County of Yuba
Community Development & Services Agency
915 8th Street, Suite 123, Marysville, CA 95901

Planning Department
Phone: (530) 749-5470
Fax: (530) 749-5434
Web: http:// www.co.yuba.ca.us

DEVELOPMENT REVIEW COMMITTEE
STAFF REPORT

MEETING DATE: May 6, 2021

TO: DEVELOPMENT REVIEW COMMITTEE

FROM: Ciara Fisher, Planner II

RE: Environmental Assessment (EA2020-0005) Long Bar Salmonid Habitat Restoration Project on the Lower Yuba River

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REQUEST: The applicant, United States Fish and Wildlife Service (USFWS), is requesting adoption of an environmental document in the form of a CEQA Mitigated Negative Declaration of the Long Bar Salmonid Habitat Restoration Project on the Lower Yuba River.

RECOMMENDATION: Staff recommends that the Development Review Committee (DRC) adopt the proposed Mitigated Negative Declaration and Mitigation Monitoring Plan pursuant to California Environmental Quality Act (CEQA) Article 6 et.seq. and make the necessary findings.

BACKGROUND/DISCUSSION: This Environmental Assessment/Initial Study (EA/IS) has been prepared to identify the environmental resources in the project area, analyze the effects to the environment of the Proposed Action and a No Action Alternative, and propose avoidance, minimization, and mitigation measures to reduce any effects to less than significant levels.

The United States Fish and Wildlife Service's (USFWS) Anadromous Fish Restoration Program (AFRP) has proposed the Long Bar Salmonid Habitat Restoration Project (Proposed Action) to directly address the USFWS AFRP goals including the Yuba River High Priority Actions. The Proposed Action would rehabilitate and enhance juvenile rearing habitat for Central Valley (CV) fall-run and spring-run Chinook Salmon and CCV steelhead in the Yuba River upstream of Daguerre Point Dam. In addition, the Proposed Action would enhance riparian vegetation through strategic planting and improved natural recruitment.

Specifically, the Proposed Action is designed to restore and enhance ecosystem processes, with a primary focus on improving productive juvenile salmonid rearing habitat to increase natural production of CV fall and spring-run Chinook Salmon and CCV steelhead in the lower Yuba River (LYR). The Proposed Action would directly address the doubling goal of the USFWS AFRP, the National Marine Fisheries Service (NMFS) priority action to increase the quantity and quality of Environmental Species Act listed Chinook Salmon and CCV steelhead rearing areas, and test hypotheses regarding a variety of habitat enhancement techniques and subsequent response of juvenile salmonids to restored floodplain and off-channel habitats.

The Proposed Action, including design, permitting, construction, and monitoring, is funded and directed by the USFWS AFRP, as authorized by several federal and state legislative acts including the CVPIA and Fish and Wildlife Coordination Act. The Proposed Action is being led by a consultant team consisting of South Yuba River Citizen's League (SYRCL), Cramer Fish Sciences (CFS), and cbec eco-engineering (cbec). The success of the Proposed Action hinges on continued working partnerships with landowners (Long Bar Mine LLC and Western Aggregates), aggregate plant operator Silica Resources Incorporated (SRI), and local and regional stakeholders and agencies. The consultant team under the direction of the USFWS AFRP will finalize the Proposed Action design plans, develop the effectiveness monitoring plan, coordinate all regulatory compliance, conduct public outreach activities, implement the project, and determine project success through a scientifically robust monitoring program. The Proposed Action team will also coordinate with adjacent landowners, resource agencies, stakeholders, and the local community to recover functioning habitat for salmonids, gain public support, and demonstrate various benefits of river restoration.

The Proposed Action will take place over 1 to 2 years in the LYR on property owned by Long Bar Mine LLC and Western Aggregates. The Proposed Action encompasses an approximately 6,929-ft segment of the LYR approximately 15 river miles upstream from the confluence with the Feather River. The Proposed Action Area is accessible via a paved access road at 6130 Hwy 20. The Proposed Action will re-grade and rehabilitate a large gravel bar on the north side of the river which is adjacent to the SRI Stringer Pit aggregate operation. The area of the LYR encompassing the Proposed Action Area is just downstream and across the river from the area commonly referred to as Long Bar. An estimated 62.4 acres of gravel bar and riparian habitat are available for rehabilitation and enhancement. A total of 42.8 acres of the gravel bar will be topographically modified to create/enhance juvenile salmonid rearing habitat through creation of seasonally or perennially inundated side channels (5.9 acres), backwaters (2.4 acres), flood runner channels (1.9 acres), and backwater channel (5.4 acres) and lowering of floodplain elevations (27.2 acres).

GENERAL PLAN/ZONING: The Proposed Action Area is located within the Extractive District (EX) Zoning Designation on the Yuba County Zoning Map (2015) and Rural Community (RC) on the Yuba County 2030 General Plan Land Use Diagram.

The Rural Community land use classification is intended to provide rural residential opportunities with supportive services and tourism-oriented uses. Allowable uses include residential; grazing, agricultural, forestry, and other natural resource-oriented commercial uses; agricultural processing; agriculture and natural resource-oriented tourism uses; local retail and commercial services; educational, medical, and other institutional uses; community halls and other cultural and civic land uses; parks and recreation facilities, multi-use recreation and stormwater management facilities, natural areas, and other types of open space-oriented uses; and public facilities and infrastructure. The Proposed Action is consistent with the RC General Plan Designation in that the project will rehabilitate and enhance juvenile rearing habitat for Central Valley (CV) fall-run and spring-run Chinook Salmon and CCV steelhead in the natural area of the Lower Yuba River.

Moreover, pursuant to Development Code Section 11.11.020, EX principally permits Resource Protection & Restoration which is defined as "lands and management activities dedicated to the protection and conservation of natural resources, such as aquatic environments, wetland and sensitive riparian habitat, water recharge areas, and rare or endangered plant or animal habitat" (Development Code Section 11.72.070, Page V-19).

Based on the aforementioned discussion, the Proposed Action meets the definition of a Resource Protection and Restoration project and therefore does not require any additional Planning Permits and is consistent with the Zoning and General Plan designation.

COMMENTS: The project was circulated to various agencies and County departments for review and comment during the early consultation phase and the environmental review stages of the project. The following is a summary of comments:

- County Staff – The Public Works Department, Environmental Health Department, and Building Department have reviewed the project and did not have any comments.

- UAIC – Tribal Consultation was satisfied.

- The Sierra Fund – This is a mining project and therefore requires a Surface Mining and Reclamation Act of 1975 (SMARA) Permit.

Aaron Zettler-Mann, from the South Yuba River Citizens League (SYRCL) prepared a response to the comment letter received from The Sierra Fund (Attachment 4). He states that the Project was presented to the California State Mining and Geology Board (SMGB) prior to the CEQA public review period to ensure that the SMGB were aware of the Project's proposed actions. Had the SMGB felt that this Project qualified as a mining operation they would have submitted a comment letter indicating this during the CEQA public review period.

It is important to note that the Long Bar Mine LLC is facilitating this project in a cost-efficient manner by allowing the Project to dispose of the excavated material onto their site. This reduces environmental and fiscal impacts associated with hauling and permanently storing excavated material away from the Project site. Saleable silica or sand resources excavated as part of this grading will be sold to help offset Project costs. Without the cost offset associated with this partnership, restoration implementation costs would be considerably higher and the restoration actions may not be financially viable to implement.

Based on communication about this project between SYRCL and Yuba County over the last three years, the stated objectives and reclamation actions described in detail in the Project IS/EA, the lack of comment from the SMGB and other State agencies on the land use classification of the project during the public review period, and the nature of the relationship between the Project and Long Bar Mine LLC support the assertion that the Project does not qualify as a mining operation.

To address The Sierra Fund's request to explicitly include excavation amounts, they have added a table in the IS/EA. The total amount of material proposed for removal to reconnect off-channel rearing habitat at a higher frequency and duration is estimated to be approximately 380,000 yd^3. A summary of cut and fill volumes by restoration feature was also provided in the letter. As mentioned in TSF's letter, these approximate volumes were provided to SMGB prior to the CEQA public review period.

In addition to the comment letter provided by the SYRCL, County Staff and SMGB Staff also held a meeting on April 27 to determine the projects exemption from SMARA. It was the professional opinion from the SMGB Staff that the Proposed Action is exempt from the statues and regulations listed in the SMARA Statutes document. Moreover, pursuant to Section 2714, SMARA does not apply to the following activity:

a) Onsite excavation and onsite earthmoving activities that are integral and necessary for the construction of structures and that are undertaken to prepare a site for the construction of DMR-SR JANUARY 2020 9 those structures, including landscaping or other land improvements associated with those structures, including the related excavation, grading, compaction, or the creation of fills, road cuts, and embankments, whether or not surplus materials are exported from the site, subject to all of the following conditions:
   i) All required permits for the construction and any associated landscaping or related land improvements have been approved by a public agency in accordance with applicable provisions of state law and locally adopted plans and ordinances, including, but not limited to, the California Environmental Quality Act (Division 13 (commencing with Section 21000)).

      No entitlement permits from Yuba County are required because the Proposed Action is principally permitted in the EX Zoning Designation. Furthermore, the Project Team has applied for and will secure all applicable environmental permits prior to construction to ensure that the project does not result in any undue environmental harm and meets all State and Federal environmental quality regulations. To that end, we are in the process of securing the following permits: NMFS and USFWS Section 7 Biological Opinions, NEPA (FONSI issued), CEQA (NOD), Section 106 – cultural impacts, USACE Section 404 Letter of Permission, Section 401 Water Quality Certification, and approval of Storm Water Pollution Prevention Plan (Addendum B). As such, the Project will comply with all relevant environmental regulations.

   ii) The lead agency's approval of the construction project included consideration of the onsite excavation and onsite earthmoving activities pursuant to the California Environmental Quality Act (Division 13 (commencing with Section 21000)).

      The Proposed Action is a floodplain restoration project. The sole goal of this Project is restoring habitat that is degraded as a result of historic dredge mining into much-needed rearing habitat for threatened salmonids. The Long Bar Mine LLC is facilitating this project in a cost-efficient manner by allowing the Project to dispose of the excavated material onto their site. This reduces environmental and fiscal impacts associated with hauling and permanently storing excavated material away from the Project site. Saleable silica or sand resources excavated as part of this grading will be sold to help offset Project costs. The specific Cut and Fill Volumes has been added to the IS/MND to clarify the excavation amounts. Specifically, the total amount of material proposed for removal to reconnect off-channel rearing habitat at a higher frequency and duration is estimated to be approximately 380,000 yd^3. These approximate volumes were provided to SMGB prior to the CEQA public review period and they did not provide any comments direction that SMARA is required.

iii) The approved construction project is consistent with the general plan or zoning of the site.

As mentioned previously, the Proposed Action Area is zoned EX, which principally permits Resource Protection & Restoration and it is consistent with the RC General Plan Designation in that it will enhance the natural area of the Lower Yuba River.

iv) Surplus materials shall not be exported from the site unless and until actual construction work has commenced and shall cease if it is determined that construction activities have terminated, have been indefinitely suspended, or are no longer being actively pursued.

The Proposed Action will take place over 1 to 2 years in the LYR on property owned by Long Bar Mine LLC and Western Aggregates. The removal of the excavated materials for the project will only be done during this time period and will only be the amount listed in the Cut and Fill Volumes. No additional excavation is proposed for this project beyond what is proposed and no additional excavation is proposed to continue after the project is completed.

FINDINGS: The necessary findings for adoption of the environmental assessment are as follows:

WHEREAS, the Community Development and Services Agency of the County of Yuba has provided due notice of a public hearing before the Development Review Committee for the consideration of the proposed project in accordance with Government Code Sections 65090 and 65091 and the intent to adopt a Mitigated Negative Declaration and Mitigation Monitoring Plan for the proposed project in accordance with the California Environmental Quality Act; and

WHEREAS, the Community Development and Services Agency of the County of Yuba has conducted an Initial Study for the proposed project and concluded that the Project would not result in any significant adverse environmental impacts provided the mitigation measures that are incorporated into the Mitigation Monitoring Plan are implemented; and

WHEAREAS, the documents and other materials constituting the administrative record of the proceedings upon which the Development Review Committee's recommendation is based are located at the Yuba County Government Center offices at 915 8th Street, Marysville, CA 95901, and that the custodian of the records is the Yuba County Planning Department.

NOW, THEREFORE BE IT RESOLVED AS FOLLOWS:

A. The Development Review Committee finds that the Project will not cause substantial environmental damage to fish and/or wildlife and their habitats, nor have the potential for adverse effect(s) on wildlife resources or the habitat upon which wildlife depends. A Notice of Determination will be recorded with the

County Recorder and Fish and Game Filing Fees will be paid to the County Recorder.

B. The Development Review Committee finds that on the basis of the whole record no substantial evidence that the Project will have a significant effect on the environment and that the Mitigated Negative Declaration reflects the lead agency's independent \judgment and analysis.

Report Prepared by:

Ciara Fisher
Planner II

ATTACHMENTS

1. Environmental Assessment/Initial Study/Mitigated Negative Declaration
2. Mitigation Monitoring Plan
3. Comment Letters
4. Response to The Sierra Fund Comment Letter

Attachment 1

Long Bar Salmonid Habitat Restoration Project on the Lower Yuba River

Environmental Assessment
and
Initial Study/Mitigated Negative Declaration
Public Draft

Prepared by:

U.S. Fish and Wildlife Service
Anadromous Fish Restoration Program
850 S. Guild Ave
Lodi, CA 95240

and

Yuba County
915 8th Street, Suite 123
Marysville, CA 95901

February 2021

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AFRP	Anadromous Fish Restoration Program
AMF	Adaptive Management Forum
ARB	Air Resources Board
BACI	Before-After-Control-Impact
cbec	cbec eco-engineering
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CV	Central Valley
CCV	California Central Valley
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFS	Cramer Fish Sciences
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CVPIA	Central Valley Project Improvement Act
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
DBH	Diameter-at-Breast-Height
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
DOI	Department of the Interior
DPS	Distinct Population Segment
DWR	Department of Water Resources
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ERPP	Ecosystem Restoration Program Plan
ESA	Environmental Species Act
FL	Fork Length
ESU	Evolutionarily Significant Unit
FONSI	Finding of No Significant Impact
FRAQMD	Feather River Air Quality Management District

GHG	Greenhouse Gas
GPS	Global Positioning System
HAPC	Habitat Areas of Particular Concern
IS	Initial Study
ISRAP	Invasive Species Risk Assessment and Planning
LYR	lower Yuba River
MBTA	Migratory Bird Treaty Act
MND	Mitigated Negative Declaration
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Units
OHWM	Ordinary High-Water Mark
PM	Particulate Matter
PBF	Physical and Biological Features
ROD	Record of Decision
RM	River Mile
RMT	River Management Team
SWPPP	Stormwater Pollution Prevention Plan
SYRCL	South Yuba River Citizen’s League
Corps	United States Army Corps of Engineers
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
VELB	Valley Elderberry Longhorn Beetle
YCWA	Yuba County Water Agency
YWA	Yuba Water Agency

Suggested citation:

U.S. Fish and Wildlife Service and Yuba County. 2021. Draft Environmental Assessment/Initial Study for Long Bar Restoration Project. Prepared by Cramer Fish Sciences and cbec eco-engineering. 25 February 2021.

1 INTRODUCTION

1.1 OVERVIEW

The Central Valley Project Improvement Act (CVPIA; Title 34 of Public Law 102-575, Section 3406(b)(1)) authorizes and directs the Secretary of the Department of the Interior (DOI), in consultation with other state and federal agencies, Native American tribes, and affected interests, to develop and implement a program which makes all reasonable efforts to at least double natural production of anadromous fish in California Central Valley (CCV) rivers and streams. Further, the CVPIA requires that this program give priority to measures that protect and restore natural channel and riparian habitat values through habitat restoration actions, modifications to Central Valley Project operations, and implementation of the supporting measures mandated by the CVPIA. The DOI approached implementation of this directive through development of the Anadromous Fish Restoration Program (AFRP), with the United States Fish and Wildlife Service (USFWS) assuming lead responsibility. The USFWS and U.S. Bureau of Reclamation (Reclamation) jointly implement the CVPIA. The AFRP doubling goal for anadromous fish includes the following species and races; fall-run, late fall-run, winter-run, and spring-run Chinook Salmon (*Oncorhynchus tshawytscha*), California Central Valley steelhead (*Oncorhynchus mykiss*), American Shad (*Alosa sapidissima*), White Sturgeon (*Acipenser transmontanus*), and North American Green Sturgeon (*Acipenser medirostris*).

In the AFRP Final Restoration Plan (USFWS 2001) one of the High Priority Actions for the Yuba River was "evaluating the benefits of restoring stream channel and riparian habitats of the Yuba River, including creation of side channels for spawning and rearing habitat for salmonids". The USFWS AFRP has proposed the Long Bar Salmonid Habitat Restoration Project (Proposed Action) to directly address USFWS AFRP goals including Yuba River High Priority Actions. The Proposed Action would rehabilitate and enhance juvenile rearing habitat for Central Valley (CV) fall-run and spring-run Chinook Salmon and CCV steelhead in the Yuba River upstream of Daguerre Point Dam. In addition, the Proposed Action would enhance riparian vegetation through strategic planting and improved natural recruitment.

2 PURPOSE OF DOCUMENT

This Environmental Assessment/Initial Study (EA/IS) has been prepared to identify the environmental resources in the Proposed Action Area, analyze the effects to the environment of the Proposed Action and a No Action Alternative, and propose avoidance, minimization, and mitigation measures to reduce any effects to less than significant levels. This document was prepared to satisfy both the National Environmental Policy Act (NEPA; 42 United States Code [USC] 433*et seq*.) and the California Environmental Quality Act (CEQA; California Public Resources Code, Sections 1000 *et seq*.). The NEPA Lead Agency is the USFWS and the CEQA Lead Agency is Yuba County.

2.1 LONG BAR SALMONID HABITAT RESTORATION PROJECT

The Proposed Action is designed to restore and enhance ecosystem processes, with a primary focus on improving productive juvenile salmonid rearing habitat to increase natural production of CV fall and spring-run Chinook Salmon and CCV steelhead in the lower Yuba River (LYR). The Proposed Action would directly address the doubling goal of the USFWS AFRP, the National Marine Fisheries Service (NMFS) priority action to increase the quantity and quality of Environmental Species Act listed Chinook Salmon and CCV steelhead rearing areas (NMFS 2014), and test hypotheses regarding a variety of habitat enhancement techniques and subsequent response of juvenile salmonids to restored floodplain and off-channel habitats.

The Proposed Action, including design, permitting, construction, and monitoring, is funded and directed by the USFWS AFRP, as authorized by several federal and state legislative acts including the CVPIA and Fish and Wildlife Coordination Act. The Proposed Action is being led by a consultant team consisting of South Yuba River Citizen's League (SYRCL), Cramer Fish Sciences (CFS), and cbec eco-engineering (cbec). The success of the Proposed Action hinges on continued working partnerships with landowners (Long Bar Mine LLC and Western Aggregates), aggregate plant operator Silica Resources Incorporated (SRI), and local and regional stakeholders and agencies. The consultant team under the direction of the USFWS AFRP will finalize the Proposed Action design plans, develop the effectiveness monitoring plan, coordinate all regulatory compliance, conduct public outreach activities, implement the project, and determine project success through a scientifically robust monitoring program. The Proposed Action team will also coordinate with adjacent landowners, resource agencies, stakeholders, and the local community to recover functioning habitat for salmonids, gain public support, and demonstrate various benefits of river restoration.

In addition to addressing USFWS AFRP's goals to increase juvenile rearing habitat, the project team will track physical and biological parameters in the restored ecosystem to answer critical questions about mechanisms and processes influencing rearing habitat quality for juvenile salmonids and the relative benefit of rehabilitating floodplain habitats. We will align our monitoring plan with the 'Ecosystem Perspective' described by the Adaptive Management Forum Scientific and Technical Panel (AMF 2004), and track floodplain ecosystem development to answer questions about the processes affecting fish use and foraging success, prey production, native vegetation recruitment, and the relationship of these factors to project design and implementation. Cost-sharing opportunities will be pursued by partnering with property owners and involving university graduate students and volunteers in project monitoring. We aim to advance scientific understanding of off-channel habitat restoration in an effort to improve the effectiveness of future salmonid habitat restoration projects in the LYR and other CV rivers.

2.1.1 **HABITAT**

2.1.1.1 Protect, improve, and restore river habitat, including benefits to fish, wildlife and water quality

The Proposed Action will take place over 1 to 2 years in the LYR on property owned by Long Bar Mine LLC and Western Aggregates. The Proposed Action encompasses an approximately 6,929-ft (2,112-m) segment of the LYR approximately 15 river miles (RM) upstream from the confluence with the Feather River between 39°13'29.45"N, 121°23'53.55"W (downstream limit), and 39°13'16.09"N, 121°22'32.76"W (upstream limit; Figure1). The Proposed Action on the LYR lies within United States Geological Survey (USGS) hydrologic unit 18020107. The Proposed Action Area is accessible via a paved access road at 6130 Hwy 20. The Proposed Action will re-grade and rehabilitate a large gravel bar on the north side of the river which is adjacent to the SRI Stringer Pit aggregate operation (Figure 2). The area of the LYR encompassing the Proposed Action Area is just downstream and across the river from the area commonly referred to as Long Bar. An estimated 62.4 acres of gravel bar and riparian habitat are available for rehabilitation and enhancement. A total of 42.8 acres of the gravel bar (Figure 2) will be topographically modified to create/enhance juvenile salmonid rearing habitat through creation of seasonally or perennially inundated side channels (5.9 acres), backwaters (2.4 acres), flood runner channels (1.9 acres), and backwater channel (5.4 acres) and lowering of floodplain elevations (27.2 acres). The Proposed Action goals are in line with several county, state, and federal mandates to restore and enhance habitat, including the Yuba County Integrated Regional Water Management Plan (YCRWMG 2018), NMFS (2014) recovery plan, the CVPIA, and AFRP (see details below).

2.1.2 **FLOOD MANAGEMENT**

2.1.2.1 Restore the floodplain and channel capacity of the LYR

Executive Order 11988 requires all federal agencies take action to reduce the risk of flood loss, to restore and preserve the natural and beneficial values served by floodplains, and to minimize the impact of floods on human safety, health, and welfare. The Proposed Action is within the 100-year floodplain and would support the preservation and enhancement of the natural and beneficial values of floodplains, in compliance with Executive Order 11988. Recovering floodplain inundation would provide rearing habitat for juvenile salmon that may contribute to improved growth conditions and recover processes to support native plant recruitment and establishment. Proposed Action activities would likely improve groundwater recharge as floodplain function is restored. Development of the Proposed Action would increase the absorption rates for floodwaters in the local area but would not dramatically change the overall runoff patterns. The Proposed Action would increase the capacity of the river to convey flood flows in a way that is beneficial to rearing salmonids and poses no increase to the pre-project level of risk to structures, agricultural fields or mining resources.

