GHG) emissions associated with implementation of the project on global climate change, as well as the impacts climate change could have on the proposed alternatives. Emissions of GHGs are a contributing factor, on a cumulative basis, to global climate change. Global climate change has the potential to result in sea level rise (which may result in flooding of low-lying areas), to affect rainfall and snowfall levels (which may lead to changes in water supply and runoff), to affect temperatures and habitats (which in turn may affect biological and agricultural resources), and to result in many other adverse effects. Although global climate change is inherently a cumulative impact, it is important to remember that any single project is unlikely to be able to generate sufficient GHGs by itself to have a significant impact on the environment. However, the cumulative effect of human activities has been clearly linked to quantifiable changes in the composition of the atmosphere, which in turn have been shown to be the main cause of global climate change.

On October 30, 2009, the USEPA published a rule for the mandatory reporting of GHGs from sources that in general emit 25,000 metric tons or more of carbon dioxide equivalent per year in the United States. On December 18, 2014, CEQ released revised draft guidance that applies to all proposed Federal agency actions, including land and resource management actions. This guidance states that "Agencies are required to consider direct, indirect, and cumulative effects when analyzing any proposed Federal actions and projecting their environmental consequences" and "climate change is a particularly complex challenge given its global nature and inherent interrelationships…however, analyzing the proposed action's climate impacts and the effects…can provide useful information to decision makers" (CEQ, 2014). Implementation of 40 CFR Part 98 is referred to as the Greenhouse Gas Reporting Program. The purpose of the rule is to collect accurate and timely GHG data to inform future policy decisions.

4.3.2.2 Global Climate Trends and Associated Impacts

Global warming is the name given to the increase in the average temperature of the Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Warming of the climate system is now considered by a vast majority of the scientific community to be unequivocal, based on observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (IPCC, 2014).

Global mean surface temperatures have risen by 0.74 degrees Celsius (°C) ± 0.18°C when estimated by a linear trend over the last 100 years (1906 to 2005). The rate of warming over the last 50 years is almost double that over the last 100 years (0.13°C ± 0.03°C versus 0.07°C ± 0.02°C per decade). The causes of this measured warming have been identified as both natural processes and the result of human actions. For the next two decades, a warming of about 0.2°C per decade is projected for a range of emissions scenarios.

The Intergovernmental Panel on Climate Change (IPCC) concludes that variations in natural phenomena such as solar radiation and volcanoes produced most of the warming from preindustrial times to 1950 and had a small cooling effect afterward. However, since 1950, increasing GHG concentrations resulting from human activity such as fossil fuel burning and deforestation have been responsible for most of the observed temperature increase. These basic conclusions have been endorsed by more than 45 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries. Since 2007, no scientific body of national or international standing has maintained a dissenting opinion (DWR, 2012). A review of published climate change studies showed an overwhelming consensus on the anthropogenic global warming (Cook et al. 2016).

Increases in GHG concentrations in the Earth's atmosphere are thought to be the main cause of human-induced climate change. GHGs naturally trap heat by impeding the exit of solar radiation that has hit the Earth and is reradiated back into space as infrared radiation. Some GHGs occur naturally and are necessary for keeping the Earth's surface habitable. However, increases in the concentrations of these gases in the atmosphere above natural levels during the last 100 years have increased the amount of infrared radiation that is trapped in the lower atmosphere, intensifying the natural greenhouse effect and resulting in increased global average temperatures.

The effects of warming of the Earth's atmosphere and oceans affect global and local climate systems. Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, in addition to temperature increases (IPCC, 2014). Based on growing evidence, there is high confidence that the following effects on hydrologic systems are occurring: (1) increased runoff and earlier spring peak discharge in many glacier- and snow-fed rivers; and (2) warming of lakes and rivers in many regions, with effects on thermal structure and water quality (IPCC, 2014).

There is very high confidence, based on increasing evidence from a wider range of species, that recent warming is strongly affecting terrestrial biological systems, including such changes as earlier timing of spring events (e.g., leaf-unfolding, bird migration, egg-laying); and poleward and upward shifts in ranges in plant and animal species. Based on satellite observations since the early 1980s, there is high confidence that there has been a trend in many regions toward earlier "greening" of vegetation in the spring linked to longer thermal growing seasons resulting from recent warming (IPCC, 2014).

There is high confidence, based on substantial new evidence, that observed changes in marine and freshwater biological systems are associated with rising water temperatures, as well

as related changes in ice cover, salinity, oxygen levels, and circulation. These include shifts in ranges and changes in algal, plankton, and fish abundance in high-latitude oceans; increases in algal and zooplankton abundance in high-latitude and high-altitude lakes; and range changes and earlier fish migrations in rivers (IPCC, 2014).

Changes in the ocean and on land, including observed decreases in snow cover and Northern Hemisphere sea ice extent, thinner sea ice, shorter freezing seasons of lake and river ice, glacier melt, decreases in permafrost extent, increases in soil temperatures and borehole temperature profiles, and sea level rise, provide additional evidence that the world is warming (IPCC, 2014).

4.3.2.3 Climate Change Conditions in California

With respect to California's water resources, the most important effects of global warming have been changes to the water cycle and sea level rise. Over the past century, the precipitation mix between snow and rain has shifted in favor of more rainfall and less snow (Mote et al., 2005; Knowles et al., 2006), and snowpack in the Sierra Nevada is melting earlier in the spring (Kapnick and Hall, 2009). The average early-spring snowpack in the Sierra Nevada has decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet of snowpack storage (DWR, 2008). These changes have major implications for water supply, flooding, aquatic ecosystems, energy generation, and recreation throughout the state.

Precipitation

Climate change can affect precipitation by changing the overall amount of precipitation, type of precipitation (rain versus snow), and timing and intensity of precipitation events. Changes to these factors propagate through the hydrologic system in California and have the potential to affect snowpack, runoff, water supply, and flood control.

Former State Climatologist James Goodridge compiled an extensive collection of longer-term precipitation records from throughout California. These data sets were used to evaluate whether there has been a changing trend in precipitation in the state over the past century (DWR, 2016). Long-term runoff records in selected California watersheds were also examined. Based on a linear regression of the data, the long-term historical trend for statewide average annual precipitation appears to be relatively flat (no increase or decrease) over the entire record. However, it appears that there might be an upward trend in precipitation toward the latter portion of the record. Precipitation in Northern California appears to have increased between 1 and 3 inches annually between 1890 and 2002 (DWR, 2016).

Snowpack

An increase in the global average temperature is expected to result in a decreased volume of precipitation falling as snow in California and an overall reduction in the Sierra Nevada's snowpack. Snowpack in the Sierra Nevada provides both water supply (runoff) and storage (within the snowpack before melting), which is a major source of supply for California. By

2100, the contributions of snowmelt to runoff will decrease by one third for the western U.S. in the Intergovernmental Panel on Climate Change Representation Concentration Pathway 8.5 scenario (Donogyue et al., 2017). According to the California Energy Commission (CEC), the snowpack portion of the water supply has the potential to decline by 30 to 90 percent by the end of the 21st century (CEC, 2016). A study by Knowles and Cayan projects that approximately 50 percent of the statewide snowpack will be lost by the end of the century (Knowles and Cayan, 2002). Snowpack conditions have been further exacerbated by drought conditions in California over the past several years (Dettinger et al. 2015).

On average, California's annual snowpack has the greatest accumulations from November through the end of March. The snowpack typically melts from April through July. California's reservoir managers rely on snowmelt to fill reservoirs once the threat of large winter and early-spring storms and related flooding risks have passed.

An analysis conducted by DWR of the effect of rising temperatures on snowpack shows that a rise in average annual air temperature of 3°C (5.4°F) would likely cause snowlines to rise approximately 1,500 feet (DWR, 2016). This would result in the equivalent of approximately 5 million acre-feet of water per year falling as rain rather than snow at lower elevations.

Runoff

Runoff is directly affected by changes in precipitation and snowpack. If the amount of precipitation falling as rain rather than snow were to increase earlier in the year, flooding potential could increase. Water that normally would be held in the Sierra Nevada snowpack until spring would flow into the Central Valley concurrently with the rain from winter storm events. This scenario would place more pressure on California's flood control system (DWR, 2016).

Changes in both the amount of runoff and the seasonality of the hydrologic cycle also have the potential to greatly affect the heavily managed water systems of the western United States. The hydrology of the Sacramento River watershed, including the Yuba River, is highly dependent on the interaction between Sierra Nevada snowpack, runoff, and management of reservoirs. Higher snow lines and more precipitation falling in the form of rain rather than snow would increase winter inflows to reservoirs. Higher winter inflows would also likely mean that a greater portion of the total annual runoff volume would occur in the winter, which would translate to higher flows in the Delta in the winter than those that currently occur.

Greenhouse Gas Emissions

As defined in Section 38505(g) of the California Health and Safety Code, the principal GHGs of concern are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). With the exception of NF_3, these are the same gases named in the USEPA's Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the CCA. Each of the principal GHGs has a long atmospheric lifetime (one year to several thousand years), and is globally well mixed. In addition, the potential heat trapping ability of

each of these gases varies significantly from one another. On a 100-year timescale, methane is about 25 times as potent as CO_2, nitrous oxide is about 298 times as potent as CO_2, and sulfur hexafluoride is about 22,800 times more potent than CO_2 (IPCC, 2007). Conventionally, GHGs have been reported as CO_2 equivalents (CO_2e). CO_2e takes into account the relative potency of non-CO_2 GHGs and converts their quantities to an equivalent amount of CO_2 so that all emissions can be reported as a single quantity.

The primary human-made processes that release these gases include: (1) the burning of fossil fuels for transportation, heating, and electricity generation; (2) agricultural practices that release methane, such as livestock grazing and crop residue decomposition; and (3) industrial processes that release smaller amounts of high global warming potential gases, such as sulfur hexafluoride, PFCs, and HFCs. Deforestation and land cover conversion have also been identified as contributing to global warming by reducing the Earth's capacity to remove CO_2 from the air and altering the Earth's surface reflectance. The major sources of GHGs that are relevant to the project are transportation sources, including the majority of mining emissions, and construction emissions. These are discussed in greater detail below.

Transportation

Transportation is a major source of GHGs in California, accounting for 37% of the State's total GHG emissions in 2015 (CARB, 2017). Transportation emissions within California are generated primarily by combustion of gasoline, diesel, and some alternative fuels by mobile sources. The indicators of vehicular activity, and resulting GHG emissions, are vehicle miles traveled and the fuel economies of the individual vehicles composing the vehicular fleet. Vehicle miles traveled are associated with movement of people and goods on local, regional, and statewide scales.

Construction

Construction emissions are generated when materials and workers are transported to and from construction sites and when machinery is used for construction activities such as trenching, grading, dredging, paving, and building. Construction emissions are not accounted for in a separate category in the California GHG inventory (or other inventories that use IPCC GHG emissions sectors for accounting purposes). Emissions from construction activities are generated for shorter periods than operational emissions; however, GHGs remain in the atmosphere for hundreds of years or more, so once released, they contribute to global climate change unless they are removed through absorption by the oceans or by terrestrial sequestration.

Greenhouse Gas Emissions Inventories

A GHG inventory is a quantification of GHG emissions and sinks within a selected physical and/or economic boundary over a specified time. GHG inventories can be performed on a large scale (i.e., for global and national entities) or on a small scale (i.e., for a particular building or person).

Many GHG emission and sink specifications are complicated to evaluate because natural processes may dominate the carbon cycle. Although some emission sources and processes are easily characterized and well understood, some components of the GHG budget (i.e., the balance of GHG sources and sinks) are not known with accuracy. Because protocols for quantifying GHG emissions from many sources are currently under development by international, national, state, and local agencies, ad-hoc tools must be developed to quantify emissions from certain sources and sinks in the interim. Table 4-7 outlines the most recent global, national, statewide, and local GHG inventories to help contextualize the magnitude of potential project-related emissions.

Table 4-7. Global, National, State, and Local GHG Emissions Inventories.

Emissions Inventory	CO_2e (metric tons)
2010 IPCC Global GHG Emissions Inventory	49,000,000,000
2015 USEPA National GHG Emissions Inventory	66,586,700,000
2015 CARB State GHG Emissions Inventory	4440,400,000
2010 Yuba County GHG Emissions Inventory	665,411

Sources: IPCC 2014; USEPA 2017, CARB 2017, Yuba County 2011

4.3.2.4 Environmental Consequences

4.3.2.4.1 Methodology

The methods for evaluating impacts are intended to satisfy Federal and State requirements, including NEPA. As discussed in the air quality assessment (Section 4.2.1), emissions were estimated based on the type of equipment being used, the level of equipment activity, and the associated construction schedules utilizing the Road Construction Emissions Model 8.1.0 (Environmental Appendix D).

4.3.2.4.2 Basis of Significance

Executive Order B-30-15, signed on 29 April 2015, established state-wide reduction targets in GHG emissions in 2030 and 2050. California Senate Bill 32 codified the 2030 target, which is based on 1990 levels of GHG emissions of 40% below the 1990 level. The same bill set the 2050 target at 80% below the 1990 levels. No specific Federal threshold has been established for identifying significant effects related to construction based emissions of GHG, nor have thresholds been established by the FRAQMD for project related GHG emissions. For the purpose of this study, the recommended thresholds for GHG emissions adopted in October 2014 by SMAQMD for land development and construction projects serve as a basis for evaluation of project effects. The recommended thresholds adopted by SMAQMD for both the construction phase and operational phase are 1,100 metric tons of CO_2e, per year. GHG emissions above this level would be considered significant.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. The resilience of the lower Yuba River to climate change would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Greenhouse gas emissions would come from the construction equipment required to implement Alternative 5, such as excavators, graders, dozers, etc., as well as from construction worker commute trips to and from the worksite. Following construction, operation and maintenance activities would be limited and associated emissions would not be expected to significantly contribute to climate change. The effects from the implementation of Alternative 5 on climate change related to GHG emissions would be short-term in nature.

Although, modeling indicates that Alternative 5 would exceed the SMAQMD recommended thresholds for GHG emissions (Table 4-8.), the overall impacts to climate change would be well under the US EPA reporting threshold of 25,000 metric tons of GHG. Modeling was conducted under a worst case scenario of annual impacts and did not account for potentially mitigating actions (i.e. restoration of riparian vegetation and expansion of aquatic habitat. Alternative 5 could lessen the effects of climate change due to GHG emissions by:

- Restoring aquatic and riparian habitats, which may contribute to improving populations' resilience to climate change by increasing availability and quality of suitable habitat. Riparian ecosystems are naturally resilient, provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change (Seavy et al. 2009).
- Enhancing riparian vegetation communities, which would promote ecosystem resiliency to the future effects of climate change.
- Improving floodplain connectivity, which would improve conditions for the natural establishment/recruitment of native species.

With the implementation of proper BMPs, improvements to project design and implementation, and acquisition of GHG emission reduction credits if necessary, it is anticipated that project impacts to climate change would be less than significant.

Table 4-8. Estimated GHG Emissions from Alternative 5.

Site Preparation & Construction	CO_{2e} (metric tons/year)
Total emissions (metric tons/year) in 2022	1657.72
SMAQMD Recommended Threshold (Metric tons/year)	1,100
USEPA Reporting Threshold	25,000

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Greenhouse gas emissions would come from the construction equipment required to implement Alternative 6, such as excavators, graders, dozers, etc., as well as from construction worker commute trips to and from the worksite. As with Alternative 5, emissions modeling indicated that although implementation of Alternative 6 would exceed SMAQMD recommended thresholds for emissions of GHGs, emissions would be well under the US EPA reporting threshold of 25,000 metric tons of GHG. Alternative 6 would result in a greater amount of GHG emissions than Alternative 5, due to the inclusion of additional restoration sites upstream of Highway 20. The additional restoration work would not represent different types of effects, but would result in an incremental increase in magnitude of construction related emission effects. Following completion of construction, Alternative 6 would include limited operations and maintenance activities which would not be expected to contribute to any significant GHG emission related effect to climate change.

As with Alternative 5, Alternative 6 could lessen the effects of climate change due to GHG emissions by:

- Restoration of aquatic and riparian habitats may contribute to improving populations resilience to climate change by increasing availability of suitable habitat
- Riparian vegetation communities would be enhanced, which would promote ecosystem resiliency to the future effects of climate change.
- Improved floodplain connectivity would improve conditions for the natural establishment/ recruitment of native species.

With the implementation of proper BMPs, improvements to project design and implementation, and acquisition of GHG emission reduction credits if necessary, it is anticipated that project impacts to climate change would be less than significant.

Table 4-9. Estimated GHG Emissions from Alternative 6.

Site Preparation & Construction	CO_{2e} (metric tons/year)
Total emissions (metric tons/year) in 2022	2207.09
SMAQMD Recommended Threshold (Metric tons/year)	1,100
USEPA Reporting Threshold	25,000

4.3.2.5 Avoidance, Minimization, and Mitigation Measures

The GHG mitigation plan would consist of feasible mitigation measures which can be implemented to reduce impacts to less than significant. To be considered less than significant, mitigation measures would need to reduce emissions to a threshold of significance of 1,100 metric tons of CO_2e per year. This threshold was established by SMAQMD and is followed by FRAQMD. SMAQMD offers suggested, feasible mitigation measures such as (SMAQMD, 2017):

- Improve fuel efficiency from construction equipment,
- Perform on-site material hauling with trucks equipped with on-road engines (if determined to be less emissive than off-road engines),
- Use alternative fuels for generators at construction sites,
- Encourage and provide carpools, shuttle vans, and secure bicycle parking,
- Reduce electricity use in the construction office by using compact fluorescent bulbs, powering off computers every day and replacing heating and cooling units with more efficient ones.
- Develop a plan to efficiently use water for adequate dust control.
- Acquisition of GHG emission reduction credits. The purchase of credits would not be expected to significantly affect project costs.

Although construction of either Alternative 5 or Alternative 6 would result in a short-term increase in CO_2e emissions, there would be no long-term operations emissions, and long-term GHG emissions would remain the same with any of the three alternatives. Therefore, there would be no significant effects to climate change as a result of the Preferred Alternative.

4.3.3 Aesthetics

This section establishes the existing conditions for aesthetic resources in the study area. There are no Federal or State laws regulating aesthetic resources in the study area. The potential effects of the proposed alternatives are discussed, and, as necessary, applicable mitigation measures are described.

4.3.3.1 Affected Environment

The North Yuba, Middle Yuba, and South Yuba rivers originate in the Sierra Nevada. The North Yuba and Middle Yuba rivers converge downstream of New Bullards Bar Reservoir, and the South Yuba River joins just upstream of Englebright Reservoir. The confluence of the Yuba and Feather rivers is located near Marysville.

The visual character of the lower Yuba River is highly variable. Rolling hills above the river are covered with green grass and wildflowers in the spring, fading to a golden brown in the summer and fall. Annual grasslands dominate areas where land is not being farmed. Interspaced riparian, vernal pool, and wetland habitat is located along river corridors and in annual grassland depressions. Grassland, agricultural fields, as well as some areas of barren land surround the lower Yuba River as it flows toward the Feather River near Marysville, creating a typical to indistinctive, medium to low scenic quality. A few rural residences and small communities also are located throughout this area (USBR, DWR, and YCWA 2007).

Views along the lower Yuba River have been extensively altered due to gold and gravel mining with gravel mining still taking place on both sides of the river. Because the river in this area has undergone extensive human modification, riparian vegetation has only re-established itself in a few small areas. There are large areas with little or no vegetation (BLM 2001).

4.3.3.2 Environmental Consequences

4.3.3.2.1 Methodology

Evaluation of the project's potential impacts on visual resources was based on a review of landscapes that could be affected by short and long term project-related activities and elements.

4.3.3.2.2 Basis of Significance

The proposed alternatives would result in a potentially significant impact to visual resources if it would:

- Have a substantial adverse effect on a scenic vista.
- Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic structures.
- 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 views in the area.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats and their associated visual conditions along the Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery

of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. The lower Yuba River ecosystem's visual resources would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Construction of the lower Yuba habitat improvements would result in temporary impacts to visual resources during construction. These temporary impacts include ground disturbance from excavation, which could also include the presence of dust and temporary stockpile areas. The presence of heavy construction equipment during construction would create a temporary visual disturbance. Additionally, there would be a temporary impact due to the use of staging areas and haul routes to store and move construction equipment around the area.

However, these temporary impacts to aesthetics would be low or insignificant, generally restricted to temporary construction periods. Restoration actions are generally consistent with the visual character of the area and would result in long term improvements to aesthetics along the Yuba River once the restoration sites are established. These improvements would primarily result from the conversion of barren landscape to riparian habitat areas.

A potential option for disposing of excavated material is to place the material within the adjacent Yuba Goldfields. This option would be explored in the PED phase and would reduce potential project impacts by reducing distance required for disposal. The Yuba Goldfields are characterized by a large expanse of disturbed area formed by historical and ongoing dredging. Essentially the Yuba Goldfields are largely comprised of large disposal piles of cobble and gravel and additional disposal of excavated material would not represent a significant change in the visual character of the area.

Due to the fact that all impacts to esthetics resources would be temporary in nature and the proposed action would result in long term improvements, these impacts would be less than significant.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Alternative 6 includes all elements of Alternative 5 plus the addition of Increment 1. With the addition of Increment 1, additional aquatic habitats would be created through the excavation of a side channel and back water area in Timbuctoo Bend upstream of Highway 20. Alternative 6 would have similar construction related effects to Alternative 5, with an incrementally higher magnitude from the additional project features. As with Alternative 5, potential effects from Alternative 6 would be short term in nature and result in long term improvements, and therefore would result in a less than significant effects to esthetic resources.

4.3.3.3 Avoidance, Minimization, and Mitigation Measures

Since all impacts to aesthetics would be temporary in nature and less than significant, no mitigation would be required.

4.3.4 Hydrology and Hydraulics

This section describes the existing hydrologic and hydraulic environment in the study area. Hydrologic frequency data referenced in this section were obtained from multiple sources and are not intended to meet USACE hydrologic analysis requirements for Flood Risk Management decision documents; however, the information presented here is suitable to provide an evaluation of the ecosystem restoration alternatives presented in this report.

4.3.4.1 Affected Environment

The Yuba River watershed includes 1,340 square miles in Sierra, Placer, Yuba and Nevada County. The watershed extends from Marysville, Ca in the Sacramento Valley to the Sierra Nevada Mountains in the east up, to an elevation of approximately 8,590 feet mean sea level. The Yuba River has three major tributary rivers: the North Yuba River, the Middle Yuba River, and the South Yuba River. These forks flow together to form the main stem Yuba River which drains into the Feather River, then the Sacramento River, and eventually passes through the Sacramento-San Joaquin Bay Delta into the Pacific Ocean. The proposed actions would be restricted to a reach of the main stem Yuba River referred to as the lower Yuba River, which extends from downstream of Englebright Dam to the confluence of the Yuba and Feather Rivers. Upstream of Englebright Dam will be referred to as the upper watershed.

The hydrology of the Yuba River watershed is complex, consisting of numerous dams, reservoirs, and diversion facilities that store and/or transfer water within and out of the basin, altering both the volume and pattern of water, sediment, organic material, and wildlife. Hydrology in the Yuba River watershed has been significantly altered through historic and current human activities. Initially these changes were driven by large scale hydraulic mining and were later driven by construction of dams, reservoirs, and diversions to address watershed issues and manage water resources. The primary factors affecting hydrology and hydraulics of the Yuba River watershed are historic and ongoing mining; the construction and operation of an extensive system of dams, reservoirs, and diversions; and land use changes.

Mining

The Yuba River suffered perhaps the most significant damage from hydraulic mining of any California river. Approximately 1.5 billion cubic yards of mining debris were washed into the Central Valley from five rivers, with the Yuba River accounting for 40 percent of that total (Mount 1995). Gilbert (1917) as cited in Yoshiyama et al. (2001) estimates that "*…during the period 1849-1909, 684 million cubic yards of gravel and debris due to hydraulic mining were washed into the Yuba River system – more than triple the volume of earth excavated during the construction of the Panama Canal*", and Beak Consultants, Inc. (1989) states "*The debris plain*

ranged from about 700 feet wide and up to 150 feet thick near the edge of the foothills to nearly 3 miles wide and 26 feet tall near Marysville" (Beak Consultants, Inc. 1989).

Hydraulic gold mining during the second half of the 19th century resulted in 684 million cubic yards of gravel and debris washing into the Yuba River system. The material moved from the foothills to the valley floor where it raised the river bed by up to 100ft, resulting in increased frequency and intensity of floods. The California Debris Commission worked to mitigate the impacts of hydraulic mining by constructing debris dams, including Englebright Dam and Daguerre Point Dam, as well as dredging the debris deposited in the lower Yuba River. Dredging of the lower Yuba River continued past initial efforts driven by gold extraction, then later as a source of aggregate. Dredging has resulted in a large 10,000 acre area of undulating dredge spoils berms and ponds. The Goldfields area is porous and acts as a drain for the lower Yuba River above Daguerre Point Dam.

Dam and Diversions

Dam construction and diversions in the Yuba Watershed began to supply gold mining operations with necessary flow to support hydraulic nozzles. Later dams were constructed to sequester the large volumes of mine tailings moving downstream. Several large dams operated by various agencies (Table 4-10) were built for a variety of purposes, including water supply, flood control, hydroelectric power generation and sediment retention (James 2005). The contemporary system is elaborate and complex, consisting of several dams (including 6 over 150 ft. in height, and over 50 additional smaller dams) with facilities in place to store and/or transfer water between the sub-watersheds of the Yuba Basin (i.e., North Yuba, Middle Yuba, South Yuba and Deer Creek), as well as out of basin transfers to major watersheds to the north and south (i.e., Feather River, Bear River and American River) (CBEC 2010).

The hydrology of the Yuba River has been altered by a series of reservoirs and water conveyance facilities that are operated for water supply, hydropower production, and flood control (Mitchell 2010).Three projects export significant amounts of water from the Yuba River watershed. South Feather Water and Power Agency (formerly Oroville-Wyandotte Irrigation District) diverts water from Slate Creek (a tributary to the North Yuba River) to the South Fork Feather River via its South Feather Power Project. PG&E's South Yuba Canal diverts water from the South Yuba River, some of which is consumptively used by the Nevada Irrigation District (NID) and some of which is released into the Bear River Watershed. These diversions also support NID's Yuba-Bear Hydroelectric Project. PG&E's Drum-Spaulding Project diverts water from the South Yuba Watershed, via the Drum Canal, to the Drum Forebay. If that water is used at PG&E's Drum Powerhouse, it is released to the Bear River Watershed. If the water is not used there, it is released to Canyon Creek (a tributary of the North Fork American River), where it is eventually used for consumptive purposes by Placer County Water Agency and other entities.

Table 4-10. Major dams in the Yuba River Watershed (CBEC 2010).

Major Dams	Operating Agency	Date of Completion[1]	Storage (Thousand Acre Feet)[2]	Drainage Sub Basin	Drainage Area (mi^2)
Spaulding	PG&E	~1913	75	South Yuba	118
Bowman	NID	1926	68	Canyon Creek (South Yuba)	28
Fordyce	PG&E	~1926	50	Fordyce Creek (South Yuba)	31
Englebright	USACE	1941	70	Mainstem Yuba	1110
Jackson Meadows	NID	1965	67	Middle Yuba	37
New Bullards Bar	YCWA	1969	966	North Yuba	489

Notes:
1) Dates indicate most recent completion. At most locations facilities were in place earlier, starting as early as 1849.
2) Approximate impounded storage at time of completion, may be less at present. For example bathymetric surveys of Englebright Reservoir have documented a 25% reduction of the initial volume (Childs et al. 2003).
3) Canyon Creek and Fordyce Creek are tributaries to the South Yuba River.
4) Drainage areas are approximate and provided solely for the purpose of comparison

The size and position within the Yuba Basin of these dams provide the ability to store large volumes of water, and therefore regulate the flow regime. The North Yuba has New Bullards Bar Reservoir, located relatively low in the watershed, functioning as the dominant flood control and water supply reservoir in the basin (LYRFTWG 2005). Storage capability in the Middle Yuba and South Yuba basins is comparably small, totaling approximately 307 thousand acre-feet (TAF), with Lake Spaulding, Bowman Lake, Jackson Meadows Reservoir, Fordyce Lake and several smaller impoundments located in the upper extents of the Yuba Basin (YCWA, 2009). The size and position of these impoundments allow the South Yuba and Middle Yuba to respond to larger precipitation and snow-melt events by sending large flood pulses downstream to Englebright Reservoir, and beyond to the lower Yuba River when the capacity of Englebright Reservoir is exceeded. Since 1969 when New Bullards Bar (the last of large dams built in the system) was completed, over 100 flow events have flowed over the crest of Englebright Dam.

Lower Yuba River Flows

The Yuba River downstream of Englebright Dam is a single-thread channel, confined in a bedrock canyon in the uppermost 2 miles, then transitions to a wider bedrock valley and finally, to a wide alluvial valley for 19 miles (YCWA 2013). In the lower Yuba River, Englebright and Daguerre Point Dams play an important role in the altered movement of water, sediment and organic matter.

Englebright is a 260ft concrete arch dam originally constructed to trap mining sediments and debris. The dam also provides for the generation of hydroelectric power, recreational activities, and serves as an afterbay for peak power generation at the New Colgate Powerhouse. During normal flow conditions, water is released from Englebright reservoir through PG&E's Narrows I hydropower facility and YCWA's Narrows II power facility. Water releases are administered by PG&E and YCWA to generate hydroelectric power, irrigation, and other

beneficial uses. During high flows, unregulated flows pass over Englebright dam into the lower Yuba River.

Approximately halfway between Englebright Dam and the Yuba-Feather River confluence is Daguerre Point Dam. This 25 ft. dam was originally constructed to trap hydraulic mining debris. In later years, the head of water created by the dam was leveraged to support several water diversions. Daguerre Point Dam affects the hydrology and hydraulics of the lower Yuba River by providing base level control for incision for the reach immediately upstream. The dam also creates a river stage differential; the river stage above Daguerre Point Dam is more than 20 feet greater than the river stage below the dam. As a result of this differential and as a result of the high permeability of the Goldfield's rocky soil, water from the Yuba River enters the Goldfield area from above Daguerre Point Dam and then migrates down gradient through the Goldfields, forming interconnected ponds and canals throughout the area (DWR, 1999). During all flows, water passes over the crest of the dam.

Despite the presence of several significant dams in the watershed, the lower Yuba River still experiences floods capable of inducing geomorphic changes to the mainstem (Pasternack 2009). A study of the geomorphic thresholds in the Timbuctoo Bend Reach identified several values including: 1) a preferential riffle scouring discharge of <11,000 cfs, 2) a preferential run scouring discharge range of ~9,000-25,000 cfs, 3) a preferential pool-scouring discharge of >45,000 cfs, and 4) a floodplain filling discharge of ~20,000 cfs (Pasternack 2009).

The past and present flood regime of the lower Yuba River is divided into two meaningful hydrologic periods: a transitional period, WYs 1904-1969, and the contemporary, regulated period, WYs 1970-2009, the period following the completion of all major storage projects within the basin (CBEC 2010). Regulation has reduced flood intensity in the lower Yuba River; flood flows with 67% ACE were reduced 67% from 20,100 cfs to 6,700 cfs; flood flows with a 20% ACE were reduced 40% from 61,400 cfs to 36,900 cfs (CBEC 2010). In addition to reducing peak flow values, the large storage reservoirs and in and out of basin transfers alter the annual runoff volume and pattern in the mainstem. In 2007 the Yuba River Accord established minimum flow requirements in the watershed (YCWA 2007) that maintain habitat suitability for fish and wildlife in the lower Yuba River.

The final array of alternatives are located just upstream from the Yuba River near Marysville gage (Gage Number 114121000). There is very little contributing drainage area between the proposed alternatives and the gage. Therefore, this gage reflects the flow conditions at each of the proposed restoration sites. Flows on the Lower Yuba River are highly influenced by upstream reservoir regulation for flood management, hydropower, and water supply purposes. As a result, flows measured at the gage prior to 1972 are not considered representative of the current hydrologic conditions with the reach. Annual peak flows measured from Water Years 1970 through 2016 (45 years of record) at the Yuba River near Marysville gage have ranged from 673cfs in water year 1977 to 161,000cfs in water year 1997. The Sacramento District USACE conducted a hydrology study of the Central Valley in 2015 for the California Department of Water Resources. The study, titled, Central Valley Hydrology Study, 29, November 2015, presented Annual Chance of Exceedance (ACE) estimates for peak flows

measured at the USGS Yuba River near Marysville Gage. The estimates were made using reservoir simulations of rare floods and the results were presented for a range of flood magnitudes from 10% (1/10) ACE to 0.002 (1/500) ACE. Table 4-11 presents these results in tabular format. These flows are considered suitable for evaluation of the ecosystem restoration alternatives presented in this report.

Table 4-11. Peak Discharge vs Annual Chance of Exceedance Estimates, USGS Gage Yuba River near Marysville, from USACE (2015).

Annual Chance of Exceedance	Peak Discharge (CFS)
10% (1/10)	71,700
2% (1/50)	112,000
1% (1/100)	178,000
0.5% (1/200)	212,000
0.2% (1/500)	305,000

4.3.4.2 Environmental Consequences

4.3.4.2.1 Methodology

Evaluation of the project's potential impacts on hydrologic and hydraulic resources was based on a review of driving physical and environmental factors that could be affected by short and long term project-related activities and elements. In addition, a hydraulic analysis performed primarily for the purpose of evaluating potential ecosystem benefits of the proposed alternatives was used to compare existing conditions to the alternatives in the lower Yuba River. Additional information can be found in the Engineering Appendix C.

4.3.4.2.2 Basis of Significance

The thresholds of significance encompass the factors taken into account under NEPA to determine the significance of an impact in terms of its context and intensity. The thresholds for determining the significance of impacts for this analysis are based on the environmental checklist in Appendix G of the State of California's CEQA Guidelines. The alternatives under consideration were determined to result in a significant impact related to hydrology and hydraulics if they would do any of the following:

- 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: (1) substantial erosion or siltation on- or off-site, and (2) substantial increase in the rate or amount of surface runoff in a manner that would result in flooding on- or off-site.
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Place housing within a 1% ACE flood hazard area.

- Place within a 1% ACE flood hazard area structures which would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury, or death involving flooding.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. The hydrologic and hydraulic conditions in the lower Yuba River would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Implementation of Alternative 5 would not affect the primary drivers of hydrology and hydraulics in the watershed (i.e., the extensive system of dams, reservoirs, and diversions resulting in highly managed inflow from upper watershed, natural precipitation patterns, and disruption to sediment transport regime); furthermore effects would be generally limited to the project footprint and areas immediately adjacent. Large scale changes to hydrology and hydraulics are not expected. Inflows and outflows in the lower Yuba River would not be affected by the types of proposed actions. Localized modifications to hydrology and hydraulics could result from project actions, including direct modifications of topography and installation of riparian and hydraulic roughness features. Alternative 5 includes modifications to terrain that involve the excavation and reshaping of terrain to create complex habitat features (i.e. construction of side channels, backwaters, and floodplain lowering). These modifications are designed to affect habitat at low to normal flow (below bankfull) conditions. Under these normal conditions, these modifications would result in additional channel capacity. During normal flood conditions, the lower Yuba River flows into the readily accessible floodplain; during these conditions, project features would be inundated. Alternative 5 would not affect the ability of the river to access high floodplain nor would it affect the hydrology of the watershed and therefore would not result in significant effects to this resource.

Alternative 5 also includes the installation of hydraulic roughness features, including planting of riparian vegetation and installation of woody material and boulders. Installation of woody materials and boulders would be limited and focused on improving and/or maintaining the hydraulic stability of constructed features. Boulders and woody material placements would not be constructed at a scale that would affect the hydrologic or hydraulic conditions of the lower Yuba River. Alternative 5 includes planting of 136 acres of riparian vegetation which could affect the conveyance of flood flows through the lower Yuba River. Potential impacts to flood

flow conveyance from the planting of vegetation would likely be offset through the increase to channel capacity resulting from the excavation of material from topographic modification actions.

Limited hydraulic modeling was completed for this study in support of ecological modeling for proposed actions. The modeling included an evaluation of Future Without Project (FWOP) and Future With Project (FWP) conditions under 3 representative flows (750 cfs, 1,850 cfs, and 5,000 cfs). A comparison of FWOP and FWP water surface elevations near Marysville gage showed a less than one-hundredth of an inch difference in water surface elevation. The effect to water surface elevation would be expected to be proportionally reduced at higher flows where flows have access to a larger floodplain. Given this limited modeling, Alternative 5 would not be expected to alter the existing large flood patterns or increase flood related risk to structures. This does not include the construction of any buildings or structures at risk of flooding nor would it increase the risk of flood damage to existing structures. Furthermore, Alternative 5 does not include the construction of any buildings or elements that would be at risk from floods or increase the risk to people from floods. Given the localized (site specific) changes in hydrology and hydraulics and the negligible effects to water surface elevation, Alternative 5 would result in less than significant effects to hydrologic and hydraulic resources. During the Planning Engineering and Design phase, proposed actions would undergo site specific evaluation (including an evaluation of potential impact to flood risk) such that features would be designed to limit any adverse effects to hydrology and hydraulics. Given these considerations, Alternative 5 would be expected to result in less than significant impacts to hydrology and hydraulics.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Potential effects to hydrology and hydraulics from Alternative 6 would be expected to be similar in type and intensity to Alternative 5. Alternative 6 includes additional restoration features upstream of Highway 20, similar in design to those included in Alternative 5. The addition of these features would increase the geographic range in which topographic/ hydraulic improvements would be implemented; however, as with Alternative 5, potential adverse effects to hydrology and hydraulics would be offset by increases to channel capacity. Given these considerations, Alternative 6 is expected to have less than significant effects to hydrology and hydraulics.

4.3.4.3 Avoidance, Minimization, and Mitigation Measures

Because effects to hydrology and hydraulics from the proposed alternatives are expected to be less than significant, no hydraulic mitigation is required.

4.3.5 Vegetation and Wildlife

This section describes the existing vegetation, wildlife, and habitats which occur in the study area. Biological resources such as plants and animals are important because they influence ecosystem functions and values, have intrinsic value, and are subject to a number of statutory and regulatory requirements. Additionally, this section evaluates the effects of the proposed alternatives on vegetation and wildlife resources in the study area and potential mitigation measures to reduce impacts to a less-than-significant level. Coordination with the USFWS, as directed by the Fish and Wildlife Coordination Act is ongoing, and a draft Coordination Act Report (CAR) is included in Appendix D – Attachment 4.

4.3.5.1 Affected Environment

The proposed project is located within the Yuba River watershed, which is further broken down into three forks: North, Middle, and South Yuba. The analysis of the affected environment will focus primarily on the lower Yuba River downstream of Englebright Lake, where the affected area would be located. Elevations range from 158 to 285 feet above mean sea level (Google Earth, 2017). The majority of the study area is within the channel of the lower Yuba, as well as side channels in the floodplain, riparian areas, and the Yuba Goldfields. The Yuba Goldfields, which are the remnant debris piles of past hydraulic mining, have greatly altered the natural environment. Proposed staging areas and access roads are located on existing dirt roads and previously disturbed areas in blue oak woodlands.

The main aquatic feature of the study area is the Yuba River which receives flows directly from Englebright Lake. After the water flows through the study area, it passes between agricultural lands and the City of Marysville, where it meets up with the Feather River.

A riparian vegetation analysis conducted on the lower Yuba River (LiDAR data collected in 2005 and field verification surveys conducted in July 2011), found that within the bankfull channel (5,000 cfs) vegetation covers approximately 50% of the total area and vegetation covers approximately 20% of the total area within the floodway (21,100 cfs) (Table 4-12). In general, riparian plant cover on surfaces away from the summer baseflow water edge is low, connectivity between older riparian patches and younger patches is low and that species and structural diversity are low throughout most of the study reach as compared to riparian zones of similar Central Valley Rivers (CBEC 2010). The longitudinal distribution of species in the Yuba River downstream of the Englebright Dam shows a trend of limited vegetation in the confined, bedrock areas, with increased vegetation in the less-confined, alluvial areas downstream, which is within expected parameters (Naiman et al. 2005).Willow species were the most abundant species covering a total of 70% of the vegetated areas (SYRCL 2013). In another analysis, the Yuba River watershed guide reported that a majority of the lower Yuba River vegetation is labeled as Barren or Urban-Agriculture (2010).

The low cover of riparian vegetative cover in portions of the lower Yuba River is likely due to a combination of anthropogenic changes generally related to the legacy effects of mining activities in the watershed. Initial impacts to vegetation resulted from large amounts of waste

material washing into the lower Yuba River, burying existing vegetation and altering topography and substrate. The construction of dams and diversions in the watershed have further altered hydrologic and geomorphologic conditions. These impacts have resulted in the removal of historic riparian and degradation of the conditions that support natural recruitment (magnitude, duration, and frequency of inundation, substrate composition, and topography). Woody material and debris from upstream sources are limited from reaching the lower Yuba River due to multiple barriers upstream (New Bullards Bar, Englebright Dam, Daguerre Point Dam, etc.), therefore limiting the habitat complexity of the lower Yuba River and suitable habitat for special status species.

Table 4-12. Estimates of Existing Cover of Riparian Vegetation

Inundation Zone	Vegetation Cover[3] (acres)	Total Area[4] (acres)	% Riparian Vegetation Cover[5]
In Channel[1]	164.7	319	52
Floodplain[2]	264.83	1193	22

[1]In channel inundation zone defined as between baseflow (880 cfs upstream DPD 530 cfs downstream DPD) and bankfull flow (5,000 cfs).

[2]Floodplain defined as between bankfull flow (5,000 cfs) and floodway filling flow (21,100 cfs)

[3]Developed by LiDAR, Lower Yuba River Riparian Vegetation Analysis Report (WSI 2012); data did not include Timbuctoo bend to Englebright Dam reaches.

[4]Developed by hydraulic analysis, Landforms of the Lower Yuba River (Wyrick and Pasternack 2012).

Active (low flow) Channel: The riverbed is generally composed of gravel/cobble, minimal bedrock, and sediment. Vegetation is largely absent from the riverbed, except on areas where sediment accumulations, depth, and water flow allow for the establishment of plants, such as sand/gravel bars or shallow banks. The 2016 annual discharge recorded within the lower Yuba River reach just downstream of the project was approximately 1,952 cfs (USGS 11421000, 2017). The river flow is highly regulated by releases from Englebright Dam, channelization, and old mine tailings. In high flow events, multiple side (or secondary) channels are activated. They are highly dynamic in high flows and create a complex river system.

Floodplain features: Many islands or bars are formed within the floodplain. The bars are sedimentary features within the fluvial channels that are typically formed deposited bed load sediment. Point bars are formed when sediment is deposited along the meander bends and the non-channel bars are formed when sediment is deposited along the middle of a straight channel reach (CRAM Photo Dictionary, 2013). The sediments on the bars range in size and consist of silt, sand, gravel, cobble, and boulders. Due to the sedimentary composition of this river channel, riffles are formed creating portions of rapid flow or surface turbulence in the fluvial channel. While the river does support riparian habitats, the riparian areas are largely distributed in patches along the sides of the floodplain or sparsely situated on top of the gravel bars.

Wildlife: The active channel and flood plain features provide suitable habitat for wildlife by providing nesting, breeding, foraging, and spawning habitat. In addition the riparian vegetation alongside the floodplain provides food and cover for numerous species of birds, mammals, reptiles, emergent aquatic insects, and amphibians. Species of birds may include the Northern harrier (*Circus cyaneus*), Swainson's hawk (*Buteo swainsoni*), Tricolored blackbird (*Agelaius tricolor*), Loggerhead shrike (*Lanius ludovicianus*), and Song sparrow, (*Ammodramus*

sacannarum). Reptile and amphibians may include: pond turtle (*Actinemys marmorta*), green racer (*Coluber constrictor*), and Gilbert's skink (*Eumeces gilbertii*). Bats, such as the Western red bat (*Lasiurus blossevillii*) or Yuma myotis (*Myotis yumanensis*), may also utilize the riparian area. Other common mammal species known to occur in the area include: mule deer (*Odocoileus hemionus*), cougar (*Puma concolor*), and opossum (*Didelphus virginiana*).

Fisheries: The riparian habitat and channel provide rearing habitat for many native and non-native fish species, specifically willows along the banks and gravel bars. Historically, the Yuba River has been a prime spawning location for many fish species since it provided the appropriate temperature, spawning gravel, and riparian cover. As the Yuba River system has been anthropomorphically altered, accessible fish habitat and hydrologic regime has also been disturbed. The influx of dams and mining in the lower Yuba River has altered the movement of sediments, large woody debris, and irregular sediment development, therefore leading to a change in both vegetation development and suitable habitat.

Currently, the river channel and floodplain system, which consists of main channels, secondary channels, side ponds, and backwater areas provide habitat for different native and non-native species. The once diverse multi-channel system now flows in a single channel, which during extreme flow events inundate the floodplain and create back water pools in the historic mining tails. These large flow events also have the potential to strand fish in the pools. These ponds primarily contain non-native fish such as black bass (*Micropterus* spp.), smaller sunfishes (*Lepomis* spp.), and Western mosquitofish (*Gambusia affinis*). Native fishes are also present in some ponds, including Sacramento sucker (*Catostomus occidentalis*) and Sacramento pikeminnow (*Ptychocheilus grandis*). In addition, non-native fish, non-native bullfrogs (*Lithobates catesbeianus*) and non-native crayfish (*Procambarus clarkii*; *Pacifastacus leniusculus*) have also been observed in the ponds (NMFS 2017).

Furthermore, anadromous fish species in the lower Yuba River include: Central Valley fall-run, Central Valley late fall–run, and Central Valley spring-run Chinook salmon (*Onchorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*), native green sturgeon (*Acipenser medirostris*) and Pacific lamprey (*Lampetra tridentatus*), and nonnative striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*). The lower Yuba River is also home to many non-anadromous native fish species including the resident rainbow trout (*O. mykiss*), Sacramento sucker, hardhead (*Mylopharodon conocephalus*), Sacramento pikeminnow, western roach (*Lavinia symmetricus*), prickly sculpin (*Cottus asper*), riffle sculpin (*Cottus gulosus*), speckled dace (*Rhinichthys osculus*), and tule perch (*Hysterocarpus traski*). Nonnative fish species include smallmouth bass (*Micropterus dolomieui*), bluegill (*Lepomis macrchirus*), green sunfish (*L. cyanellus*), red ear sunfish (*L. microlophus*), and mosquitofish (AECOM, 2015).

4.3.5.2 Environmental Consequences

4.3.5.2.1 Methodology

Evaluation of the project's potential impacts to vegetation and wildlife resources was based on a review of vegetation, wildlife, and habitats that occur in the project area and could be affected by short and long term project-related activities and elements.

4.3.5.2.2 Basis of Significance

Under NEPA, the significance of project impacts is a function of context and intensity. For biological resources, context refers to the importance (ecological, commercial, scientific, recreational, etc.) or regulatory (i.e. legally protected) status of the resource, and intensity refers to the magnitude – scale and duration – of the impact. Both beneficial and adverse impacts are recognized; either can be significant.

In the study area, the habitats of greatest importance are riverine habitat and adjacent riparian habitat. These habitats are most important because of their degraded and fragmented condition and high value to fish and wildlife species. Losses or gains of population and habitat for special status species may also be significant, depending on the magnitude of the impact relative to the population size and distribution of the species in the region. Finally, any impact leading to new introductions or the expansion of invasive species would also be considered significant in terms of potential far-reaching effects on the ecosystem of the project area. Adverse effects on vegetation and wildlife were considered significant if implementation of an alternative plan would result in any of the following:

- Result in a substantial loss of native vegetation or species.
- Removal, or substantial disturbance of a sensitive natural community.
- Substantial reduction in the quality and quantity of important habitat or access to such habitat for wildlife species.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. The lower Yuba River ecosystem's vegetation and wildlife resources would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Under Alternative 5, it is expected that there would be low impacts to the existing vegetation. Construction of permanent aquatic features (secondary channels and backwaters) could result in the removal of existing vegetation and permanent conversion of floodplain to riverine habitat. The final alignment of aquatic features would be revisited in Planning, Engineering and Design Phase and existing vegetation would be protected in place when possible. All impacts from removal of vegetation due to construction of permanent aquatic features would be more than offset by associated riparian plantings. Temporary disturbances to vegetation, including removal and/or trimming could occur in areas of the project where grading and excavation would be used to lower the floodplain. The extent of vegetation impacted in this way, would be limited as existing vegetation would be protected in place to the greatest extent possible. Any vegetation removed due to floodplain lowering would be replaced as project design targets the entire lowered floodplain area for planting. Other potential disturbances to vegetation could occur from staging and access activities. Construction access would occur along previously established roads, some paved and some gravel and no impacts to vegetation from access are anticipated at this time. Staging would generally occur in areas with little vegetation, such as previously disturbed areas, gravel bars within the channel, and parking lots. Trees located in staging areas would be protected in place.