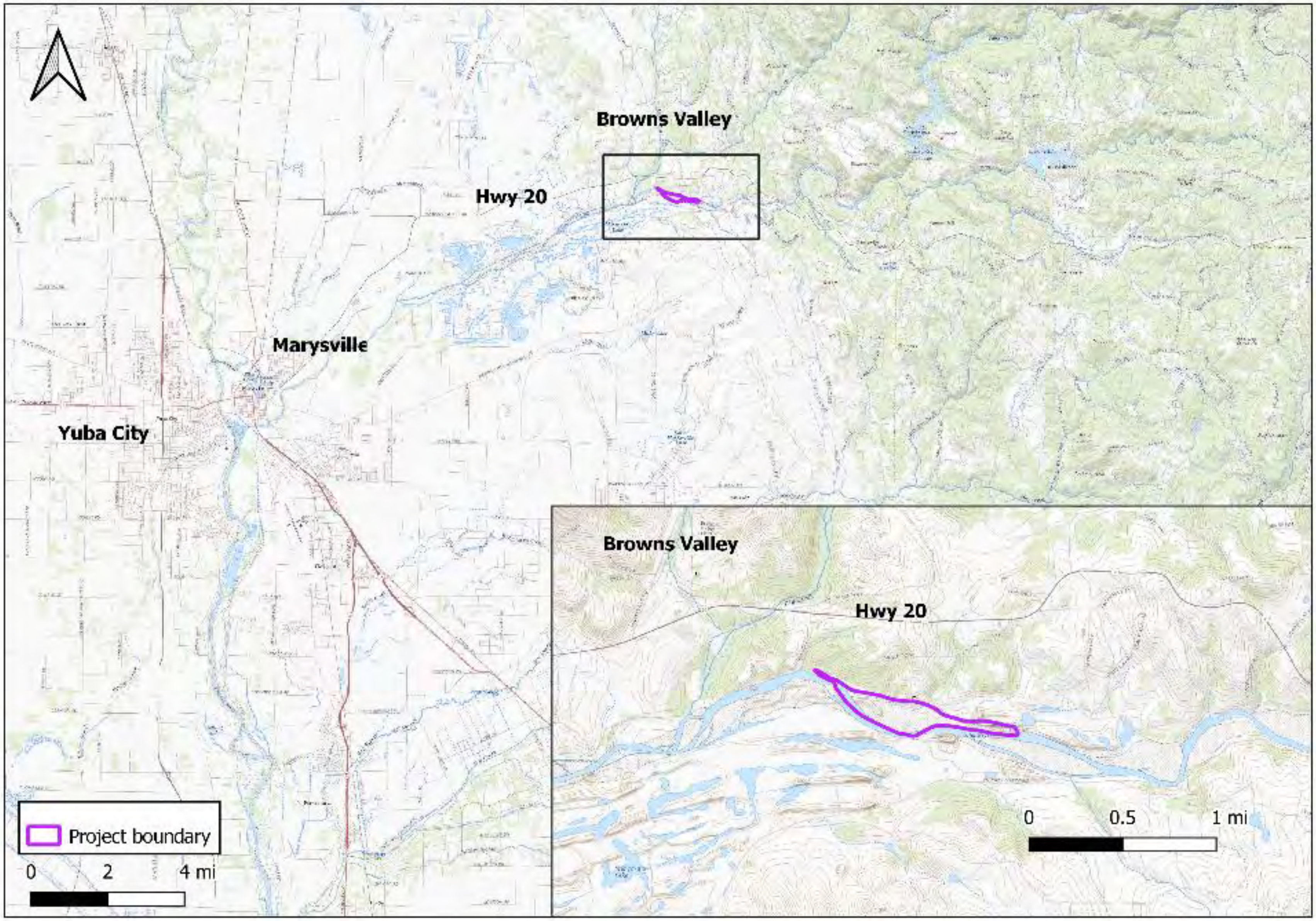

Figure 1. Location of the Long Bar Salmonid Habitat Restoration Project on the lower Yuba River.

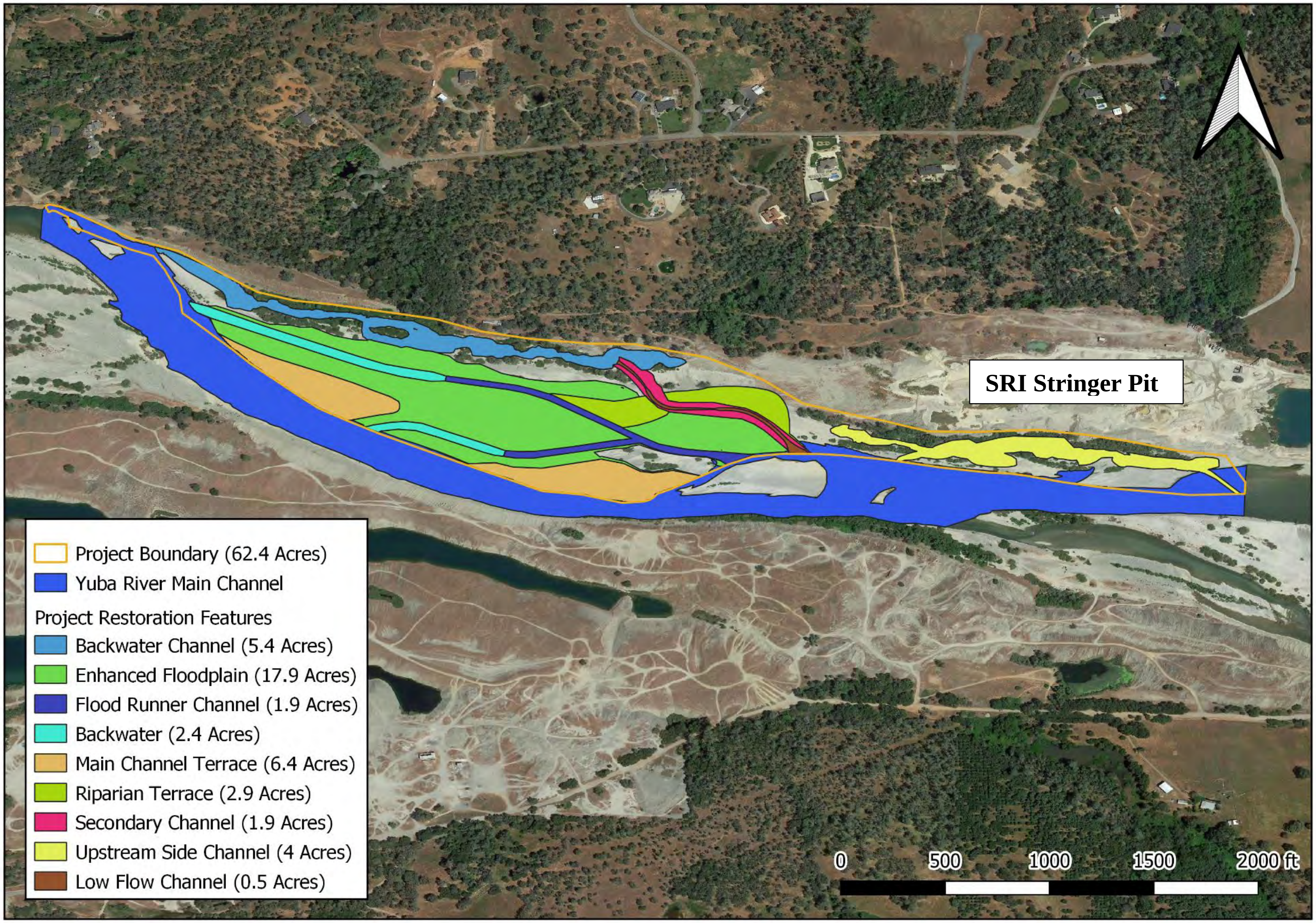

Figure 2. Proposed Action conceptual design with grading for side, secondary, flood-runner, and backwater channels and floodplain areas (enhanced floodplain, main channel terrace, and riparian terrace) indicated.

2.1.3 CONSERVATION AND PUBLIC OUTREACH

The Proposed Action supports the purpose of AFRP by addressing the following goals from the AFRP Restoration Plan (USFWS 2001):

(1) improve habitat for all anadromous life stages through improved physical habitat;

(2) collect fish habitat data to facilitate evaluation of restoration actions; and,

(3) involve local partners in the implementation and evaluation of restoration actions.

The AFRP action item of increasing available juvenile salmonid rearing habitat (USFWS 1995) is met by the Proposed Action goal of enhancing floodplain and side channel condition and connectivity. Fish habitat data would be collected before and after project implementation to facilitate assessment of project effectiveness at meeting its restoration goals. Current and potential coordination among agencies, universities, and local groups, particularly the Yuba River Management Team (Yuba RMT), would provide opportunities for collaboration during the implementation and validation phases of the Proposed Action, along with educational opportunities. The coordinated work would provide an opportunity to restore a river landscape; track key parameters of ecosystem productivity; collaborate with other completed or anticipated restoration activities such as those at Hammon Bar, Yuba Canyon, and Hallwood; inform fisheries research and management throughout the Central Valley; and develop outreach programs to foster public support for Yuba River habitat restoration.

2.2 BACKGROUND

As in many CV rivers, historic gold and gravel mining greatly altered geomorphic and hydraulic conditions under which salmonids evolved with in the Yuba River prior to European expansion. Gold was discovered on the Yuba River in 1848, and the subsequent influx of thousands of miners forever changed the physical attributes of the Yuba River, adversely impacting species and displacing native tribes that relied upon the river for sustenance. Hundreds of millions of cubic yards of gravel and debris from hydraulic mining were washed into the river and its tributaries between 1849 and 1909 (Gilbert 1917). The sediment from hydraulic mining caused the LYR to aggrade from 16 to 82 ft in the Yuba Goldfields area (Hunerlach et al. 2004). The resulting sedimentation and siltation of the Sacramento River channel and farmlands led to the construction of debris dams to block mining sediment from flowing down the river (Beak Consultants, Inc. 1989). These dams also blocked anadromous fish migration upstream, eliminating up to 60% of traditional spawning habitat in the Yuba River (Beak Consultants, Inc. 1989). Dredger mining of the LYR occurred subsequent to the hydraulic mining. A 9,000 acre area, known as the Yuba Goldfields, has been dredged numerous times. In order to protect the Yuba Goldfields, training walls were constructed using coarse mine tailings, which redirected the Yuba River to the north of its historic channel and confined it to a 1,000-1,500 ft-wide channel in the Dry Creek and Daguerre Point Dam reaches (Wyrick and Pasternack 2012; cbec 2013a).

Anthropogenic factors contribute to loss of high-quality salmonid rearing habitat in the LYR, including hydraulic gold mining, subsequent dredger mining, levee construction, and the highly regulated flow regime. Rearing habitat loss is a key factor in the precipitous decline of Pacific salmon (Nehlsen et al.1991) and with additional impacts related to invasive predators and climate change, already depressed salmonid populations have experienced a marked decline in the past several years (Mantua et al. 1997; Yoshiyama et al. 2001; Lindley et al. 2006; Katz et al. 2013). Rearing habitat is defined as the physical conditions, including water temperature, Dissolved Oxygen (DO), turbidity, substrate size/composition, water velocity and depth, and available cover (Bjornn and Reiser 1991; Healey 1991; Jackson 1992) that maintain the biological components (e.g., invertebrate prey resources) critical to habitat productivity for fish (Simenstad and Cordell 2000). Prior to European westward expansion, the LYR had a meandering to braided channel with extensive floodplain areas and riparian vegetation, large woody debris, and ample prey production (cbec 2013a). In off-channel habitats young salmonids exploit food resources, find optimal temperatures, and escape unfavorable environmental conditions of the main channel such as predators, inadequate cover, and high velocity and turbidity (Sommer et al. 2001, 2005). Currently, the LYR has one main channel with few secondary channels and its floodplains are high terraces separated from the main channel under most flow conditions. This was caused by incision into hydraulic mining sediment deposits resulting from multiple dams in the watershed that regulate flow and reduce sediment supply.

The precipitous decline of CV Pacific salmon (*Oncorhynchus* spp.) has led to extirpation of many populations of this ecologically and commercially important fish (Nehlsen et al. 1991; Merz and Moyle 2006; Katz et al. 2013). Current flood control practices in California often require peak flood discharges to be held and released over a period of weeks. Consequently, river mainstems often remain too high and turbid to provide quality rearing habitat and floodplain habitat is limited for the reasons described above. In addition, loss of sinuosity and braiding has reduced habitat complexity and the remaining habitat is degraded, with depths and velocities generally outside of juvenile salmonid habitat preferences. Therefore, floodplain and side channel enhancement provide a potential management action to increase salmonid growth and survival. Sommer et al. (2001, 2005), Heady and Merz (2007), and Sellheim et al. (2016a) have demonstrated the value in recovering shallow-water habitats to improve salmonid rearing conditions. Floodplains and side channels inundated at appropriate times of year promote conditions that can enhance juvenile salmonid growth and survival and increase carrying capacity of the river if water temperatures, prey biomass, and velocities are more favorable in comparison to main channel habitats during the rearing period (Kjelson et al. 1981, Swales et al. 1986, Ahearn et al. 2006).

The purpose of this EA/IS is to address specific environmental impacts that may result from implementing the Proposed Action. This document relies on various regional studies and published reports that address in detail the effects or impacts associated with the Proposed Action. The "Hydrologic and Geomorphic Analysis to Support Rehabilitation Planning for the LYR from Parks Bar to Marysville" (cbec 2013a) included identification of potential sites for habitat enhancement using floodplain grading, riparian planting, and placement of large wood, one of which included the Proposed Action Area. The USFWS (1995) Working Paper on salmonid restoration in the CV identified the need to restore and protect in-stream and riparian habitat in the LYR to ensure the long-term sustainability of physical, chemical, and biological conditions needed to meet production goals for Chinook Salmon. In the AFRP Final Restoration Plan (USFWS 2001), collaboration among Yuba Water Agency (YWA), Pacific Gas and Electric (PG&E), California Department of Fish and Wildlife (CDFW), and USFWS to evaluate the benefits of restoring stream channel and riparian habitats in the LYR is a high priority. Objectives of the Proposed Action fit into the framework of LYR salmonid population recovery and are aligned with three primary AFRP goals listed above in Section 2.3.3 (USFWS 2001).

This EA/IS is an informational document used in the local planning and decision-making process and is not intended to recommend approval or denial of the Proposed Action. The USFWS and Yuba County prepared this EA/IS to determine whether the Proposed Action would have a significant effect on the environment. The purposes of this EA/IS are to:

- provide the lead agencies with information to use in deciding whether to prepare an Environmental Impact Statement/Environmental Impact Report (EIS/EIR), Mitigated Negative Declaration (MND), or a negative declaration;
- enable the lead agencies to modify the Proposed Action to mitigate adverse impacts before an EIS/EIR is prepared, thereby enabling the Proposed Action to qualify for a negative declaration; and,
- document the factual basis for the finding, in a negative declaration, that a Proposed Action would not have a significant effect on the environment.

As lead agencies, USFWS and Yuba County are required to circulate an EA/IS for public review before adopting it. This document is being circulated for a 30-day review period. A notice will be posted at the Marysville, CA post office that includes a Proposed Action description, the location where the document is available for interested parties to review and contact information to request a copy of the document. The EA/IS will be available from the USFWS AFRP office (850 S. Guild Avenue Lodi, CA 95240) and at the Yuba County office (915 8th St # 125 Marysville, CA 95901). Any comments should be returned attention Paul Cadrett (USFWS AFRP) or Kevin Perkins (Yuba County). Additionally, USFWS anticipates attending a Yuba RMT Meeting during the public review period, in which they will discuss the Proposed Action and provide 'notice of availability' and the location where the document is available. Yuba County intends to adopt a MND for the Proposed Action. The USFWS intends to issue a Finding of No Significant Impact (FONSI). The EA/IS will be circulated by the State Clearinghouse so it may be reviewed by state agencies. Before adopting the Proposed Action, the USFWS must consider the proposed EA/IS along with any comments received during the public review process. If the USFWS and Yuba County find, on the basis of this EA/IS and any comments received, that the study adequately addresses the environmental issues associated with the Proposed Action and that no substantial evidence indicates that the Proposed Action will have any significant effect on the environment, a FONSI will be prepared and a MND will be adopted. Adoption of the proposed EA/IS does not require implementation of the Proposed Action.

2.2.1 **CENTRAL VALLEY PROJECT IMPROVEMENT ACT**

There are a series of documents regarding the Yuba River that rely on analyses conducted and recommended in the broader programmatic review (CALFED 2000), which is used to guide specific projects. The AFRP is a component of a broader program, the CVPIA, which supports provisions for fish and wildlife habitat restoration. The CVPIA program prepared a programmatic environmental impact statement (Reclamation 1999) and Record of Decision (ROD) (Reclamation 2001) in accordance with NEPA. A programmatic environmental document is frequently used to evaluate new programs, analyze a series of actions that are part of a larger project, or consider broad policy alternatives and programmatic mitigation measures. This document was prepared to address details and site-specific factors of the restoration actions in the Yuba River. This EA/IS for the Proposed Action is consistent with the CALFED and CVPIA programs and adopts appropriate provisions of the CVPIA's ROD. This EA/IS has been prepared to assess the impacts of the Proposed Action components as required by the State CEQA Guidelines and comply with NEPA requirements.

2.2.2 **ANADROMOUS FISH RESTORATION PROGRAM (AFRP)**

The CVPIA authorizes and directs the Secretary of DOI, in consultation with other state and federal agencies, Native American tribes, and affected stakeholders to develop and implement a program which makes all reasonable efforts to at least double natural production of anadromous fish in CCV rivers and streams. Anadromous fish under the purview of CVPIA include Chinook Salmon, CCV steelhead, American Shad, White Sturgeon, and Green Sturgeon. CV fall-run and spring-run Chinook Salmon and CCV steelhead are the primary management focus in the LYR because of the fall-run Chinook Salmon's value as a sport and commercial fishery and the listing of CV spring-run Chinook Salmon evolutionarily significant unit (ESU) and CCV steelhead distinct population segment (DPS) by NMFS as threatened under the ESA. Further, the CVPIA requires that this program give priority to measures that protect and restore natural channel and riparian habitat values through habitat restoration actions, modifications to Central Valley Project operations, and implementation of the supporting measures mandated by the CVPIA. The DOI implemented this directive by creating the AFRP, led by the USFWS. The AFRP encourages local citizens and groups to share or take the lead in implementing restoration actions. This approach is consistent with California's Coordinated Regional Strategy to Conserve Biological Diversity (Available: http://biodiversity.ca.gov/) in which 26 state and federal agencies emphasize regional solutions to regional problems. The successful implementation of the Proposed Action would contribute to LYR salmonid recovery goals and provide public outreach and education opportunities to local citizens and stakeholders.

2.3 PURPOSE AND NEED FOR ACTION AND PROJECT OBJECTIVES

NEPA requires that an EA include a discussion of the Proposed Action's need and CEQA Guidelines (Section 15124 (b)) require a statement of the Proposed Actions objectives. The following paragraphs address these requirements.

The LYR ecosystem has been affected by European-American activities for more than a century, beginning with extensive gold mining in the 1850s. Since that time, riparian and in-stream habitats have been modified or converted for uses such as agriculture, gravel and gold mining, increased water diversions, and flood protection using levees and dams to regulate streamflow. These major impacts have led to the deterioration of riparian and aquatic habitat conditions on the LYR. Despite extensive habitat degradation, CV Chinook Salmon and CCV steelhead populations are still present in the lower reaches of the LYR downstream of Englebright Dam. The LYR still produces one of the largest fall-run Chinook Salmon populations in the CV and also supports CV spring-run Chinook Salmon and CCV steelhead, which are federally listed as threatened. From 2009-2010, salmon spawning in the Yuba River made up 14-20% of all salmon spawning in Sacramento River tributaries (Yuba RMT 2013). The LYR is designated as critical habitat for the CV spring-run Chinook Salmon ESU (70 FR 52488) and the CCV steelhead DPS (70 FR 52488) between its confluence with the Feather River and Englebright Dam. The Action Area occurs within this reach. Thus, restoring habitat in this river provides an opportunity for management actions that will directly support natural production.

The "Final Central Valley Chinook Salmon and Steelhead Recovery Plan" (NMFS 2014) identified key threats to salmonids in the Sacramento River system, which contains the Yuba River watershed, including:

- loss of off-channel habitat affecting juvenile rearing and outmigration;
- predation; and
- lack of biological data for steelhead in the Diversity Group.

To address these threats, Priority Recovery Actions were identified, including:

- restoring and maintaining floodplain ecosystems to provide diverse habitats including riparian forest, shady vegetated banks, side channels, and sheltered wetlands; and

To guide restoration planning and address the various environmental impacts in the LYR, the Recovery Plan identified the following specific restoration goals, based on current scientific understanding of the LYR:

- Enhance off-channel habitat in remnant side channel and adjacent floodplain areas through increased connectivity with the main channel.
- Implement natural habitat features and floodplain revegetation.

The NMFS identified the following physical or biological features (PBFs) of freshwater rearing habitat for salmonids:

- water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
- water quality and forage supporting juvenile development; and
- natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks (70 FR 52488).

Components of high quality juvenile salmonid rearing habitat typically include appropriate water temperatures, suitable DO concentrations, decreased water velocity, overhanging or partially submerged riparian vegetation for cover and source of terrestrial insects for food, in-water natural wood structure, and suitable substrate for cover and benthic macroinvertebrate production. High complexity riverine habitats, including off-channel habitats such as floodplains, side channels, and backwaters, with a diversity of riparian vegetation provide many of the high-quality components and are known to be of special importance for rearing juvenile salmonids (Moyle 2002, Beechie et al. 2005). Juvenile salmon may migrate into side channel and floodplain habitats to exploit food resources, seek optimal temperatures, and escape unfavorable environmental conditions in the main channel such as predators and high turbidities (Swales and Levings 1989). Shallow, off-channel rearing habitat has been found to be more productive than main channel rearing, supporting higher growth rates and more favorable temperatures (Sommer et al. 2001, Jeffres et al. 2008, Limm and Marchetti 2009). Existing remnant side channels and riparian vegetation on the LYR provide flood refugia, protection from invasive predators, and abundant food resources, which promote extended rearing and the “expression of the stream-type rearing characteristic of spring-run Chinook Salmon” (DWR & PG&E 2010; NMFS 2014).

However, habitat complexity and juvenile rearing habitat in the LYR is currently limited (NMFS 2014) and enhancing off-channel rearing habitat is a key step in increasing salmonid populations in the LYR and the entire Sacramento River system (DWR & PG&E 2010). The LYR Accord River Management Team Interim Monitoring and Evaluation Report (Yuba RMT 2013) recommended the “investigation of potential actions to enhance or restore habitat or improve population status” of Yuba River anadromous salmonids. The LYR has two major salmonid habitat deficiencies: a lack of functional floodplain for salmonid rearing and a reduced quality and quantity of riparian vegetation and large woody debris (cbec 2013a). Construction of several dams on the Yuba River has impeded the movement of coarse gravels and large woody debris through the river system. With a large reduction in sediment supply from upstream sources and dam flow regulation, the LYR has incised into the massive amounts of sediment deposited by hydraulic gold mining and formed a single main channel with perched floodplain areas and a lack of secondary channels and off-channel areas (cbec et al. 2010, cbec 2013a). In addition, training walls composed of dredge tailings have confined the channel to a specific width and prevented access to historic floodplain areas (cbec 2013b). Large portions of remaining perched floodplain areas are disconnected from the main channel during common flood flows (1.5 to 5 year recurrence intervals) (cbec et al. 2010, cbec 2013b). Eliminating natural river processes has resulted in a disconnection of the floodplain from the active channel that historically would have provided seasonal rearing habitat for juvenile salmonids. The channel incision, flow regulation, and historic gold mining have also severely reduced the quality and quantity of riparian vegetation along the LYR (cbec et al. 2010). Without inundation, off-channel habitat cannot provide terrestrial food for juvenile salmonids, enhance in-river primary and secondary production, or physical habitat for fish in the form of inundated riparian vegetation and woody debris.

Chinook Salmon are the most abundant native salmonid in the LYR and demonstrate an example of a keystone species (Merz and Moyle 2006). Therefore, management actions that enhance Chinook Salmon health and production would confer benefits to the overall health and production of the LYR ecosystem. Spring-run Chinook Salmon egg incubation occurs from September through December with alevins emerging from the gravel from November through February (Yuba RMT 2013). Fall-run Chinook Salmon egg incubation occurs from October through March with alevins emerging from the gravel from December through April (Yuba RMT 2013). Emerging Chinook Salmon fry are immediately susceptible to the influence of flow (Allen and Hassler 1986; Moyle et al. 2007). Displacement and dispersal to lower velocity habitats shortly follows, assuming such refugia are present. Side-channel, floodplain, and backwater habitats serve to dissipate flow in areas where these complex in- and off-channel habitat associations exist; thereby providing suitable refugia for newly emerged fish (Swales and Levings 1989, Beechie et al. 2005).

The overall objective for the Proposed Action is to restore (i.e., rehabilitate and enhance) channel, floodplain and riparian ecosystem processes and critical habitats for juvenile salmonids, in coordination with local communities and stakeholders. The work aims to promote the recovery of healthy and diverse Chinook Salmon and CCV steelhead populations in the LYR. This Proposed Action would create high quality juvenile rearing habitat for the threatened anadromous salmonid populations in the LYR, CV spring-run Chinook Salmon and CCV steelhead and contribute to AFRP abundance goals. The Valley Elderberry Longhorn Beetle (VELB; *Desmocerus californicus dimorphus*) would also benefit from implementation of the Proposed Action due to a projected increase in elderberry (*Sambucus nigra* ssp. *caerulea*) habitat, upon which the beetle specializes.

The Proposed Action vision is considered in the context of historic land use and current water management constraints. In order to realize maximum benefits from the rehabilitation of side-channel and floodplain habitats, the Proposed Action is designed to inundate at regular intervals, both within and among years based on the Yuba Accord flow schedule and current hydrologic regime.

The Proposed Action goals are to:

- augment, rehabilitate, and enhance productive juvenile salmonid habitat in the Yuba River;
- promote a diverse riparian assemblage including elderberry plants;
- retain existing riparian vegetation resources;
- determine project effectiveness with an efficient and scientifically robust monitoring program; and
- construct a project that can provide a research opportunity to improve understanding of restoration/rehabilitation/enhancement in similar settings.

2.4 PROJECT SETTING AND LOCATION

The Proposed Action is on the Yuba River, a tributary to the Feather River, in the rural community of Browns Valley on private property on the LYR owned by Long Bar Mine LLC and Western Aggregates (Figure 1). The Proposed Action encompasses an approximately 6,929-ft (2,112-m) segment of the LYR approximately 15 RM upstream from the confluence with the Feather River between 39°13'29.45"N, 121°23'53.55"W (downstream limit), and 39°13'16.09"N, 121°22'32.76"W (upstream limit). The Proposed Action on the LYR lies within USGS hydrologic unit 18020107. The Proposed Action Area is located at 6130 State Highway 20, Browns Valley CA, 95918(Figure 1).

The LYR at the Action Area includes an existing seasonal backwater channel with perennial isolated ponds, gravel bar floodplain, seasonal side channel, and a training wall on the south side of the river (cbec 2021). The LYR main channel overflows onto the gravel bar floodplain, including into the backwater channel at its upstream end, starting at approximately 10,000 cfs. The backwater channel at the downstream end connects to the LYR main channel at approximately 2,000 cfs. The backwater channel and isolated ponds are perennially inundated even when a main channel surface connection is absent through subsurface flow. The isolated ponds and backwater support established riparian and emergent vegetation. An estimated 62.4 acres of floodplain are available to be rehabilitate

2.5 PREVIOUS ENVIRONMENTAL DOCUMENTATION

Floodplain, riparian, and side channel habitat rehabilitation and enhancement for the LYR have been identified as priority actions in USFWS's Working Paper (USFWS 1995) and the AFRP Final Restoration Plan (USFWS 2001); in the NMFS Central Valley Salmon and Steelhead Recovery Plan (NMFS 2014), by the LYR Fisheries Technical Working Group (LYRFTWG 2005), in the Habitat Expansion Plan for CV spring-run Chinook Salmon and CCV steelhead (DWR and PG&E 2010), and, in several California Department of Fish and Game publications (CDFG 1990, 1993, 1996) as part of the effort to improve rearing habitat for spring-run and fall-run Chinook Salmon and CCV steelhead in the LYR. In addition, the following environmental documents have addressed the issues being considered at the Action Area:

- **CVPIA and AFRP.** In Section 3406(b)1, the Secretary of the Interior is required to develop and implement a program that makes all reasonable efforts to double natural production of anadromous fish in CV rivers and streams by 2002. In response to this directive, USFWS prepared a draft plan for the AFRP and identified anadromous fish habitat deficiencies in each tributary within the CV (USFWS 2001). One of the High Priority actions was 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 (USFWS 2001).
- **NMFS.** The Central Valley Salmon and Steelhead Recovery Plan recommended multiple actions in the LYR that would help contribute to recovery of CV spring-run Chinook Salmon and CCV steelhead (NMFS 2014). In recovery action YUR-1.3, NMFS recommends to "develop programs and implement projects that promote natural river processes, including projects that add riparian habitat and in-stream cover" (NMFS 2014). In recovery action YUR-2.2, NMFS recommends to "increase floodplain habitat availability in the LYR" (NMFS 2014).
- **CALFED Bay-Delta Program.** This a cooperative state and federal effort which was established to reduce conflicts in the Delta by solving problems in ecosystem and water quality, water supply reliability, and levee and channel integrity. The goal of CALFED's Ecosystem Restoration Program Plan (ERPP) is to improve and increase aquatic and terrestrial habitats and improve ecosystem functions in the Delta to support sustainable populations of diverse and valuable plant and animal species (CALFED 2000). One of the conservation priorities identified in the Ecosystem Restoration Program's Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta, Sacramento Valley and San Joaquin Valley Regions is to "reestablish floodplain inundation and channel-floodplain connectivity of sufficient frequency, timing, duration, and magnitude to support the

restoration and maintenance of functional natural floodplain, riparian, and riverine habitats, including freely meandering reaches" (ERP 2014).

- **CDFW.** Habitat rehabilitation is recommended in the Yuba River as part of the fisheries management strategies in several CDFW reports including Salmon and Steelhead Restoration and Enhancement Plan (CDFG 1990), LYR Fisheries Management Plan (CDFG 1991), Restoring Central Valley Streams - A Plan for Action (CDFG 1993), and Steelhead Restoration and Management Plan (CDFG 1996), and Strategic Plan for Trout Management (CDFG 2003).
- **Federal Energy Regulatory Commission (FERC).** At present, there are six FERC licenses for hydroelectric projects on the Yuba River. Several of these licenses are currently undergoing relicensing (FERC Project No. 2266 – Yuba-Bear, FERC Project No. 2310 – Drum-Spaulding, and FERC Project No. 2246 – Yuba River Development). The first hydroelectric projects upstream from the confluence of the Yuba and Feather rivers is the Narrows I powerhouse and then the Narrows II powerhouse, which are both below Englebright Dam. The Narrows I powerhouse, FERC Project No. 1403, is owned and operated by YWA with its license effective until 2023. The Narrows II powerhouse is part of the Yuba River Development Project (FERC Project No. 2246). The Yuba River Development Project is owned by YWA and is in the relicensing process. The YWA received an initial license for the Yuba River Development FERC Project No. 2246 from FERC's predecessor, the Federal Power Commission effective May 16, 1963. On May 6, 1966 the Federal Power Commission amended the initial license and made the license effective from May 1, 1966 to April 30, 2016. The Narrows II powerhouse, FERC Project No. 2246, is located immediately below Englebright Dam in Yuba County and discharges into the LYR. The Narrows I and II powerhouses are responsible for the flows in the LYR during non-flood periods (Corps 2014).
- **Lower Yuba River Accord River Management Team Interim Monitoring and Evaluation Report**. In 2008, the Lower Yuba River Accord was approved which included a Fisheries Agreement containing in-stream flow schedules and creating a Monitoring and Evaluation Program. The RMT was created to oversee the Fisheries Agreement and guide the Monitoring and Evaluation Program and consists of representatives from the Yuba County Water Agency, National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, Pacific Gas and Electric Company, California Department of Water Resources, Friends of the River, The Bay Institute, South Yuba River Citizens League, and Trout Unlimited. The Monitoring and Evaluation Program was designed to evaluate: 1) the effectiveness of the Accord in protecting anadromous salmonids, 2) the condition of fish resources in the LYR, and 3) the viability of fall-run and spring-run Chinook Salmon and CCV steelhead in the LYR. In collaboration with the

Pacific States Marine Fisheries Commission and UC Davis, the RMT produced the Interim report in 2013.

- **Yuba County Integrated Regional Water Management (IRWM) Plan.** The goal to "Protect, restore, and enhance water quality for water users and in support of healthy watersheds" (IRWM 2018) by rehabilitating floodplain function and complying with water quality standards and monitoring required by the Regional Water Quality Control Board during construction activities. The Proposed Action also addresses the IRWM goal to "preserve and restore watershed health and promote environmental stewardship" by restoring wetland and riparian habitats, in particular floodplain and side channel rearing habitat for juvenile salmonids, reducing invasive predator habitat, and improving flood conveyance. Finally, the Proposed Action addresses the goal to "enhance regional economic development" by "promoting regional collaboration" among resource agencies, non-profit organizations, and private consulting and aggregate companies.

Rearing habitat restoration is recommended by the AFRP, ERP, NMFS, and CDFW. The actions undertaken at the Action Area could be substantially beneficial to anadromous fish in the LYR and the LYR ecosystem.

2.6 PREVIOUS SALMONID HABITAT IMPROVEMENT EFFORTS

LYR salmonid habitat improvement projects in recent years have included the on-going gravel augmentation below Englebright Dam, the completed Yuba Canyon Salmonid Habitat Restoration Project (2018) and Hammon Bar Riparian Enhancement Project (2012), and the Hallwood Side Channel and Floodplain Restoration Project (ongoing). Since 2007, gravel augmentation in the LYR below Englebright Dam has been used to rehabilitate the natural gravel delivery process impeded by dam construction and enhance spawning grounds for Chinook Salmon and CCV steelhead in the Yuba River. The LYR gravel augmentation is being funded and performed by the U.S. Army Corps of Engineers (Corps 2014). A gravel/cobble augmentation implementation plan for the Englebright Dam reach of the LYR was produced (Pasternack et al. 2010). In 2007, 453 short tons of gravel/cobble were placed in the Narrows II pool followed by about 5,000 short tons being injected just downstream of the Narrows I powerhouse in 2010/2011 (Brown and Pasternack 2013). In 2012, 2013, and 2014 about 5,000 short tons per year were injected into the LYR just downstream of the Narrows I powerhouse, with yearly gravel injections of 5,000 to 15,000 short tons predicted to continue until 2024 (Corps 2014). The effectiveness of the 2010/2011, 2011/2012, and subsequent gravel injections has been monitored since installation (Brown and Pasternack 2012, 2013; Campos and Massa 2012; Campos et.al 2013, 2014; Stearman and Massa 2015; Stearman et al. 2017). Chinook Salmon spawn in the location of the gravel injection and in downstream locations where added gravel has been redistributed too during high flow events (Stearman et al. 2017).

The Yuba Canyon Salmon Habitat Restoration Project was constructed in the summer of 2018 and enhanced approximately 3.35 acres of salmonid spawning riffles and created an approximately 0.86 acre seasonal side channel for juvenile salmonid rearing. The Hammon Bar Riparian Enhancement Project was implemented in 2011 and 2012 (SYRCL 2013). As part of the project 6,389 large cuttings of willow (*Salix spp*.) and Fremont cottonwood *(Populus fremontii*) were planted on five acres of Hammon Bar (SYRCL 2013). Phase 1 of the Hallwood Side Channel and Floodplain Restoration Project began in 2019 and was completed in 2020. Phase 1 included the creation/enhancement of 89 acres of side channel and floodplain habitat for juvenile salmonid rearing; when completed, the Hallwood project will ultimately restore 157 acres of off-channel rearing habitat. The Corps completed a pilot large woody material placement project at Lower Gilt Edge Bar in 2013 (Corps 2014).

Reports have also been completed to help guide LYR restoration efforts; rehabilitation concept report for Parks Bar to Hammon Bar (cbec et al. 2010), a hydrologic and geomorphic analysis report for Parks Bar to Marysville (cbec 2013a), and habitat management and restoration plan for the Yuba River Canyon – Englebright Dam and Narrows Reaches (ESA 2015).

2.7 REQUIRED PROPOSED ACTION PERMITS AND APPROVALS

The following federal, state, and local agency permits or approvals are required prior to implementing the Proposed Action:

Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act

The Corps is authorized to issue permits for discharges of dredged or fill material into waters of the United States. Application will be made for a Letter of Permission for the restoration of wetland and riverine habitats.

Section 401 of the Clean Water Act

State water quality standards cannot be violated by the discharge of fill or dredged material into waters of the U.S. The State Water Quality Control Board, through the Central Valley Regional Water Quality Control Board (CVRWQCB), is responsible for issuing water quality certifications, or waivers thereof, pursuant to Section 401 of the Clean Water Act (CWA).

Federal Endangered Species Act (ESA)

The Federal ESA (16 USC 1531 et seq., 50 CFR 17, 22) grants protection over species that are formally listed as threatened, endangered, or proposed. Section 7(a)(1) requires Federal agencies to use their authorities to further the conservation of listed species. Section 7(a)(2) requires Federal agencies to consult (or confer for proposed species) with the Services to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. In addition to Section 7 requirements, Section 9 of the ESA prohibits the taking of endangered species of fish and wildlife. Take is broadly defined as those activities that “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect [a protected species], or attempt to engage in any such conduct.” An activity can be in violation of take prohibitions even if the activity is unintentional or accidental. Significant modification or degradation of occupied habitat for listed species, or activities that prevent or significantly impair essential behavioral patterns, including breeding, feeding, or sheltering, are also considered “take” under the ESA. Section 10 provides exceptions to Section 9 take prohibitions. The USFWS and NMFS can issue permits to take listed species for scientific purposes, or to enhance the propagation or survival of a listed species. The USFWS and NMFS can also issue permits to take listed species incidental to otherwise legal activity. The Secretary of Commerce, acting through NMFS, is involved with projects that may affect marine or anadromous fish species listed under the ESA. All other species listed under the ESA are under USFWS jurisdiction.

California Endangered Species Act, California Fish and Game Code 2081 and 2090

The California Endangered Species Act (CESA) allows CDFW the ability to authorize, by means of an incidental take permit, incidental take of state-listed threatened, endangered or candidate species if certain conditions are met. For species that are both federally and state listed, CDFW can perform a consistency determination process to decide whether the federal biological opinion can also serve as the state incidental take permit. The Proposed Action is exempt from CESA since it is entirely federally funded.

The Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 USC 661 et seq.), amended 1946, 1958, 1978, and 1995, requires Federal agencies to coordinate with USFWS, or in some cases with NMFS, and with State fish and wildlife resource agencies before undertaking or approving projects that control or modify surface water. This coordination is performed to ensure that wildlife resources held in public trust receive appropriate consideration in and are coordinated with water resource development projects. Federal agencies undertaking water projects are required to fully consider recommendations made by USFWS, NMFS, and State fish and wildlife resources agencies in project documents, such as NEPA and CEQA, and to include measures to reduce impacts on fish and wildlife in project plans. The AFRP will work to ensure the Proposed Action complies with the Fish and Wildlife Coordination Act.

Magnuson-Stevens Fishery Conservation and Management Act of 1996 (reauthorized in 2007)

The Magnuson-Stevens Fishery Conservation and Management Act (MSA; Public Law 94-265) is the primary law governing management of marine fisheries in federal waters of the U.S. (within 200 nautical miles of shore). Pacific coast salmon species are subject to the MSA. Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect essential fish habitat (EFH). The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". Adverse effects means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of or injury to benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

Fish and Game Code Section 1600 et. seq., Streambed Alteration Agreement

California Department of Fish and Wildlife has regulatory authority with regard to activities occurring in streams and/or lakes that could adversely affect any fish or wildlife resource, pursuant to Fish and Game Code Section 1600 et seq. Authorization is required for proposed actions prior to any activities that could substantially divert, obstruct, result in deposition of any debris or waste, or change the natural flow of the river, stream, or lake, or use material from a stream or lake. The Proposed Action is exempt from Section 1600 (memo to CDFW 6/5/2020).

Central Valley Flood Protection Board Encroachment Permit

The Flood Protection Board issues permits to maintain the integrity and safety of flood control project levees and floodways that were constructed according to flood control plans adopted by the Board of the State Legislature. An encroachment permit is not needed for the Proposed Action as it is outside of CVFPB jurisdiction.

State Water Resources Control Board

The State Water Resources Control Board requires projects that disturb one or more acres of soil to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity as part of the National Pollution Discharge Elimination System (NPDES). The Construction General Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP must list BMPs the discharger will use to protect storm water runoff and the placement of those BMPs. The contractor will work with CFS to ensure the Proposed Action has compliance. The contractor will be contractually required to implement the BMPs in the SWPPP.

National Historic Preservation Act, Section 106

Projects must coordinate with the State Historic Preservation Office and the Advisory Council on Historic Preservation regarding the effects that a project may have on properties listed, or eligible for listing, on the National Register of Historic Places. Section 106 also requires Federal agencies to evaluate the effects of Federal undertakings on historical, archaeological, and cultural resources. The AFRP will work to ensure the Proposed Action has compliance with Section 106 of the National Historic Preservation Act (NHPA).

Feather River Air Quality Management District

The Feather River Air Quality Management District (FRAQMD 2010) requires that all portable equipment registrations are obtained for all project equipment. Portable equipment used in project is registered by the contractor.

The following Executive Orders and Legislative Acts have been reviewed as they apply to the Proposed Action, and the following permits/authorizations are required to implement the proposed action:

National Environmental Policy Act

This joint EA/IS was prepared pursuant to regulations implementing the NEPA (42 USC 4321 et seq.). National Environmental Policy Act provides a commitment that Federal agencies will consider environmental effects of their actions. This EA/IS provides information regarding the No-Action Alternative, the Proposed Action, and their environmental impacts. If, after certain key permits are obtained and the final EA/IS is released, the Proposed Action is found to have no significant environmental effects, a FONSI will be filed.

Floodplain Management - Executive Order 11988

Executive Order 11988 requires that all Federal agencies take action to reduce the risk of flood loss, to restore and preserve the natural and beneficial values served by floodplains, and to minimize the impact of floods on human safety, health, and welfare. The project is within the 100-year floodplain. The Proposed Action supports the preservation and enhancement of the natural and beneficial values of floodplains and is in compliance with Executive Order 11988.

Protection of Wetlands - Executive Order 11990

Executive Order 11990 requires Federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction on wetlands. The EA/IS has identified that the restoration actions will not result in the net loss of any wetlands. Implementation of the proposed restoration could enhance wetlands or increase their area, and is in compliance with Executive Order 11990.

Environmental Justice in Minority and Low-income Populations-Executive Orders 13007 and 12898

Executive Order 12898 requires Federal agencies to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies, and activities on minority and low-income populations. The Proposed Action has considered the environmental, social, and economic impacts on minority and low-income populations and is in compliance with Executive Order 12898.

Indian Trust Assets, Indian Sacred Sites on Federal Land-Executive Order 13007, and American Indian Religious Freedom Act of 1978

These laws are designed to protect Indian Trust Assets, accommodate access and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites, and protect and preserve the observance of traditional Native American religions, respectively. The Proposed restoration activities and their associated mitigation measures will not violate these protections.

3 ALTERNATIVES

Two alternatives are considered in this document: the No Action alternative and the Proposed Action alternative.

3.1 ALTERNATIVE 1 – NO ACTION ALTERNATIVE

The No-Action alternative would consist of not implementing restoration activities and no change to existing conditions.

If the Proposed Action is not implemented, existing floodplain habitat would continue to be limited and degraded. The LYR floodplain habitat is limited by several anthropogenic factors, which are described in Section 2.2 above. These factors will continue to limit salmonid rearing habitat and native riparian vegetation recruitment through ongoing floodplain erosion and decreased deposition of fine sediments.

3.2 ALTERNATIVE 2 – PROPOSED ACTION ALTERNATIVE

3.2.1 OVERVIEW

The objective for the Proposed Action is to restore (i.e., rehabilitate and enhance) channel, floodplain, and riparian ecosystem processes and critical habitats for juvenile salmonids in the LYR, in coordination with local communities and stakeholders. The Proposed Action is a collaborative effort by AFRP, Long Bar Mine, Western Aggregates, SYRCL, CFS, cbec, inc., eco-engineering, Yuba RMT, and local stakeholders. The Proposed Action would directly address the CCV Chinook Salmon population doubling goal of the USFWS AFRP and test hypotheses regarding a variety of habitat enhancement techniques and subsequent utilization (or lack thereof) of juvenile salmonids in floodplain and side channel habitats. The Proposed Action would also provide additional flood management.

The proposed habitat enhancement actions include topographic modification and strategic riparian planting. Topographic modification would include lowering of floodplain elevations, and enhancement and/or creation of a network of perennially and seasonally inundated side and backwaters. Up to 4,500 feet of side and backwaters would be created or enhanced. Riparian planting would be conducted in some areas where roughness features will be created, while other areas would rely on natural recruitment. Areas that are planted would be done so using the most suitable method for the particular location, including the “pod” method, which was successfully used for the Hammon Bar riparian restoration project to install pole cuttings of native riparian vegetation (SYRCL 2013). Existing riparian vegetation would be preserved as much as possible. A monitoring program would document the success of the implementation, the effectiveness of the Proposed Action to recover suitable juvenile salmonid rearing habitat, and a validation component to test hypotheses about the function of the recovered habitats. SYRCL, as the Project Manager, will direct local outreach activities and project participation by stakeholders, landowners and other interested parties.

One of the primary objectives of the Proposed Action is to restore/enhance juvenile rearing habitat for CV Chinook Salmon and CCV steelhead. The Proposed Action would increase the extent and duration during which juvenile salmonids are able to access floodplain, side channel, and backwater habitat within the Action Area at a range of ecological flows. Functional off-channel juvenile salmonid rearing habitat requires inundation of floodplain and side-channel habitats during the winter and spring periods, typically outside of the optimal mosquito breeding season. Enhanced rearing habitat, including floodplain and side channels, will reduce water level fluctuation and potential production of floodwater mosquitoes and discourage warm water conditions that have been found to be associated with avian botulism outbreaks. Aquatic insects, such as mosquitoes, are key prey items for juvenile salmonids that are the target for the Proposed Action’s habitat enhancement actions (Merz 2001; Merz 2002). Floodplain and side channel habitats would be graded to minimize juvenile salmonid stranding as flows recede; this would also reduce the presence of standing water in stagnant, disconnected pools which may harbor mosquitoes.

Recovering floodplain and side channel inundation would provide rearing habitat for juvenile salmon that may contribute to improved growth conditions (Sommer et al. 2001; Merz et al. 2004; Jeffres et al. 2008) and recover processes that promote the native riparian plant community (Sellheim et al. 2016b). The Proposed Action, funded by the AFRP, advances the effort to restore the Yuba River and provides measures to address whether design objectives are met.

3.2.2 ASSUMPTIONS FOR DEVELOPING PROPOSED ACTION

Basic assumptions that influenced the development of the Proposed Action include:

- Stream flow in the Action Area is suitable for CV spring-run and fall-run Chinook Salmon and CCV steelhead. Stream flow is controlled by YWA via releases from Narrows I and II powerhouses directly below Englebright Dam.
- Existing Land Use: The Action Area is owned by Long Bar Mine LLC and Western Aggregates who support and contribute to the Proposed Action
- The currently degraded channel provides low fisheries benefits
- Proposed Action construction activities would have minimal impacts to the stream corridor, riparian vegetation and any sensitive habitats.