Proposed staging areas were identified using satellite imagery and a field verification of vegetation has not been performed at this time. There is potential for elderberry shrubs to occur in or near staging areas, especially for staging areas in downstream reaches. Elderberry shrubs are an obligate host plant for the Threatened Valley Elderberry Longhorn Beetles (VELB) therefore a disturbance to any shrubs would represent a potential adverse impact to the VELB. To avoid, minimize, or mitigate impacts to VELB, the project would be implemented following the conservation guidelines described in the Framework for Assessing Impacts to the Valley Elderberry (USFWS 2017).

The potential impacts to vegetation from Alternative 5 are summarized in Table 4-13. Below. In general disturbance to existing riparian vegetation would be avoided or minimized (through implementation of BMPs) and any removal of vegetation would be more than offset through proposed planting of riparian vegetation, therefore implementation of alternative 5 would result in a less than significant impact to vegetation.

Table 4-13. Summary of Potential Impacts to Vegetation

Alternative	Construction related impacts	Staging related impacts	Planted vegetation	Net Change in Vegetation
Alternative 5 (TSP)	13.4 acres	6 acres	136 acres	116.6
Alternative 6	14.8 acres	7.4 acres	143 acres	120.8

During implementation of the project, common fish and wildlife species could be directly or indirectly affected. Direct effects may include injury or mortality due to movement of large equipment, placement/movement of fill, or construction noise. Indirect effects may include impacts to habitat conditions during construction, but an overall increase in habitat quality is

expected to increase from project implementation. It is also expected that there would be temporary physical and noise disturbance, which could disturb wildlife in and around the project area. This may also cause temporary displacement of wildlife.

While short term impacts could occur to wildlife and vegetation from construction related activities, such as floodplain grading, creation of backwater areas and side channels, and placement of woody material and boulders, these actions would result in long term benefits through the enhancement and creation of aquatic and riparian habitat. For example, the creation of backwater areas would not only enhance juvenile anadromous salmonid rearing habitat, but would also provide enhanced habitat for use by waterfowl, amphibians, and other wildlife species. Furthermore, implementation of BMPs described below would lessen the potential effects of project actions. Project activities would create higher value habitat over the long term for common and special status species of amphibians, reptiles, birds, and mammals. Given these considerations, implementation of Alternative 5 would result in less than significant impacts to vegetation and wildlife resources.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

In addition to the increments included in Alternative 5 (2, 3a, and 5), Alternative 6 would also include implementation of Increment 1. Increment 1 would include creation of additional aquatic habitat features, including 1 side channel and 1 backwater area in the Timbuctoo Bend reach of the lower Yuba River, upstream of Highway 20. This increment would also include 4.9 acres of riparian vegetation planted to complement and enhance function of the aquatic habitat features. The construction methods would be the same as those used to implement Alternative 5; therefore it is expected that the same potential types of impacts to vegetation and wildlife would occur. The additional restoration work of Increment 1 would result in a slight increase in potential short term impacts compared to Alternative 5; however, with implementation of BMPs, short term, construction related impacts would be reduced to a less than significant level. Furthermore, implementation of Alternative 6 would result in long term gains in quality and quantity of riparian and riverine habitats. Given these considerations, Alternative 6 would be expected to result in less than significant impacts to vegetation and wildlife resources.

4.3.5.3 Avoidance, Minimization, and Mitigation Measures

The following measures would be implemented to reduce the potential short-term impacts that could result from the introduction or spread of invasive plant species as result of project construction:

- Prior to work in riparian areas, in-channel work, and floodplain, machinery would be washed to control movement of weeds, invasive species, and sedimentation.
- The project limits would be clearly marked and erosion control fencing would be placed on the edge of work areas that have the potential for run-off or spills. All fencing would be installed prior to construction activities and would be maintained throughout the work period.

- All temporary impacts would be restored to pre-project contour and revegetated as necessary. Avoiding impacts to sensitive resources to the maximum extent possible
- To avoid or minimize the introduction or spread of noxious weeds, the following measures would be incorporated into the proposed project plans and specifications for the project construction sites:
    - Certified, weed-free, imported erosion-control materials (or rice straw in upland areas) would be used.
    - Construction supervisors and managers would be educated by the biological monitor about noxious weed identification and the importance of controlling and preventing their spread. The biological monitor would conduct a tailgate meeting before construction at which handouts identifying noxious weeds would be distributed and workers would be briefed on the techniques used to prevent their spread.
    - To reduce the movement of noxious weeds into uninfected areas, the contractor would stockpile and cover topsoil removed during excavation
- Ensure that construction contractors limit ground disturbance to the smallest feasible areas and that they implement BMPs along with the planting or reseeding of disturbed areas using native plants to assist in the re-establishment of native vegetation.
- Before construction begins, the project engineer and a qualified biologist would identify locations for equipment and personnel access and materials staging that would minimize disturbance to vegetation and wildlife. During construction, as much understory brush and as many trees as possible would be retained.
- Work would not start until June 1 each year to minimize impacts to nesting migratory birds.
- Mitigation measures for special status species are discussed below in Section 4.2.6.

4.3.6 Special Status Species

This section describes special status species that either occur or have the potential to occur in the project area that may be potentially impacted by the project. This section evaluates the effects of the proposed alternatives on special status species in the project area. An initial evaluation determined that several species have the potential to occur, or that suitable habitat exists, in the project area.

4.3.6.1 Affected Environment

For the purpose of this analysis, special-status species include species that are legally protected under the Federal Endangered Species Act (ESA), California Endangered Species Act (CESA), or other regulations including rare plant species listed by the native Plant Society. Migratory birds will also be discussed in this section as a broad group of species that are afforded protection under the Migratory Bird Treaty Act (MBTA). Species identified as species

of special concern by the California Department of Wildlife (CDFW) were not considered in this analysis; however, these species would be considered in a CEQA compliant environmental effects analysis. Information on special status species that may be affected by the project was gathered from various resources:

- USFWS official list of special-status species (Obtained August 16, 2017 through USFWS ECOS-IPaC system)
- NMFS West Coast Region, California (Sourced November 2016) Endangered Species Act List (unofficial list obtained August 2017)
- California Natural Diversity Database BIOs (CNDDB) (August 2017)California Native Plant Society's online Inventory of Rare and Endangered Vascular Plants of California (August 2017)

Each database was queried for special-status species was based on a search of the USGS 7.5' quadrangles that overlap the affected areas (Yuba City, Browns Valley, and Smartsville). All queries were reviewed, suitable habitat for each of the species were compared with the affected areas and project description. In addition to database queries, the public draft EA/IS for the Hallwood Side Channel and Floodplain Restoration Project on the lower Yuba River (USFWS 2017) was referenced for information regarding the potential of occurrence for special status species in the project area. The Hallwood project is within the study area. A total of 28 species were identified as having the potential to occur in the study area, including: 3 amphibians/reptiles, 5 birds, 6 fish, 4 invertebrate, 1 mammal, and 9 plant species. Thirteen of these species were listed as Threatened or Endangered under the ESA. Ten species were identified as likely to occur or as possibly occurring within the study based on presence of suitable habitat or nearby known occurrences; additional information on these species is provided below. The potential for occurrence of all 32 species is summarized in Table 4-14 below.

Table 4-14. Summary of special status species with potential to occur in the study area.

Scientific Name	Common Name	Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Amphibians/reptiles					
Ambystoma californiense	California Tiger Salamander	FT, ST	No designated critical habitat in the Study Area	Restricted breeding in seasonally inundated waters, including artificial ponds, in grassland and oak savannah plant communities, predominantly from sea level to 2,000 ft (609.6 m), in central California	Unlikely; the Study Area does not overlap with species range
Rana draytonii	California red-legged frog	FT	No designated Critical Habitat in the Study area 75 FR 12815-12959, April 16, 2010	Adults require dense, shrubby or emergent riparian vegetation closely associated with deep (>2 1/3-ft), still or slow moving water. Associated with deep pools with dense stands of overhanging willows (*Salix* spp.) and cattails (*Typha latifolia*). Well-vegetated terrestrial riparian areas may provide important winter habitat. Aestivate in small mammal burrows and moist leaf litter. Found up to 100 ft from water in adjacent dense riparian vegetation. Cannot inhabit water bodies that exceed 21.1°C (USFWS 2002)	Possible; there is potentially suitable riparian and aquatic habitat within the Study area.
Thamnophis gigas	Giant Garter Snake	FT, ST	No current designated critical habitat rules have been published	Glenn County to southern edge of San Francisco Bay-Delta and from Merced County to northern Fresno County. Found in small, isolated patches of highly modified agricultural wetlands (Wood et. al 2015). Prefers marsh and wetland habitat including sloughs, drainage canals and irrigation ditches associated with rice cultivation (Halstead et al. 2014)	Unlikely; the Study Area does not support preferred habitat characteristics.

Scientific Name	Common Name	Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Birds					
Buteo swainsoni	Swainson's hawk	ST	NA	Within California Central Valley, the largest population is located between Sacramento and Modesto in the northern San Joaquin Valley. Breeding often occurs in riparian systems with close proximity to agricultural land for foraging (Woodbridge 1998)	Likely; the Study Area overlaps the range of species
Coccyzus americanus	Western Yellow-billed Cuckoo	FT, SE	No critical habitat proposed in the Study Area (79 FR 48547 – 48652; 15 August 2014)	Migrates to area west of the Rocky Mountains to breed in the summer, between June and early September (CDFW 2016). Habitat includes large (>37 acre) patches of riparian thickets or forests with a dense understory (CDFW 2016, Dettling et al. 2015); rare in California, found primarily along Sacramento and Feather rivers (USFWS 2013)	Unlikely; the Study Area does not support large patches of riparian vegetation that are its preferred habitat
Elanus leucurus	White-tailed Kite	FP	NA	Valley lowlands west of Sierra Nevada range. Breeds from February to October in dense tree groves, often in riparian zones	Possible; White-tailed kites have been observed nesting close to the project site.
Haliaeetus leucocephalus	Bald Eagle	SE/ FP	NA	Present year-round at higher elevation areas in California, winter resident in other parts of the state. Nest near lakes or flowing rivers for foraging (USFS 2008)	Possible; the Study Area overlaps the range of species
Laterallus jamaicensis coturniculus	California Black Rail	BCC, ST	NA	Rare; resident of saline, brackish, and fresh emergent wetlands (CDFW 2016). Found along the coast from northern Baja California to Bodega Bay, in the San Francisco Bay, Sacramento-San Joaquin Delta, Salton Sea, along the lower Colorado River, an northern Sierra Nevada foothills (CDFW 2016, Richmond et al. 2010)	Unlikely; Study Area does not support freshwater emergent wetland habitat

Scientific Name	Common Name	Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Fish					
Acipenser medirostris	North American Green Sturgeon	FT	Designated critical habitat in the Study Area (50 FR 52301–52351, October 9, 2009).	Mainstream Sacramento River downstream of Keswick Dam (including the Yolo and Sutter bypasses), the Feather River below Oroville Dam, the Yuba River below Daguerre Point Dam, and the Sacramento-San Joaquin Delta (NOAA 2009)	Likely; the Study Area overlaps the range of the species
Hypomesus transpacificus	Delta Smelt	FT, SE	No designated critical habitat in the Study Area (50 FR 65256-65257, December 19, 1994)	Found only from Suisun Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano and Yolo counties (Sommer and Mejia 2013). Tolerant of a wide salinity range, from to 2-14 ppt (parts per thousand)	Unlikely; the Study area does not overlap species range or provide suitable habitat for the species
Oncorhynchus mykiss	California Central Valley steelhead	FT	Designated Critical Habitat in the Study Area (70 FR 52488–52536, September 2, 2005)	Sacramento-San Joaquin basin; San Francisco, San Pablo, and Suisun bays eastward to Chipps Island	Likely; the Study Area overlaps the range and habitat of species
Oncorhynchus tshawytscha	Spring-run Chinook Salmon	FT, ST	Designated critical habitat in the Study Area (70 FR 52488–52536, September 2, 2005).	Sacramento-San Joaquin basin; San Francisco, San Pablo, and Suisun bays eastward to Chipps Island	Likely; the Study Area overlaps the range and habitat of species
Oncorhynchus tshawytscha	Fall-run Chinook Salmon	MSA	Essential Fish Habitat	Sacramento-San Joaquin basin; San Francisco, San Pablo, and Suisun bays	Likely; the Study Area overlaps the range and habitat of species
Oncorhynchus tshawytscha	Winter-run Chinook Salmon	FE, SE	No designated critical habitat in the Study Area (58 FR 33212–33219, June 16, 1993)	Sacramento basin; San Francisco, San Pablo, and Suisun bays eastward to Chipps Island	Unlikely; the Study Area does not overlap the species range

Scientific Name	Common Name	Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Invertebrates					
Branchinecta conservatio	Conservancy Fairy Shrimp	FE	No designated critical habitat in the Study Area (71 FR 7117-7316, February 10, 2006)	Northern two-thirds of the California Central Valley, at elevations of 16-476 ft (4.9-145 m). Occur in few fragmented localities with short grass vernal pool landscapes. No occurrences documented near Study Area (Eriksen and Belk 1999, CDFW 2016)	Unlikely; Study Area does not support short grass vernal pool habitats
Branchinecta lynchi	Vernal pool Fairy Shrimp	FT	No designated critical habitat in the Study Area (71 FR 7117-7316, February 10, 2006)	Occurs in a variety of vernal pool habitats in California coast ranges and Central Valley and two locations in southern Oregon (USFWS 2006b)	Unlikely; Study Area does not support vernal pool habitats
Desmocerus californicus dimorphus	Valley Elderberry Longhorn Beetle	FT	No designated Critical Habitat in the Study Area (45 FR 52803-52807	Southern Shasta County to Fresno County. Associated with elderberry plants (Talley et al. 2006)	Likely; elderberry plants are present within the Study Area
Lepidurus packardi	Vernal Pool Tadpole Shrimp	FE	No designated critical habitat in the Study Area (71 FR 7117-7316, February 10, 2006)	Vernal pools throughout the California Central Valley. Distribution is patchy within vernal pool complexes (King et al 1996)	Unlikely; Study Area does not support vernal pool habitats
Mammals					
Corynorhinus townsendii	Townsend's Big-eared Bat	Sc	NA	Throughout California; requires caves, mines, tunnels, buildings or other human-made structures for roosting (CDFW 2016)	Unlikely; Study Area does not support preferred roosting habitat
Plants					
Astragalus tener var. *ferrisiae*	Ferris' Milk-Vetch	1B.1	NA	Grows in northern California on clay, alkaline soils that are moist in the springtime, and with elevation from 6 to 46 meters (20-150 ft) (USFWS 2005)	Unlikely; Study Area does not overlap species range

Scientific Name	Common Name	Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Brodiaea sierra	Sierra Foothills Brodiaea	4.3	NA	Found in the Sierra Nevada foothills of Butte, Yuba, and Nevada counties, typically between 320 and 945 m (1050 to 3100 ft) (Preston 2006). Primarily on basic and ultramafic outcrops in chaparral and open areas in foothill woodlands (Preston 2006).	Unlikely; Study Area is below known elevation and does not have ultramafic geology
Clarkia bilba ssp. *brandegeeae*	Brandegee's Clarkia	4.2	NA	Below 2,800 ft in elevation in dry habitats in six northern Sierra counties (USACE 2014). Typically grows in foothill woodland habitat, often in road cuts and gravelly slopes above creeks and rivers.	Unlikely; Study Area does not support preferred habitat
Delphinium recurvatum	Recurved Larkspur	1B.2	NA	Typically found in poorly drained alkaline soils in valley and foothill grasslands and woodlands up to an elevation of 2400 ft.	Unlikely; Study Area does not support preferred habitat
Downingia pusilla	Dwarf Downingia	2B.2	NA	Annual herb that grows in foothill woodlands, valley grasslands, freshwater wetlands in vernal pools (Cal Flora 2017)	Unlikely; Study Area does not support habitat requirements
Juglans hindsii	Northern California black walnut	1B.1	NA	Found throughout riparian forest, riparian woodland communities in California.	Possible; occurrences of this species have been reported in the study area; however, many reported occurrences may be misidentified, hybridized individuals. CNPS notes that only one confirmed native occurrence appears viable as of 2003 (CNPS 2017).

Scientific Name	Common Name	Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Legenere limosa	Legenere	1B.1	NA	Found in a variety of habitats that include vernal pools, vernal marshes, ponds, sloughs, and floodplains of intermittent streams (USFWS 2005). Typically found within grassland, open woodland, or hardwood forest from 0 to 2000 ft elevation (USFWS 2005)	Unlikely; has not been documented to occur along the Yuba River
Monardella venosa	Veiny Monardella	1B.1	NA	Endemic to California; annual herb found in valley and foothill grasslands in Butte, Sutter, Tuolumne and Yuba counties. Blooms May-July (CNPS 2017)	Unlikely; the Study Area does not overlap the range of the species.
Pseudobahia bahiifolia	Hartweg's Golden Sunburst	FE, 1B.1	No current designated critical habitat rules have been published	Endemic to California; annual herb found in valley and foothill woodlands in several CV counties. Blooms May-September (CNPS 2017)	Unlikely; habitat not present in study area and species is considered extirpated from the area

Source: USFWS ECOS IPaC 2017, NMFS 2017; CNDDB, 2017 and CNPS, 2017

Federal

FE = Listed Endangered under the Federal Endangered Species Act
FT = Listed Threatened under the Federal Endangered Species Act
BCC = Listed as Bird of Conservation Concern
MSA = Magnuson Steven's Fisheries Act Managed Species

California Native Plant Society Rank

1B = rare, threatened, or endangered in California and elsewhere
2B = rare, threatened, or endangered in California only
.1 = seriously threatened in California
.2 = moderately threatened in California
.3 = not very threatened in California
4 = plants of limited distribution (watch list)

State

SE = Listed Endangered under the California Endangered Species Act
ST = Listed Threatened under the California Endangered Species Act
Sc = candidate for listing under the California Endangered Species Act
FP = Listed as Fully Protected under California Fish and Game Code Sections 3511, 4700, 5050 and 5515.
T =Threatened

4.3.6.2 Special Status Amphibian Species:

California Red-legged Frog

Status: On May 31, 1996, the CRLF was listed as "Threatened" by USFWS under the Endangered Species Act (61 FR 25813). Due to threats from invasive species and habitat loss, critical habitat was designated on March 13, 2001 (66 FR 14626). On April 13, 2006, a Special Rule Exemption Associated with Final Listing for Existing Routine Ranching Activities in conjunction with the designation of critical habitat for the species occurred (75 FR 12816).

Distribution and Habitat: The historic range of the CRLF is primarily along the coast from Point Reyes National Seashore in Marin County inland to Redding in Shasta County and downwards to Baja California and Mexico. The USFWS has quantified the species to live in only 248 streams in 26 counties, whereas it had previously been documents in 46 California Counties. The CRLF is primarily found within wetlands and streams with dense emergent vegetation that is associated with deep still/slow moving water. Other suitable habitat may include backwaters of ponds, marshes, springs, and reservoirs (61 FR 25813). The dense riparian vegetation and leaf detritus provide protection from predators so that they may burrow and also provides shade from the sun to prevent desiccation. Reproduction typically occurs in the late winter or early spring when females will deposit egg masses on emergent vegetation. The eggs will hatch within one to two weeks, metamorphosis occurs between 3.5 to 7 months, and sexual maturity is reached by 3 years of age. The life span of the CRLF is believed to be 8 to 10 years.

Potential for Occurrence in Project Area: There is possible chance that the CRLF is located within the project area; however, the project area generally contains low quality habitat with minimal riparian cover. This would make it difficult for the species to survive in the project area.

4.3.6.3 Special Status Birds Species:

Five special status bird species were identified as having the potential to occur within the study area. Of those species, 3 were identified as possibly occurring or likely to occur in the study area, including: the Bald Eagle, Swainson's Hawk, and White Tailed Kite.

Bald Eagle

Status: The Bald Eagle was delisted under the ESA but remains listed as Endangered under the California ESA and is also designated as a Fully Protected species under California Fish and Game Code section 3511.

Distribution: 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.

The bald eagle occurs during its breeding season in a variety of wetland habitats such as seacoasts, rivers, large lakes or marshes or other large bodies of open water with an abundance of fish. The Bald Eagle is an opportunistic forager; food habits highly varied across range and site-specific, based on prey species available. Bald Eagles use carrion of fish, birds, and mammals extensively wherever encountered at sites that provide disturbance-free access from the ground. Bald Eagles hunt from perches or while soaring over suitable habitat and attempt to take most prey on the wing (e.g., fish, waterfowl, and small mammals) but success varies greatly.

Potential for Occurrence: This species may occur in the study area during winter months as the study area is provides suitable foraging and nesting habitat.

Swainson's Hawk

Status: Swainson's hawk is Federally listed as a species of concern protected under the Migratory Bird Treaty Act and State listed as threatened.

Distribution: As many as 17,000 Swainson's hawk pairs may have nested in California at one time (DFG 1994). According to the 2005 California Department of Fish and Game (CDFG) survey, an estimated 1,830 pairs of nesting hawks were found in the California Central Valley. September) and winter in Mexico and South America. The Central Valley population migrates only as far south as central Mexico. Swainson's hawks begin to arrive in the Central Valley in March; nesting territories are usually established by April, with incubation and rearing of young occurring through June (Estep 2003).

Swainson's hawks typically occur in California only during the breeding season (March through September) and winter in Mexico and South America. The Central Valley population migrates only as far south as central Mexico. Swainson's hawks begin to arrive in the Central Valley in March; nesting territories are usually established by April, with incubation and rearing of young occurring through June (Estep 2003).

Swainson's hawks are found most commonly in grasslands, low shrub lands, and agricultural habitats that include large trees for nesting. Nests are found in riparian woodlands, roadside trees, trees along field borders, and isolated trees. Corridors of remnant riparian forest along drainages contain the majority of known nests in the Central Valley (England, Bechard, and Houston 1997; Estep 1984; Schlorff and Bloom 1984). Nesting pairs frequently return to the same nest site for multiple years and decades.

Prey abundance and accessibility are the most important features determining the suitability of Swainson's hawk foraging habitat. In addition, agricultural operations (*e.g.*, mowing, flood irrigation) have a substantial influence on the accessibility of prey and thus create important foraging opportunities for Swainson's hawk. Swainson's hawks feed primarily on small rodents, but also consume insects and birds.

Potential for Occurrence in project area: There is suitable foraging and nesting habitat for the Swainson's hawk adjacent to the study area and potentially within some of the proposed staging areas. The study area is within the normal range of the species and occurrences have been recorded in the area. It is likely that this species would occur with the study area.

White Tailed Kite

The white-tailed kite is protected under the MBTA and is a fully protected species under the California Fish and Game Code. White-tailed kites were threatened with extinction in North America during the early twentieth century. Populations recovered throughout its range in the United States from small populations that survived in California, Texas, and Florida. However, since the 1980s, many white-tailed kite populations have been declining, apparently because of loss of habitat and increased disturbance of nests (Dunk 1995).

The breeding season generally extends from early February through early August. White-tailed kites usually nest in large native trees, although nonnative trees also are occasionally used. Nest trees are generally at the edge of wooded habitat next to open fields. Large trees in areas that have been developed may also be used, although the trees need to be close to open fields for foraging (Dunk 1995). White-tailed kites feed primarily on small mammals including voles (*Microtus* spp.), pocket mice (*Perognathus* spp.), and harvest mice (*Reithrodontomys megalotis*).

Potential for Occurrence: White-tailed kites are likely to nest within or around the study area due to the abundance of suitable nesting habitat and adjacent foraging habitat. Large trees located in the study area provide suitable nesting habitat, and row and field agricultural lands and grasslands provide suitable foraging habitat. Although suitable habitat is present, no occurrences have been reported in the study area on CNDDB, therefore this species has been identified as possibly occurring in the study area.

Migratory Birds:

For the purpose of this analysis, migratory birds are considered as a group for their relative likelihood of occurrence due in part to the great number and diversity of species afforded equal protection under a common law, the Migratory Bird Treaty Act (MBTA). A large number of migratory birds are protected under the MBTA. Additionally, USFWS has identified 18 Birds of Conservation Concern (BCC) with potential to occur within the project area. BCCs are species with potential to become candidate species for listing under the ESA. It is likely that many migratory birds will be present in or adjacent to the study area during construction activities and that many species will utilize project features in the future. Migratory birds would be expected to breed, nest, forage, reside, and migrate through the study area during construction and following completion of construction. The likelihood of a particular species to occur within the study area would vary due to differences in behavior, habitat use, and local, regional, and global environmental conditions.

4.3.6.4 Special Status Fish Species:

California Central Valley Steelhead DPS

Status: The CCV Steelhead DPS was listed as "threatened" on March 19, 1993, by the National Marine Fisheries Service (63 FR 13347). When NMFS completed a 5-year status review of the species, it indicated that the biological status of the species has declined since the previous 5-year review (NMFS 2011). Critical habitat was designated for the species, which including the lower Yuba River from the Feather River confluence to Englebright Dam, on September 2, 2005 by NMFS (70 FR 52488).

Distribution and Habitat: Historically, the CCV steelhead migrated to the upper reaches of Central Valley Streams and rivers up into the foothills for spawning and juvenile rearing. The geographic distribution of the species on the Central Valley Rivers has been significantly impaired from the construction of dams and impoundments. The current distribution of the species is now limited to the valley due to impoundments in the lower foothills, therefore restricting movement upstream. This especially impacts the spawning and juvenile rearing of the species, as they are not able to migrate to suitable spawning habitat and have a smaller area to inhabit. The main distribution of the species is limited to the main-stem of the Sacramento River downstream of Keswick Dam, the Feather River downstream of Oroville Dam, the American River downstream of Nimbus Dam, the Mokelumne River downstream of Comanche Dam, and the various tributaries to the Sacramento River system, Delta and San Francisco Bay. The CCV steelhead have access to the Yuba River up to Englebright Dam as the Yuba River is a tributary to the Feather River.

The CCV steelhead is a very complex species with geographically distributed life stages. The adult holding period in the lower Yuba River is typically from August through March, and the spawning generally occurs from January through April. The majority of downstream movement of the juveniles typically occurs from April through September, but some may stay for one to three years for rearing (USACE 2014).

Potential for Occurrence in Project Area: CCV steelhead are present in the lower Yuba River and would be subject to effects of the project.

Central Valley Spring-run Chinook salmon

Status: On September 16, 1999, the central valley Spring-run Chinook salmon was listed as a Federally "threatened" species by the NMFS (64 FR 50394). After review, NMFS updated this listing on April 14, 2014 (79 FR 20802). Critical Habitat for the species was also posted in 70 FR 52488 on September 2, 2005. Critical habitat includes the lower Yuba River up to Englebright Dam. The central valley Spring-run Chinook salmon have the ability to make it upstream of Daguerre Point Dam by use of the fish ladders (USACE 2014).

Distribution and Habitat: The central valley Spring-run Chinook salmon has been extirpated from much of its historical range. The species past range typically included the

headwaters of major rivers within the Central Valley, but due to dams, water diversions, urbanization/development, logging, grazing, agriculture, and mining, the population of the species has declined. In addition, hybridization of the species with fall-run Chinook salmon and hatchery populations has also affected the species numbers (HDR/SWRI 2007).

In April and June, adult spring-run Chinook salmon will migrate into the lower Yuba River. Spawning will begin in September and continue through October. Although dependent upon water temperatures, central valley Spring-run Chinook salmon embryo incubation occurs September through March within the lower Yuba River (HDR/SWRI 2007) and the fry then disperse downstream after emerging.

Potential for Occurrence in Project Area: Central valley Spring-run Chinook salmon are known to occur within the lower Yuba River and would be subject to effects of the project.

Southern DPS Green Sturgeon

Status: On April 7, 2006, the southern DPS of North American green sturgeon was listed as a Federally threatened species (71 FR 17757). NMFS also designated critical habitat for the Southern DPS of the North American sturgeon on October 9, 2009 (74 FR 52300), which includes the Sacramento River, lower Feather River, lower Yuba River, the Sacramento-San Joaquin River Delta, and San Francisco Estuary.

Distribution and Habitat: Green Sturgeon live in both freshwater and saltwater from the Sacramento River north to British Columbia. It is typical for adults to spend time in oceanic waters, bays, or estuaries when they aren't spawning. While the southern DPS' spawning preferences and specific distribution is unclear, it is believed that their spawning habitat is large cobble substrates in turbulent fresh river mainstems from April through July. They also spawn in deep pools or "holes" (NOAA, 2015). While most of the green sturgeon spawning is believed to occur in the Sacramento River, evidence also suggests that they may spawn in the lower Yuba River too. During May 2011, video surveys conducted on the lower Yuba River show five adult sturgeon immediately below Daguerre Point Dam. Additionally, spawning behavior was noted by two of the individuals (AECOM, 2015). While Daguerre Point Dam does have fish ladders designed for salmonid passage, it is believed that the adult sturgeon are unable to ascend the ladders (YCWA 2011).

Potential for Occurrence in Project Area: Southern DPS of North American green sturgeon are known to occur within the project areas below Daguerre Point Dam and would be subject to project effects in the area.

Essential Fish Habitat (EFH):

According the Pacific Coast Salmon Fisheries Management Plan, the project location contains designated Essential Fish Habitat for Chinook salmon. There are four major components of Chinook Salmon EFH, which the project area contains: 1) Spawning and incubation, 2) juvenile rearing, 3) juvenile migration corridors, and 4) adult migration corridors

and adult holding habitat (NMFS, 2011). While the overall project would have beneficial effects, EFH may be temporarily adversely affected due to sedimentation, turbidity, and in channel work.

4.3.6.5 Special Status Invertebrates:

Valley Elderberry Longhorn Beetle

The USFWS has designated critical habitat for VELB along the American River Parkway and in an area within the Sacramento metropolitan area (54 FR 48229). The species has no State status (the State of California does not list insects).

Distribution and Habitat: The VELB is endemic to the Central Valley and is found in riparian habitats and associated uplands where the elderberry (*Sambucus* spp.), the beetle's food plant, grows. The beetle is a pith-boring species that depends on elderberry plants during its entire life cycle. Larvae feed on tree pith, while adults eat the foliage and possibly the flowers of the plants. The adult stage of the VELB is short-lived, and most of the life cycle is spent in the larval stage. The adults are active from early March through early June with mating occurring in May. Eggs are laid singly, or in small groups, in crevices in elderberry bark and hatch in about 10 days. Larvae bore into the pith of elderberry roots, branches, and trunks to create an opening in the stem within which they pupate, remaining in this stage for one to two years before emerging as adults. After metamorphosing into an adult, the VELB chews a circular exit hole through which it emerges, sometime during the period of late March to June. It has been suggested that the VELB is a poor disperser, based on the spatial distribution of occupied shrubs.

Potential for Occurrence in Project Area: There are 7 known CNDDB records in the vicinity of the project area. Although elderberry shrubs are known to occur throughout the lower Yuba River, the shrubs were found to be most abundant in the downstream-most reaches near Marysville and Hallwood. The majority of plants are distributed in areas above the valley floor and as proximity to the wetted edge of the river increases, the number of plants declines (YCWA 2013b). Given these considerations, elderberry shrubs and VELB may occur in the project area.

4.3.6.6 Special Status Plant Species:

Of the 9 special status plant species initially identified as having the potential to occur in the study area, only one species, Northern California black walnut (*Juglans hindsii*) was identified as potentially occurring in the study area.

Northern California black walnut

Status: The Northern California black walnut is ranked as a 1B.1 status species on the CNPS Inventory of Rare and Endangered plants. A 1B.1 ranking identifies the species as rare, threatened, or endangered in California and elsewhere and as seriously threatened in California (CNPS 2017).

Distribution and Habitat: The historic range of the Northern California Black Walnut is in riparian forest and riparian woodland communities at elevations from 150 – 3000 ft in central and southern California. Most, if not all, natural stands of the species are associated with former Native American camps. The species has become naturalized in the interior coast ranges and central valley. The species is threatened by hybridization with orchard trees, urbanization, and conversion to agriculture. Most of the plants in the northern range of the species are assumed to be the result of hybridization with eastern black walnut (*Juglans nigra*) (Stuart 2001).

Potential for Occurrence in project area: Calflora has reported 24 occurrences of this species in Yuba County (source California Department of Fish and Wildlife Vegetation Classification and Mapping Program). CNDDB reports only one occurrence in the 3 quadrats considered. This species often hybridizes with orchard trees and eastern varieties and it is unclear whether reported occurrences in the study area are valid. Due to uncertainties in the occurrence for this species in the study area has been identified as possible. Surveys would need to be conducted prior to project construction to evaluate potential impacts to this species.

4.3.6.7 Environmental Consequences

4.3.6.7.1 Methodology

Evaluation of the project's potential impacts to special status species was based on a review of special status that occur or have the potential to occur in the project area and could be affected by short and long term project-related activities and elements. A list of special-status species was developed by obtaining sensitive species lists from the NMFS, USFWS, CNDDB, and other projects in the area as described in the affected environment section above.

4.3.6.7.2 Basis of Significance

Under NEPA, the significance of project impacts is a function of context and intensity. For biological resources, context refers to the importance (ecological, commercial, scientific, recreational, etc.) or regulatory (i.e. legally protected) status of the resource, and intensity refers to the magnitude – scale and duration – of the impact. Both beneficial and adverse impacts are recognized; either can be significant.

In the study area, the habitats of greatest importance are riverine habitat and adjacent riparian habitat. These habitats are most important because of their degraded and fragmented condition and high value to fish and wildlife species. Losses or gains of population and habitat for special status species may also be significant, depending on the magnitude of the impact relative to the population size and distribution of the species in the region. Finally, any impact leading to new introductions or the expansion of invasive species would also be considered significant in terms of potential far-reaching effects on the ecosystem of the project area. Adverse effects on special status species were considered significant if implementation of an alternative plan would:

- Directly or indirectly reduce the growth, survival, or reproductive success of species listed or proposed for listing as threatened or endangered under the FESA.
- Directly or indirectly reduce the growth survival, or reproductive success of substantial populations of Federal species of concern.
- Substantial interference with the movement of any native resident or migratory wildlife species or with the established native resident or migratory wildlife corridors.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. The Yuba River ecosystem's habitat would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Implementing Alternative 5 would have direct and indirect effects on the environment, special status species, migratory birds, critical habitat, and EFH. The proposed in channel work, such as lowering and excavating the floodplain to facilitate more frequent inundation or for the placement of Engineered Log Jams, would temporarily disturb soil and sediments therefore causing an increase in turbidity and sedimentation. These effects could potentially interfere with feeding, social organization, spawning, rearing, and juvenile survival in fish species; however, these effects would be expected to be short term and localized to the project area. Mitigation measures would be implemented to minimize effects of sedimentation and turbidity to special status species and habitat.

The project also has the potential to interfere with the movement of native resident or migratory wildlife species through disruption to nesting, foraging, and migratory habitat. Construction related impacts to migratory birds would be limited by protecting existing habitat elements in place and limiting construction related disruptions during critical periods (i.e., nest). Construction would begin in June each year, which would be expected to avoid the primary nesting season for many species. Furthermore, prior to construction, surveys would be conducted to assess the potential for project actions (staging, access, and construction) to impact migratory birds and other vegetation and wildlife resources. In general staging and access would result in minimal impacts to existing vegetation (section 4.2.5) and design of features would prioritize the protection of existing vegetation in place.

Construction equipment have the potential to leak toxic substances such as gasoline and diesel, lubricants, and other petroleum-based projects. As a result of spills or leaks in storage

containers, the substances could enter waterways within and adjacent to the project site, causing mortality or physiological impairment of fish or disrupt other behavioral patterns. Development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) and other BMPs described below, would reduce potential impacts from leaks to a less than significant level.

Despite the temporary impacts, the project would be beneficial overall by increasing habitat quality and quantity. Excavating gravel to create additional floodplain and side channels would emulate a more natural river system and create more suitable habitat. Placement of Large Woody Material and Engineered Log Jams would not only stabilize channel features but provide valuable habitat that wildlife may use for feeding, resting, concealment from predators, and rearing. These would also help increase organic matter in the lower Yuba River system and increase habitat complexity. Another long term benefit of the project is to create a more diversified riparian community, which can provide spawning habitat as well as provide shade which can help lower water temperatures. The lowering and grading of floodplains would improve the availability of habitats used by rearing fish. Although implementation of Alternative 5 could result in short term impacts to special status species, implementation of BMPs would reduce potential construction related impacts to a less than significant level. Furthermore, the project would result in long terms gains in habitat quality and quantity; therefore, implementation of Alternative 5 would result in less than significant impacts to special status species.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Alternative 6 includes all elements of Alternative 5 plus the addition of Increment 1. With the addition of Increment 1, additional aquatic habitats would be created through the excavation of a side channel and back water area in Timbuctoo Bend upstream of Highway 20. Alternative 6 would have similar construction related effects to Alternative 5, with an incrementally higher magnitude from the additional project features. As with Alternative 5, these effects would be short term in nature and with implementation of BMPs and mitigation measures, less than significant. Improvements to aquatic and riparian habitat would result in long term benefits for special status species.

4.3.6.8 Avoidance, Minimization, and Mitigation Measures

The following measures would be implemented to reduce the potential short-term impacts to special status fish species as result of project construction and proposed alternatives:

- During construction, stockpiling of construction materials, portable equipment, vehicles, and supplies would be restricted to designated construction staging areas.
- USACE would provide a NMFS-approved Worker Environmental Awareness Training Program for construction personnel to be conducted by a NMFS-approved biologist for all construction workers prior to the commencement of construction activities. The program would provide workers with information on their responsibilities with regard to Federally-listed fish, their critical habitat, an overview of the life-history of all the

species, information on take prohibitions, protections under the ESA, and an explanation of terms and conditions identified in this BO.

- Erosion control measures would be implemented as appropriate to prevent sediment from entering surface waters, agricultural water features, and storm drains to the extent feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on exposed slopes.
- In addition, the proposed project would include preparation and implementation of a SWPPP in compliance with the State Water Resources Control Board's General Permit for Discharges of Storm Water Associated with Construction Activity.
- Work would be restricted to a window of June 1 to November 30 to minimize impacts to nesting migratory birds. Prior to construction, surveys would be conducted to determine if site specific conditions require further modification of work windows.
- If project activity is scheduled to occur during the nesting season for special-status bird species (March 1–August 31), focused surveys would be conducted in areas of suitable habitat in and within 500 feet of areas subject to disturbance from project activities, including staging. At least one survey would be conducted within 7 days prior to project construction activities to confirm the presence or absence of sensitive status species. Surveys would be conducted by a qualified biologist.
- In water work would be restricted to a window of July 1 – October 31 downstream of Highway 20 and July 1 – August 31 upstream of Highway 20 to minimize impacts to spawning and rearing fish. In water work windows would be subject to final approval by NMFS.

4.3.7 Water Quality

This section describes the existing surface and groundwater water resources and quality, and jurisdictional wetlands in the project area. Additionally, this section evaluates the effects of the proposed alternatives on the water resources, surface and ground water quality conditions, and jurisdictional wetlands in the project area. Qualitative effects on water quality were estimated based on construction practices and materials, location, and duration of construction.

4.3.7.1 Affected Environment

The Yuba River watershed is approximately 1,340 square miles covering Sierra, Placer, Yuba, and Nevada counties (SRWP 2010). The water flows west from the Sierra Nevada Mountains carrying melted snow run-off and water from the three main Yuba tributary forks down to the confluence with the Feather River. While the primary location of the project is in the lower Yuba River, the overall watershed quality plays a large role in water quality in the project area. Multiple factors affect the water quality of the lower Yuba River including: hydroelectric power generation, dams and reservoirs, mining activities, urbanization, and timber harvesting.

Major dams in the Yuba River watershed completed in dates from 1913 to 1969 include Spaulding, Bowman, Fordyce, Englebright, Jackson Meadows, and New Bullards Bar. Part of the reason the first dams in the Yuba River watershed were created was for gold mining, but later on the use of dams shifted for emphasis on flood control, water supply, and hydropower. The lower Yuba River is currently operating under the lower Yuba River Accord flow regime, which is a joint project between the Yuba County Water Agency and the United States Department of the Interior-Bureau of Reclamation to manage the interests of approximately 17 stakeholders in the area to balance interests of irrigation, conservation, water supply, and fisheries concerns (USACE 2014). The physical, thermal, and chemical changes that occur from water being retained behind dams can greatly affect the downstream quality and temperature of the river.

The lower Yuba River experiences temperature fluctuation from inflows of Deer Creek (RM 22.7), irrigation diversions at Daguerre Point Dam (RM 11.6), and operational releases from Englebright Dam (RM 24). Furthermore, the general width to flow ratio in conjunction with low riparian cover provide opportunity for solar heating of the water. The water within the lower Yuba River can increase up to 7°C from the release at Englebright Dam to the City of Marysville (LYRA 2010), but this is seasonally dependent and influenced by amount of water released from Englebright Dam, solar input, and air temperature. Data taken near Marysville showed that dissolved oxygen concentrations, total dissolved solids, pH, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater organisms (USACE 2012). In 2007, instream flow requirements were codified by the Yuba Accord (YCWA 2007) to maintain suitable habitat in the lower Yuba River for fish and wildlife.

Mercury contamination from hydraulic mining in the watershed poses a risk to environmental and human health. Mercury was used in hydraulic gold mining to increase the removal of gold from hard rock, but mercury particles would wash through the sluice before they could settle and be confined. The accumulated mercury in river sediments pose a risk to human health through consumption of contaminated fish, drinking potentially unsafe water, and improper handling of sediments (Wentz et al., 2014). From an environmental standpoint, mercury methylation and biomagnification are a problem, especially when the biomagnification occurs in great geographic distribution. Many environmental factors such as temperature, dissolved organic carbon levels, salinity, oxidation-reduction conditions, acidity (pH), and concentration of sulfur in the water and sediments influence the rates of mercury methylation as well as demethylation (Wentz et al., 2014). An increased potential for methylation of mercury has also been linked to hydrologic factors including an increased duration and frequency of inundation (Singer 2016).

Mercury levels in natural systems are often reported as either total mercury (HgT) or as (mono) methylmercury (mmHg). Levels are typically provided in units of μg/L (10-6) or ng/L (10- 9) for liquid samples or, for soil samples, in mg/kg (equivalent to parts per million or ppm) or ng/g (parts per billion or ppb). Total mercury levels (HgT) measured within the Goldfield sediments analyzed for the Western Aggregate Reclamation Plan ranged from 0.03 mg/kg to 0.59 mg/kg (SMGB 2014). Analysis of the bank sediments near the USGS gage just downstream of the Goldfields found levels generally less than 0.63 mg/kg (James et al. 2009). Hunerlach et al. (2004) sampled above Daguerre Point Dam and analyzed sediments by size

fraction. That study found concentrations of total mercury (HgT) up to 0.08 mg/kg in the sandy fraction, and up to 1.1 mg/kg in the clay-silt fraction (slightly higher than downstream in the Goldfields). These are above 'normal' background crustal levels (around 0.05 mg/kg, (James et al. 2009)) and consistent with the finding that Sediment sampling near Marysville yielded similar ranges, from 0.1 mg/kg to 0.7 mg/kg (CEDEN 2006-2007).

4.3.7.2 Environmental Consequences

4.3.7.2.1 Methodology

Effects on water quality resources were analyzed qualitatively based on existing water quality monitoring data. Coordination with the Central Valley Regional Water Quality Control Board (CVRWQCB) would occur prior to construction to determine if additional testing would be required. A formal wetland delineation was not conducted, however, for the purpose of this analysis waters within the project area were assumed to be jurisdictional under Section 404 of the Clean Water Act (CWA). In addition, an analysis prepared in accordance with 40 CFR Part 230- Section 404(b)(1) guidelines and ER 1105-2-100, was performed to evaluate the potential for project related discharges into waters of the US to result in unacceptable adverse effects on the aquatic ecosystem (Environmental Appendix D – Attachment 3).

4.3.7.2.2 Basis of Significance

Adverse effects on water quality were considered significant if implementation of an alternative plan would:

- Substantially degrade surface water quality such that it would violate criteria or objectives identified in the CVRWQCB basin plan or otherwise substantially degrade water quality to the detriment of beneficial uses.
- Disturb existing channel banks, channel beds, or levees to the extent that erosion and sedimentation could be accelerated.
- Remove, fill, or substantially disturb a jurisdictional wetland.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural

resource use, regional development, and climate change. The water quality in the area would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Implementation of Alternative 5 would have the potential to impact water quality due to construction related activities and may also affect long term water quality conditions due to changes in habitat types. Increases in sedimentation and turbidity resulting from the restoration activities would be temporary and limited to small and specific areas of the river. With implementation of BMPs to control turbidity and monitoring during construction to ensure turbidity levels are within standards set by the Regional Water Control Board (to be identified in a Water Quality Certification 401 permit), the impacts to water quality would be low to moderate.

Construction of Alternative 5 has the potential to expose clay and silt sized particles which are known to have elevated mercury levels. The finer sized sediments are easily transported downstream into the wetted channel of the lower Yuba River during high flow events. A fraction of the mercury may then methylate and become toxic to fishes and other biota in the lower Yuba River and in downstream waterbodies. Most of the mercury transport occurs during high winter and spring when high flows and run-off scour channels and inundate floodplains resulting in an increase in suspended sediment (Roth et al. 2001). The inundation of floodplains at the time the project is implemented also plays an important role in the methylation, mobilization, and transport of mercury. Methylmercury has a range of toxic effects to fish including; behavioral, neurochemical, hormonal, and reproductive changes.

Under current conditions mercury transport out of the Yuba River is a potential significant impact. All of the major rivers in the Yuba River watershed have been identified as water bodies impacted by mercury. In a statewide survey conducted by the SWRCB's Surface Water Ambient Monitoring Program, the fish tested for mercury in the tributaries of the Yuba River were the highest in the state (Yuba County, 2015). A loading study conducted by Larry Walker and Associates (1997) conducted from October 1994 to September 1995 indicated that the Feather and American River watersheds accounted for approximately 25% of the total mercury passing from the Sacramento River into the Delta. The Sacramento River in turn accounts for approximately 50% of the total mercury passing into the Delta (USEPA 2015). Although no specific thresholds of significance such as a Total Maximum Daily Load (TMDL) for methylmercury has been established for the Yuba River, plans for the development of TMDLs for tributary rivers to the Delta are underway and may warrant specific consideration in the future. A TMDL for methylmercury has been established by the State Water Resources Control Board (SWRCB) for the Sacramento-San Joaquin Delta (Delta) under the Delta Mercury Control Program. The TMDL for methylmercury in the Delta states that average methylmercury concentrations should not exceed 0.08 mg/kg in the Delta. Although the Yuba River is likely a major contributor of mercury to the Delta, especially during periods of high flow, there is insufficient data to quantify the contribution of the Yuba River toward the TMDL for methylmercury.

The potential increase for mercury methylation and subsequent downstream transport as the result of implementation of Alternative 5 would consist of two critical components, (1) potential short term increases due to construction related activities, and (2) potential long term increases in methylation of mercury due to changes in environmental conditions.

Short term increases in methylation of mercury and subsequent adverse impacts to water quality would be minimized through implementation of BMPs, including monitoring during project construction. Surveys would be conducted during PED to identify locations of high risk for mercury contamination and designs would be adjusted accordingly to avoid or minimize risk.