3.2.3 PROPOSED ACTION DESCRIPTION

3.2.3.1 Site Selection

The Action Area was chosen as a key restoration location on the LYR. The following factors were important in determining site selection:

- existing condition (e.g., perched floodplain habitat that is currently disconnected from the main river channel due to decades of channel incision; a lack of channel complexity during normal flows, and minimal quality and quantity of riparian vegetation)
- potential for enhancement (suitable gradient; suitable depth)
- physical access to the site to allow equipment entrance that would have minimal impacts on the stream corridor, riparian vegetation, any sensitive species habitat, and local community
- landowner collaboration (Long Bar Mine LLC and Western Aggregates) and,
- consistency with Yuba County General Plan (Yuba County 2011).

3.2.3.2 Existing Conditions

3.2.3.2.1 Biological Resources

Three anadromous fish species: CV spring-run Chinook Salmon, CV fall-run/late fall-run Chinook Salmon; CCV steelhead, and two species of special concern: Hardhead (*Mylopharodon conocephalus*) and Riffle Sculpin (*Cottus gulosus*) are present in the LYR (Moyle 2002). The CV spring-run Chinook Salmon ESU was listed as threatened in 1999 (64 FR 50394). In 2005, NMFS reaffirmed the threatened status of the CV spring-run Chinook Salmon ESU (70 FR 37160). The critical habitat designated for CV spring-run Chinook Salmon includes the Yuba River and adjacent riparian habitat downstream of Englebright Dam (70 FR 52488). The CCV steelhead was first listed as a threatened ESU in 1998 (63 FR 13347). In 2006, NMFS reaffirmed the threatened status of CCV steelhead and applied the DPS policy to the species, creating the CCV steelhead DPS (71 FR 834). The CCV steelhead DPS was updated in 2014 (79 FR 20802). The Yuba River and adjacent riparian habitat downstream of Englebright Dam were included in the final critical habitat designation for this species in 2005 (70 FR 52488).

CV Chinook Salmon and CCV steelhead are the primary focus of LYR management efforts. Spring-run and fall-run Chinook Salmon in the Yuba River typically emigrate to the ocean in the spring of their first year (Yuba Accord RMT 2013) and spend 1-4 years in the ocean before returning to their natal stream to spawn (Yuba Accord RMT 2013). LYR Chinook Salmon escapement in the past 20 years (2000-2019) averaged 11,104, with a low of 1,634 in 2017 and a high of 28,316 in 2003 (Table 1; CDFW 2020). However, GrandTab reports all Chinook Salmon escapement to the LYR as fall-run Chinook Salmon (CDFW 2020). In YWA’s (2017) application for a new FERC license they separated escapement of fall-run and spring-run Chinook Salmon to the LYR from 2004 to 2015 based on the timing of fish passing the cameras (VAKI Riverwatcher) in the fish ladders at Daguerre Point Dam. The estimated escapement of fall-run and spring-run Chinook Salmon to the LYR from 2004 to 2015 is presented in Table 1. Chinook Salmon escapement estimates for the LYR made prior to 2011 (and reported in CDFW 2020) used a modified Schaefer mark-recapture statistical estimation technique which has been found to overestimate escapement (Bergman et al. 2012).

Table 1: Estimated escapement to the LYR of Chinook Salmon in GrandTab and split into spring-run and fall-run Chinook Salmon based on VAKI Riverwatcher upstream passage data at Daguerre Point Dam (YCWA 2017, CDFW 2020).

Year	GrandTab	Spring-run Chinook Salmon	Fall-run Chinook Salmon
2000	14,995	n/a	n/a
2001	23,392	n/a	n/a
2002	24,051	n/a	n/a
2003	28,316	n/a	n/a
2004	15,269	738	14,531
2005	17,630	3,592	14,038
2006	8,121	1,326	6,795
2007	2,604	372	2,232
2008	3,508	521	2,987
2009	4,635	723	3,912
2010	14,375	2,886	11,489
2011	8,928	1,159	7,769
2012	7,668	1,046	6,622
2013	14,880	3,130	11,750
2014	11,615	2,336	9,279
2015	6,507	184	6,323
2016	4,057	n/a	n/a
2017	1,634	n/a	n/a
2018	3,455	n/a	n/a
2019	3,446	n/a	n/a

CCV steelhead in the LYR typically emigrate to the ocean in the spring at 1 to 3 years of age (Yuba RMT 2013). CCV steelhead spawning in the LYR primarily occurs upstream from Daguerre Point Dam and generally occurs from January through April, with peaks in February and April (Yuba RMT 2013). In 2010, 227 CCV steelhead redds were observed in the LYR, while only 38 were observed in 2011 (Yuba RMT 2013).

Englebright Dam (RM 23.6) is the uppermost extent of fish migration, limiting all anadromous species and life stages to the low-gradient lower river. Natural salmon production is therefore limited because accessible spawning and rearing habitat extent is dramatically reduced compared to historical conditions. However, in 2015 a term sheet was signed by several government agencies and non-profits to explore reintroduction of spring-run Chinook Salmon to the North Yuba River above New Bullards Bar Reservoir (YSPI 2015).

The Proposed Action study area currently supports patches of riparian vegetation that are found around the backwater complex and on the gravel bar (Figure 3). Riparian forest is primarily found along the northern edge of the Action Area including the backwater channel (Figure 3). The primary native trees comprising the riparian forest include Fremont cottonwood (*Populus fremontii)* and white alder (*Alnus rhombifolia*) with an understory shrub layer including willows and buttonbush (*Cephalanthus occidentalis*). The riparian scrub/shrub vegetation is scattered in patches throughout the gravel bar and is comprised primarily of willows *(*Figure 3*).* Emergent vegetation, comprised of a combination of cattails (*Typha* spp.), rushes (*Juncus* spp.), and dock (*Rumex* spp.), is found around one isolated pond in the backwater complex and along the seasonal outlet channel of the backwater (Figure 3). Four elderberry shrubs with stem diameter greater than 1 inch were documented in the Action Area (Figure 3). The elderberry bushes were from 6 to 12 feet and over 12 feet in relative elevation above low flow conditions (880 cfs; Fremier and Talley 2009; Figure 4). Some of the elderberry plants within the site may be occupied by the VELB. However, only one of the shrubs had a possible exit hole as of fall 2020 (CFS unpublished data). The VELB is federally listed as threatened but there is no designated critical habitat for the species within the Action Area (45 FR 52803). In 2014, the USFWS withdrew a proposed rule to delist the VELB (79 FR 55879).

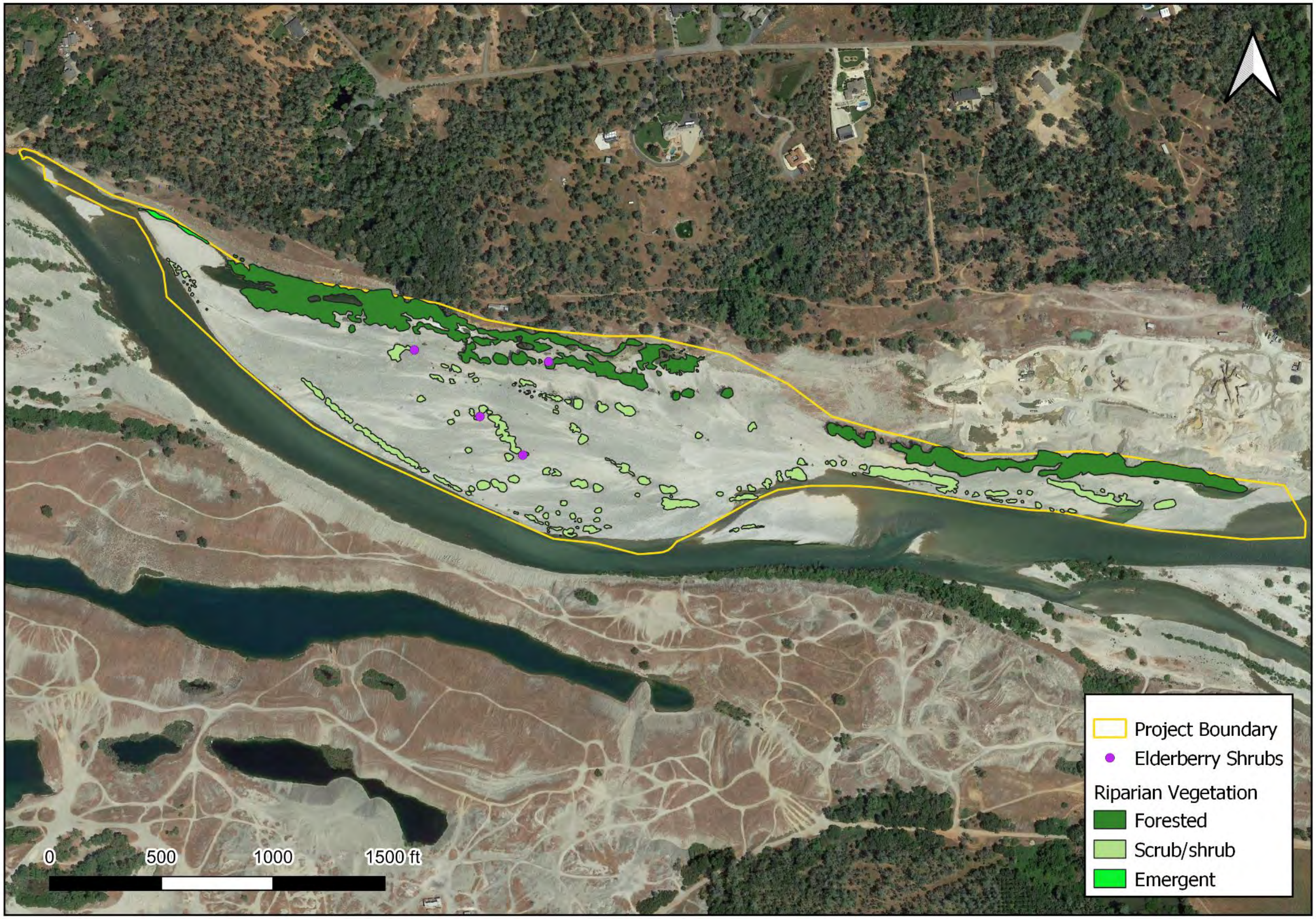

Figure 3. Existing Proposed Action riparian vegetation. Existing elderberry plants are depicted with purple dots.

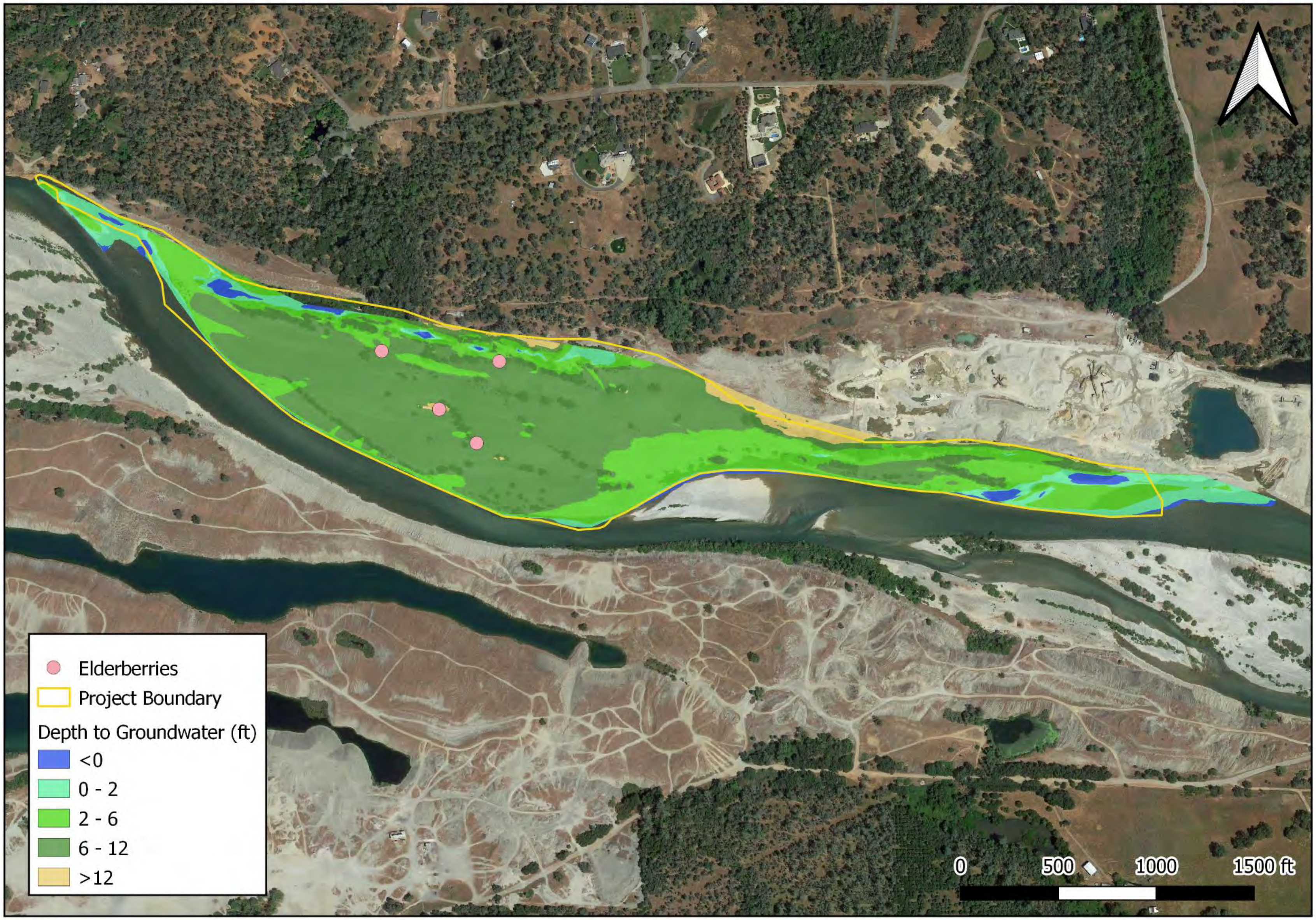

Figure 4. Depth to groundwater within the Proposed Project Boundary at a LYR flow of 880 cfs with the existing elderberries depicted by pink dots.

The habitat within the Action Area likely supports a wide variety of wildlife species. Some of the wildlife species observed within the site include: Black Tail Deer (*Odocoileus hemionus*), Osprey (*Pandion haliaetus*), Great Blue Heron (*Ardea herodias*), North American Beaver (*Castor canadensis*), and Bullfrog (*Rana catesbiana*) (CFS, unpublished data).

The closest known population of California Red-legged Frog (*Rana draytonii*) to the Action Area is approximately 19 miles away, in historic mining ponds adjacent to Little Oregon Creek, a tributary to New Bullards Bar Reservoir (Barry and Fellers 2013). However, many areas of potentially suitable habitat have not been surveyed for California Red-legged Frog and recent surveys have discovered previously unknown populations (Barry and Fellers 2013), suggesting that it is possible but not likely that California Red-legged Frog are present with the Action Area. Tadpoles captured during surveys in the backwater pond were all identified as bullfrogs (CFS unpublished data). It is also possible that individual frogs could be transported downstream to within the Action Area during spring flows. However, California Red-legged Frog are not likely to persist at the site for several reasons: existing ponds/wetlands are occupied by bullfrogs and predatory fishes, absence of fine sediment substrate used for predator avoidance at the site, little woody material and wrack available for thermal regulation and predator avoidance, and the nearest known occupied breeding habitat is approximately 19 miles away.

3.2.3.2.2 Hydrology

The LYR hydrologic regime is characterized as a mixed rain and snowmelt system (cbec 2013a). Peak flows occur during the winter and spring in response to precipitation events, particularly rain on snow. Snowmelt runoff in the LYR occurs from March through the end of May and recedes in June and July to summer baseflows in August and September (cbec 2013a). The upstream reservoir water regulation has reduced monthly flow variation and has shifted the pattern of peak and minimum flows (Corps 2012). Water regulation has reduced the magnitude of floods that occur with 1.5- and 5-year recurrence intervals and has increased summer baseflows (cbec 2013a, cbec 2020). Despite the presence of several large dams in the watershed, the LYR still experiences moderate to major floods capable of inducing geomorphic changes to the mainstem (Pasternack 2009; Wyrick and Pasternack 2012).

3.2.3.2.3 Geomorphology

The Action Area is in the Parks Bar reach which extends from the Highway 20 bridge to the Dry Creek confluence (Wyrick and Pasternack 2012). The Parks Bar reach marks the LYR entering into a wider alluvial valley, whereas the Timbuctoo Bend reach immediately upstream is confined by steep valley walls (Wyrick and Pasternack 2012). Lateral migration is the dominant topographic change process in the Parks Bar reach, as observed from topographic change detection surveys between 1999 to 2017 (Carley et al. 2012; Weber and Pasternack 2017). Using the Parker (1976) classification scheme, the reach is "transitional" and using Rosgen (1996) the reach is a C3 stream type. The median (D_{50}) substrate size is 118 mm, which is classified as cobble.

3.2.3.3 Project Characteristics

The Proposed Action would take place in and adjacent to a reach of the LYR above Daguerre Point Dam over a one- or two-year period. The Proposed Action includes a detailed effectiveness monitoring program to determine its success in terms of riparian vegetation and habitat for salmonids. The Proposed Action has been designed to improve habitat for native fish and wildlife while not affecting flood management along the LYR. SRI, the aggregate company that leases the land, would perform site construction while simultaneously harvesting excavated coarse sediment to sell, which would help offset project costs. The Proposed Action team including cbec eco engineering, SYRCL, and CFS have been working collaboratively on the Proposed Action design, under the direction of AFRP. The Yuba RMT has and will continue to provide input and public comment as the Proposed Action moves forward.

3.2.3.4 Design and Construction Activities

This Proposed Action would reclaim the currently infrequently inundated gravel bar floodplain, create seasonal and perennial side and backwaters through the floodplain, enhance the backwater complex including creation of a perennial side channel, and restore riparian vegetation. All of these actions would enhance juvenile salmonid rearing habitat within the Action Area.

3.2.3.5 Side Channel and Floodplain Restoration and Enhancement

3.2.3.5.1 Design Approach

The development of the Proposed Action was based on the mindset that restoration of a more natural river and floodplain morphology will do more to create a healthy, productive river system than attempting restoration to some specific historical condition or to achieve some optimized fixed topographic configuration (cbec 2021). This is crucially important in the LYR given the significant annual sediment yield and the prevalence of stories from local residents about the river's uncanny ability to rapidly (i.e. overnight) fill excavated depressions with coarse sediment. Thus, while descriptions of the habitat created by the Proposed Action include specific, constructible, geometric considerations it is understood, and desirable, that the system geometry will naturally evolve over time.

The Proposed Action was designed according to the LYR Accord flow schedule to support frequent inundation of salmonid rearing habitat.

An analysis was completed using the Corps Hydrologic Engineering Center - Ecosystem Functions Model (HEC-EFM) to inform ecologically significant flows on which to base Project design criteria. For the LYR, ecosystem function relationships (EFRs) were previously developed using available information regarding LYR-specific species life history characteristics and fisheries use datasets (cbec 2013a). To develop habitat that is inundated for the preferred duration at an expected frequency over the target ecological period, specific flow values were selected to guide the design based on these datasets (Table 2). Based on the ecological flow evaluation, design flows were developed to govern the development of habitat enhancements. Table 3 lists the various design flows along with their ecological importance and their significance related to physical processes. A more detailed description of design methodology is available in Appendix A and 65% design plans are provided in Appendix B.

Table 2. Summary of ecologically significant flows guiding Proposed Action design

	January to June			**January to June**			**July to October**
	21-day Duration Flow (cfs)			**3-day Duration Flow (cfs)**			**Baseflow (cfs)**
Dataset	**33%**	**50%**	**67%**	**33%**	**50%**	**67%**	
Yuba River Development Project (YRDP) Model[1]	5,000	4,100	2,000	10,400	6,900	3,800	700

[1]YRDP Operations Model (FERC No. 2246) accessed from http://www.ycwa-relicensing.com

Table 3. Design flows based on HEC- EFM results from the Yuba River Development Project model

Flow (cfs)	Ecological Significance	Physical Process Significance
700	Minimum required flow September 1– April 15	Baseflow
880	Typical fall-run spawning flow	Main channel spawner bed modification (Hassan et al. 2008; DeVries 2012)
1,000	Upper end of fall-run spawning flow	Surface water flow disconnection to all floodplain features (cbec design)
2,000	21-day duration occurring almost every year (January to June); lower end of rearing range	Channel defining flow for Secondary Channel geometry (cbec design)
3,500	21-day duration about every other year; activates riparian corridor	Potential for vegetation and sediment recruitment feedbacks (cbec design)
5,000	21-day duration every third year to support yearly broods; upper end of steelhead spawning	LYR bankfull (Wyrick and Pasternack 2012)
7,500	Occurs for ~3 days every other year; provides access to floodplain	Potential for vegetation and sediment recruitment feedbacks (cbec design)
10,000	Upper end of rearing range	~1.5-year recurrence interval flood; Secondary Channel riffle-pool maintenance
40,000	Linked to implications for the floodway	~5-year recurrence interval flood; material critical grain size threshold (cbec design) for riffle crests, inlets, and roughness features
70,000	Linked to implications for the floodway (scour and vegetation regeneration); vegetation recruitment assumptions	~10-year recurrence interval flood

3.2.3.5.2 Proposed Action Design

The Proposed Action has the potential to create/enhance up to 43 acres of juvenile salmonid rearing habitat including floodplain lowering and creation/enhancement of 4,400 linear feet of seasonal and perennial side and backwaters. Channel and floodplain grading designs were based on site hydrology and geomorphic considerations (i.e., evolution and persistence). The spatial extent of the topographic modifications (grading limits) were designed to target the existing swaths of largely disconnected and mostly barren cobble fields, and to avoid significant impacts to existing riparian vegetation. The grading changes were also aimed at improving existing floodplain habitat connectivity. These topographic modifications were designed to increase the frequency, duration, extent, and suitability of inundated habitat during the period juvenile CV Chinook Salmon and CCV steelhead are rearing in the LYR. Hydrology was evaluated to determine ecologically significant flows that occur during the juvenile salmonid rearing period. The goal of floodplain and channel grading was to provide inundation throughout the range of ecological flows so water surface elevations associated with those flows were used as grading design criteria. Table

4 lists the various channel and floodplain types included in the design and the ranges of ecological flows under which they were designed to function. The functional range column reports the target range for which habitat is optimized in each feature, but this is not to imply that habitat stops functioning outside of that range.

Habitat features were designed to "initiate" or begin to inundate at the approximate flows listed in Table 4 to develop inundation depths that would satisfy the needs of fry and juvenile salmonids over the rearing period according to selected habitat suitability indices (Moniz and Pasternack 2019). The grading designs for the features identified in Table 4 were refined through an iterative process of evaluation and redesign to target fry and juvenile salmonid habitat suitability index (HSI) and to maximize weighted useable area (WUA; Appendix A).

Included in the target performance ranges for evaluated flows identified in Table 4, it should be noted that the Backwater Channel and Secondary Channel bed elevations were designed to maintain a minimum of 1 ft depth throughout the driest months in about half of all years to provide over-summer habitat for rearing juvenile salmonids.

Table 4. Summary of design habitat elements and flow criteria

Habitat Element	Flow (cfs)		Inundation Regime			
	Initiation	**Functional Range**	**Analysis Flow (cfs)**	**Timing**	**Duration (days)**	**% Exceedance**
Secondary Channel	2,000	2,000-5,000	2,000	Jan - June	21	67%
Backwater Channel	700	700-5,000	2,000	Jan - June	21	67%
Upstream Side Channel	2,000	2,000-10,000	2,000	Jan - June	21	67%
Flood Runner Channels (frequent flows)	3,000	3,500-10,000	3,500	Jan - June	21	50%
Riparian Terraces[1] (seasonally inundated, off-channel habitat)	2,000	5,000-10,000	3,500 / 5,000	Jan - June	21	33 – 50%
Backwaters	700	700-5,000	2,000	Jan - June	21	67%
Enhanced Floodplain	5,000	5,000-26,000	10,000	Jan - June	3	33%
Main Channel Terraces	1,000	2,000-10,000	2,000	Oct - June	21	67%

[1]Includes terracing north of the Secondary Channel and the Connector Channel.