Construction equipment have the potential to leak toxic substances such as gasoline and diesel, lubricants, and other petroleum-based projects. As a result of spills or leaks in storage containers, the substances could enter waterways within and adjacent to the project site, causing mortality or physiological impairment of fish or disrupt other behavioral patterns. Development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) and other BMPs described below, would reduce potential impacts from leaks to a less than significant level.

Long term risks associated with general water quality are low. Overall the long term impacts of the restoration activities would provide a higher quality riverine system and improve water quality. The restored vegetated riparian areas would improve long-term water quality by providing shade that would help moderate stream temperatures and light penetration; and providing root structure and woody material that would help stabilize stream banks, moderate stream velocities, reduce channelization, and reduce erosion and suspended sediments. Potential long term risks associated with increases in mercury methylation are related to project actions of increasing the duration and frequency of inundation of floodplain areas. Methylation of mercury occurs on floodplains as conditions are created that support microbes capable of methylation of mercury and as conditions that support these microbes increase, the rate of methylation could also increase. The potential increase in methylated mercury associated with increased duration and frequency of inundation cannot be quantified, however, the scope of the project can be expressed in acres.

Implementation of Alternative 5 would result in the increase of 38.8 acres of permanently inundated habitat and 47.6 acres of seasonally inundated floodplain habitat. Combined, these habitat improvement represent an increase in duration and frequency of inundation in 86.4 acres of habitat which represents approximately 3% of the full alluvial river corridor (Wyrick and Pasternack 2012). Due to the wide variety of factors that contribute to methylation of mercury, it is not possible to directly quantitatively relate an increase in the frequency and duration of inundation of floodplain areas to an increase in the mercury contamination of a system; however, the comparatively small area of change (compared to the full area contributing to baseline mercury contamination) proposed under this alternative serves to demonstrate the scope of this potential impact.

An important basis of significance is whether the project would adversely affect any waters of the U.S. As stated above, a formal wetland delineation was not conducted, however, for the purpose of this analysis waters within the project area were assumed to be jurisdictional

under Section 404 of the CWA. Although implementation of Alternative 5 would result in temporary and permanent discharges of fill material (including placement of LWM, boulders, and cobble to improve aquatic habitat structure and hydraulic integrity) into waters of the U.S., the alternative would be expected to result in a net increase in waters of the US. The quantity of fill material is not known at this time but would be far less than the 782,000 cubic yards of material (approximately 240 Olympic swimming pools) to be excavated resulting in improvement or creation of up to 86.6 acres of aquatic habitat (floodplain lowering, side channels, backwaters, and bank sculpting; Tables 3-11 through 3-14).

Given the long-term benefits to water quality associated with implementation, net increase in waters of the US, and anticipated minor changes to potential for mercury methylation, implementation of Alternative 5 would be expected to result in less than significant impacts to water quality.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Alternative 6 includes all elements of Alternative 5 plus the addition of Increment 1. With the addition of Increment 1, additional aquatic habitats would be created through the excavation of a side channel and back water area in Timbuctoo Bend upstream of Highway 20. Alternative 6 would have similar construction related effects to Alternative 5, with an incrementally higher magnitude from the additional project features; these effects would be short term in nature and with implementation of BMPs and mitigation measures, less than significant. Improvements to aquatic and riparian habitat would result in long term benefits for special status species. As with Alternative 5, Alternative 6 would be expected to result in a net increase in waters of the U.S., including the excavation of 782,000 cubic yards of material (approximately 327 Olympic swimming pools) resulting in improvement or creation of up to 112.3 acres of aquatic habitat (floodplain lowering, side channels, backwaters, and bank sculpting; Tables 3-10 through 3-14). Given the long term benefits to water quality associated with implementation, net increase in waters of the US, and anticipated minor changes to potential for mercury methylation, implementation of Alternative 6 would be expected to result in less than significant impacts to water quality.

4.3.7.3 Avoidance, Minimization, and Mitigation Measures

Activities conducted in the floodplain, including restoration efforts, have the potential to mobilize mercury and can lead to a greater bioavailability of mercury in the food chain, to reduce this the following mitigation measures are in place:

- Impacts could be minimized by conducting construction at low flows, during dry conditions, and transporting sediments off-site.
- Fine material encountered during grading and excavation would be monitored regularly and tested for mercury concentration. If an area of mercury is encountered during construction that is significantly above the background mercury level then the construction in that area would cease and the proper Federal and state agencies would be

contacted and a method for proceeding would be determined.

- To minimize the risk of mercury contamination in the water, all materials excavated to reach design grades (including the finer-grained clay and silt sediments associated with mercury) would be transported off site and discharged outside of the river corridor.
- During construction, stockpiling of construction materials, portable equipment, vehicles, and supplies would be restricted to designated construction staging areas.
- All hazardous materials, such as fuels, oils, solvents, etc., would be stored in sealable containers in designated locations that are at least 100 feet away from drainages or other aquatic habitats. All fueling and maintenance of vehicles and other equipment would occur within designated areas or at least 100 feet away from drainages or other aquatic habitats.
- Throughout the construction period, water quality (turbidity, settleable material, and visible construction pollutants) would be monitored as required by Section 401 Regional Water Quality Control Board certification requirements.
- Erosion control measures would be implemented as appropriate to prevent sediment from entering surface waters, agricultural water features, and storm drains to the extent feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on exposed slopes.
- In addition, the proposed project would include preparation and implementation of a SWPPP in compliance with the State Water Resources Control Board's General Permit for Discharges of Storm Water Associated with Construction Activity.

4.3.8 Transportation

This section describes the existing transportation system within the study area and evaluates the construction-related effects of the alternatives on the transportation system.

4.3.8.1 Affected Environment

Classification of roadways in Yuba County:

- Freeway: a multi-lane divided highway with a minimum of two lanes in each direction and access provided at interchanges.
- Conventional Highway: a roadway with limited access and few cross streets generally along high-volume corridors that connect cities or unincorporated communities.
- Arterial: a road that accommodates longer distance travel, but also provides access to adjacent residential, commercial, and industrial properties.
- Collector Road: a two-lane roadway that collects traffic from adjacent developments and delivers that traffic to Freeways, Highways, and Arterials. These roads have limited to moderate access control.

- Local road: a road that provides direct access to abutting land and provide for traffic movement within a single-neighborhood or part of a neighborhood. Local roads are designed for low traffic volumes and speeds.

To evaluate a roadway's operational characteristics, a simple grading system is used that compares the traffic volume carried by a road with that road's design capacity. Levels of service (LOS) are used to measure the quality of operational conditions within a traffic stream based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. Six LOS range from A (best) to F (worst) and describe each type of transportation facility discussed above.

Most analyses typically use service flow rates at LOS C, D, or higher to describe acceptable operating service for facility users. LOS E generally is considered unacceptable for planning purposes, unless there are extenuating circumstances or attain a higher LOS is not feasible or extremely costly. For LOS F, it is difficult to predict flow due to stop-and-start conditions. LOS are typically described in terms of traffic operating conditions for intersections, and would be applicable to roadway conditions, as shown in Table 4-15 below.

Table 4-15. Regulatory Criteria for Roadways and Intersections.

Level of Service (LOS)	Description of Traffic Conditions
A	Conditions of free flow; speed is controlled by the driver's desires, speed limits, or roadway conditions.
B	Conditions of stable flow; operating speeds beginning to be restricted; little or no restrictions on maneuverability from other vehicles.
C	Conditions of stable flow; speeds and maneuverability more closely restricted; occasional backups behind left-turning vehicles at intersections.
D	Conditions approach unstable flow; tolerable speeds can be maintained, but temporary restrictions may cause extensive delays; little freedom to maneuver; comfort and convenience low; at intersection, some motorists, especially those making left turns, may wait through one or more signal changes.
E	Conditions approach capacity; unstable flow with stoppages of momentary duration; maneuverability severely limited.
F	Forced flow conditions; stoppages for long periods; low operating speeds.

Source: Transportation Research Board 2000

The haul routes that are proposed for use to access the staging areas and project sites are generally described in Chapter 3. Table 4-16 displays the existing levels of service for these roadways and the LOS Threshold established by Yuba County, where available. Many of the proposed haul roads are small local farm roads, some of which are privately owned and operated dirt or gravel roads. In these cases, no existing data is available, but based on the rural nature of these roads it is assumed that they have existing low traffic counts and only sporadic use.

Table 4-16. Existing Conditions on Major Roadways in the Study Area.

Roadway	Cross Street	Type of Road	Peak Daily Traffic Count	Level of Service Threshold
Highway 20	Hallwood Boulevard	Conventional Highway	10,300	13,500 (LOS D)
Highway 20	Marysville Road	Conventional Highway	7,600	13,500 (LOS D)
Highway 70	Feather River Boulevard	Freeway	17,600	77,400 (LOS D)
Hammonton Smartsville Road	N/A	Collector Road	2,100*	7,800 (LOS D)

Source: Caltrans 2015; Yuba County 2011

* Average Daily Traffic rather than Peak Daily Traffic

4.3.8.2 Environmental Consequences

4.3.8.2.1 Methodology

Evaluation of the project's potential impacts on transportation resources was based on a review of transportation infrastructure in the area that could be affected by short and long term project-related activities and elements.

4.3.8.2.2 Basis of Significance

Adverse effects on transportation were considered significant if implementation of an alternative plan would result in any of the following:

- Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system;
- Expose people to significant public safety hazards resulting from construction activities on or near the public road system; or
- Result in inadequate emergency access.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural

resource use, regional development, and climate change. The traffic conditions in the area would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

As described in Chapter 3, the proposed action would include the hauling of disposal material from the restoration sites to an offsite disposal facility. During construction of Alternative 5, it is assumed that 24 trucks would be hauling 10 loads a day between the restoration sites and the disposal facility. In addition to these trucks, there would be between 5-25 (depending on construction activity) construction workers commuting to and from the study area. All restoration sites would be located along the lower Yuba River and no public roadways would be altered by a construction action.

The proposed haul routes are primarily located in rural areas and the addition of the vehicles described above would not significantly impact the traffic or flow on these roadways to the point where the level of service of any roadway would exceed the thresholds described in Table 4-16 above. In addition, there would not be additional significant public hazards created by the construction of Alternative 5. There would be no change in the emergency access conditions in the study area.

There is the potential that the additional presence of heavy construction vehicles on the roadways could cause damage to the roadways. However, with implementation of the proposed mitigation measures, this damage would be less than significant. Given these considerations, implantation of Alternative 5 would result in less than significant effects to transportation in the area.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Alternative 6 includes all elements of Alternative 5 plus the addition of Increment 1. With the addition of Increment 1, additional aquatic habitats would be created through the excavation of a side channel and back water area in Timbuctoo Bend upstream of Highway 20. Alternative 6 would have incrementally higher construction related effects compared to Alternative 5, due to construction of additional project features; however, as with Alternative 5, these effects would be short term in nature and with implementation of BMPs and mitigation measures, less than significant.

4.3.8.3 Avoidance, Minimization, and Mitigation Measures

In order to further reduce the effects from traffic, measures would be implemented which could include, but are not limited to, the following:

- The contractor would be required to prepare a Traffic Control and Road Maintenance Plan and coordinate it with Yuba County.
- Parking for construction trucks, equipment, and worker vehicles would be confined to the

designated staging areas.

- Emergency vehicle access would be made available at all times. The contractor would be required to coordinate with local emergency responders to inform them of the construction activities, impacts, and schedule prior to construction.
- The construction contractor would assess damage to roadways used during construction and repair all potholes, fractures, or other damages.
- Following construction, any temporary access and haul routes would be restored to pre-project conditions.

4.3.9 Recreation

This section describes the existing recreational setting within the study area and evaluates the construction-related effects of the alternatives on the recreational opportunities.

4.3.9.1 Affected Environment

The primary recreation activities within the project area are fishing, boating, recreational exercise and wildlife viewing. Other activities may include hunting, swimming, and gold panning. Hiking and boating opportunities in the lower Yuba River are limited by poor access. Informal public river access in the 24-mile long lower Yuba River is available at Parks Bar approximately 5 miles northwest of Smartsville and the Hallwood Avenue Access approximately five miles northeast of Marysville. Off-road vehicle (OHV) activities are popular on the sand bars adjacent to Parks Bar.

Formal recreation areas along the Yuba River that are operated by Yuba County include Sycamore Ranch and Hammon Grove Parks near the Dry Creek and lower Yuba River confluence. Sycamore Ranch is a 90 acre park that includes both tent and RV camping, picnic areas, horseshoe pits, volleyball courts, and a boat launch. Hammon Grove is a smaller 46 acre day-use park adjacent to Sycamore Ranch that features picnic areas, hiking trails, and horseshoe pits. These parks are located just downstream of the proposed Increment 3a restoration area (Yuba County 2007).

Where access is available, fishing, picnicking, rafting, kayaking, tubing, and swimming are the dominant recreational uses. The lower Yuba River offers excellent American shad, Chinook salmon, and steelhead, smallmouth bass, and striped bass fishing.

4.3.9.2 Environmental Consequences

4.3.9.2.1 Methodology

Evaluation of the project's potential impacts on recreational resources was based on a review of recreational opportunities in the area that could be affected by short and long term project-related activities and elements.

4.3.9.2.2 Basis of Significance

Impacts to recreation would be considered significant if implementation of an alternative would result in any of the following:

- Eliminate or substantially restrict or reduce the availability, access, or quality of existing recreation sites or opportunities in the project area; or
- Result in inconsistencies or non-compliance with regional planning documents.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, there would be no improvements to the riparian and aquatic habitat along the Yuba River and no associated impacts to recreation. Unless another organization decided to implement habitat improvement measures, the recreation conditions in the area would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

The proposed habitat restoration increments would not directly impact either of the formal recreation sites in the study area. However, temporary impacts would occur to the informal recreation access points and recreation users of the river itself. There are proposed staging areas located in the vicinity of both the Hallwood and Parks Bar river access points. The proposed staging areas would not restrict access at these locations, but they would cause the area to have a degraded recreation experience due to the presence of heavy construction equipment, increased dust, and noise. These impacts would be significant, but with implementation of the proposed mitigation measures they would be reduced to less than significant.

A temporary impact could occur during construction from the construction and presence of the temporary bridge crossings. These would restrict stream access for temporary periods of time to allow for construction access to some restoration sites. When present, boating would not be feasible in some stretches of the river. This impact would be significant, but would be reduced to less than significant with mitigation.

Additionally, there would be a long-term impact to the informal OHV use areas, as some restoration sites would be constructed in and adjacent to these areas. The restoration sites would not be usable for OHV activities. However, since these are informal recreation uses in the area, and since there would still be land permanently available for these activities, this impact would be considered less than significant. Given these considerations, implantation of Alternative 5 would result in less than significant effects to recreational opportunities in the area.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Impacts resulting from implementation of Alternative 6 would include all of the impacts described under Alternative 5, with the addition of the presence of an additional staging area in the vicinity of Parks Bar. The impacts associated with this additional staging area would be consistent with those described in Alternative 5. These additional impacts would be less than significant, with the implementation of the proposed mitigation measures.

4.3.9.3 Avoidance, Minimization, and Mitigation Measures

To reduce effects to recreation areas to less than significant, the following measures would be implemented:

- To ensure public safety, flaggers, warning signs, and signs restricting access would be posted before and during construction, as necessary.
- Temporary fencing would be erected in order to prevent public access to the project areas during construction.
- In areas where recreation traffic, including boating, intersects with construction vehicles, traffic control would be used to maintain public safety, as appropriate.

4.3.10 Cultural Resources

This chapter describes the environmental setting associated with cultural resources, assesses the effects to cultural resources that would result from implementation of the proposed alternative, and presents mitigation measures that would reduce these effects to a less than significant level. Cultural resources are defined in this chapter as prehistoric and historic archaeological sites, the historic built environment, and traditional cultural properties.

4.3.10.1 Affected Environment

The lower Yuba River, between Englebright Dam and the city of Marysville covers more than thirty linear miles and crosses different physiographic zones and biomes. This includes the nearly level alluvial plain of the Sacramento Valley Floor near Marysville and the western foothills of the Sierra Nevada Mountains near Englebright Dam. The history of human occupation and exploitation of the areas surrounding this environmentally diverse project area is long and equally complex. Prehistoric occupation of the area likely began around 10,000 years ago. Traditional Native American cultures and technologies developed over the subsequent

millennia until roughly 200 years ago. With the arrival of the first Europeans, Native American culture was consequently subsumed by Early European settlement of California, mining development, hydroelectric development and water control, transportation, and development of agriculture, cattle ranching. Archaeological evidence from these various aspects of human history is located within various portions of the proposed project area.

4.3.10.1.1 Methods Used to Identify Cultural Resources

As the lead federal agency it is USACE responsibility to identify historic properties within the project area and to assess the potential adverse effects under Section 106 of the National Historic Preservation Act (NHPA). Initial inventory efforts for this feasibility study were conducted by a U.S. Army Corps of Engineers, Sacramento District archaeologist. The inventory tasks comprised background research utilizing in-house resources including maps, photographs, site records, reports, and primary source literature from previous USACE' projects conducted in the vicinity of the project area. Records searches were also conducted at the Northeast Information Center in Chico California.

A tribal consultation list provided to USACE by the Native American Heritage Commission (NAHC) indicated various Native American Tribes with interests in the Yuba River. These Tribes were contacted by USACE in July 2017 and provided with maps of the project area and descriptions of the proposed project measures. USACE also requested information regarding cultural resources within the project area.

4.3.10.1.2 Cultural Resource Expectations

Based on the consideration of environmental and cultural background information and the results of the limited cultural resources investigations in the project vicinity, the types of archaeological sites that are likely to be found include Prehistoric archaeological surface features such as artifact scatters, bedrock mortars, isolated artifacts, and buried Prehistoric archaeological deposits. Large sites with complex deposits and features may represent remnants of large settlements or villages and small or low density surface scatters many represent camps or activity areas.

Mining, in many ways drove Euro-American settlement of the area. In the Yuba River Basin has a relatively long history, was developed to an industrial scale by the end of the nineteenth century, and was responsible for the documented massive environmental impacts to river drainages throughout the Sacramento Valley. Also, considering the projects location within lower Yuba River stream channel, it is expected that mining sites and features will constitute dominant elements of the surrounding landscape. As mentioned previously, the undulating dredge piles of the Yuba Gold Field cover almost 10,000 acres. Aside from ubiquitous mining spoil, dredge, or tailing piles, it is also expected that other mining related features such as roads, ditches, canals, abandoned equipment, foundations, and debris are common in the project area.

Remnants of historic settlements, agricultural features, and the remains of historic infrastructure that developed concurrently with mining in the area are also expected to be common within the project area. These features may include foundations, historic debris scatters, old roads and trails, and canals.

4.3.10.1.3 Known Cultural Resources

Archival research and the records search revealed that a limited number of archaeological surveys have been conducted in and around the proposed project area. This background research also revealed the presence of two known Prehistoric and nine historic sites within the proposed project area (Table 1). The Prehistoric sites included an isolated artifact (Site P-58-001896) recorded in ca. 1973 by Peak and Associates. This comprised an isolated granitic mano situated in an open valley near the intersection of Highway 20 and a surface road that runs south to Yuba River and the Yuba Gold Fields. This site has not been formally evaluated, but, as an isolated artifact this site may potentially lack the elements of integrity required for assessing significance and eligibility. Site P-58-388 was recorded by J. Wood and E. Smith in 1975 as a possible midden mound. Nine chert and basalt flaked were reportedly collected from the surface of the site and disturbance from building, disking, plowing, cattle grazing, grading, and erosion was noted. This site has not been evaluated and is potentially eligible for listing on the NRHP.

Historic resources within the APE include Daguerre Point Dam, the Hallwood-Cordua Canal, the Yuba Gold Fields, three historic mining sites, a remnant of an electrical power line, a historic canal, and a portion of the Yuba River South Levee (Table 1). None of these sites have been assessed for integrity, significance, of NRHP eligibility.

Construction of Daguerre Point Dam started in 1910 to contain mining debris following the Woodruff vs. Bloomfield case and under the purview of the California Debris Commission. Through subsequent decades, additions and modifications were made and a significant portion of the dam was rebuilt. Specifically, three training walls were completed in 1935, construction or modifications of fish passages were completed in 1937, 1942, 1949, and 1952, and a major portion of the dam was rebuilt in 1963. Daguerre Point Dam appears to represent a rather unique and old water and sediment control feature associated with a significant aspect of California's history. Portions of the dam are likely more than 100 years old, dam modifications were completed more than fifty years ago, it largely functions as originally intended, and fish passages were added relatively early. The dam is therefore potentially eligible for NRHP listing. However, Daguerre Point Dam has not been fully recorded using the California State Department of Recreation Form 523B for buildings, structures, or objects and it has not been formally evaluated using NRHP Criteria A, B C, or D.

The Hallwood-Cordua Canal was built sometime between 1911 and 1947 to divert water for agriculture. A concrete outlet structure and retaining walls were added in 1964 following the 1964 flood and modern metal diversion gates to channel water into the Stahl Ditch were recently added. Some portions are concrete lined and previously recorded sections of the ditch measure 22 feet wide and 6 feet deep. Portions of the original canal may remain and as the canal is more

than 50 years old, it may potentially be eligible for NRHP listing. However, it appears the Hallwood-Cordua Canal has not been fully recorded using the California State Department of Recreation Form 523B for buildings, structures, or objects and it has not been formally evaluated using NRHP Criteria A, B C, or D.

The project area within the Yuba River drainage runs through roughly 13 kilometers of the expansive Yuba Gold Fields. As a result of almost seventy years of placer dredge mining 9,700 acres hydraulic mining debris from the Yuba River floodplain were shaped into irregular undulating mounds of gravel and cobbles interspersed with ponds. Although the Yuba Gold Fields have not been formally assessed as a historic property, its association with Wendell P. Hammon, arguably a key historic figure in regards to the development of the placer dredge mining industry, suggests the Yuba Gold Fields is potentially NRHP eligible.

Sites P-58-307, P-58-312, and P-58-1287 are all mining sites located along the Yuba River. Sites P-58-307 are P-58-312 are hydraulic mining sites with related features. For P-58-307, this includes a canal, washing pits, out wash, and other possible associated features. Site P-58-1287 appears to be an old remnant of the Yuba Gold Fields. This site, however, has been recently disturbed. None of these mining sites have been formally evaluated and are potentially NRHP eligible.

The historic canal was in use when recorded in 1975. From the original site record it appears this is an agricultural irrigation feature. If this sites has retained its integrity since it was recorded as a functional canal in 1975, it is potential eligible for NRHP listing.

The South Yuba Levee was recorded in 2002, however, the researchers were not able to directly access the levee during this investigation. Its current condition, and therefore, the integrity of the levee is currently unknown. According to the California State, Department of Parks and Recreation Primary Record for the site, construction of the levee was first done in 1876. This indicates the feature is potentially eligible for NRHP listing.

Background research and the records search conducted for the present project indicated that significant portions of the project area have not been adequately surveyed for the presence of cultural resources. The eleven sites identified during initial inventory efforts highlights the potential for additional resources within the current project area. Without a more complete understanding of the overall density of sites and distribution of site types within the project area, the overall impacts of the project on cultural resources cannot be determined.

4.3.10.2 Environmental Consequences

4.3.10.2.1 Methodology

Evaluation of the project's potential impacts on cultural resources was based on a review of known cultural and historically significant resources in the area that could be affected by short and long term project-related activities and elements. The analysis also considered the potential

for unknown cultural and historically significant resources to be disturbed through project activities.

Table 4-17. Cultural Resources Within the Project Area.