3.2.3.5.2.1 Secondary Channel Features

During baseflow conditions, when total LYR flow upstream of Daguerre Point Dam (DPD) is approximately 700-1,000 cfs, the Secondary Channel will not exhibit a direct surface connection to the main river at the upstream connection. Baseflows occur in most years from mid-August to October corresponding to the latter portion of the adult CV Chinook Salmon immigration period (Table 5). During this period, there is a focus on providing deeper, colder, main channel habitat. It is not desirable to distribute the limited surface water flows onto the floodplain or Secondary Channel because if redds are built in these areas they are at risk of becoming stranded if flows are reduced.

Table 5: The critical periods for CV fall-run and spring-run Chinook Salmon and CCV steelhead within the Action Area. The dark gray squares represent the primary period of occurrence for that life stage and light gray the secondary period. White indicates absence of the life stage.

Species/ Life Stage	Yuba River Distribution	Month Present											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Central Valley Fall-Run Chinook Salmon													
Adult holding and spawning	Feather River confluence to Englebright Dam												
Egg incubation	Feather River confluence to Englebright Dam												
Juvenile emergence and rearing	Feather River confluence to Englebright Dam												
Juvenile/smolt out-migration	Feather River confluence to Englebright Dam												
Central Valley Spring-Run Chinook Salmon													
Adult migration and holding	DPD pool and locations upstream												
Adult spawning	Primarily upstream of DPD												
Egg incubation	Primarily upstream of DPD												
Juvenile emergence and rearing	Primarily upstream of DPD												
Juvenile/smolt out-migration	Feather River confluence to Englebright Dam												
California Central Valley steelhead[c]													
Adult migration	Feather River confluence to Englebright Dam												
Adult spawning	Primarily upstream of DPD												
Egg incubation	Primarily upstream of DPD												
Juvenile emergence and rearing	Primarily upstream of DPD												
Juvenile/smolt out-migration	Feather River confluence to Englebright Dam												

The sectional design geometry of the Secondary Channel is planned as a combination of four different functional elements: 1) Inlet, 2) Riffles, 3) Low Flow Channel, 4) Floodplain Terraces. A description of the geometric considerations for the components follows. Specific attention is placed on the hydrologic flow criteria used to inform and refine restoration concept geometry.

3.2.3.5.2.2 *Inlets*

Secondary Channel and Upstream Side Channel inlet elevations were set to approximate the 2,000 cfs WSE to correspond with the habitat goals for the channels. Because the inlets were designed to divert flows from the main channel when total river flows exceed 2,000 cfs, spawning habitat in the main channel should not be affected, since spawning typically occurs when main channel flows are below 1,000 cfs. Inlet mouth sections are narrow by design to maintain their form by inducing sediment-clearing flow velocities. To the extent possible, inlets were located outside of geomorphically active areas to avoid sediment deposition or scour. However, locating inlets was balanced with goals for maximizing channel length to enhance habitat and aligning the inlets with the channel form to conduct flow more effectively.

3.2.3.5.2.3 *Riffles*

Riffles were included in the design in the pattern and form identified by Newbury and Gadboury (1993) (also known as Newbury riffles) to provide habitat variability, increase floodplain connectivity, and provide grade control in the Low Flow Channel (Figure 2). Three distinct habitat units are created by the inclusion of Newbury riffles in the Proposed Action: an upstream glide/pool section, a riffle section, and a downstream transition section. Riffle spacing was designed so that the downstream riffle backwaters the majority of the riffle upstream, creating a series of pools 1 to 2.5 ft in depth to target rearing juvenile salmonid HSI and to provide dry season groundwater-fed habitat. The backwater created by the pools will reduce the hydraulic slope and flow velocity in the Secondary Channel to help maintain velocity within target HSI values. As flows approach the riffle crest, the channel conveyance is reduced, encouraging flows to disperse laterally onto the adjacent floodplain.

Newbury riffles are intended to resist erosion and headcutting, thereby providing grade control. The riffles will be composed of well-graded (i.e., not uniform in size) sediment that will adjust to fill voids caused by such erosion. Riffle rocks will be placed in a mound with a relatively steep upstream face and a milder slope on the downstream side. Riffle crests will be keyed into the banks of the Low Flow Channel to resist lateral flanking. Rock gradations for the riffles will be selected to resist transport during a 5-year event.

The Low Flow Channel riffles are anticipated to be a self-sustaining feature that will maintain channel form by facilitating the flushing out of finer pool sediments during relatively high recurrence flow events. In low flows, velocity in the pools is slower than over the riffles due to the relatively larger cross-sectional area. In higher flows, the cross-sectional area of the riffles can exceed that of the pools, as flows spread out over the riffle (Lane and Borland 1954). This leads to a “flow reversal” (Keller and Florsheim 1993; MacWilliams et al. 2006) in which the pool velocities are higher than those over the riffle. This may assist in maintaining pool depth and riffle form by removing sediment from the pools and distributing it to the floodplain adjacent to the riffles, or to the riffles downstream (Lane and Borland 1954). The Floodplain Terraces allow flows to spread onto a wider floodplain and slow down, reducing the shear stress, or erosive power. The Secondary Channel flows required to activate this process are associated with ~1.75-year recurrence interval flow.

3.2.3.5.2.4 *Low Flow Channel*

The channel that serves as a connection between the upstream end of the Backwater Channel and the main channel is a two-stage design, with a Low Flow Channel and shallow Floodplain Terraces. The Low Flow Channel profile elevation varies to allow for perennial, groundwater-fed, trickle flows through a series of shallow riffle habitats separated by deeper pool and glide habitats. The Low Flow Channel was designed as a patterned sequence of deeper and narrower areas (pools) followed by wider and shallower areas (riffles) imitative of natural, gravel bedded river forms. It is important to note that these are not uniformly-trapezoidal channels with unchanging widths and fixed slopes.

The Low Flow Channel was designed to maintain full depth during dry year baseflow conditions, when it is disconnected from surface flow to provide habitat for over-summering juvenile spring-run Chinook Salmon and CCV steelhead. The Low Flow Channel geometry design is based on the estimated depth to groundwater at an 880 cfs main channel flow (the 98% exceedance baseflow in June-August, and the 55% exceedance baseflow in September-October) to provide a continuous, wetted channel in the dry months of approximately half of all years. The Secondary Channel riffle crest elevations were set 6 inches below the estimated groundwater elevation to provide egress from the pools they form, and pool depths were set to 2.5 ft to discourage occurrence of predatory species.

The Low Flow Channel is designed to provide habitat to support extended juvenile salmonid rearing without providing favorable habitat for predatory and invasive species that are known to use and benefit from deeper, slow-moving water (Gelwick et al. 1997; CFS 2018). Optimal depth and velocity for juvenile salmonids are approximately 0.9 ft deep and 0 to 0.8 ft/s, according to the HSIs used for the Proposed Action. The varying slope and elevation in the riffle pattern is intended to provide a range of appropriate depths, and velocities are anticipated to be appropriately low when the Secondary Channel is disconnected from the main channel, and fed by groundwater inputs.

3.2.3.5.2.5 Floodplain Terraces

The Low Flow Channel is set into broad and shallow Floodplain Terraces, comprising the Secondary Channel (Figure 2). The alignment of the Low Flow Channel moves with respect to the Floodplain Terraces, swinging left and right to move to the outside of bends. As the Low Flow Channel position moves to the outside of the bend, the Floodplain Terraces area increases on the inside of the bend. This design mimics natural channel morphology promoting helical flow patterns and floodplain activation.

The Floodplain Terraces of the Secondary Channel are designed to disperse flows out of the Low Flow Channel, creating a broader refuge area with reduced velocity. The Floodplain Terraces connect to Riparian Terrace features on the north and south sides of the Secondary Channel.

3.2.3.5.2.6 Riparian Terraces

The Connector Channel is a Riparian Terrace feature on the south side of the Secondary Channel that contributes to the performance of the Backwater Channel. The Connector Channel is intended to divert water away from the Backwater Channel as main channel flows increase, thereby reducing depth and velocity in the Backwater Channel and extending its function as a refuge for rearing fish. The Connector Channel is a wide, shallow channel that extends from the top of bank on the south side of the Secondary Channel to the Flood Runner Channel. While it serves to divert water away from the Backwater Channel, it also provides expanded floodplain habitat over the upper range of ecological flows associated with salmonid rearing (5,000 to 10,000 cfs).

A Riparian Terrace was included on the north side of the Secondary Channel to disperse flows and reduce velocity. This Riparian Terrace slopes up from the top of bank of the Secondary Channel Floodplain Terrace, activating around 5,000 cfs. This feature is intended to disperse flows on the higher end of the ecological flows range to maintain the effectiveness of the Secondary Channel and Backwater Channel to provide habitat value to rearing juvenile salmonids at these flows.

3.2.3.5.2.7 Backwater Channel

The Backwater Channel is an existing feature on the north side of Long Bar that this Proposed Action seeks to enhance through opportunistic grading to develop perennial access to high quality edge habitat. Perennial access will be provided by maintaining a minimum depth in the channel and lowering local high spots to provide continuous egress to the outlet at the downstream end. The bed of the Backwater Channel grading was designed to provide 1 ft of depth during the low water period, based on the estimated groundwater elevation surface. Existing vegetation will be preserved to the extent practicable to maintain existing habitat value and grading will be designed to increase edge length and to bring the channel edges closer to overhanging vegetation. Because the area is spatially small and narrow, it is anticipated that it will function best as rearing habitat over the lower end of the range of ecological flows associated with salmonid rearing (2,000 to

5,000 cfs), which occur as often as 2 out of 3 years, but not less than 1 out of 3 years. The enhanced perennial access will also provide increased habitat for over-summering juvenile CV spring-run Chinook Salmon and CCV steelhead.

Enhanced edge habitat will be provided by widening the channel, opportunistically, to bring the edges of the feature into contact with existing vegetation. Grading extents were based on vegetation observed in cbec's 2017 aerial orthophoto. A varied bank line was established to increase edge length and to incorporate flow diversity in the design to provide habitat variability. Design grading elevations along the edges of the Backwater Channel were set to provide topographic heterogeneity such that the feature functions over the lower end of the range of ecological flows.

3.2.3.5.2.8 *Upstream Side Channel*

Like the Backwater Channel, the Upstream Side Channel is an existing feature that will be enhanced to provide increased access to and egress from the floodplain. Flow connection was enhanced by extending a small channel upstream to connect to the main channel and to activate at 2,000 cfs. A narrow, shallow central channel was included to convey flows from the upstream inlet to the downstream outlet, providing constant slope and drainage to minimize fish stranding potential. The central channel was designed with a minimum depth of 6 inches to encourage spreading of flows onto the broad floodplains adjacent to it. Floodplain grading around the central channel was designed to activate just above 2,000 cfs. Main channel flow and floodplain elevations were varied to provide suitable depth and velocity over the range of ecological flows associated with salmonid rearing (2,000 cfs to 10,000 cfs). A varied bank line was established to increase proximity to vegetation and edge length, and to create flow diversity. Grading extents were based on vegetation observed in cbec's 2017 aerial orthophoto.

3.2.3.5.2.9 *Flood Runner Channels*

The Flood Runner channels are intended to mimic natural features that form on bars due to scour during elevated flows. The Flood Runner channels will provide off-channel rearing habitat through regular and sustained shallow inundation of these channel features in most years. Main channel flows are expected to exceed 2,000 cfs for a duration of 21 days in two out of three years (i.e., 66% exceedance) and to exceed 4,100 cfs for a duration of 21 days in 1 out of 2 years (i.e., 50% exceedance) (Table 3). The Flood Runner channels were designed to activate at 3,000 cfs, meaning it should be inundated for a 21-day period at least every other year.

The Flood Runners are designed to provide shallow-water habitat within their banks, and access to the larger, open floodplain areas that surround them as flows increase. The channels have a 30 ft bottom width, are 9 inches deep, and are anticipated to be full at main channel flows of 3,500 cfs.

As main channel flows increase to 5,000 cfs, the banks of the Flood Runners are anticipated to be covered by 6 inches of water, and flows should spread out onto the larger Enhanced Floodplain.

3.2.3.5.2.10 *Backwaters*

Backwaters, defined as partially enclosed, low-velocity areas separated from the main channel, were designed to create shallow, slackwater areas that salmonids have shown preference for over higher velocity in-channel habitats (Beechie, et al. 2005). The perennial Backwaters will provide habitat diversity, and increased edge habitat during the fall-run Chinook Salmon rearing period, and are hypothesized to provide beneficial habitat for over-summering juvenile spring-run Chinook Salmon and steelhead. Backwaters were designed to perform during main channel flows ranging from base flow to 5,000 cfs. Backwater bed elevations were set for shallow inundation (less than 1 ft) during main channel flows of 1,000 cfs and less than 3 ft depth at 5,000 cfs. The Backwaters, located at the downstream extent of Flood Runner Channels, were sloped toward the downstream ends to allow egress from the upstream end of the Alcoves Backwaters and adjacent floodplain areas. Inundation depths and seasonality were reviewed with respect to predator habitat preferences to confirm the Backwaters do not provide favorable conditions.

Enhanced Floodplain

In addition to the riparian terraces surrounding the Secondary Channel, and the fringes of the Backwater Channel and Upstream Side Channel, the habitat restoration design also includes several larger areas of restored floodplain habitats. These are located on the larger degraded portion of Long Bar, adjacent to the Flood Runners. Enhanced Floodplain elevations were set to provide inundation of the entire graded floodplain area for a period of 21 days in 1 out of 3 years (i.e., 33% exceedance), which corresponds to a main channel flow of approximately 5,000 cfs. These floodplain areas are intended to provide additional inundated acreage at the upper end of the targeted range of ecological flows (5,000 cfs to 10,000 cfs), and to provide a depth to groundwater that will promote native riparian vegetation establishment and recruitment.

3.2.3.5.2.11 *Main Channel Terraces*

Large areas of more frequently inundated floodplain were added to the design adjacent to the main channel. The elevations of these large terraces were designed to maintain in-channel flows during the spawning season, but to potentially activate during all other times of the year to provide a significant addition to available shallow edge habitat in the Proposed Action area. The terraces slope gently toward the main channel at variable slopes. The edges adjacent to the main channel are anticipated to inundate around 1,000 cfs and the backs of the terraces are anticipated to become wet at 2,000 cfs main channel flow. The variation in elevation in the terraces was intended to promote utilization over the range of ecological flows associated with salmonid rearing (2,000 cfs to 10,000 cfs).

__3.2.3.5.2.12__ Roughness Features

Inorganic roughness features were added to areas of broadly graded floodplain (Enhanced Floodplain, Main Channel Terraces) to add hydraulic variability and promote fine sediment accretion. These features will be oriented to form ridges perpendicular to flow to encourage sediment deposition on the downstream side. They will be constructed of locally available, well-graded, rounded rock stacked approximately 3-6 ft high, with 3:1 slopes.

__3.2.3.5.2.13__ Riparian Habitat

Riparian vegetation can benefit rearing salmonids both directly and indirectly. Direct benefits include cover from predation and high velocities, while indirect benefits include shading impacts on water temperature, allochthonous nutrient and prey (invertebrate) contributions, and woody material inputs for cover and habitat complexity (Bisson et al. 1987; Kawaguchi et al. 2003; Eberle and Standford 2010; Sellheim et al. 2016a). However, these mechanisms have not been well tested in large Mediterranean climate streams similar to the LYR. Floodplain grading was designed according to the hydrology that will support both rearing juvenile salmonids and vegetation recruitment and establishment. Riparian plants are constrained by the availability of soil moisture at their roots, and they are limited by exposure to high velocity flows (Mahoney and Rood 1998; Amlin and Rood 2002; Stella and Battles 2010; Bywater-Reyes et al. 2015). Soil moisture availability is influenced by substrate texture, plant distance from a flowing channel, and/or relative elevation above groundwater (e.g., Vaghti et al. 2009). Fine sediment particle sizes help to increase pore pressure, slow drainage and also increase capillary action that draws moisture up from a lower water table to increase soil moisture retention (Selheim et al. 2016b). High velocity exposure relates primarily to extant plant root strength and position with respect to scouring velocities (Bywater-Reyes et al. 2015).

As summarized in Table 2, there is a 50% likelihood in any year that flows of approximately 4,100 cfs would persist for at least 21 consecutive days during January-June. Thus, some riparian areas that were graded to begin inundating between 2,000 and 3,000 cfs are anticipated to be partially inundated when flows reach or exceed 4,100 cfs. Proposed floodplain grading will remove material from higher elevation areas such that these features are anticipated to inundate above 2,000 cfs (Upstream Side Channel, Secondary Channel and Backwater Channel) or above 3,000 cfs (Flood Runners). Floodplains adjacent to the Upstream Side Channel, Secondary Channel and Backwater Channel features are anticipated to inundate incrementally above 2,000 cfs. Enhanced Floodplain areas adjacent to the Flood Runners that cover a majority of Long Bar are anticipated to inundate above 5,000 cfs. The resulting gradient of elevations, inundation frequencies, groundwater depths and flood energy are intended to generate a diverse mosaic of habitat types for juvenile salmonid rearing and riparian vegetation.

3.2.3.5.2.14 *Vegetation Recruitment*

Given the mining and dredging legacy in the LYR, several factors influence the success, or hypothesized lack thereof (e.g., cbec et al. 2010), of riparian vegetation recruitment. Dredging activities altered the character and distribution of the sediment in the river corridor. Prior to the influx of hydraulic mining sediment, historical accounts describe cultivated "bottom lands" along the Yuba with dark fertile soils, presumably representing floodplains in frequent connection with the river (James et al. 2009). Because of dredging, the modern channel alluvium is a mix of hydraulic-mining sediment and Quaternary alluvium (James et al. 2009; Hunerlach et al. 2004). In the process of dredging, the mined sediment was separated into fine and coarse fractions, with a mixture of clay, silt, and sand typically tens of feet thick, with the coarse fraction (gravel and larger) stacked above 40-100+ ft in thickness. Such dredger tailings hinder vegetation recruitment due to detachment from groundwater, relatively high porosity due to larger sediment sizes, and lack of soil horizon (e.g., cbec et al. 2010).

When tailings are re-contoured to inundate more frequently, and sediment size classes are reduced, native recruitment of riparian vegetation can be rapid (Sellheim et al. 2016b). Although it is expected that flood disturbance will keep vegetation in earlier successional stages for many areas of the Proposed Action site, young willows, cottonwoods, alders etc. provide important rearing habitat (Sellheim et al. 2016a). Mature vegetation will require a longer time to develop but will potentially provide future allochthonous inputs such as terrestrial invertebrates and woody material. Funding availability limits Proposed Action revegetation efforts. Therefore, the floodplain area grading was designed with consideration for promoting natural vegetation recruitment. Vegetation success is related to availability of soil matrix, groundwater, and exposure to high flows. Reducing floodplain elevation increases potential for available groundwater by reducing the distance to the water table, but it also increases the frequency of inundation that could expose plants to higher velocities/scour, so a balance was established between the opposing constraints.

Floodplains were primarily designed as rearing habitat, and as such, were designed for initial inundation at 2,000 to 5,000 cfs total river flow to provide habitat at the upper range of ecological flows. At elevations corresponding with 2,000 to 5,000 cfs total river flow, floodplains are typically within 2 and 12 ft of estimated groundwater to support a variety of vegetation (Figure 4). Flows exceeding 5,000 cfs typically occur between December and March, during which the floodplains receive water, fine sediment deposits, and seeds. After June, flows typically diminish and vegetation becomes established in the floodplain into late October, supported by available groundwater. Shallow groundwater depths from 0 to 2 feet are expected to support herbaceous vegetation and shrubs (e.g. willows and California buttonbush [*Cephalanthus occidentalis* var. *californicus*]). Moderate groundwater depths of 2 to 6 feet may support establishment of elderberry and Fremont cottonwood but would support similar shrubs to shallow groundwater and trees such as white alder. High groundwater depths of 6 to 12 feet are expected to support successful establishment of elderberry, Fremont cottonwood, and western sycamore (*Platanus recemosa*).

Recruited floodplain vegetation is expected to create hydraulic roughness, reduce flow velocity, and encourage sediment deposition that will promote this natural recruitment process (Bendix and Hupp 2000; Nepf 2012; Yager and Schmeeckle 2013; Manners et al. 2015). Established floodplain vegetation roots are expected to stabilize the soil and help sustain the form of the floodplains and channels designed to convey water through them.

A secondary goal of floodplain grading is to increase edge contact with vegetation. Where possible, floodplain grading was extended to meet existing vegetation as interpreted from a 2017 aerial orthophoto. Provision will be made for adaptive grading during construction to preserve existing vegetation and to maximize shaded edge habitat. Floodplain grading will require removal of existing vegetation in some instances; the resulting woody debris will be utilized within the Proposed Action as appropriate to provide additional cover for juvenile salmonids.

A monitoring program would document the success of the implementation, the effectiveness of the Proposed Action to recover suitable juvenile salmonid rearing habitat, and a validation component to test hypotheses about the function of the recovered habitats. Adjacent property owners have been contacted to solicit their input and support for the Proposed Action, and public outreach activities will continue throughout project implementation.

Table 4 provides a description of the major habitat elements and their inundation frequency and duration. Descriptions of each proposed habitat component are also included in the Basis of Design Report (Appendix A).

3.2.3.6 Earthwork Approach and Construction Timing

Earthwork would be performed using heavy equipment and methods similar to those used at aggregate processing plants and for construction site grading and trenching, but subject to the additional and heightened conservation measures, as necessary, to protect the river and the terrestrial/aquatic biota.

The construction season will be limited to 16 April-31 October following the definition of the dry season used by the Central Valley Flood Protection Board (CVFPB). Most work would be conducted on the dry floodplain. Heavy equipment including excavators, bulldozers, front-end loaders, and haul trucks would be used to create the Proposed Action restoration features and transport excavated material to the aggregate processing plant. Any excavation adjacent to or in the main Yuba River Channel (e.g., to connect a side channel) or to enhance an existing wetted side channel/pond would be conducted during an appropriate summer work window (e.g., 15 July-30

September), and the area would be surveyed in advance to ensure species listed under the ESA or other sensitive species are not present. Additional measures to avoid or minimize environmental impacts would include using existing roads and off-highway vehicle trails for vehicle travel where possible and inspecting and maintaining all equipment to avoid fluid leaks, etc. Crews would adhere to BMP's and SWPPP requirements at all times; these would be developed prior to construction.

Riparian tree planting would occur between October and February, with a target of late November. Monitoring of the planting success would occur for three years through at least fall 2024. If data indicate survival is less than 60%, the reason for poor survival would be evaluated and addressed and additional native riparian trees would be planted.

3.2.3.7 Work Hours

Construction activities would primarily take place during normal working hours, 5:30 am to 4:30 pm, Monday through Friday.

3.2.3.8 Best Management Practices (BMPs)

The Project includes the following Best Management Practices (BMPs) to minimize adverse environmental effects. BMPs that shall be included in the Project include, at a minimum, the following: 1) water quality; 2) air quality and traffic; and, 3) vegetation, fish and wildlife. In this section, a general approach to minimizing these impacts is discussed; specific mitigation measures are described in the CEQA impact analysis sections and listed in the Mitigation Monitoring and Report Program (MMRP; Appendix C).

3.2.3.8.1 Water Quality

Limited work would occur in the LYR main channel. Main channel in-water work would occur when side channel and backwater entrances and exits are excavated and floodplain terraces are graded. In-water work would also occur in the backwater and isolated ponds as part of creating/enhancing the backwater channel and upstream side channel. All equipment working within the river corridor would be inspected daily for fuel, lubrication, and coolant leaks; and for leak potential (e.g., cracked hoses, loose filling caps, stripped drain plugs) and would not be used if any are present. Vehicles or equipment would be washed and/ or cleaned only at approved off-site areas. All equipment would be steam cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands. All equipment would be fueled and lubricated in a designated staging area located outside the stream channel or banks, wetlands, and riparian corridors.

A SWPPP, including a Spill Prevention and Response Plan, would be developed as part of the BMP's for the Proposed Action. All pertinent staff would be trained and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them would be made available at the site and staff would be trained in its use. Spill prevention kits would be in close proximity to construction areas, and workers would be trained in their proper use.

The Proposed Action would comply with Section 401 of the CWA and certification would be obtained for project-related activities to control and monitor sediment entering the main river channel during construction. To minimize risk from additional fine sediments, all trucks and equipment would be cleaned. Stream bank impacts would be isolated and minimized to reduce bank sloughing. Banks would be stabilized, as needed, with the appropriate erosion control method following Proposed Action construction activities.

3.2.3.8.2 Air Quality and Traffic

Basic Air Quality Control Measures would be implemented within the Action Area, including, but not limited to, watering dirt roads and construction areas. Construction equipment operation would be limited to the existing operational hours for the SRI Stringer Pit, including occasional double-shifts as needed.

3.2.3.8.3 Vegetation, Fish and Wildlife

All reasonable and prudent measures in the biological opinions issued for the Proposed Action by the NMFS and USFWS would be followed (described in detail in Sections 4.6 and 5). Pre-project wildlife surveys would be conducted by a qualified biologist no more than 30 days prior to start of construction activities. Nesting birds and raptors are protected under the Migratory Bird Treaty Act (MBTA) and California Fish and Game Code. Several bat species of special concern may be present with the Action Area. Trees and shrubs within the Action Area may provide nesting and roosting habitat for songbirds, raptors and/or bats. If tree removal is unavoidable, it would occur during the non-breeding season (mid-September through January), as possible. Any trees that must be removed during breeding season would be examined thoroughly for nests and roosts by a qualified biologist prior to removal. If other construction activities must occur during the potential breeding season (February through mid-September) surveys for active nests and/or roosts would be conducted by a qualified biologist no more than 30 days prior to the start of construction. A minimum no disturbance buffer of 250 ft (76.2 m) would be delineated around active nests until the breeding season has ended or until a qualified biologist has determined that the birds/bats have fledged and are no longer reliant upon the nest or parental care for survival.

Pre-project vegetation surveys were conducted within the Proposed Action Area in the spring 2020 (SYRCL 2020; Appendix D). No special status plants were identified; if any special status plants are observed in subsequent surveys they would be avoided with appropriate sized buffers. Pre-project elderberry plant surveys were conducted to assess impacts to the VELB and surveyors identified four shrubs with stem diameter greater than one inch within the Action Area (Figure 3). The Proposed Action design was modified to include 100-ft buffers around the elderberry plants; however, the buffers precluded many of the restoration actions. With the use of 20-ft buffers, all restoration actions were still not possible. Through coordination with the USFWS, it was determined that three elderberry shrubs with stem diameter at ground level greater than one inch that could not be avoided using 20-ft buffers would be transplanted to appropriate areas within the site that support a 20-ft buffer (Figure 5). The measures described above are included in the USFWS Biological Opinion for the Proposed Action (Appendix E).

Following issuance of the USFWS Biological Opinion and subsequent consultation with U.S. Fish and Wildlife Service, these unavoidable elderberry shrubs were transplanted to an appropriate area following the USFWS transplanting guidelines, with the exception of the prescribed time period (USFWS 1999). The USFWS transplanting guidelines prescribe that elderberry plants should be transplanted when dormant between November and the first two weeks of February (USFWS 1999). Heavy equipment to be used for transplanting may not be able to access the site to perform the transplanting during this time period due to potential high flows in the Yuba River. Therefore, the elderberry plants were transplanted on 21 January 2021 to improve their opportunity for successful establishment (CFS unpublished data). These dormant elderberry plants were transplanted into appropriately sized pre-dug holes in the restoration area using a backhoe. Elderberry bushes were transplanted to appropriate locations within the Action Area and will be monitored to ensure survival. The elderberry transplant monitoring would be performed in years one, two and three following restoration completion, according to the protocol outlined in the Conservation Guidelines for the VELB (USFWS 1999) and as prescribed in the Proposed Action's USFWS Biological Opinion (Appendix E).

The construction approach for the Proposed Action is designed to prevent impacts to Chinook Salmon, CCV steelhead, and other native fishes. Use of the construction approach would reduce impacts to fish from construction activities. In addition to the construction approach, fish relocation may be performed prior to in-channel construction activities to prevent injury or mortality to Chinook Salmon, CCV steelhead, and other native fishes. The Proposed Action is currently in consultation with NMFS and a Biological and Essential Fish Habitat Assessment (BEFHA) has been developed (Appendix F). The Proposed Action will not occur until a NMFS Biological Opinion is issued, and the Proposed Action will implement all required measures.

All equipment entering the water would be steam cleaned before it is used elsewhere to minimize the chance of introducing invasive species such as New Zealand Mud Snails (*Potamopyrgus antipodarum*) to other water bodies. Additional measures may be taken at the recommendation of CDFW.

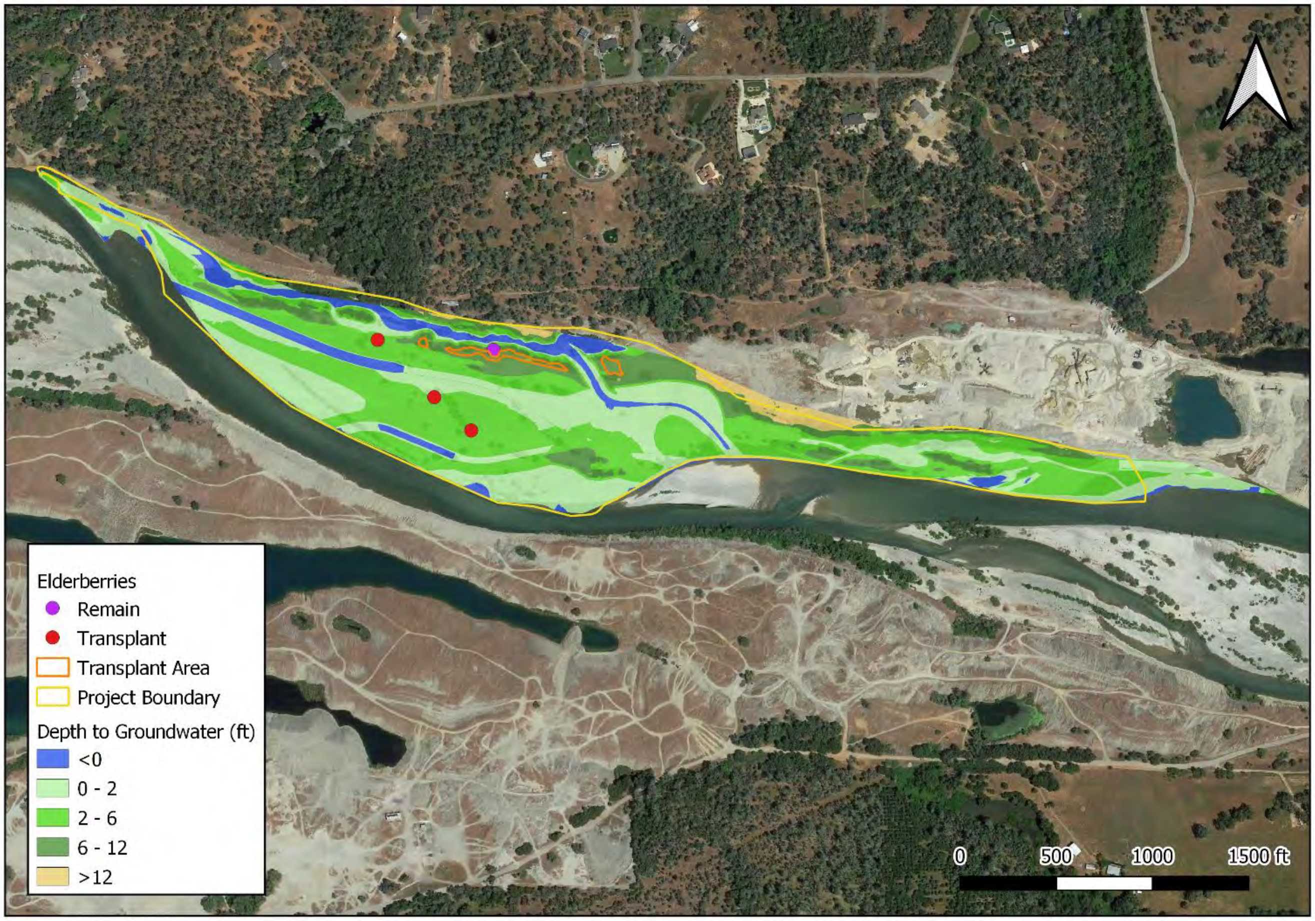

Figure 5. The elderberry shrubs which will be transplanted (red dots) and remain in place and protected with 20 foot buffer (purple dot). The elderberries will be transplanted to area outlined in orange which has depth to groundwater of 6 -12 feet.

3.2.3.9 Post-Construction Erosion Control Measures

Surface grading will result in a level area with a very slight slope from upstream to downstream and positive drainage into a side channel or backwater. Native riparian trees and shrubs would be planted in select locations, particularly in locations which have been disturbed by construction activities. The Action Area is below the Ordinary High Water Mark (OHWM), so no fiber rolls or hydroseeding will occur.

3.2.3.10 Restoration and Revegetation of Disturbed Area

After floodplain grading activities have been completed, disturbed areas that contain fine sediment would be stabilized as prescribed in the SWPPP. Existing native trees with a diameter of at least 6 in (15.2 cm) would be protected with appropriately sized buffers, to the extent possible. Native riparian tree and shrub species, such as Fremont Cottonwood, willow (*Salix spp*.), and Elderberry would be planted in some areas to compensate for the removal of riparian shrubs and trees during Proposed Action implementation. Planting would occur between October and February with a target of late November, which is the typical beginning of the winter storm season, to maximize survival rates. A revegetation plan was developed to identify tree and shrub species that would be planted, how, where, and when they would be planted. A detailed monitoring program would document the pre-project conditions, restoration and revegetation, and the effectiveness of the planting in terms of vigor and survival.

Exotic species present in the riparian area would be eradicated, where logistically and economically feasible.

3.2.3.11 Funding

Through grant agreements with SYRCL (made under the authority of the CVPIA, Title 34, Public Law 102-575, Section 3406(b)(1)), the USFWS AFRP is funding the Proposed Action. USFWS is also acting as the lead federal action agency.

3.2.3.12 Project Monitoring

A detailed Monitoring Plan has been developed for the Proposed Action (CFS 2020), with the primary goal of defining the current state of the system before restoration and determining whether the implemented Proposed Action has had the desired effect on target species and overall system health. The Monitoring Plan follows a Before-After-Control-Impact (BACI) design to account for background variation in success metrics. The Monitoring Plan is intended to be a working document, and will be further refined with input from USFWS AFRP, NMFS, CDFW, and the Corps.

The monitoring program consists of four monitoring stages: 1) pre-project site description, 2) implementation, 3) effectiveness, and 4) validation (Table 6). Pre-project monitoring helps identify the baseline for the Proposed Action, including the identification of deficiencies in ecosystem health, and is necessary to detect change over time (Roni and Quimby 2005). Implementation monitoring will determine if the Proposed Action was constructed according to the design standards. Hydrology, topography and bathymetry, sediment dynamics, and vegetation will be assessed. Effectiveness monitoring will determine if the Proposed Action was effective in meeting target physical and biological objectives. A range of physical and biological traits will be tracked before and after restoration to assess ecosystem function. Pre-project monitoring is essential for effectiveness monitoring because it establishes an objective baseline of ecosystem function with which to evaluate change caused by Proposed Action implementation. Finally, validation monitoring will be conducted to substantiate the underlying assumptions of the restoration work and determine if restoration projects, like the Proposed Action, recover productive habitat that promotes juvenile CV Chinook Salmon and CCV steelhead growth and riparian vegetation recruitment. Surveys of elderberry plant recruitment success in areas within the site that are expected to be favorable for elderberry recruitment will be performed as part of validation and effectiveness monitoring.

The monitoring efforts described in this plan will improve our understanding of restored ecosystem function and the potential of restoring off-channel rearing habitat to enhance salmonid populations within streams impacted by dam flow regulation and channel modification.

Table 6. Monitoring stages associated with Proposed Action.

Monitoring stage	**Question addressed**	**Time frame**
Pre-project	What is the baseline condition of the site? Does the site contain special-status species?	1-3 years before project implementation
Implementation	Was the project installed as planned?	2+ years
Effectiveness	Was the project effective at meeting restoration objectives?	1 year to decades
Validation	Are the basic assumptions behind the project conceptual model valid?	1-10 years

3.2.3.13 Sampling Sites

Sampling sites will be stratified and randomized in the BACI context, and replicate samples within these sites will be collected. Sampling sites will be upstream, within, and downstream of restored reaches. Within the restoration area, three off-channel (side channel, backwater, floodplain) and three main channel (glide, run, riffle) habitat types will be sampled. Figure 6 depicts the area to be monitored, with example locations of sampling sites.

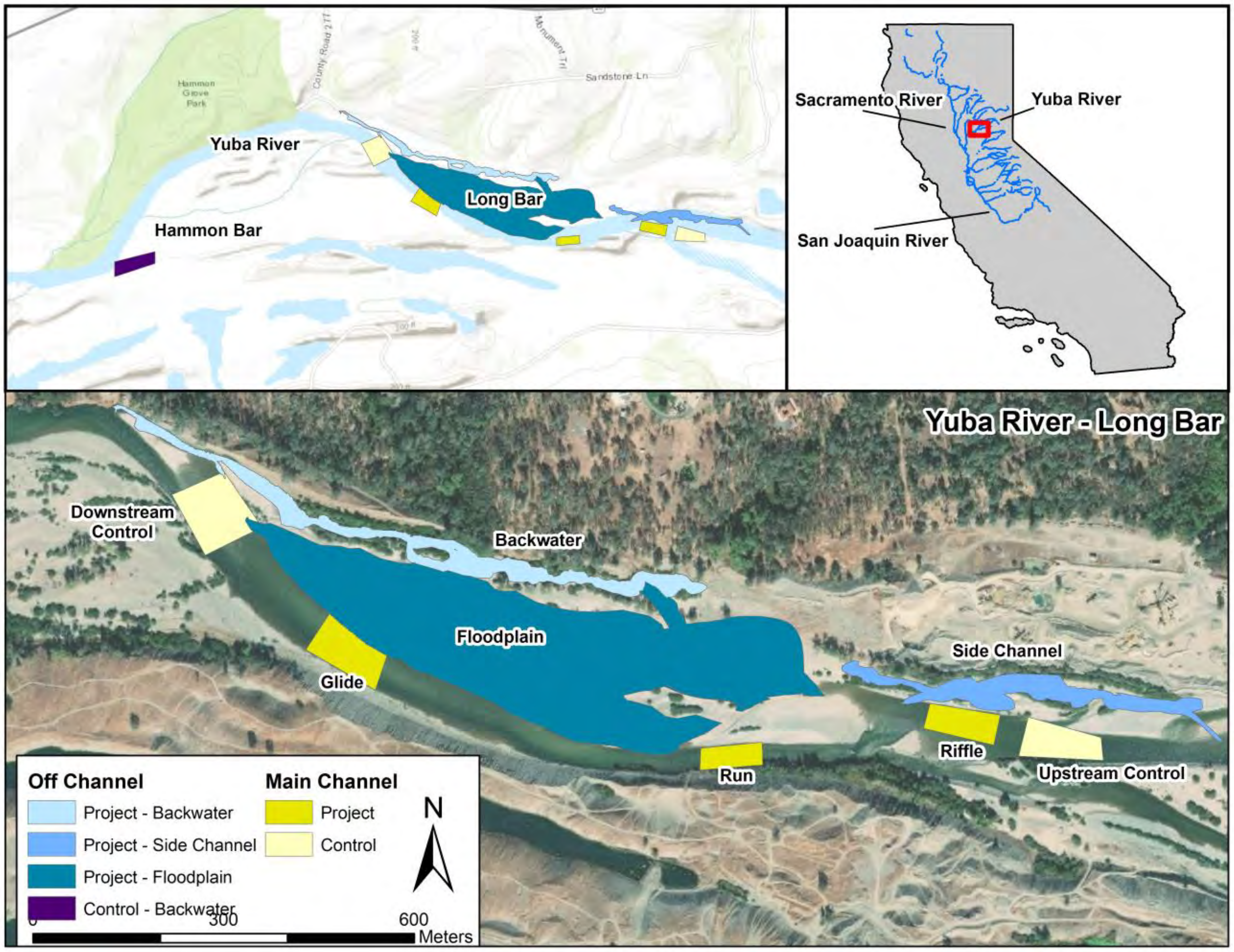

Figure 6. Location of Long Bar Juvenile Salmonid Habitat Restoration Project (Proposed Action) monitoring locations. Monitoring will be performed in main channel and off-channel habitats within the Proposed Action Area and at control sites within the Yuba River.

3.2.3.14 Fish Monitoring Surveys

3.2.3.14.1 Fish Community

Snorkel surveys will be conducted to test hypotheses related to juvenile use of the restored treatment and unrestored control sites (Table 7). Surveys will be conducted in the spring through summer, coinciding with rearing for juvenile CV fall-run Chinook Salmon (spring), CV spring-run Chinook Salmon (spring and summer), and CCV steelhead (spring and summer; Table 5). Stream flow conditions must also be considered prior to conducting a survey for safety precautions. Snorkeling methods will be consistent with other studies (Edmundson et al. 1968; Dolloff et al. 1996; Cavallo et al. 2004). All surveys will be led by a biologist or senior technician with training and experience conducting snorkel surveys. Sample units will be snorkeled by two or three divers moving upstream adjacent to each other for margin habitats and downstream for mid-channel habitats. Fish will be observed, identified, and counted by size group. Counts will later be converted to densities (fish/m^2) using the transect length and a standard width of 2 m/snorkeler to calculate total area sampled. Fish will be categorized by species and size classes (0-50 mm, 51-80 mm, 81-100 mm, 101-120 mm, 121-150 mm, 151-200 mm, 201-300 mm, and >301 mm).

Table 7. Effectiveness monitoring juvenile salmonid questions and parameters measured.

Question	Parameter
Will restored habitat support greater densities of juvenile salmonids compared to unrestored habitats?	Snorkel surveys
When off-channel habitat is fully restored, will more complex side channel and backwater habitats support greater densities of juvenile salmonids than floodplain habitat?	Snorkel surveys
Which off-channel habitats (side channels, backwater, floodplain) support greater densities of juvenile salmonids over the duration of the rearing season?	Snorkel surveys
Will cover features (e.g., large wood, boulders) increase the probability of juvenile salmonid habitat occupancy?	Physical structure mapping (woody material, aquatic and riparian vegetation) Snorkel surveys
Will restored habitats support greater drift and/or benthic macroinvertebrate density relative to unrestored habitats and pre-restoration conditions? Will densities differ between off-channel habitats?	Macroinvertebrates (density, biomass)

Depth and velocity will be measured for each fish observation. Habitat characterizations, including qualitative assessments of river margins, cover habitat, and predominant substrate types, will also be assessed. River margins will be classified according to position in the channel (i.e., left, middle, or right). Cover habitat will be broken down into three qualitative classes (i.e., type, size, and quality). Cover types include large woody material, undercut bank, overhanging vegetation, flooded terrestrial plants, aquatic vegetation, and boulders. Aerial extent of the cover (m^2) will also be estimated. Dominant and sub-dominant substrate types will be defined by organic matter/silt, sand, gravel, cobble, boulder, bedrock, and rip-rap.

3.2.3.14.2 Juvenile Chinook Salmon Rearing Experiment

Previous studies have suggested that fish rearing in off-channel habitats exhibit enhanced growth and survival as compared to those in the main channel (Sommer et al. 2001; Jeffres et al. 2008). However, these studies were conducted in low-elevation, expansive, managed floodplain systems that are geomorphologically and hydrologically quite different from the off-channel habitat present in the LYR and that which will be created/enhanced by the Proposed Action. The extent to which the enhanced growth observed in these studies is applicable to off-channel habitat in the upper reaches of the Sacramento River system is unknown. Backwater habitat is relatively common in the LYR but it is unknown if this habitat would provide similar growth/survival benefits as demonstrated by previous off-channel habitat studies. To examine this, juvenile Chinook Salmon will be captured by beach seine (see beach seining method description below), injected with a passive integrated transponder (PIT) tags, and will rear in the backwater habitat at the restoration sites and in an unrestored backwater habitat before and after restoration to test the hypothesis that juvenile salmon rearing in restored off-channel habitats will exhibit greater growth rate and health condition than those that rear in unrestored backwater habitats (Table 8).

Table 8. Juvenile Chinook Salmon rearing experiment questions and parameters measured.

Question	Parameters Measured
Will juveniles that rear in restored off-channel habitats exhibit greater growth rates than those that rear in non-restored habitats?	Juvenile rearing experiment (growth from recaptures and otoliths)
Will juvenile salmonid diet composition and fullness differ before and after restoration, and as compared with an unrestored control site?	Juvenile rearing experiment (stomach contents)
Will the abundance of invasive predatory fish decrease following restoration?	Snorkel surveys

Approximately 500 fish will be released at each location (additional hatchery fish from the Feather River Hatchery will likely also be used). All natural-origin juvenile Chinook Salmon captured by seining that are PIT-tagged will also have a genetic tissue sample/swab collected from them to determine run (spring-run vs. fall-run) using genetic analysis. The ratio of spring-run to fall-run Chinook Salmon among PIT-tagged fish can be expanded to other juvenile Chinook Salmon captured by beach seine or in the fyke-net which are not genetically analyzed for run. This will allow for an estimate of juvenile spring-run and fall-run Chinook Salmon capture over the course of the experiment. PIT-tagged fish will be captured at the downstream end of the backwater using a fyke trap and compare growth, health condition, diet, and development of fish that reared in each habitat.

Prior to fish being released into the restoration site and the unrestored backwater, a fyke-trap with nylon mesh wings which spans the channel will be set up at the exit (downstream) end of each site to recapture fish as they swim towards the main channel. Depending on the final design for the restoration, an additional net may need to be set up at the upstream end following restoration to prevent PIT-tagged fish from migrating upstream out of the system. Traps will be checked daily, and each captured salmon will be scanned with at PIT tag reader, its size (fork length [FL] and weight) recorded, and a photo taken. Incidental catch (including all native and non-native fish species) will also be recorded and measured to provide additional data on fish assemblages. A sub-sample (100; 50 from Project and 50 from Control) of natural origin PIT tagged fish recaptured in the fyke-net will be euthanized and placed into a small vial containing 100% ethanol, and all other fish will be released downstream of the trap. Stomach contents will also be analyzed following recapture to assess prey biomass and composition. In addition, smoltification level will be assessed to test for differences in development trajectories between fish in restored and unrestored habitat, hypothesizing that fish rearing in restored habitat will develop more quickly and be physiologically more prepared to out-migrate successfully than fish at unrestored sites. This will be accomplished quantitatively using either a handheld chromameter or by taking standardized photos and testing for differences in light reflectance across treatments.