Primary Site Number	Trinomial Site Number	Site Description	Eligibility Status
P-58-1896	Not assigned	Isolated granitic *mano*.	Not eligible.
Not assigned	Not assigned	Daguerre Point Dam, 1910–1963.	Not evaluated
Not assigned	Not assigned	Hallwood-Cordua Canal, 1911-1947.	Not evaluated
Not assigned	Not assigned	Yuba Gold Fields, 1903–1968.	Not evaluated
P-58-1619	Not assigned	South Yuba Levee, 1876.	Not evaluated
P-58-307	CA-YUB-289H	Hydraulic mining site.	Not evaluated
P-58-311	CA-YUB-293H	Historic canal.	Not evaluated
P-58-312	CA-YUB-294H	Hydraulic mining site.	Not evaluated
P-58-388	CA-YUB-370	Possible Prehistoric midden mound with chert and basalt flakes.	Not evaluated
P-58-594	CA-YUB-576H	Historic electrical power line route consisting of cleared path with old decayed power poles.	Not evaluated
P-58-1287	CA-YUB-1243H	Dredge mining tailings.	Not eligible

4.3.10.2.2 Basis of Significance

Any adverse effects on cultural resources that are listed or eligible for listing in the NRHP (i.e., historic properties) are considered to be significant. Effects are considered to be adverse if they:

> *Alter, directly or indirectly, any of the characteristics of a cultural resource that qualify that resource for the NRHP so that the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association is diminished.*

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. The cultural resources in the area would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

All of the project related measures, such as riparian planting, floodplain lowering, floodplain terracing and grading, side channel excavations, bank scalloping, and the placement of large woody material and boulders will be limited to the stream channel of the lower Yuba River. Considering the extensive alterations of the stream channel though destructive hydraulic and dredge mining practices, which also in many cases extended beyond the proposed action areas, the potential that these activities could also reveal buried or otherwise obscured Prehistoric archaeological deposits appears to be low. Proposed access routes and staging areas in unsurveyed portions of the study area may contain cultural resources and any modifications to these areas, such as grading, have the potential to impact resources.

Potential indirect impacts to cultural resources, primarily vandalism, could result from increased access to, and use of, the general area during construction. Such disturbance could result in significant disturbances to cultural deposits, the loss of information and the alteration of a site's overall integrity.

It appears that most if the known sites described above have not yet been assessed for eligibility for listing on the NRHP and the proposed alternatives have not been adequately surveyed for the presence of additional resources. There is also potential for the presence of more eligible resources within the project area. Therefore, although potential impacts to cultural resources are unlikely, the proposed alternative's full potential to adversely affect cultural resources is currently unknown. Because of this, a programmatic agreement (PA) shall be developed for this undertaking. Development of this PA will be coordinated with the State Historic Preservation Officer, the Advisory Council on Historic Preservation, tribes, and other interested parties and will contain stipulations regarding identifying cultural resources, assessing resources for significance and eligibility, determining the effects of the undertaking upon NRHP eligible resources, and will include conditions to resolve adverse effects to these resources. In all cases, efforts will be made to avoid and minimize the effects of the undertaking upon cultural resources. It will also contain stipulations on post Section 106 review discoveries and the treatment of human remains. Given these considerations, the implementation of Alternative 5, would results in less than significant impacts to cultural resources.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Alternative 6 includes all elements of Alternative 5 plus the addition of Increment 1. With the addition of Increment 1, additional aquatic habitats would be created through the excavation of a side channel and back water area in Timbuctoo Bend upstream of Highway 20. Alternative 6 would therefore have incrementally higher construction related effects compared to Alternative 5, due to construction of additional project features; however, as with Alternative 5, these effects would be short term in nature and with the development of a PA and implementation of stipulations in the PA to resolve adverse effects would result in a less than significant impact to cultural resources. As with Alternative 5, efforts will be made to avoid and minimize the effects to cultural resources.

4.3.10.3 Avoidance, Minimization, and Mitigation Measures

To reduce effects to cultural resources to less than significant, the following measures would be implemented:

A Programmatic Agreement will be developed in coordination with the State Historic Preservation Officer, tribes, and other interested parties that will include mitigation measures for potential significant impacts or adverse effects to known and unknown historic properties.

4.3.11 Noise

This section describes the existing acoustic conditions within the study area and evaluates the construction-related effects of the alternatives on the acoustic environment.

4.3.11.1 Affected Environment

Sound is energy that is transmitted through the air as the result of a disturbance or vibration, which may evoke an auditory sensation. Noise is generally defined as sound that is loud, unpleasant, unexpected, or disagreeable.

Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency or pitch), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level is the most common descriptor used to characterize the loudness of an ambient sound level. Due to the human ear's ability to detect a wide range of sound-pressure fluctuations, sound-pressure levels are expressed in logarithmic units called decibels (dB). Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) provides this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

Typical sounds range from 40 dBA (very quiet) to 100 dBA (very loud).
Conversation is roughly 60 dBA at three to five feet. As background noise levels exceed 60 dBA, speech intelligibility becomes increasingly difficult. Noise becomes physically discomforting at 110 dBA. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level.

Several rating scales have been developed to analyze the adverse effect of community noise on people. Development of these scales has considered that the potential effect of noise on people largely depends on the total acoustical energy content of the noise, as well as the time of day when the noise occurs. The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often used to describe traffic, community, and environmental noise are defined below (Caltrans 2008):

- **L_{eq}:** the equivalent energy noise level, is the average acoustic energy content of noise during the time it lasts. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure, no matter what time of the day of night they occur.
- **L_{dn}:** the day-night average noise level, is a 24-hour average L_{eq}, with a 10-dBA penalty added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for the greater noise sensitivity of people at night.
- **L_{max}**: the maximum instantaneous noise level during a specific period of time. The L_{max} may also be referred to as the peak (noise) level.
- **CNEL** (community noise equivalent level): A noise level similar to the L_{dn} described above, but with an additional 4.77-dBA penalty for the noise-s ensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. When the same 24-hour noise data are used, the CNEL value is typically about 0.5 dBA higher than the L_{dn} value.

Yuba County has adopted a noise ordinance, codified as Chapter 8.20 of the Yuba County Ordinance Code, to protect the citizens of Yuba County from unnecessary, excessive, and annoying noise and vibration and maintain quiet in areas that exhibit low noise levels. The maximum permissible noise levels for different land uses are shown in Table 4-18 below. The noise ordinance also states that where the ambient noise level is less than designated in this listing, the governing permissible noise level is the respective maximum noise level shown. Furthermore, the noise ordinance also states that it is unlawful for construction or repair work to cause discomfort or annoyance to occur within a residential zone between the hours of 10:00 p.m. and 7:00 a.m. without a permit.

Local regulation of noise involves implementation of general plan policies and noise ordinance standards. Local general plans identify general principles intended to guide and influence development plans. Local noise ordinances typically set forth standards related to construction activities, nuisance-type noise sources, and industrial property-line noise levels. Noise in the Project Area is regulated by the Yuba County General Plan Noise Element and Yuba County noise ordinance (Yuba County 2008).

The existing Yuba County General Plan Noise Element was adopted in 1980 and contains objectives for acceptable noise exposure for several land use designations. The recommended noise level criteria are summarized in Table 4-20. These designations are established for land use planning purposes and are intended to apply to long-term exposure to noise.

Most of Yuba County is rural in nature and areas of the county that are not urbanized are relatively quiet. Areas of the county that are more urbanized are subjected to higher noise levels due to roadway traffic, industrial activities, and other human activities.

Table 4-18. Recommended Ambient Allowable Noise Level Objectives.

Land Use	7 a.m. to 10 p.m. (dBA)	10 p.m. to 7 a.m. (dBA)
Low Density Residential	50	50
Multi-Family Residential	55	50
Schools	45	45
Retail/Commercial	60	55
Passive Recreation Areas	45	45
Active Recreation Areas	70	70
Hospitals/Mental Facilities	45	40
Agriculture	50	50
Neighborhood Commercial	55	55
Professional Office	55	55
Light Manufacturing	70	65
Heavy Manufacturing	75	70

Source: Yuba County 2011

Table 4-19. Yuba County Noise Regulations.

Zone	Time Period	Ambient Level	Maximum Permissible Noise Levels (dBA)
Single-family residential	10 p.m. to 7 a.m. 7 p.m. to 10 p.m. 7 a.m. to 7 p.m.	45 50 55	55 60 65
Multi-family residential	10 p.m. to 7 a.m. 7 a.m. to 10 p.m.	50 55	60 65
Commercial-BP	10 p.m. to 7 a.m.	55	65
Commercial	7 a.m. to 10 p.m.	60	70
M1 (General industrial)	Any time	65	75
M2 (Extractive industrial)	Any time	70	80

Source: Yuba County 2011

Table 4-20. Population Density and Associated Ambient Noise Levels.

	dBA, L_{dn}
Rural	40–50
Suburban	
Quiet suburban residential or small town	45–50
Normal suburban residential	50–55
Urban	
Normal urban residential	60
Noisy urban residential	65
Very noisy urban residential	70
Downtown, major metropolis	75–80
Under flight path at major airport, 0.5 to 1 mile from runway	78–85
Adjoining freeway or near a major airport	80–90

Sources: Cowan 1984; Hoover and Keith 1996.

Within the county, major sources of noise include roadway traffic on state routes, major arterials, and other roadways; railroad noise; aircraft operations at Beale Air Force Base and Yuba and Sutter County Airports; and fixed noise sources from industrial, commercial, mining, and farming activities. People who live or work within the influence of these facilities may experience noise levels which could be considered annoying. Table 15 summarizes typical ambient noise levels based on population density.

Sensitive receptors in the study area that would be impacted by construction noise include intermittent rural residences along the river corridor. Additionally, any wildlife using the area would be considered a sensitive receptor. Recreationists using the river access points and boating on the river could also be disturbed by construction noise.

4.3.11.2 Environmental Consequences

4.3.11.2.1 Methodology

Evaluation of the project's potential impacts on acoustic conditions was based on a review of sensitive receptors in the area that could be affected by short and long term project-related activities and elements.

4.3.11.2.2 Basis of Significance

Effects associated with noise would be considered significant if an alternative would result in any of the following:

- Exposure of persons to or generation of noise levels in excess of standards established in

the local general plan or noise ordinance, or applicable standards of other agencies.

- Substantial short-term or periodic increase in ambient noise levels in the Project vicinity above existing levels without the Project.
- Substantial long-term increase in ambient noise levels in the Project vicinity above levels without the project.

Alternative 1 – No Action

Under the No Action Alternative, USACE would not participate in ecosystem restoration in the Yuba River watershed. As a result, recovery of riparian and aquatic habitats along the lower Yuba River would rely on the implementation of small, independent projects which may fail to address fragmentation of these habitats and disruption to associated processes of these habitats. Outside of the immediate areas of these projects, long-term recovery of the lower Yuba River would rely largely on natural processes, which may be insufficient to address the scope of ecosystem degradation in the face of continued and expanding stressors, including natural resource use, regional development, and climate change. The ambient acoustic conditions in the area would remain consistent with current conditions.

Alternative 5 – Lower Yuba Habitat Increments 2, 3A, 5a, and 5b

Construction activity noise levels at and near the Project Areas would fluctuate depending on the particular type, number, and duration of uses of various pieces of construction equipment. Construction-related material haul trips would raise ambient noise levels along haul routes, depending on the number of haul trips made and types of vehicles used. Table 4-21 shows typical noise levels produced by various types of construction equipment.

Table 4-21. Typical Noise Levels from Construction Equipment.

Construction Equipment	Noise Level (dBA, Leq at 50 feet)
Backhoe	80
Bulldozer	85
Air-Compressor	81
Concrete Mixer	85
Generator	81
Grader	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver	101
Scraper	89
Truck	88

Source: Cowan 1984, Federal Transit Administration 1995

Construction activities associated with the Project would be temporary in nature and related noise impacts would be short-term. Construction would occur between the hours of 7 a.m. to 7 p.m., up to seven days a week. The noise associated with the construction activities would

typically fall within Yuba County's construction exemption for noise, limited to the hours described above (Yuba County Ordinance Code, §8.20.310). During that time, residents, wildlife, and recreationists adjacent to the river would be exposed to increases in noise. Based on the noise falling within the construction exemption, this would be considered less than significant. However, the mitigation measures listed below would be implemented to further reduce noise, as applicable.

Alternative 6 – Lower Yuba Habitat Increments 1, 2, 3a, 5a, and 5b

Implementation of Alternative 6 would result in similar impacts to those described under Alternative 5, with incrementally higher magnitude related to the additional construction included in habitat Increment 1. The addition of Increment 1 would not change the nature or significance of the potential construction related impacts to noise levels, therefore Alternative 6 would result in less than significant impacts to the acoustic environment. The mitigation measures listed below would be implemented to further reduce the noise effects.

4.3.11.3 Avoidance, Minimization, and Mitigation Measures

The following mitigation measures would be implemented to reduce the adverse effects on noise as much as possible:

- Construction activities would be limited to the hours of 7:00 a.m. to 7:00 p.m., up to seven days a week in accordance with the Yuba County Noise Ordinance exemptions for construction (Yuba County Ordinance Code, §8.20.310).
- Construction equipment noise would be minimized during Project construction by muffling and shielding intakes and exhaust on construction equipment (per the manufacturers' specifications) and by shrouding or shielding impact tools.
- All equipment, haul trucks, and worker vehicles would be turned off when not in use for more than 30 minutes.
- Prior to construction of each Phase, the city or county would provide written notification to potentially affected residents, workers, and the general public identifying the type, duration, and frequency of construction activities. Notification materials would also identify a mechanism for residents to register complaints with the city or county if construction noise levels are overly intrusive or construction occurs outside the required hours. The city or county would take corrective action.
- Reduce vehicle and truck speeds to 10 miles per hour.

With the implementation of the above listed mitigation measures, any potentially significant effects from noise and vibration would be reduced to less than significant levels.

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Chapter 5 - Cumulative Impacts

The Council on Environmental Quality's regulations for implementing NEPA define a cumulative effect as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

This section discusses the potential cumulative effects of the Yuba River Ecosystem Restoration Feasibility Study when added to other past, present, and reasonably foreseeable future actions. As presented in Section 4.2.1 – 4.2.12, 12 resources are identified as potentially impacted by the project. These resources could experience a cumulative effect related to the project, and are therefore evaluated below. As described in Section 4.1, other resources (geology, seismicity, land use, and socioeconomics) would not be affected, and are therefore not evaluated below.

5.1 Methodology and Geographic Scope of the Analysis

5.1.1 Methodology

The cumulative effects analysis determines the combined effect of the proposed project with other past, present, and reasonably foreseeable projects. Cumulative effects were evaluated by identifying projects in and around the study area with effects that, when combined with the effects of the proposed alternatives, could have significant adverse or beneficial effects. These potential effects are combined with the potential adverse or beneficial effects of the proposed alternatives to determine the type, length, and magnitude of potential cumulative effects. Significance of cumulative effects is determined by meeting Federal and State mandates and the specific criteria identified throughout Chapter 4 of this document for the affected resources.

5.1.2 Geographic and Temporal Scope

The geographic and temporal scope that could be affected by the project varies depending on the type of environmental resource being considered. As an ecosystem restoration project, adverse effects are generally expected to be limited to short term construction related actions. For most resources, effects would generally be confined in geographic scope to the immediate project area, specifically the Lower Yuba River from Englebright Dam to the confluence of the Yuba and Feather Rivers. The temporal scope would be limited to actions with effects that overlap with the estimated duration of construction for the project (generally a 3 year construction period beginning approximately in 2022). Potentially affected air and water resources extend beyond the confines of the project footprint due to the dynamic nature of these resources. Table 5-1 presents the general geographic areas associated with the different resources addressed in this cumulative effects analysis.

Table 5-1. Geographic Areas that Would Be Affected by the YRER Feasibility Study.

Resource	Geographic Scope	Temporal Scope
Vegetation and Wildlife	lower Yuba River from Englebright Dam to the confluence of the Yuba and Feather Rivers	For the duration of construction and the establishment period.
Special Status Species	lower Yuba River, Feather River, Sacramento River	For the duration of construction and the establishment period.
Water Quality	lower Yuba River, Feather River, Sacramento River	For the duration of construction
Air Quality	Regional Air Quality District (FRAQMD)	For the duration of construction
Climate Change	Regional and Global Environment	For the duration of construction
Aesthetics	lower Yuba River	For the duration of construction and the establishment period.
Hydrology and Hydraulics	lower Yuba River from Englebright Dam to the confluence of the Yuba and Feather Rivers	For the duration of construction
Transportation	Yuba County	For the duration of construction
Hazardous, Toxic, and Radiological Waste	lower Yuba River from Englebright Dam to the confluence of the Yuba and Feather Rivers	For the duration of construction
Noise	lower Yuba River from Englebright Dam to the confluence of the Yuba and Feather Rivers	For the duration of construction
Recreation	lower Yuba River from Englebright Dam to the confluence of the Yuba and Feather Rivers	For the duration of construction
Cultural Resources	Immediate vicinity of the individual sites of construction activity	For the duration of construction

5.2 Past, Present, and Reasonably Foreseeable Future Projects

Projects and actions with the potential to result in cumulative effects are summarized below in Table 5-2. The exact construction timing and sequencing of these projects are not yet determined or may depend on uncertain funding sources. All of these projects are required to evaluate the effects of the proposed project features on environmental resources in the area. In addition, mitigation or mitigation measures must be developed to avoid or reduce any adverse effects to less than significant based on Federal and local agency criteria. Those effects that cannot be avoided or reduced to less than significant are more likely to contribute to significant cumulative effects in the area.

The Yuba River Ecosystem Restoration Feasibility Study and related projects would be located in a rural area of Yuba County. Relevant projects are projects that are related or similar

projects that are reasonably foreseeable, and have the potential to affect the same resources and fall within the same geographic and temporal scope. A cumulative impact refers to two or more individual effects which, when considered together, are significant or compound or increase other environmental impacts. The individual effects may be changes resulting from a single project or a number of separate projects.

Table 5-2. Past, Present, and Reasonably Foreseeable Future Projects

Project Name/ Proponent	Description	Potential cumulative effects
Hallwood Side Channel and Floodplain Restoration Project USFWS, Bureau of Reclamation	Rehabilitate and enhance juvenile rearing habitat for CV fall-run and spring-run Chinook salmon and CCV steelhead in the Lower Yuba River, below Daguerre Point Dam. In addition, the Proposed Project would enhance riparian vegetation through direct planting and improved natural recruitment.	All resources affected during construction action
Yuba River Canyon Salmon Habitat Restoration Project USFWS (Anadromous Fish Restoration Program)	Increase the spawning success and enhance juvenile rearing of the Central Valley spring-run Chinook salmon ESU.	All resources affected during construction action
Yuba Goldfields Sand and Gravel Mining Teichert Aggregates, Western Aggregates, and Baldwin Contracting Company And Springer Family Trust Hallwood Aggregate Facility	Ongoing aggregate dredging along the lower Yuba River.	All resources affected during construction action
Voluntary Conservation Measures USACE	Annual habitat improvement actions related to the ongoing operation and maintenance of Daguerre Point Dam including placement of large woody material and spawning gravel.	All resources affected during construction action
Yuba County General Plan Update Yuba County	The Yuba County General Plan Update Final EIR, in part, evaluated cumulative biological impacts in 2030 associated with implementing the general plan (Yuba County 2011). The cumulative effects assessment stated that past development in Yuba County, ranging from conversion of land to agricultural production to recent expansion of urban development, has resulted in a substantial loss of native habitat to other uses.	All resources affected during construction action

5.3 Cumulative Impacts Analysis

5.3.1 Vegetation and Wildlife

Implementation of the proposed alternatives would contribute to restoration and expansion of riverine and riparian habitat and would benefit aquatic and wildlife species in decline due to the degradation of these habitat types in the study area. As a result, because the YRERS contributes beneficial effects, any cumulative adverse effects that would result from the combination of the other local projects in the area would be minimized by implementation of the

proposed alternatives. As a result, the study would not contribute to a cumulative adverse impact on vegetation and wildlife. The YRERS, in combination with the other restoration projects discussed in Section 1.5, such as the Hallwood Side Channel and Floodplain Restoration Project, would contribute to the overall future health of the lower Yuba River and would improve overall habitat conditions. As a result, any cumulative impacts associated with the study would be beneficial.

5.3.2 Special Status Species

Implementation of the project has the potential to affect special status species through short-term construction-related impacts, such as an increase in turbidity from earth moving activities. However, planned project mitigation measures would limit adverse impacts to a less-than-significant level. By creating new and enhancing existing riverine and riparian habitats, the study would bring significant ecosystem benefits to special status fish species, such as salmonids, steelhead, and green sturgeon. In conjunction with the restoration actions proposed by other projects, such as the Hallwood Side Channel and Floodplain Restoration Project, the proposed restoration project will create new near shore habitat for listed species and improve the overall health of the lower Yuba River's ecosystem. As a result, the study, in combination with these other local projects, would result in beneficial cumulative effects due to improved riparian and aquatic habitat conditions along the Lower Yuba River.

5.3.3 Water Quality

Construction activities have the potential to temporarily degrade water quality through the direct release of soil and construction materials into water bodies or the indirect release of contaminants into water bodies through excavation activities. Related projects, including the Hallwood Side Channel and Floodplain Restoration Project, the Yuba River Canyon Salmon Habitat Restoration Project, ongoing voluntary conservation measures related to DPD continuing operations and maintenance, as well as continuous sand and gravel mining in the lower Yuba River area could be under construction during the same timeframe as this project. If construction occurs during the same timeframe water quality could be diminished primarily due to increased turbidity.

In particular, since the Hallwood Project consists of a similar type of construction as the proposed alternatives, the associated cumulative impacts would be the same as those described in Section 4.2.7 for the YRERS, only at a greater magnitude. This could include an increase in potential methylmercury bioaccumulation associated with an increase in turbidity from construction of the side channels. Additionally, the creation of side channels associated with these projects would result in an increase in flooded, aquatic habitat in the system, which could also result in potential increases in mercury in the system. However, USACE would test for mercury prior to construction, and BMPs would be applied to both the YRERS and Hallwood projects to reduce potential impacts associated with increased turbidity.

All projects would be required to coordinate with the RWQCB and overall water quality will be required to meet the Basin Plan objectives. The proposed riverine and riparian

restoration activities associated with the study would result in less-than-significant effects to water quality. Degradation of water quality from the project would be short term and limited to the construction period. The project would not cumulatively contribute to long-term adverse effects that may result from development projects.

5.3.4 Air Quality

Construction of the proposed alternatives would result in emissions of criteria pollutants, as displayed in Table 4-5; however, with the implementation of mitigation measures these emissions are expected to be below the thresholds of the CAA. All of the related projects discussed above and in Section 1.5 would cumulatively contribute to emissions of criteria pollutants throughout the region, particularly if projects are constructed concurrently, which could have a significant cumulative effect on air quality. It is anticipated that each of these projects would implement separate mitigation plans, as required by air quality control agencies, to reduce the emissions to below significance levels.

5.3.5 Aesthetics

Short-term impacts to visual resources would result from the presence of construction equipment in the river corridor during construction activities. The proposed alternative, cumulatively with the Hallwood Side Channel and Floodplain Restoration Project, would result in a net increase of aquatic and riparian vegetation. These restoration actions would improve the current visual character of the river, which would be a beneficial effect and would reduce any potential significant impacts from ongoing projects along the river, such as the sand and gravel mining operations.

5.3.6 Hydrology and Hydraulics

Implementation of the proposed project would alter the hydrology and hydraulics of the lower Yuba River on a site specific scale; however, the driving factors of hydrology and hydraulics in the lower Yuba River would not be affected. Existing projects control the hydrology and hydraulics of the lower Yuba River to a large extent. Some key projects affecting hydrology and hydraulics in the lower Yuba River are New Bullards Bar, Englebright, and Daguerre Point Dams, levee projects, ongoing sand and gravel mining, and agricultural diversions. Flows in the lower Yuba River are regulated to meet minimum flows. During periods of high precipitation and runoff from the upper watershed, the lower Yuba River is subject to high flows that may pass over the crests of Englebright and Daguerre Point Dams.

In general other projects with the potential to have impacts to hydrology and hydraulics, include existing projects that may augment the magnitude, duration, and frequency of flows through the Lower Yuba river (i.e. flood control, power generation, and water supply), as discussed above. Additionally, some projects have the potential to physically alter the river channel (i.e., habitat restoration projects). A number of laws regulate and/or require consideration of flood risk and it is expected that any project that could augment the flow of water through the lower Yuba River would be required to consider adverse impacts to flood risk

and provide mitigation such that no cumulative impact to flood risk would occur. Potential cumulative impacts from modification of the river channel (habitat restoration) is unlikely, restoration projects would also be generally subject to consideration and mitigation of and potential effects to flood risk. One other major habitat restoration project in the area, the Hallwood Side Channel and Floodplain Restoration Project, involves the removal of a large amount of material from the channel, including a training berm that would result in a net decrease in flood risk. The project would result in an increase to channel capacity and would not contribute to a cumulative risk to flood events in the study area.

5.3.7 Noise

Short term increases to noise levels in the project area would result from construction activities. These effects generally fall within Yuba County's construction exemption for noise and would therefore not result in a significant impact. Other projects could cumulatively contribute to noise levels if they occur in the immediate vicinity of the project actions, however, due to the nature of the construction activities which require a closed construction site to comply with OSHA Safety Standards, this is unlikely to occur. Noise attenuates over distance to become less than significant and as a result would not combine with any of the related projects listed in Section 1.5 or in Table 5-1 above to create a cumulative effect on ambient noise levels.

5.3.8 Climate Change

It is unlikely that any single project by itself could have a significant impact on the environment with respect to GHGs. However, the cumulative effect of human activities has been linked to quantifiable changes in the composition of the atmosphere, which, in turn, have been shown to be the main cause of global climate change (IPCC 2014). Therefore, the analysis of the environmental effects of GHG emissions is inherently a cumulative impact issue. While the emissions of one single project will not cause global climate change, GHG emissions from multiple projects throughout the world have a cumulative effect on global climate change.

It is expected that the primary GHG impacts from present and planned projects in the study area would arise from their construction phases. On an individual basis, each of these projects would mitigate emissions below the general reporting threshold. If these projects are implemented concurrently, it is possible that the combined cumulative effects could be above reporting requirements for GHG emissions. However, with the implementation of mitigation measures, which would be required for each of these projects, the effects would be reduced to less than significant.

5.3.9 Transportation

The study would not have a significant impact on local roadways or traffic in the study area. The only potential impacts are associated with the increase in traffic due to hauling of material on local roadways. Related projects with ongoing operations, like the sand and gravel mining in the area, or any proposed project that is constructing concurrently with the YRERS would cumulatively contribute to increases in traffic. However, ongoing operations such as the

local mining practices is part of the baseline condition and both the YRERS and any other proposed short-term construction project would be expected to implement separate traffic control and mitigation plans, which would reduce the impacts to transportation to below significance levels.

5.3.10 Recreation

Cumulative impacts to recreation are primarily related to other construction projects that could occur during the same time frame as those considered for this study and within the same vicinity as both this study and local recreation opportunities. Recreation opportunities are limited along the Lower Yuba River due to lack of access. The proposed YRERS, Hallwood Side Channel and Floodplain Restoration Project, and other proposed actions are not expected to overlap with formal recreation access points. There would be some disturbance along the river for kayakers or other river users, but these impacts would be short-term and less than significant because of the amount of activity that is part of the baseline condition, including the ongoing gravel and sand mining. The resulting improved riparian and aquatic habitat from these restoration projects would create a more pleasant recreational experience long-term along the river, which would be a beneficial cumulative effect.

5.3.11 Cultural Resources

Cumulative impacts to cultural resources would be primarily related to other construction projects that could occur during the same timeframe as those considered for this study and within the same vicinity as this study. For this study, impacts to cultural resources are considered significant if the proposed alternative would result in any adverse effects on cultural resources that are listed or eligible for listing in the NRHP (i.e., historic properties). Effects are considered adverse if they alter, directly or indirectly, any of the characteristics of a cultural resource that qualify that resource for the NRHP so that the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association is diminished. It is anticipated that each of these projects would conduct separate coordination with appropriate groups and implement separate mitigation plans to reduce the impacts to cultural resources to below significance levels. It is important to acknowledge that even with implementation of avoidance, minimization, and mitigation measures, the full extent of adverse effects may not be mitigated and it is possible that these remnant effects for separate projects could contribute to some degree of cumulative impact; however, given the nature of the proposed alternative, current understanding of cultural resources in the area, and other construction projects occurring in the same time and area, remnant effects to cultural resources would not likely result in a significant cumulative effect.

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Chapter 6 – Compliance with Applicable Laws and Regulations

The status of the proposed action's compliance with applicable Federal environmental requirements is summarized below. Prior to initiation of construction, the work would be in compliance with all applicable Federal laws and Executive Orders.

6.1 Federal Laws

Clean Air Act, as amended, PL 91-604; 42 U.S.C. 1857h-7, *et seq.* *Full Compliance.* The USEPA is the Federal agency responsible for managing the Nation's air quality. USEPA establishes national ambient air quality standards, and oversees the air quality plans developed and implemented by the states. FRAQMD is responsible for developing local district air quality management plans and enforcing regulations pertaining to air emissions in the study area. As discussed in Section 4.2.1, the proposed action would not exceed national air quality standards based on modeled estimates of emission rates during construction of the project.

On November 30, 1993, the USEPA promulgated final general conformity regulations at 40 CFR 93B for Federal activities. These regulations apply to a Federal action in a non-attainment or maintenance area if the total emissions of the criteria pollutants and precursor pollutants caused by the action equal or exceed certain *de minimis* amounts, thus requiring the Federal agency to make a determination of general conformity. As discussed in Section 4.2.1, at least part of the study area is in non-attainment for $PM_{2.5}$. Modeled estimates of emission rates during construction of the project demonstrate that the proposed action would not exceed *de minimis* thresholds, and would be in full compliance with the CAA.

Clean Water Act, PL 92-500; 33 U.S.C. 1251, *et seq*. *Partial Compliance.* The USEPA is the Federal agency responsible for managing the Nation's water quality. USEPA establishes national water quality standards and oversees the water quality plans developed and implemented by the states. The CVRWQCB is responsible for developing local district water quality management plans, issuing permits, and enforcing regulations pertaining to water quality in the study area. In addition, USACE is responsible for issuing Section 404 permits for projects that involve discharge of fill material into Waters of the U.S.

The proposed action would involve discharge of fill material into Waters of the U.S. in the lower Yuba River. Although USACE does not issue permits for their own projects, USACE does comply with the guidelines and substantive requirements of Section 404, including Sections 404(b)(1) and 401. As discussed in Section 4.2.7, a Section 404(b)(1) analysis will be conducted on the TSP and is included in the Environmental Appendix D. The analysis concluded that the project would not result in significant effects to water quality. The construction contractor would be required to implement the measures listed in the mitigation subsection of Section 4.2.7 to avoid or minimize adverse effects on the aquatic ecosystem. Section 401 water quality certification would be obtained from the CVRWQCB prior to initiation of construction.

The proposed action would also require an NPDES permit since it would disturb one or more acres of land and involve possible storm water discharges to surface waters. Prior to initiation of construction, the contractor would be required to prepare a Storm Water Pollution Prevention Plan and then submit a Notice of Intent form to the CVRWQCB, requesting approval of the work. This storm water plan and an In-Water work plan would identify the measures to be implemented by the contractor to avoid or minimize any adverse effects of construction on surface waters.

After the issuance of a 401 certification the project would be in compliance.

Endangered Species Act of 1973, as amended, PL 93-205; 16 U.S.C. 1531, *et seq.*

Partial Compliance. USACE obtained a list of the Federally threatened, endangered, proposed, and candidate species that have the potential to occur in the study area via the USFWS ECOS-IPaC website on August 16, 2017. Based on the locations of the proposed work, the listed species that could be affected by the proposed action include the Yellow-billed Cuckoo, California Red-legged Frog, and Valley Elderberry Longhorn Beetle under the jurisdiction of the USFWS and Southern DPS green sturgeon, Central Valley steelhead, and Central Valley spring-run Chinook salmon under the jurisdiction of NMFS. USACE is currently preparing a Biological Assessment discussing the potential effects of the proposed action on USFWS and NMFS regulated species. The Biological Assessment would be submitted to USFWS and NMFS, along with letters requesting initiation of formal consultation with each of these agencies following or concurrent with public review of the FR/EA. Once USFWS and NMFS have issued Biological Opinions, the study will be in full compliance with this Act.

Fish and Wildlife Coordination Act of 1958, as amended, PL 85-624; 16 U.S.C. 661, *et seq.* *Partial Compliance.* The USFWS is the Federal agency responsible for administering this act, which requires Federal agencies to coordinate with USFWS and State wildlife agencies during the planning of projects that would result in the control or modification of a natural stream or body of water. The FWCA intends that wildlife conservation be given equal consideration with other features of these projects. USACE initiated coordination with USFWS early in the planning process.

The USFWS prepared a draft Coordination Action Report (CAR) (Appendix D – Attachment 4). This report details the vegetation, wildlife, and fisheries resources in the project area; evaluates the potential effects of the proposed action on those resources; determines required mitigation for adverse effects; and provides recommendations for consideration by USACE. Although adoption of the recommendations is not required by the act, USACE usually adopts the recommendations unless there is an overriding consideration not to do so. The CAR would be included in the Final integrated FR/EA to be distributed for public and agency review. Once the CAR is finalized and the recommendations are considered by USACE, the study would be in full compliance with the FWCA.

Magnuson-Stevens Fishery Conservation and Management Act of 1996, as amended, PL 104-267; 16 U.S.C. 1801, *et seq*. *Partial Compliance*. The Magnuson-Stevens Act 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 permitted, funded, or undertaken 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. USACE will incorporate an EFH effects analysis into the Biological Assessment provided to NMFS during formal ESA consultation. Once NMFS has issued a Biological Opinion for the proposed project, the study will be in full compliance.

Migratory Bird Treaty Act of 1928, as amended; 16 U.S.C. 715, *et seq*. *Full Compliance.* USFWS is the Federal agency responsible for administering this act, which implements a treaty between the U.S. and Great Britain (for Canada), Mexico, Japan, and the Soviet Union (now Russia) for the protection of migratory birds. Unless permitted by regulations, this law prohibits anyone to "pursue, hunt, take, capture, kill, attempt to take, capture or kill … any migratory bird …or any part, nest, or egg of any such bird" (16 U.S.C. 703). Areas in the study area have foraging, resting, nesting, and breeding habitat for numerous migratory birds. To the extent possible, USACE would schedule construction outside periods of nesting to avoid or minimize effects on migratory birds. In any case, prior to initiation of construction, surveys would be conducted by a USFWS-approved biologist to determine the presence of migratory birds and/or their nests in or near the work areas. If active nests are found, the USFWS would be contacted for advice and recommendations for how to avoid disturbance and whether a permit is necessary. With the implementation of these actions, the study would be in full compliance with this Act.

National Environmental Policy Act of 1969, as amended, PL 91-190; 42 U.S.C. 4321, *et seq*. *Partial Compliance.* The Council on Environmental Quality (CEQ) is responsible for ensuring that Federal agencies operate in accordance with NEPA, which requires full disclosure of the environmental effects, alternatives, potential mitigation, and environmental compliance procedures of most Federal management, regulation, or funding activities that affect the environment. NEPA requires the preparation of an environmental document to ensure that Federal agencies accomplish the law's purposes. This draft integrated FR/EA is in partial compliance with NEPA. Full compliance will be achieved when the final integrated FR/EA and Finding of No Significant Impact are filed with the USEPA.

National Historic Preservation Act of 1966, as amended, PL 89-655; 16 U.S.C. 470a, *et seq*. *Partial Compliance.* The SHPO in each state is responsible for ensuring that Federal agencies comply with Section 106 of this act, which requires that they consider the effects of a proposed undertaking on properties that have been determined to be eligible for, or included in, the National Register of Historic Places. The Section 106 review process consists of four steps: (1) identification and evaluation of historic properties; (2) assessments of the effects of the undertaking on historic properties; (3) consultation with the SHPO and appropriate agencies to develop a plan to address the treatment of historic properties; and (4) concurrence from the SHPO regarding the agreement or results of consultation.

As discussed in Section 4.2.11, both archeological and historic sites are found in the study area. Although proposed project actions are unlikely to affect known cultural resources, portions of the study area are unsurveyed and may contain cultural resources and additional cultural resources may be discovered during construction; therefore, the full extent of potential effects from proposed project actions are unknown at this time. A Programmatic Agreement will be developed in coordination with the State Historic Preservation Officer, tribes, and other interested parties and will contain stipulations regarding identifying cultural resources, assessing resources for significance and eligibility, determining the effects of the undertaking upon NRHP eligible resources, and mitigating any effects to these resources. The study will be in full compliance with the National Historic Preservation Act of 1966 when a programmatic agreement is executed.

Resource Conservation and Recovery Act of 1976, PL 94-580; 7 U.S.C. 1010*, et seq.* *Pending Compliance.* The USEPA is the Federal agency responsible for administering this act, which regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. The lower Yuba River has known elevated levels of mercury, arsenic, and other hazardous materials that may disturbed due to project actions. The full extent of the contamination and potential for the project to result in adverse environmental effects is unknown at this time.

During PED, a Phase I Site Assessment of the proposed work areas will be conducted, including a database search of recorded spills and a windshield survey of the areas. Any identified hazardous waste at the work sites would be required to be cleaned up completely by the local sponsor prior to initiation of construction of the proposed action. The contractor would also be required to develop a spill prevention, containment, and countermeasures plan to avoid or minimize any effects due to minor accidental spills of fuels, lubricants, and other supplies during construction. Completion of these commitments would put the study in full compliance with this Act.

6.2 Executive Orders

Executive Order 13112, Invasive Species, February 3, 1999. *Full Compliance.* This EO directs Federal agencies to prevent the introduction of invasive species, provide for their control, and minimize their economic, ecological, and human health effects. As discussed in Section 4.2.1, invasive species, including aquatics and weed species, are found throughout the study area. Prior to construction, the construction contractor would be required to prepare an invasive species control plan to be approved by USACE and acceptable to appropriate Federal and State resource agencies. The study would be in full compliance with this order.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, February 11, 1994. *Full Compliance.* This EO directs Federal agencies not to exclude persons from participation in, deny persons the benefits of, or subject persons to discrimination under their programs, policies, and activities because of their race, color, or national origin. As discussed in Section 4.1., the proposed action

would have no disproportionate effects on minority or low-income populations in the study area. Therefore, the study would not be subject to this order.

Executive Order 11988, Floodplain Management, May 24, 1977. *Full Compliance.* This EO directs Federal agencies to avoid, to the extent possible, long- and short-term adverse effects associated with the occupancy or modification of the base flood plain (1% annual event), as well as to avoid direct and indirect support of development in the base flood plain, wherever there is a practicable alternative. As discussed in Section 4.2.4, the proposed action would have no measurable effect on the (FEMA's 100-year) floodplain in the lower Yuba River. In addition, because of the nature of the proposed work, the proposed action would not directly or indirectly support development in the floodplain. The study would be in full compliance with this order.

Executive Order 11990, Protection of Wetlands, May 24, 1977. *Full Compliance.* This EO directs Federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance their natural and beneficial values. As discussed in Section 4.2.5, the proposed action would have a net positive effect on study area aquatic and riparian habitats by creating additional ephemeral and seasonal riverine and riparian habitats. Consequently the study would be in full compliance with this order.

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Chapter 7 – Public Agency Involvement and Review

This chapter describes the public involvement activities associated with the Yuba River Ecosystem Restoration Feasibility Study. To date, public involvement for the study has included completion of a planning charrette; agency meetings and coordination; public notices, media releases (including a website), and meetings; and distribution of the draft interim Feasibility Report/ Environmental Assessment for public review and comment. It is important to note that the scope of this study has been reduced in a number of ways: (1) plan formulation (as described in Chapter 3) resulted in a reduction in geographic scope of the measures carried forward for study in the final array of alternatives, and (2) the PDT determined that the remaining measures would not result in any significant impacts and reduced scope analysis from an Environmental Impact Statement (EIS) to an Environmental Assessment.

7.1 List of Agencies and Persons Consulted

USACE has been coordinating with various Federal, State, and local agencies throughout the duration of the study to discuss the concerns and issues of these agencies regarding the project, including:

- U.S. Fish and Wildlife Service
- National Marine Fisheries Service
- California Department of Fish and Wildlife
- California Department of Water Resources
- U.S. Forest Service
- Central Valley Regional Water Quality Control Board
- Feather River Air Quality Management District

Additional Federal, State, and local agencies and organizations participated in the public scoping process through submission of comments.

7.2 Public Meetings and Workshops

Following the release of the Notice of Intent (NOI) on October 9th, 2015 and Notice of Preparation (NOP) October 12th, 2015, USACE and YCWA hosted a series of 4 joint NEPA/CEQA public scoping meetings. The NOI is included in the Environmental Appendix D. The complete schedule of public scoping meetings included:

- Meeting #1 – Wednesday, October 28, 2015, 1:00 p.m. – 3:00 p.m. at John E. Moss Federal Building Stanford Room (650 Capitol Mall, Sacramento, CA 95814).
- Meeting #2 – Thursday, October 29, 2015, 5:00 p.m. – 7:00 p.m. at Nevada County Library Community Room (980 Helling Way, Nevada City, CA 95959).

- Meeting #3 – Wednesday, November 4, 2015, 5:00 p.m. – 7:00 p.m. at Yuba County Government Center Marysville and Wheatland Conference Room (915 8th Street, Marysville, CA 95901).
- Meeting #4 – Thursday, November 5, 2015, 4:00 – 6:00 p.m. at the Downieville Community Hall (322 Main Street, Downieville, CA 95936)

The meeting locations were chosen because they are each central to various parts of the large geographic region encapsulated in the study area. 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 proposed alternatives and interact with project staff, including representatives of USACE and YCWA. The views expressed in the scoping meeting are summarized below.

7.3 Scoping Comments

Public comments were requested for submission within 30 days after the last scoping meeting (December 5, 2015). A total of 180 people attended the public meetings and a total of 224 comments were received during the public comment period. In general public comments expressed a high degree of support for ecosystem restoration in the Yuba River watershed. The health of the native fisheries in the Yuba River watershed has been at the center of extensive study and public debate and the great majority of comments were related to this issue. Many commenters expressed a specific interest in the study evaluating potential fish passage opportunities associated with USACE owned dams (Daguerre Point Dam and Englebright Dam). Fish passage at these and other barriers in the watershed is complicated by ongoing resource use and legacy environmental challenges. There is a general desire and expectation for this feasibility study to evaluate and recommend a plan that progresses or ends the ongoing debate over the natural resource management in the watershed. Participation in public meetings and submission of comments reflects an engaged public with a high level of awareness of issues and interest in outcomes. Although the range of proposed restoration actions included in the TSP would result in significant ecosystem restoration outcomes, the absence of proposed solutions to fish passage (connectivity) problems may be perceived as disappointing.

A summary of comments received during public scoping will be recorded in the project files. A similar open-house format will be used for the public draft Integrated Feasibility Report and EA. USACE will ensure all agencies, organizations, and individuals who request a copy of the final integrated report will be provided a copy upon completion.

7.4 Public Review and Comments on the Draft Report

This draft interim report will be circulated for a 45 day review to Federal, State, and local agencies; organizations; and individuals who have an interest in the project. A notice will be

sent to all interested parties indicating the availability of the draft FR/EA for review and comment. Public workshops will be held during the public review period to provide additional opportunities for comments on the draft document.

All comments received during the public review period will be considered and incorporated into the final interim FR/EA, as appropriate.

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Chapter 8 – Tentatively Selected Plan

This chapter describes the Tentatively Selected Plan (also called the preferred alternative for NEPA purposes), as well as procedures and cost sharing requirements to implement the plan. A schedule and list of further studies are also included.

8.1 Tentatively Selected Plan

The plan identified as the TSP is Alternative 5 (Figure 8-1). The TSP is described in detail below.

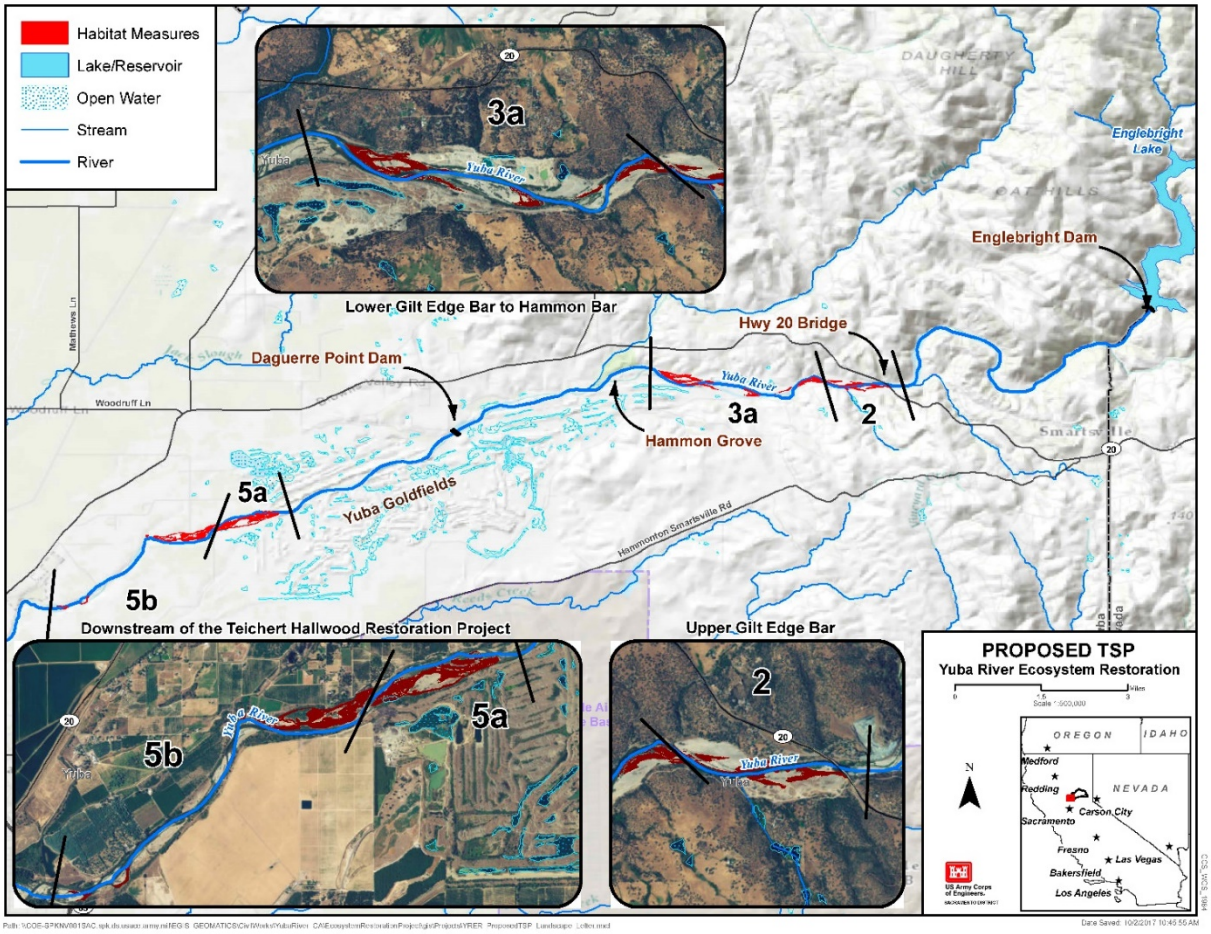

Figure 8-1. Tentatively Selected Plan.

8.1.1 Features and Accomplishments

The TSP is composed of nature-based features that restore ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Nature-based features are

those created by human design, engineering, and construction that work in concert with natural processes or mimic as closely as possible conditions which would occur in the area absent human changes to the landscape or hydrology.

The principal features of the TSP include restoration of approximately 43 acres of aquatic habitat including side channels, backwater areas, bank scallops, and channel stabilization. These features will provide shallow, low velocity, rearing habitat and refugia for juvenile anadromous salmonids and potentially increase benthic macroinvertebrate producing habitat. Engineered log jams (ELJs) and placement of boulders and large woody material have been incorporated in the TSP at strategic locations. ELJs and boulders will be placed at actively eroding banks or sites with high velocities and shear stresses. These features will promote bank stabilization, add structural complexity, provide velocity refuge for juvenile fish, and modify local hydraulics and sediment transport.

The TSP also includes about 136 acres of riparian habitat restoration consisting of floodplain lowering and grading and riparian vegetation plantings, which will increase the quantity and quality of riparian habitat in the river corridor. The TSP addresses fragmentation of habitat by targeting areas adjacent to existing vegetation that have been unable to initiate revegetation through natural processes due to substrate composition and depth to groundwater. Floodplain lowering reconnects the river to its floodplain and makes planting feasible where it was not previously due to excessive groundwater depths. Four native species will be planted to provide species and structural diversity, including arroyo willow which is known to support neotropical bird habitat (RHJV 2004). When the restored riparian habitat is inundated by high flows, it will also function as aquatic habitat, providing additional feeding habitat and refugia for juvenile fish.