Otoliths will also be collected from a sub-set of the sacrificed juvenile Chinook Salmon. Otoliths have been successfully used to track juvenile Chinook Salmon growth, life history and habitat use (Kennedy et al. 2002, Limm and Marchetti 2009). The methods of Secor et al. (1992) will be used for otolith preparation. Right side otoliths will be mounted on microscope slides in Crystalbond™ (Aremco, Valley Cottage, NY) with the sulcus acoustics facing down. The otolith will then be polished using 600 wet grit sandpaper followed by alumina micropolish (0.05 μm grit, Buehler ltd.). Polishing will continue until central primordia and daily increments are clearly visible using light microscopy. The left otolith will be used if the right otolith is in the vaterite form rather than the more common aragonite form.

Otoliths will be photographed at 400X using a digital camera mounted to a compound microscope. Daily increment widths will be measured using ImageJ imaging analysis software and a daily growth will be calculated. Two independent researchers will count the number of increments to avoid reader bias in the otolith analysis. The ten most recently accreted daily increment widths will be measured to characterize growth for each fish at each site. All measurements will be made at a 45° angle to the longitudinal axis at the posterior end, ventral side. Otolith increment width will be compared for fish rearing in the restoration site before and after restoration and those rearing in the unrestored backwater. One of the primary hypotheses behind salmonid habitat restoration projects is that juvenile salmonids that rear in restoration areas are expected to have enhanced growth, which would result in higher downstream migration and marine survival (Zabel and Achord 2004; Welch *et al.* 2011; Osterback *et al.* 2014), ultimately resulting in higher adult returns. Otolith microstructure analysis provides a very fine scale for growth analysis, as daily rings are laid down on the otolith with the increment width of each ring corresponding to growth (Neilson and Green 1982). Otolith microstructure analysis has previously been used to compare daily growth between restored and control sites (Miller and Simenstad 1997), including in the CV (Utz *et al.* 2012). Similarly, otolith microstructure analysis has been used to compare daily growth between main channel and off-channel habitat in the CV (Limm and Marchetti 2009). Otolith microstructure analysis will be used to test the hypothesis that juvenile Chinook Salmon rearing in restored habitat will have higher daily growth than those rearing in un-restored habitat.

3.2.3.15 Macroinvertebrate Sampling

Aquatic macroinvertebrates play a pivotal role in river food webs and provide essential ecosystem services in rivers and streams (Wallace and Webster 1996; Woodward and Hildrew 2002). They function in nutrient cycling, processing both autochthonous and allocthonous carbon inputs, and controlling algal growth (Vannote et al. 1980; Power 1992). Juvenile salmonid biomass and production are strongly correlated with invertebrate drift densities (Elliott 1973; Wilzbach et al.1986) and drift densities are positively correlated with benthic primary and secondary productivity (Benke et al. 1991; Sagar and Glova 1992). Food availability, abundance, and quality determine when and in what condition anadromous juvenile salmonids exit the freshwater riverine system (Sommer et al. 2001; Jeffres et al. 2008). Despite this, little attention has been paid to the importance of the composition and abundance of invertebrate drift in stream restoration projects (Wipfli and Baxter 2010).

Benthic macroinvertebrates (BMI) generally dominate the diet of juvenile salmonids in CV rivers (Merz and Vanicek 1996; Merz 2001; Utz et al. 2012). Previous studies have demonstrated that BMI biomass in newly-inundated off-channel habitats can achieve levels similar to the main channel in a period of four to eight weeks (Merz and Chan 2005). However, floodplains may receive drift BMI from the main channel immediately following inundation that may be more readily available as prey for juvenile salmonids compared to in the main channel due to lower velocity conditions in the floodplain. Over time, BMI production in the inundated floodplain may represent a significant prey source for rearing juvenile salmonids that utilize this habitat.

Terrestrial invertebrates can comprise a significant proportion of drift and are an important food subsidy for juvenile salmonids in some systems (Elliott 1973; Rondorf et al. 1990). Terrestrial imports are particularly important in unproductive (e.g., Ellis and Gowing 1957) or impaired rivers, such as the Stanislaus River in the California CV (CFS 2013). Aquatic and terrestrial invertebrate peak densities in the drift may not overlap over the course of the season (Stoneburner and Smock 1979; Sagar and Glova 1992) and juvenile salmonid diets may shift accordingly.

Many studies have demonstrated the importance of biological productivity on salmonid growth rates (Naman et al. 2019; Lusardi et al. 2018 and 2020), and food availability can be a primary factor in determining fish growth and residency (Wilzbach 1985; Boss and Richardson 2002). Therefore, restoration projects may have limited success if they do not explicitly include juvenile salmonid food requirements and resource availability. Floodplains are nutrient-rich environments that can enhance prey productivity and, subsequently, salmonid growth and survival; however, their productivity is strongly related to inundation duration (Jeffres et al. 2008; Bellmore et al. 2013). Further, most floodplain research in the CV has focused on reaches far downstream in the system near the San Francisco-San Joaquin Delta, and floodplain productivity and function in river reaches further upstream are not well understood. The hypotheses listed in Table 8 will be tested to determine how physical habitat features influence floodplain productivity and juvenile growth.

Restoration actions including creation/enhancement of side channels and floodplains are predicted to increase the density and biomass of macroinvertebrates in the drift (Table 7, Hypothesis 5). To address this hypothesis, drift sampling will be used to sample both terrestrial and aquatic invertebrates that are present in the drift and readily available for drift-feeding juvenile salmonids during the time period that they are present (January through October; Table 5). Drift samples would be collected pre- and post-project at both control and treatment sites. Drift macroinvertebrate communities will be monitored through the spring and summer to determine the composition and abundance of various species available to juvenile salmon as prey items. Replicate macroinvertebrate samples will be collected using drift nets from habitats with sufficient flow. Drift insects will also be collected using a drift sampler with 106 µm mesh pulled for 32.8 ft (10 m) across the water's surface. In addition, replicate samples will be collected from all habitats using Schindler traps, which involve taking a standardized water sample from the water column do not require flowing water. Collected samples are rinsed into 500 mL labeled bottles with 70-95% ethanol. Samples will be transported to the laboratory and sorted under a light dissecting scope (e.g., 60X).

Additionally, it is hypothesized that the increase in drift availability will result in a subsequent increase in consumption by juvenile Chinook Salmon (Table 8). To test this hypothesis, a sub-sample of juvenile Chinook Salmon captured by seine or fyke-net in control and restored locations pre- and post-project would be euthanized and preserved for later stomach content analysis. The sampled fish will also be used for otolith microstructure analysis as a secondary means of comparing growth across treatments. Following the methods of Limm and Marchetti (2009), juvenile Chinook Salmon to be euthanized for stomach content and otolith microstructure analysis would be captured between 08:00 and 11:00 am to minimize differential digestion of prey items.

For both stomach content and drift samples, taxa will be identified to the lowest possible taxonomic level, enumerated, and further classified according to size class (<2, 2-7 mm, 8-13 mm, 14-20 mm, > 20 mm) and life stage (larva/nymph, pupa, adult).

3.2.3.15.1 Fish Sampling Methods

3.2.3.15.1.1 Beach Seine Sampling

In general, a 50 ft wide seine net with 1/8-inch mesh will be used for beach seine sampling. However, a smaller width and/or mesh size may be used depending on seining location and timing. At each seining location three non-overlapping seine hauls will be performed. Seine hauls are typically performed parallel with shore. The seine is stretched out moving in the upstream direction until it is the full width and parallel to shore and then it is pulled by the team into the shore. The team will work together to keep the lead line down while bringing it into shore, making sure that the floats stay at the water surface. If any rocks, sticks, or other objects are caught in the seine, they will be removed to avoid crushing fish and damaging the seine. Water volume sampled is calculated from the length, width and depth of haul area and is used as a metric of effort. After most of the debris has been removed, fish will be concentrated into a small pocket in the seine and removed either by hand or with a net. Fish captured from each seine haul will be stored in separate 5-gallon buckets containing fresh water and an aerator or live-cars secured in the body of water being seined. No more than 25 fish should be placed into any one bucket, and a live car should be used if water or air temperatures are high. Buckets or live cars should be placed in the shade, and a canopy set up if no natural shade is available. Water quality (temperature and DO) of recovery buckets will be monitored frequently and water changed if needed, particularly if air temperatures are high. Captured fish will be processed separately for each site using standard procedures, described below. All captured fish will be released in the area of capture after recovering from processing except for juvenile Chinook Salmon selected to be used in the juvenile rearing experiment.

3.2.3.15.1.2 Fyke-net Sampling

Fyke-net sampling will be used as part of the juvenile Chinook Salmon rearing experiment. A four-ft-tall by five-ft-wide fyke made of 1/4 inch nylon mesh or a three-ft-tall by four-ft-wide fyke made of 1/8 inch nylon mesh, both with 25-ft wings, will be used for trapping. The cod end of the fyke net will be connected to a live box that is 4 ft long, 2.5 ft wide, and 2.5 ft high. A velocity break will be inserted into the live box to ensure that captured fish are not impinged on the back of the box. The fyke net will be placed in the downstream end of the backwater/channel and the wings will be extended as necessary by adding additional 1/4 or 1/8 inch nylon mesh to cover the width of the channel. The fyke net is planned to be “fished” continuously during the experiment but may be temporarily removed in advance of a high flow event that would be likely to damage or destroy the equipment. Depending on the number of fish captured and debris loads, the live boxes will be checked once or twice a day, typically in the morning and afternoon, to process fish and to clean debris from the traps and live boxes. During each trap check, the fyke trap will be cleaned of debris and all fish in the live box will be netted out using aquarium nets and placed in five-gallon buckets of fresh river water. Larger, piscivorous fish will be placed in separate buckets from juvenile salmonids and other smaller fish to prevent predation. Water in the buckets will be monitored to ensure that temperature remains within 2°C of the river water and DO is above 5 milligrams per liter (mg/L). Water will be replaced and aerators used, as necessary to maintain water quality. All non-target fish will be identified to species, enumerated, and released. All salmonids with a FL greater than 50 mm will be anesthetized, measured and weighed, and scanned for a PIT tag, while salmonids with a FL less than or equal to 50 mm will only be anesthetized and measured. After processing, the fish will be immediately placed in a recovery bucket with a battery powered aerator. Once all fish in the recovery bucket are behaving normally, they will be released immediately downstream of the live box (except for the sub-sample of 100 recaptures that will be sacrificed for otolith and stomach content analysis).

3.2.3.15.1.3 Fish Processing and Tagging

Fish will be placed in a five-gallon bucket containing an anesthetic solution created by adding Alka Seltzer Gold brand sodium bicarbonate (NaHCO3) or MS-222 to fresh river water. The lowest concentration of sodium bicarbonate or MS-222 to allow safe fish handling will be used and will vary depending on fish size and water temperature. When using Alka Seltzer Gold, typically 1 to 2 tablespoons will be used per gallon of water. MS-222 is typically used at a concentration of 50 mg/L. Smaller fish (fry, small parr) will be placed in the anesthetic solution in groups of ten or fewer while larger fish (large parr, smolts) will be added in groups of two. After groups of fish are placed in the anesthetic solution they will be closely monitored and will be processed immediately after they have lost equilibrium but still have operculum movement. After processing, fish will be placed in aerated 5-gallon buckets containing fresh river water and allowed to recover until they exhibit normal behavior. Water in the buckets will be monitored to ensure that temperature remains within 2°C of the river water and DO is above 5 mg/L. Water will be replaced and aerators used, as necessary to maintain water quality.

All juvenile Chinook Salmon and *O. mykiss* greater than 50 mm FL will be anesthetized, FL measured to the nearest mm and weighed to the nearest 0.01 g. After processing, all fish will either be PIT tagged (see below) or be immediately placed in a recovery bucket containing fresh river water, a battery powered aerator, and Stress Coat (API Inc.) at a concentration of 1 mL per 1 gallon of water. Juvenile Chinook Salmon and *O. mykiss* that are less than or equal to 50 mm FL will only be anesthetized and FL measured to the nearest mm.

Only juvenile Chinook Salmon between 55 and 65 mm FL will be PIT tagged with 8 mm tags; fish larger than 65 mm FL will be PIT tagged using a 12 mm tag. While still anesthetized and after measuring and weighing, the juvenile salmonid will be PIT tagged using a PIT tag injector. The needle of the PIT tag injector will be inserted posterior of the tips of the pelvic fins and to the left of the mid ventral line and then the tag injected in the posterior direction. Alternatively, a micro-scalpel may be used to tag the fish in the same location. PIT tags will be sterilized in Nolvasan (chlorhexidine diacetate) disinfectant, rinsed in reverse osmosis or distilled water, and scanned with a handheld PIT tag reader and the unique number recorded on the datasheet before being inserted. The PIT tagging instrument will be dipped in Nolvasan and then reverse osmosis or distilled water between each PIT tagged fish. Immediately after being PIT tagged, the fish will be placed in a recovery bucket containing a battery powered aerator. The PIT tagged fish will only be released once they have recovered (are swimming normally and will avoid/swim away from a disturbance). PIT tagged fish will be re-captured in the fyke-net(s) or during periodic beach seine sampling. After the first batch of PIT-tagged fish have been released, all juvenile Chinook Salmon captured during beach seining or in fyke-nets will be scanned with a handheld PIT tag reader.

A subset of recaptured PIT-tagged juvenile Chinook Salmon (55 mm or greater FL) will have a genetic tissue sample taken via either fin-clip or swab while the fish is anesthetized during processing. A fin-clip will consist of cutting a small piece of tissue from the upper caudal lobe using clean surgical scissors. Tissue size will be approximately 1 mm^2 for fish less than 65 mm and 4 mm^2 for fish greater than 65 mm FL. All scissors will be sterilized in a 20% bleach solution, rinsed in reverse osmosis or distilled water, and then rinsed in 70% ethanol between each use. Each fin-clip will be placed in an individually labeled cryotube filled with 95% ethanol or on a piece of rite in the rain paper and placed in an individually labeled scale envelope. The cryotubes or scale envelopes will be labeled with the sample ID, collection location, date, fish species, and FL.

Genetic tissue samples from juvenile Chinook Salmon will be analyzed by Genidaqs to determine the run of each fish (fall-run or spring-run). This will allow a more accurate estimate of the relative proportion of fall- and spring-run fish that are impacted by the study and provide resource agencies with important information to better understand the temporal distribution of the two runs.

3.2.3.15.1.4 Humanely Sacrifice

Juvenile Chinook Salmon selected to be sacrificed for otolith and stomach content analysis will be processed for length and weight and then euthanized using an overdose of MS-222. They would then be placed in individually labeled Whirl-Paks® and placed on ice prior to freezing in the lab.

3.2.3.16 Vegetation Monitoring

Transplanted elderberry plants will be monitored within the restoration area as required by the USFWS (Appendix E). The elderberry transplant monitoring would be performed in years one, two and three following restoration completion, according to the protocol outlined in the Conservation Guidelines for the VELB (USFWS 1999) and as prescribed in the Proposed Action's USFWS Biological Opinion (Appendix E). A written report detailing the results of the restoration area monitoring would be prepared and provided to the USFWS following each survey year. All monitoring data collected would also be submitted for inclusion in the California Natural Diversity Database (CNDDB).

DETERMINATION:

On the basis of this initial evaluation:

	I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
X	I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
	I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
	I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
	I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature: Ciara Fisher	**Date:** 3/1/2021
Printed Name: Ciara Fisher	

4 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

4.1 ANALYTICAL APPROACH

This section presents the affected environment and environmental consequences associated with each environmental issue area. The following guidance, adapted from Appendix H of the State CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000 – 15387; 27 July 2007) was followed. A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required. "Negative Declaration: Potentially Significant Unless Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Significant Impact." Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR. Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). The analysis of each issue should identify: (1) the significance criteria or threshold used to evaluate each question; and (2) the mitigation measure identified, if any, to reduce the impact to less than significance.

The significance criteria used are based on Appendix G of the CEQA Guidelines and the Council on Environmental Quality NEPA Regulations (2016), and each impact category begins with a tabular summary of the criteria for determining significance and level of impact from the Proposed Action. Each subsection for which impacts are anticipated includes a description of existing conditions against which the potential for impacts is compared for each alternative. A discussion of the direct and indirect environmental consequences is followed with recommendations to avoid, minimize, and/or mitigate adverse effects. If no impact is anticipated for a particular impact category, a brief justification is provided.

4.1.1 IMPACT AND MITIGATION TERMINOLOGY

This EA/IS uses the following terms to describe the significance of environmental impacts.

No Impact: A no impact determination is made when the Proposed Action would not have any direct or indirect impacts on the environment. It means no change from existing conditions.

Less than Significant Impact: An impact is considered less than significant when the physical change resulting from the Proposed Action would not exceed the applicable significance criterion. A less than significant impact would not result in a substantial or potentially substantial adverse change in the physical conditions within the area affected by the Proposed Action.

Significant Impact: An impact is considered significant when the physical change from the Proposed Action would result in a substantial or potentially substantial adverse change in the physical conditions within the area affected by the Proposed Action. Significant impacts are identified by the evaluation of the physical change resulting from the Proposed Action compared to the applicable significance criteria.

Potentially Significant Impact: An impact is considered potentially significant when there is substantial evidence that an effect may be significant however, there is some uncertainty in conditions related to the Proposed Action or the affected environment. This document takes a conservative approach, treating a potentially significant impact as significant.

Cumulative Impact: A cumulative impact refers to two or more effects, when considered together, are considerable or which compound or increase other environmental impacts. A significant cumulative impact is when the cumulative adverse change in the physical conditions within the Action Area would exceed the applicable significance criterion and the Proposed Action's contribution is "cumulatively considerable".

Mitigation Measure: Mitigation measures to avoid, minimize, reduce, or compensate for significant and potentially significant impacts of the Proposed Action, in accordance with the State CEQA Guidelines (§15370) and with NEPA regulations (40 CFR §1508.20), are recommended where applicable.

Evaluation of the potential effects of the alternatives resulted in the determination that there would not be any adverse direct, indirect, or cumulative effects on many resources due to the scale, scope, and schedule of the Proposed Action. The resource categories which were determined to have no impact were the following: land use and planning, agricultural and forest resources, population and housing, transportation/traffic, mineral resources, hazards and hazardous materials, public services, and recreation. These resource categories are discussed in the environmental checklist for CEQA. The resource categories which were determined to have potential adverse effects are discussed in more detail below.

4.2 AESTHETICS

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Have a substantial adverse effect on a scenic vista?	0	0	0	X
Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	0	0	0	X
In non-urbanized areas, substantially degrade the existing visual character or quality of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	0	0	0	X
Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	0	0	0	X

The Proposed Action is located on private land in the Yuba Goldfields, a reach of the Yuba River that has been highly impacted by historic mining activities. No public viewpoints or areas (e.g., parks, recreation areas) are located adjacent to this portion of the Yuba River. There are several private residences downstream from and scattered on the hillside north of the Action Area. There are no designated scenic vistas or notable geographic features identified in the Action Area in the Yuba County General Plan (Yuba County 2011). The area is zoned as Agriculture/Rural Residential (Yuba County 2011).

4.2.1 DISCUSSION

4.2.1.1 No Action Alternative

Aesthetic or visual resources would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.2.1.2 Proposed Action

Aesthetic or visual resources include the "scenic character" of a particular region and site. Scenic features can include both natural features, such as vegetation and topography, and manmade features (e.g. historic structures). Areas that are more sensitive to potential effects are usually readily observable, such as land found adjacent to major roadways and hilltops.

The Proposed Action would not adversely impact a scenic vista as defined by the state of California. The Proposed Action Area is not visible from any public roadways. Therefore, there would be **no impact.** The Proposed Action Area is located on private property and much of the Proposed Action Area would not be visible to recreational users of the river. Portions of the Proposed Action Area can be seen from the public using four-wheel drive and off-highway vehicles on the south side of the river and using the main channel of the Yuba River for recreation; primarily anglers who access the area by floating or on foot via access from a gravel road on the south side of the river. Temporary changes in visual resources would result during the excavation, grading, and transport of material within the site in this rural area of Yuba County. Because impacts would be relatively short term, temporary, and with limited visibility to the public, there will be **no impact** to scenic resources or the visual character and quality of the site. When the Proposed Action is complete the visual resources would be improved as river users would be able to see a more complex channel configuration with areas of riparian vegetation that will increase quality and quantity of habitat for rearing juvenile salmonids.

The Proposed Action would not create a new source of light or glare; therefore, the Proposed Action would have **no impact** on day or nighttime views.

4.3 AGRICULTURAL AND FORESTRY RESOURCES

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	0	0	0	X
Conflict with existing zoning for agricultural use, or a Williamson Act contract?	0	0	0	X
Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	0	0	0	X
Result in the loss of forest land or conversion of forest land to non-forest use?	0	0	0	X
Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	0	0	0	X

4.3.1 DISCUSSION

4.3.1.1 No Action Alternative

Agriculture and forestry resources would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.3.1.2 Proposed Action

The Proposed Action does not involve land conversion and does not conflict with existing zoning for agricultural use or a Williamson Act contract; therefore, **no impacts** to agriculture would occur. The Proposed Action does not occur on forest land and would have **no impacts** on any timber resources.

4.4 AIR QUALITY

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
Conflict with or obstruct implementation of the applicable Air Quality plan?	0	0	0	X
Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?	0	0	X	0
Expose sensitive receptors to substantial pollutant concentrations?	0	0	0	X
Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	0	0	0	X

The Proposed Action is within the Sacramento Valley Air Basin. The FRAQMD is responsible for monitoring air quality in Yuba County. The Clean Air Act requires the EPA to set National Ambient Air Quality Standards to protect public health. National standards have been set for the following; ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, respirable particulate matter (particulate matter less than 10 microns in diameter; PM_{10}), fine particulate matter (particulate matter less than 2.5 microns in diameter; $PM_{2.5}$), and lead. The air quality in Yuba County has been designated nonattainment-transitional by the California Air Resources Board (ARB) for ozone and nonattainment for PM_{10} (ARB 2017; Table 9). The federal Clean Air Act and the California Clean Air Act require areas that are designated nonattainment to reduce emissions until standards are met. Air quality is affected by a combination of air contaminants, meteorological conditions and the topographical configuration of the valley. A primary factor responsible for the increase of air pollution is the increased amount of pollutants and PM produced by vehicles, industrial processes, mining operations, and agricultural activities, such as burning and ground disturbance.

Table 9. Yuba County federal and state attainment status for criteria pollutants (ARB 2017, USEPA 2020b)

Pollutant	State Standards	Federal Standards
Ozone	Nonattainment	Nonattainment/Severe
Carbon Monoxide	Unclassified	Unclassified/Attainment
Nitrogen Dioxide	Attainment	Unclassified/Attainment
Sulfur Dioxide	Attainment	Unclassified
Respirable Particulate Matter (PM_{10})	Nonattainment	Unclassified
Fine Particulate Matter ($PM_{2.5}$)	Unclassified	Unclassified

4.4.1 SENSITIVE RECEPTORS

Sensitive receptors include hospitals, schools, daycare facilities, elderly housing, and convalescent facilities. The occupants of these facilities, children, elderly, and the infirm, are more sensitive to poor air quality and associated health effects than the general population. In addition, residential areas are considered sensitive receptors because the general public spends substantial amounts of time at home. There is a large lot rural residential development bordering the northern edge of the site with the closest house being approximately 0.25 miles to the North. The closest sensitive receptor to the project site, Browns Valley School, is approximately 1.1 miles northwest from the nearest area where restoration activities would occur.