Additionally, a draft Monitoring and Adaptive Management Plan is included as Appendix D, Attachment 6 of this report. Monitoring and Adaptive Management costs are currently estimated to be $739,200 for monitoring and $3,011,500 for adaptive management. The preliminary total first project cost of this alternative is $99 million.

Systems / Watershed Context

Although designed to stand alone, the TSP complements other efforts underway on the Yuba River. As described in the Future Without Project Condition Section, USFWS has been funding stream restoration projects through its Anadromous Fish Restoration Program (AFRP). The TSP was formulated to not impede or be dependent upon the AFRP; however, the TSP in conjunction with the AFRP would synergistically contribute to the goal of restoring aquatic and riparian habitat (Figure 8-2). Specifically, restoration of riparian habitat is a high priority because less than 5% of the historic riparian habitat remains throughout western United States.

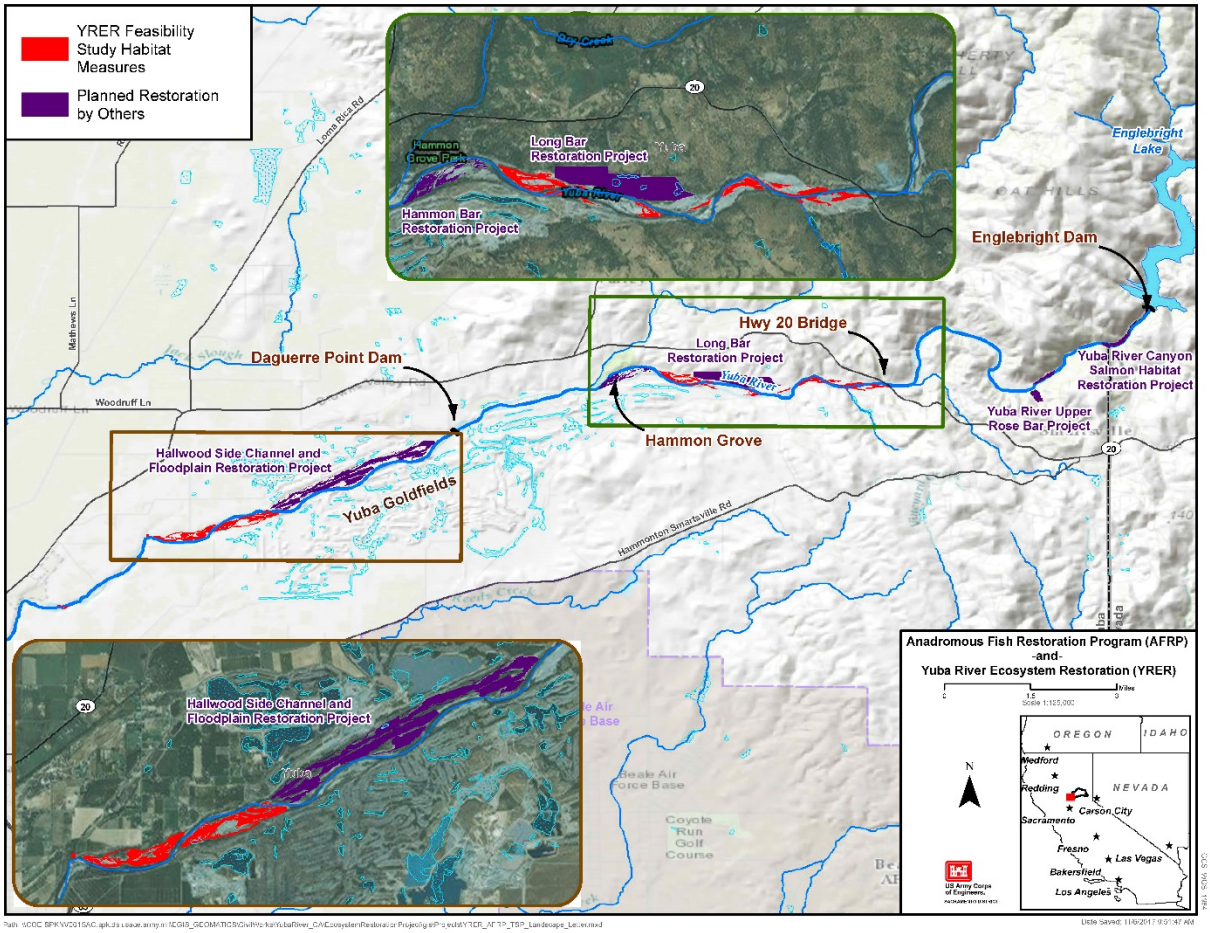

Figure 8-2. Yuba River Ecosystem Restoration TSP and AFRP Measures.

Environmental Operating Principles

The TSP supports the Environmental Operating Principles by avoiding environmental impacts while restoring historic aquatic and riparian habitat. The proposed habitat restoration is a sustainable solution. The study leverages scientific knowledge by proposing a solution with a proven history of success in the study area. Stakeholder meetings and public workshops were held, which allowed USACE to achieve a balance of project goals and public concerns throughout the process.

USACE Campaign Plan

One of the goals of the USACE Campaign Plan is to transform the civil works program and deliver enduring and essential water resource solutions to the nation in an effective and efficient manner. The feasibility study process has been transformed with a focus on decision-making earlier in the study process, using a progressive and iterative planning process to address key areas of uncertainty, rather than spending critical time and funding resources collecting and

analyzing all possible data points. The Yuba River Ecosystem Restoration Feasibility Study embraced planning modernization by utilizing extensive existing data to analyze the watershed and arrive at a potential solution.

8.1.2 Federal Interest

The Federal interest in restoration of the ecosystem of the Yuba River watershed is demonstrated by the national significance of the resources associated with restoration of ecosystem structure, function, and processes. Per ER 1105-2-100, significance of resources and effects is derived from institutional, public, and technical recognition.

Institutional Recognition

Public agencies and private interests, from the Federal to local levels, have worked collaboratively for years to restore the Yuba River. The USFWS recovery plan for anadromous fish recognizes the importance of Yuba River habitat. NOAA Fisheries, CALFED, and the State of California also have institutional agreements, laws, or plans to protect and/or restore ecosystem resources. For example, the California Department of Water Resources and Pacific Gas and Electric Company have a Habitat Expansion Agreement for spring-run Chinook salmon and steelhead in the Yuba Watershed. The North American Waterfowl Management Plan (NAWMP), an international treaty signed by Canada, the United States, and Mexico, protects waterfowl and migratory birds in North America. The Sierra County General Plan also acknowledges the importance of the ecosystem resources in the Yuba River watershed.

Public Recognition

Groups such as the South Yuba River Citizens League (SYRCL), American Rivers, and Friends of the River aim to restore salmon habitat in the Yuba River, expand fish passage, and conserve and protect wetlands and waterfowl habitat. The Yuba River also supports a significant fly fishing industry and many local residents have fostered deep connections to the river.

Technical Recognition

Riparian and wetland ecosystems are critical for wildlife, yet are exceedingly rare. Studies have documented that at least 80% of historic riparian habitat has been lost in the Western United States and less than 5% of historic riparian forests remain in the Central Valley of California. Federally listed threatened species that rely on riparian habitat in the Yuba River watershed include the Western yellow-billed cuckoo, Valley elderberry longhorn beetle and California red-legged frog.

Additional Federally listed threatened species include spring-run Chinook salmon, steelhead, and green sturgeon. The lower Yuba River is essential to the conservation of these species and has therefore been designated as critical habitat. The Yuba River does not have a hatchery facility and therefore hosts one of the last remaining wild salmon runs in the Sierra Nevada Mountain range.

The lower Yuba River is along the Pacific Flyway for migratory birds, which have long been an indicator of ecosystem health. Recent evidence suggests that many songbird populations that migrate each year between temperate breeding areas and tropical winter quarters are declining and that these declines have accelerated in recent years. The neotropical migrants that breed in the West reside primarily in riparian habitats. California's riparian habitat provides important breeding and over wintering grounds, migration stopover areas, and corridors for dispersal. The loss of riparian habitats may be the most important cause of population decline among land bird species in western North America.

Climate change is further exacerbating habitat degradation, fragmentation, and subsequent impacts to wildlife. A May 2017 report from biologists at the University of California, Davis, Center for Watershed Sciences and California Trout states that nearly 75 percent of California's salmon, steelhead, and trout will be extinct in 100 years unless critical habitat is protected and restored. If present trends continue, 45 percent of California's native salmon, steelhead, and trout are likely to be extinct in the next 50 years.

8.1.3 Monitoring and Adaptive Management

Nature-based features may be affected by conditions and processes differently than conventional structural measures. Addressing the uncertainties related to the design and long-term performance of nature-based features could require additional monitoring and potential adaptive management measures to ensure continued functional performance. A description of monitoring activities is included in the draft Monitoring and Adaptive Management Plan, which will include criteria for ecosystem restoration success, as well as the estimated cost and duration of the monitoring. Per Section 2039 of Water Resources Development Act (WRDA) of 2007, as amended, monitoring will continue until the Secretary of the Army determines the criteria for ecosystem restoration success have been met. Necessary monitoring for a period not to exceed ten years from the completion of construction will be cost-shared as a construction cost. Any additional monitoring beyond ten years will be the responsibility of the non-Federal sponsor.

8.1.4 Operation, Maintenance, Repair, Replacement, and Rehabilitation

Routine operation and maintenance requirements for the TSP are expected to be minimal. No public access facilities or other features requiring active operation will be included in the project. The non-Federal sponsor will need to periodically inspect the project to prevent encroachments or other damage caused by human activities and to determine whether any repair, replacement, or rehabilitation of project features is needed.

Section 1161 of the WRDA 2016 states that the responsibility of a non-Federal interest for operation and maintenance of the nonstructural and non-mechanical elements of a project, or a component of a project, for ecosystem restoration shall cease 10 years after the date on which the Secretary of the Army determines the criteria for ecosystem restoration success have been met. Riparian vegetation plantings have been identified as a nonstructural feature. The other features of the TSP (floodplain lowering and grading, side channels, backwaters, bank scallops, and large woody material) have been identified as structural features. Therefore, operation and

maintenance of riparian vegetation plantings would cease 10 years after success criteria have been met, while operation and maintenance of other features would be ongoing.

The cessation of operation and maintenance of riparian vegetation plantings poses low risk to the ecological success and sustainability of project features and functions. Control of invasive plant species or other vegetation management is not anticipated to be necessary after the ecological success criteria are met. Should flood events damage a stand of vegetation, it is expected that improved depth to groundwater, source seed availability, and improved substrate conditions will encourage appropriate seed dispersal, germination, and establishment of new growth. Additionally, disruptions from flood events will create new age classes within the vegetation stands, creating natural variability in composition, structure, and function. Natural disruptions and regeneration of vegetation are a component of dynamic ecosystem processes and evidence of a self-sustaining feature.

According to USACE guidance (ER 1110-2-401), "Repair is considered to entail those activities of a routine nature that maintain the project in a well-kept condition. Replacement covers those activities taken when a worn-out element or portion thereof is replaced. Rehabilitation refers to a set of activities as necessary to bring a deteriorated project back to its original condition. Repair, Replacement and Rehabilitation actions are to conform to the project as-built plans and specifications unless other arrangements are made with the district commander." If rehabilitation of the project is required because of natural changes in the morphology of the river channel and floodplain, conforming the project to the original plans and specifications may not be the most practical or ecologically preferable method of providing the intended ecological outputs of the project. Therefore, the Sacramento District commander would consider other plans proposed by the non-Federal sponsor for rehabilitation of the project that would provide equivalent ecological outputs within the project site.

Subsequent to the completion of the design of the project features and prior to construction, a draft OMRR&R manual would be prepared in coordination with the non-Federal sponsor and affected resource agencies. A final OMRR&R manual would be prepared after the completion of construction and provided to the non-Federal sponsor.

8.1.5 Real Estate

The non-Federal sponsor will be responsible for the acquisition of about 176 acres in fee title along with about 12 acres of temporary work area easements and 8 acres of staging sites and access routes to implement the TSP. In addition, implementation of the TSP would require acquisition of 24 parcels with severed mineral rights.. Mineral rights would be acquired at fair market value. No relocation costs are currently anticipated. A draft Real Estate Plan is included as Appendix E.

8.1.6 Plan Economics

The project first cost was estimated on the basis of October 2017 price levels and amounts to $96,755,000. Table 8-1 shows this cost by cost account. Estimated average annual costs were based on the October 2017 discount rate of 2.75 percent, a period of analysis of 50 years, and four years of physical construction. Table 8-2 shows the average annual costs and outputs.

Table 8-1. Estimated Costs of TSP.

Item	Cost[1] ($1,000s)
Lands and Damages	6,406
Relocations[2]	0
Construction (Fish and Wildlife Facilities)[3]	71,279
Planning, Engineering, Design	11,756
Construction Management	3,563
Monitoring	739
Adaptive Management	3,012
Total First Cost	**96,755**

[1]Based on October 2017 price levels with a 2.75% discount rate and a 50-yaer period of analysis.
[2]No relocations required in TSP.
[3]Fish and Wildlife Facilities account includes all ecosystem restoration features (excavation, grading, planting, etc.).

Table 8-2. Economic Costs and Benefits of TSP.

Item	Costs ($1,000s)	Benefits
Investment Cost		
First Cost[1]	96,755	
Interest During Construction	5,560	
Total Investment Cost	102,315	
Annual Cost		
Annualized First Cost	3,790	
Average Annual OMRR&R	1,470	
Total Average Annual Cost	5,260	
Annual Benefits Non-monetary (Ecosystem)		72.86 AAHUs

[1]Based on October 2017 price levels with a 2.75% discount rate and a 50-yaer period of analysis.

8.1.7 Cost Sharing

Table 8-3 shows costs apportioned as either Federal or non-Federal costs based on October 2017 price levels.

8.1.8 Risk and Uncertainty

In general, the ability of the TSP to provide the expected accomplishments depends on the validity of pertinent assumptions, base data, and analytical techniques used in this study; the successful completion of future studies, designs, and construction; and appropriate operation, maintenance, and repair after construction. However, nature-based features may be affected by

Table 8-3. Summary of Cost-Sharing Responsibilities of the TSP.

Item	Federal ($1,000s)	Non-Federal ($1,000s)	Total First Costs ($1,000s) [1]
Lands, Easements, Rights-of-Way, Relocations and Disposal Sites	0	6,406	6,406
Construction (Ecosystem Restoration)	71,279	0	71,279
PED	11,756	0	11,756
Construction Management	3,563	0	3,563
Monitoring	739	0	739
Adaptive Management	3,012	0	3,012
Subtotal	*90,349*	*6,406*	*96,755*
Cash Contribution	-27,458	27,458	
Total	*62,891*	*33,864*	*96,755*
Percentage	*65%*	*35%*	

[1]Based on October 2017 price levels with a 2.75% discount rate and a 50-yaer period of analysis.

conditions and processes differently than conventional structural measures. Addressing the uncertainties related to the design and long-term performance of nature-based features could require additional monitoring and potential adaptive management measures to ensure continued functional performance. Nature-based features must be evaluated for effectiveness, including reliability and performance of those features over time and over an expected range of conditions. Engineering guidance on the reliability and performance of some natural and nature-based features is still emerging, so close coordination with subject matter experts is required

The Yuba River is a dynamic system, experiencing periods of drought and flood. There is a risk that severe conditions may alter restoration features and potentially reduce the effectiveness of the proposed project. However, the proposed habitat restoration measures were designed based on extensive hydrologic and geomorphic analysis. Flooding during the winter of 2016-2017 demonstrated the fidelity of project designs. Record setting precipitation and snow pack run-off caused the Yuba River to flood, which created an anabranching channel at river mile 4 as previously proposed in project designs. Essentially, hydrologic and geomorphic analysis adequately influenced the measures to mimic natural processes. Although the flooding event validated the likely performance of restoration designs, risk still remains. Currently, this risk is addressed through cost contingency.

Climate change is a source of uncertainty regarding long-term project performance and resiliency. Because all alternatives in the final array would be affected similarly by climate change, it was not a factor in selection of the TSP. It is anticipated that climate change effects will be addressed as required by ECB 2016-25 (Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects) during feasibility level design of the TSP for the final report.

As the study progresses into feasibility level design, sustainability and resiliency will continue to drive design criteria, with a goal of maximizing performance and durability in a highly variable system.

8.2 Plan Implementation

This section describes the remaining steps to potential authorization of the project by Congress and implementation by USACE and the sponsor.

8.2.1 Report Completion

The draft FR/EA will be circulated for public and agency review for 45 days. Meetings will be held to obtain comments from the public, agencies, and other interested parties. After completion of the public review period, comments will be considered and incorporated into the FR/EA, as appropriate. The final FR/EA will be provided to any agency that provided comments on the draft report and will be available to the public on the District's internet site.

8.2.2 Report Approval

USACE will notify all interested parties when the final report is available for review. USACE will receive comments from Federal and State agencies, and complete policy review of the final report.

After its review of the final Feasibility Report/EA, including consideration of public, state, and agency comments, USACE will prepare the Chief of Engineers Report. This report will be submitted to the Assistant Secretary of the Army for Civil Works, who will coordinate with the Office of Management and Budget and submit the report to Congress.

8.2.3 Project Authorization and Construction

If the project is authorized by Congress, construction funds must be appropriated for the project by Congress before a Project Partnership Agreement (PPA) can be signed by USACE and the sponsor and before detailed project design and construction could begin. A project management plan outlining Federal and non-Federal obligations, requirements, tasks, costs, and schedule from design through construction would also be prepared.

8.2.4 Division of Responsibilities

Federal Responsibilities

USACE would first accomplish Preconstruction Engineering and Design (PED) studies. After the PPA is signed and the non-Federal sponsor provides the required lands, easements, rights-of-way, relocations, and disposal areas (LERRD), and cash contribution, the Federal Government would construct the project. The Federal Government would be responsible for cost-shared monitoring until the Assistant Secretary of the Army (Civil Works) determines the criteria for ecosystem restoration success have been met, up to a maximum of ten years from the completion of construction.

Non-Federal Responsibilities

Under the PPA, the non-Federal sponsor would be responsible to USACE for LERRD, cash contributions, and all OMRR&R requirements (see items of cooperation in Chapter 9). Any required ecological monitoring beyond ten years would be included in the OMRR&R requirements.

Views of Non-Federal Sponsor

The non-Federal sponsor supports the Tentatively Selected Plan.

Financial Capability of Sponsor

The non-Federal sponsor has indicated that it intends to fund the project, pending further development through the final report and supporting documents. The non-Federal sponsor will provide self-certification of financial capability prior to the completion of the final report.

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. The PPA defines the responsibilities of the parties throughout the project's design, construction, and operational phases, and specifies the non-Federal sponsor's required financial and real estate contributions.

8.2.5 Schedule

If the project is authorized in 2019, construction activities could start as early as 2022. The following is a schedule showing the approval and construction phases of the project, assuming optimal funding.

Division Commander's Transmittal	FEB 2019
Chief of Engineers Report	JUL 2019
Potential Congressional Authorization	OCT 2019
USACE and Sponsor Sign Design Agreement	NOV 2019
Initiate PED	2019
Initiate Construction	2022
Complete Physical Construction	2025
Complete Plant Establishment Period	2030
Complete Monitoring	2035

8.2.6 Further Studies

During Preconstruction Engineering and Design (PED), some additional studies would be undertaken as part of developing detailed designs for the project. Upon initiation of PED, any new information that has been collected by others would be considered before undertaking these additional studies. These additional studies include:

- Hydraulic modeling for project design;
- Topographic surveys for project design;
- Geomorphic and scour analysis;
- Cultural resource surveys;
- Development of operation and maintenance manual.

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Chapter 9 – Recommendations

The following text will be included in the final report, pending public review, policy review, technical reviews, and subsequent comments and revisions:

I recommend that the Yuba River Ecosystem Restoration plan (Tentatively Selected Plan – Alternative 5) 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 is $96,755,000 and the estimated annual OMRR&R cost is $1,470,000 (2017 price level). The Federal portion of the estimated first cost is $62,891,000. Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

a. Provide 35 percent of total project costs as further specified below:

    1. 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;

    2. 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, operation, and maintenance of the project;

    3. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total project costs;

b. 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 funds verifies in writing that the funds are authorized to be used to carry out the project;

c. 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 outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

d. Shall not use the project or lands, easements, and rights-of-way required for the project as a wetlands bank or mitigation credit for any other project;

e. 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 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, 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;

f. 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;

g. 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;

h. Hold and save the United States free from all damages arising from the construction, operation, 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;

i. 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;

j. Comply with all the requirements of applicable Federal laws and implementing regulations, including, but not limited to: Title VI of the Civil Rights Act of 1964, Public Law 88-352, as amended (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; the Age Discrimination Act of 1975 (42 U.S.C. 6102); the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Army Regulation 600-7 issued pursuant thereto; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

k. 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 U.S.C. 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, operation, 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;

l. 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, operation, and maintenance of the project;

m. 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

n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 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.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

_____

Date

David G. Ray
Colonel, U.S. Army
Corps of Engineers
District Engineer

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Chapter 10 – List of Preparers

The individuals listed in the following table were primarily responsible for the preparation of this report.

Table 10-1. List of Preparers.

Name	Experience	Credentials	Role in the Study
Stefanie Adams, Cultural Resources Specialist	9 years Environmental Planning and Cultural Compliance, USACE	BA: Linguistics	Document organization/preparation
Anne Baker, Senior Environmental Manager	11 years NEPA and Environmental Planning, USACE	BA: English	Document preparation, environmental planning
Diego A. Benavidez, Civil Engineer	8 years Cost Engineering, USACE	GS: Civil Engineering Technology; Certified Cost Engineering Technician	Cost engineering
Tom Borrowman, Civil/Environmental Engineer	14 years, USACE	MS: Civil Engineering	Engineering Technical Lead
Nate Eskridge, GIS/Cartographer	2.5 years Geomatics Section, USACE; 2 years Military Installation GIS, US Marine Corps; 3 years Engineering Technician/GIS, Bureau of Reclamation; 8 years Active Army GIS	BS: Information Technology	Geographic Information System activities
Michael Fong, Biological Science Environmental Manager	5 years Environmental Planning and Compliance, USACE	BS: Biology; Certificate: Field Ecology	Environmental planning and compliance
Melissa Hallas	9 years, USACE	BS: Engineering	Lead Planner; plan formulation and evaluation, document preparation
Gene Maak			Hydraulic Lead – Ecosystem Output Modeling
Scott Miner, Regional Technical Specialist	36 years Water Resources Planning, USACE	BS: Biology; MS: Wildland Resource Science	Plan formulation, policy and review
Vanessa Niño-Tapia, Civil Designer	4 years Civil Design, USACE	BS: Civil Engineering; MS: Civil Engineering	Lead Civil Designer
Patrick O'Day Archeologist		PhD: Anthropology	Lead Cultural Resources
Laurie Parker	26 years, USACE; Civil Works Projects; Real Estate, Planning, Project Management and Engineering; California	B.A. Geography	Lead Real Estate

Brooke Schlenker, Certified Water Resources Planner	15 years, USACE; Military and Civil Works Projects; Planning, Environmental, and Engineering; California and Georgia	MS: Physical Science; BS: Integrated Science and Technology	Lead Planner; plan formulation and evaluation, document preparation
Jesse Schlunegger, P.E., Hydraulic Analysis Section Chief	14 Years of Experience in Water Resources Engineering	BS: Civil and Environmental Engineering, Registered Professional Engineer in California	Hydraulic Engineer, Technical Advisor, document review
Corrie Stetzel, Water Resources Planner	1.5 years Water Resources Planning, USACE; 2 years Environmental Compliance, National Park Service	BS: Community and Regional Development	Document preparation, plan formulation
Chelsea Stewart, Project Manager	3 years Civil Works Project Manager, USACE; 5 years Natural Resources Specialist, Bureau of Reclamation	BA: Nature and Culture	Project oversight

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