4.4.2 DISCUSSION

The FRAQMD has established criteria for determining local air basin impact significance. For the purpose of determining significance, the District's criteria for emissions from nitrous oxides (NO_x) and reactive organic gases (ROG) is 25 pounds per day (ppd) multiplied by project length (annual duration); not to exceed 4.5 tons per year (tpy), and 80 pounds per day (ppd) for PM_{10} emissions (FRAQMD 2010). A threshold of significance has not been established by FRAQMD for $PM_{2.5}$ (FRAQMD 2010). Project emissions that exceed the threshold limits set forth by the District are considered significant and require mitigation. Criteria pollutant emissions were also compared to the federal General Conformity *de minimis* thresholds (USEPA 2020a) to determine whether pollutant emissions would have an adverse effect under NEPA. FRAQMD has not established a significance threshold for construction GHG emissions. Therefore, to evaluate GHG emissions for the Proposed Project the Sacramento Metropolitan Air Quality Management District (SMAQMD) threshold of 1,100 metric tons (1213 tons) of CO_{2e} was used for CEQA purposes.

A significance threshold amount of GHG emissions has not been established for NEPA (CEQ 2016). Exposure of sensitive receptors to substantial pollutant concentrations would be considered a significant impact.

4.4.2.1 No Action Alternative

Without the Proposed Project and under existing conditions, the air quality for the area would not be affected except for actions that take place under existing conditions; therefore, there would be **no impact**.

4.4.2.2 Proposed Project

The Proposed Project restoration activities would result in emissions which would have effects on air quality in the area, including the generation of dust and small particulates from the excavation and transportation of material from the floodplain grading, and operation of heavy equipment. The following heavy equipment is estimated to be used for the Proposed Project; 2 bulldozers, 2 hydraulic excavators, 4 articulated haulers, 1 grader, and 1 water truck (Table 10). The Proposed Project is expected to take one construction season (April 16 – October 31) in 2021. Restoration activities are expected to occur for approximately 90 days during the 198-day construction season length (16 April – 31 October).

Table 10. Construction equipment number and total estimated use for the Proposed Project.

Type of Equipment	Number of Each Type	Estimated Total Use (days)	Estimated Total Use (hours)
Bulldozer	2	63	733
Excavator	2	63	663
Articulated Hauler	4	63	2012
Water Truck	1	63	250

Restoration activities may potentially result in localized, short-term emissions. Emissions may include hydrocarbons, nitrous oxides, sulfur oxides, carbon monoxide, and particulate matter. Activities are temporary, so any changes in air quality due to the Proposed Project would be limited in duration. Fugitive dust may be emitted during use of earth working equipment. Fugitive dust emissions during restoration activities would vary daily based on activity type and level, fines content of the sediment, and the weather. The fine sediment composition of the sediment is low throughout the areas of the site which would be impacted by restoration activities. Fine sediment within the site is generally only found in areas with dense riparian vegetation and these areas would generally not be impacted by the Proposed Project. The majority of restoration activities would occur on exposed alluvial bars where the sediment size is predominantly gravel and cobble sized with some sand sized particles included. Therefore, generation of high quantities of dust is not expected to occur during the majority of restoration activities. However, quantities of dust could occasionally be produced and result in temporary increases in PM_{10} concentrations. Implementation of **Mitigation Measure 1 – Reduce Dust Impacts** would ensure that production of dust would be minimized and result in a **less than significant** impact. Heavy equipment used

Table 11. Criteria pollutant emissions estimates in pounds per day and tons per year by Proposed Project phase and FRAQMD thresholds (FRAQMD 2010).

Year	NO_x (ppd/tpy)	ROG (ppd/tpy)	PM_{10} (ppd/tpy)	$PM_{2.5}$ (ppd/tpy)
2021	9.38 / 0.62	3.72 / 0.23	30.84 / 2.01	7.00 / 0.44
FRAQMD Threshold	2.275 tpy[1]	2.275 tpy[1]	80 ppd	No Threshold
FRAQMD *de minimis* Threshold	25 tpy[2]	25 tpy[2]	100 tpy[3]	No Threshold

[1] The FRAQMD threshold for NO_x and ROG is calculated as 25 ppd x length of the project (days); not to exceed 4.5 tpy.

[2] The FRAQMD *de minimis* threshold for NO_x and ROG is 25 tpy based on FRAQMD being in severe nonattainment for ozone.

[3] The FRAQMD *de minimis* threshold for PM_{10} is 100 tpy based on FRAQMD being in moderate nonattainment for PM_{10}.

during construction is summarized in Table 10, and emissions estimates of criteria pollutants by phase compared with FRAQMD emissions thesholds are summarized in Table 11. The emission of criteria pollutants during restoration activities would not exceed the FRAQMD significance thresholds (Table 10) resulting in a **less than significant** impact.

The Proposed Project's restoration activities would result in short term emissions of diesel particulate matter. The heavy equipment used for the Proposed Project all run on diesel and would produce diesel emissions during excavation, grading, and transport of material. The FRAQMD has not adopted a methodology for analyzing the impact of diesel particulate matter emission. Considering the limited construction season (mid-April through October) and the distance from the nearest sensitive receptor to the project site, the Proposed Project would not expose sensitive receptors to substantial pollutant concentrations; therefore, this impact would be **less than significant**.

The only objectionable odor that may be produced by the Proposed Project would be from diesel exhaust from operation of the earth moving equipment. The closest residence to the Proposed Project site where restoration would occur is approximately 0.25 miles north. Overall, there are a limited number of residences in the vicinity of the Proposed Project and the area is primarily agricultural/rural residential. Diesel exhaust from restoration activities would be expected to be restricted to the construction season and would dissipate over time and distance. Therefore, diesel exhaust resulting from restoration activities would not be expected to create objectionable odors to which residents would be exposed, resulting in a **less than significant impact**.

4.5 BIOLOGICAL RESOURCES

Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	0	X	0	0
Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	0	X	0	0
Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	0	0	X	0
Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or impede the use of wildlife nursery sites?	0	0	X	0
Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	0	0	0	X
Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan?	0	0	0	X

The Proposed Action Area consists of a 63-acre gravel bar on the north side of a 1.3 mile section of the LYR (Figure 1). The LYR main channel and gravel bar with riparian areas contain biological resources and provide habitats that support them. We used several sources to inventory these resources and assess impacts below. The potential presence of special-status species or other special habitats in the Proposed Action Area was investigated with a search of the USFWS, CDFW, and California Native Plant Society (CNPS) databases. Vegetation surveys of the Proposed Action Area were also performed on 23-24 April, 20-21 May, and 15-16 June 2020, with no special status plant species observed (SYRCL 2020; Appendix D). Juvenile salmonid out-migration monitoring data from rotary screw traps on the Yuba River near Hallwood Boulevard (RM 6) was also used (Campos and Massa 2010).

Several animal and plant species listed by state and federal agencies as threatened, endangered, or a species of concern occur on the Yuba River (CDFW 2020; USFWS 2020). Table 12 lists the special status species that occur in the Action Area (Browns Valley quadrant) and the eight adjoining quadrants and may be affected by restoration activities. Table 13 lists the specials status species that are unlikely to be impacted by the Proposed Action. Winter-run Chinook Salmon are listed in the USFWS Sacramento Endangered Species Program database (http://www.fws.gov/sacramento/es/default.htm), and its ESU boundary includes the LYR (59 FR 440; 70 FR 37160). However, winter-run Chinook Salmon have not been observed in the LYR nor were they believed to have historically occurred in the Yuba River (NMFS 2014). Therefore, for the purposes of this assessment we assume the Proposed Action would have no impact on their ESU.

4.5.1 PLANT COMMUNITIES AND WILDLIFE HABITATS

The wildlife habitats described below are based on the California Wildlife Habitat Relationships described in CDFW's Guide to Wildlife Habitats (Mayer and Laudenslayer 1988). Wildlife communities are correlated with vegetation communities. Vegetation communities within the Action Area were delineated using field surveys in combination with aerial photos. CDFW uses vegetation alliances to classify vegetation and the alliances are the unit for conservation of special status plant communities. The vegetation alliances within the Action Area were determined based on Sawyer et al. (2009). Vegetation alliances are typically a finer scale of vegetation classification than wildlife habitat relationships; therefore, CDFW provides "crosswalks" to correlate vegetation alliances with wildlife habitat, which are referenced in this document.

The LYR and its floodplain historically supported dense riparian woodland. While much of the CV upland and foothills were historically covered by sparsely wooded grasslands, pre-settlement riparian zones supported dense, multistoried stands of broadleaf trees including Valley Oak (*Quercus lobata*), Fremont Cottonwood, Western Sycamore, several willow species, Oregon Ash (*Fraxinus latifolia*), Box Elder (*Acer negundo),* California Black Walnut (*Juglans californica*) and other species (Thompson 1961; Roberts et al. 1980; Conard et al. 1980; Holland and Keil 1995). Currently, the site supports patches of riparian vegetation that are found around the backwater complex at the northern edge of the gravel bar and in scattered patches throughout the rest of the gravel bar (Figure 3). The riparian plant species currently found at the site are similar to historical assemblages and include Fremont cottonwood, willows, white alder, buttonbush, and elderberry. gray pine (*Pinus sabiniana*) and blue oak (*Quercus douglasii*) are found on the hillside to the north of the Action Area boundary.

Mining activities including channel confinement, dam construction, and water regulation have altered and impacted habitats within the LYR, including the Proposed Action Area. Habitats present in the Proposed Action Area include riparian and wetland communities, alluvial gravel bar, and riverine habitats including LYR main channel, isolated pools, and a backwater (Appendix G).

4.5.2 TERRESTRIAL HABITATS

4.5.2.1 Vegetation Alliances

Vegetation alliances include Great Valley Mixed Riparian Forest and Great Valley Willow Scrub.

4.5.2.2 Valley Foothill Riparian

The Valley Foothill Riparian plant community is the most common plant community found within the Proposed Action Area, covering 7.68 acres, is distributed at the northern edge of the gravel bar, particularly around the backwater complex (Appendix G). The dominant tree species is Fremont cottonwood with the subdominant trees being white alder and Goodding's willow (*Salix gooddingii*). Shrub species present include elderberry, buttonbush, and willows.

4.5.2.3 Riparian Scrub

Riparian Scrub is the second most common plant community found within the Proposed Action Area, covering 3.40 acres, and is distributed along the edge of the Yuba River and scattered throughout the gravel bar (Appendix G). This community is dominated by willows, including *Salix exigua*, *S. melanopsis*, and *S. lasiolepis*.

4.5.3 CRITICAL PERIODS

The potentially significant impacts from the Proposed Action would be those associated with site construction, including: excavation and grading of material from the floodplain, creating inlets and outlets for perennial and seasonal side channels and backwaters with the main channel, and the placement of native sediment in the ponds and backwater to create shallow side channel habitat. Table 15 lists the critical periods when disturbance could result in significant impacts to individuals or populations of special status species. To avoid these impacts, most ground disturbing activities would be conducted during the period 15 July through 30 September, which is outside the listed critical periods (Table 14). However, some ground disturbing work would be conducted as early as 16 April, and appropriate surveys would be performed and buffers implemented around observed special status species to avoid impacts to these species, discussed in greater detail below.

Table 12. Special status species likely to occur in the Action Area. Data compiled from the USFWS database for Yuba County (USFWS 2020) and from the CNDDB by searching the Browns Valley quadrant and eight adjoining quadrants (CDFW 2020).

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Fish						
Cottus gulosus	Riffle Sculpin	None	Species of Special Concern	NA	Sacramento-San Joaquin drainage except Pit River; coastal streams from Morro Bay northward to Noyo River (McGinnis 2006)	Likely; the Study Area overlaps the range of species
Mylopharodon conocephalus	Hardhead	None	Species of special concern	NA	Typically found in undisturbed areas of larger low to mid elevation streams in the main Sacramento-San Joaquin basin (Moyle 2002)	Likely; the Study Area overlaps the range of species
Oncorhynchus mykiss	California Central Valley steelhead	Threatened	None	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	Threatened	Threatened	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	FSC; FMP, MSA managed species	Species of Special Concern	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
Birds						
Accipiter cooperii	Cooper's Hawk	None	Watch list	NA	Deciduous and mixed forests; also found in other open woodland habitats (Johnsgard 1990; Dewey and Perepelyuk 2000)	Likely; the Study Area supports suitable habitat for the species
Accipiter striatus	Sharp-shinned hawk	None	Watch list	NA	Throughout forested regions of North America, also found in suburban and agricultural areas (Snyder and Snyder 1991; Bildstein and Meyer 2000)	Likely; the Study Area supports suitable habitat for the species
Buteo swainsoni	Swainson's hawk	None	Threatened	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

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Elanus leucurus	White-tailed Kite	None	Fully Protected	NA	Valley lowlands west of Sierra Nevada range. Breeds from February to October in dense tree groves, often in riparian zones	Likely; the Study Area overlaps the range of species
Haliaeetus leucocephalus	Bald Eagle	Delisted	Endangered / Fully Protected	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)	Likely; the Study Area overlaps the range of species
Icteria virens	Yellow-breasted Chat	None	Species of special concern	NA	Occurs in California as a migrant and summer resident from late March to late September, breeding April - August (Garrett and Dunn 1981, Unitt 2004, Eckerle and Thompson 2001). Nesting restricted to narrow borders near streams with thick vegetation and large trees (Grinell and Miller 1944)	Likely; the Study Area overlaps the range of species
Pandion haliaetus	Osprey	None	Watch list	NA	Worldwide distribution. Nests near marshes, swamps, lakes and rivers between April and May (Kirschbaum and Watkins 2000; Poole 1989)	Likely; the Study Area overlaps the range of species
Phalacrocorax auritus	Double-crested Cormorant	None	Watch list	NA	Year-round resident found along the coast of California as well as inland lakes, rivers, and estuaries (Adkins and Roby 2010). Roosts on steep cliffs and in dead tree branches and snags near water.	Likely; the Study Area contains suitable roosting habitat
Amphibians/reptiles						
Emys marmorata	Western Pond Turtle	None	Species of special concern	NA	Throughout the Central Valley in reservoirs, water treatment ponds, agricultural ponds, rivers and seasonal creeks (Pilliod et al. 2011)	Likely; the Study Area overlaps the range of the species
Rana draytonii	California red-legged frog	Threatened	Species of special concern	No designated Critical Habitat in the Action 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 Action Area.

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Distribution and Habitat Association	Potential for Occurrence
Invertebrates						
Desmocerus californicus dimorphus	Valley Elderberry Longhorn Beetle	Threatened	None	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
Mammals						
Antrozous pallidus	Pallid Bat	None	Species of special concern	NA	Common in desert and grassland habitats throughout the southwestern U.S., especially near water (Hermanson and O'Shea 1983). Documented within the Action Area quadrants (CDFW 2016)	Likely; the species has been observed near the Study Area
Lasiurus blossevilli	Western Red Bat	None	Species of special concern	NA	Ranges throughout California's Central Valley in broadleaf tree communities; may also occur above low and middle elevations in mixed conifer forests (Pierson et al. 1999)	Likely, Study Area and habitat overlaps species range
Lasiurus cinereus	Hoary Bat	None	Western Bat Working Group List	NA	Widespread throughout North America. Roosts in large trees with medium to dense foliage (Shump and Shump 1982)	Likely; the Study Area contains suitable habitat for the species

**Indicates the Action Area is within federal Critical Habitat for the species.*

Table 13. Special status species unlikely to occur in the Action Area. Data compiled from the USFWS database for Yuba County (USFWS 2020) and from the CNDDB by searching the Browns Valley quadrant and eight adjoining quadrants (CDFW 2020).

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Habitat Association	Potential for Occurrence
Fish						
Hypomesus transpacificus	Delta Smelt	Threatened	Endangered	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 Action Area does not overlap species range or provide suitable habitat for the species
Lavinia exilicauda exilicauda	Sacramento Hitch	None	Species of special concern	NA	Native to the Sacramento-San Joaquin, Clear Lake, Russian River, and Pajaro-Salinas drainages. Warm, low-elevation lakes, sloughs and slow moving stretches of river. (Moyle 2002)	Unlikely; although Study Area overlaps species range, habitat is not suitable
Oncorhynchus tshawytscha	Winter-run Chinook Salmon	Endangered	Endangered	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
Acipenser transmontanus	White Sturgeon	None	Species of Special Concern	NA	Mainstem Sacramento River downstream of Keswick Dam (including the Yolo and Sutter bypasses), Feather River downstream of the fish barrier dam, the San Joaquin River downstream of the Merced River confluence, and the Sacramento-San Joaquin Delta (Moyle et al. 2015).	Unlikely, there is only anecdotal evidence of occurrence in LYR
Acipenser medirostris	North American Green Sturgeon	Threatened	None	Designated critical habitat in the Study Area (50 FR 52301–52351, October 9, 2009).	Main-stream 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)	Unlikely; Daguerre Point Dam prevents access of the species to the Study Area
Entosphenus tridentata	Pacific Lamprey	None	Species of Special concern	NA	Throughout the Pacific Rim from Japan to Baja California	Unlikely; Daguerre Point Dam prevents access of the species to the Study Area
Lampetra ayresi	River Lamprey	None	Species of special concern	NA	Coastal streams from just north of Juneau, AK south to San Francisco Bay. Also observed in the Stanislaus and Tuolumne rivers within the San Joaquin basin	Unlikely; Daguerre Point Dam prevents access of the species to the Study Area
Birds						

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Habitat Association	Potential for Occurrence
Agelaius tricolor	Tricolored Blackbird	None	Species of special concern	NA	Northern California to upper Baja California, Mexico. Nests and forages in fresh water marshes with cattails and bulrushes (CDFW 2016)	Unlikely; the Study Area does not support breeding/feeding habitat
Aquila chrysaetos	Golden Eagle	None	Fully protected; Watch list	NA	Uncommon in California except for an are in the Central Valley where they are more common. Breeding occurs from late January to August and nesting occurs on cliffs and in large trees (CDFW 2016)	Unlikely; the Study Area does not support nesting habitat
Asio Otus	Long-eared Owl	None	Species of special concern	NA	Broadly distributed throughout the Holarctic; breeds in North America from central Canada to northern Baja. Scarce in the Central Valley of California (CDFW 2016)	Unlikely; scarce in the Central Valley and Study Area does not contain typical nesting habitat
Athene cunicularia	Burrowing Owl	None	Species of special concern	NA	Widely distributed throughout the lowlands of California; breeds/nests in open, sandy areas with low vegetation and grasslands (Bates 2006; Small 1994; Klute et al. 2003)	Unlikely; the Study Area does not support breeding/nesting habitat
Circus cyaneus	Northern Harrier	None	Species of special concern	NA	Found throughout the northern hemisphere; breeds from Alaska to Baja California; prefers open habitats, such as fields, meadows, and marshes, but also found in agricultural areas and riparian zones (Wheeler and Clark 1987; Macwhirter and Bildstein 1996).	Unlikely; Study Area does not support preferred habitat
Coccyzus americanus	Western Yellow-billed Cuckoo	Threatened	Endangered	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 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 2014a)	Unlikely; the Study Area does not support large patches of riparian vegetation that are its preferred habitat
Dendroica petechia	Yellow Warbler	None	Species of special concern	NA	Migrant and summer resident in California from late March through early October; breeds from April to late July (CDFG 2008). Breeding populations are found throughout California but are nearly extirpated in the Central Valley (CDFG 2008). Occupy open riparian woodlands including cottonwoods, willows, and alders, near streams and wet meadows (CDFG 2008).	Unlikely; they are very rare in the Central Valley

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Habitat Association	Potential for Occurrence
Dendrocygna bicolor	Fulvous Whistling-Duck	None	Species of special concern	NA	Worldwide distribution, but nearly extirpated as a breeder in California (CDFG 2008). Inhabits freshwater and coastal marshes; prefers dense emergent wetland and flooded rice fields and tall grass (CDFG 2005).	Unlikely; the species is nearly extirpated from California and Study Area does not support freshwater marsh habitat
Laterallus jamaicensis coturniculus	California Black Rail	None	Threatened	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, and northern Sierra Nevada foothills (CDFW 2016, Richmond et al. 2010)	Unlikely; Study Area supports little freshwater emergent wetland habitat
Melospiza melodia mailliardi	Modesto Song Sparrow	None	Species of special concern	NA	Northern Central Valley from Colusa County to Stanislaus County (CDFG 2008). Very rare in riparian vegetation along the Sacramento River and its tributaries north of Sacramento (CDFG 2008). Riparian habitat obligate found in emergent freshwater wetlands containing tules, cattails, and willows (CDFG 2008)	Unlikely; it is very rare along Sacramento River tributaries
Progne subis	Purple Martin	None	Species of special concern	NA	Summer resident and migrant typically from mid-March to late September, breeds May to mid-August (CDFG 2008). Widely distributed throughout California in forest and woodland areas at low to intermediate elevations (up to 6,000 ft) but only occur in very small, local populations (CDFG 2008).	Unlikely; Study Area is outside of its current range in California
Riparia riparia	Bank Swallow	None	Threatened	NA	Neotropical migrant present in California from spring to the fall; breeds in early May through July (CDFW 2016). Colonial breeder that digs nest burrow in fine-textured banks or cliffs near water (CDFW 2016, BSTAC 2013). Nesting colonies primarily in Sacramento River basin (BSTAC 2013).	Unlikely; Study Area does not contain nesting habitat.
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered	No designated critical habitat in the Study Area (59 FR 4845, February 2, 1994)	In California, almost all breeding records are restricted to southern California and very rarely observed in the Central Valley (USFWS 2006a, Howell et al. 2010). Nesting typically occurs in early to mid-successional riparian vegetation (Kus 2002)	Unlikely; species is rarely observed within the Central Valley
Amphibians/reptiles						

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Habitat Association	Potential for Occurrence
Ambystoma californiense	California Tiger Salamander	Threatened	Threatened	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
Spea hammondii	Western Spadefoot	None	Species of special concern	NA	Throughout California Central Valley and foothills and along the Coast Ranges south to Baja, Mexico. Prefers grassland, scrub, chaparral, oak woodlands with permanent and temporary wetlands for breeding (Santos-Barrera 2004)	Unlikely; the Study Area does not support breeding habitat
Thamnophis gigas	Giant Garter Snake	Threatened	Threatened	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.
Invertebrates						
Branchinecta conservatio	Conservancy Fairy Shrimp	Endangered	None	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	Threatened	None	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
Lepidurus packardi	Vernal Pool Tadpole Shrimp	Endangered	None	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
Plants						
Astragalus pauperculus	Depauperate Milk-Vetch	None	Rare plant 4.3	NA	Annual herb native to valley and foothill regions of northern California. It grows in vernally mesic chaparral, woodland, and grassland habitat.	Unlikely; Study Area does not overlap species known range.

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Habitat Association	Potential for Occurrence
Astragalus tener var. *ferrisiae*	Ferris' Milk-Vetch	None	Rare plant 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
Azolla microphylla	Mexican Mosquito Fern	None	Rare Plant 4.2	NA	Found in still water, particularly ponds and marshes, at elevations ranging from 30 to 100 meters (98 to 328 ft)	Unlikely; Study area does not support preferred habitat
Brodiaea rosea ssp. *vallicola*	Valley Brodiaea	None	Rare Plant 4.2	NA	Found in vernal pools and grassland swales. Grows in silty, sandy, and gravelly loam often associated with old alluvial terraces.	Unlikely; Study area does not support preferred habitat
Brodiaea sierra	Sierra Foothills Brodiaea	None	Rare Plant 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	None	Rare Plant 4.2	NA	Below 2,800 ft in elevation in dry habitats in six northern Sierra counties (Corps 2014). Typically grows in foothill woodland habitat, often in roadcuts and gravelly slopes above creeks and rivers.	Unlikely; Study Area does not support preferred habitat
Cryptantha rostellata	Red-stemmed cryptantha	None	Rare Plant 4.2	NA	Annual herb found in valley and foothill grassland and cismontane woodland. Often in gravelly, volcanic openings or along roadsides.	Unlikely; Study Area does not support preferred habitat
Delphinium recurvatum	Recurved Larkspur	None	Rare Plant 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	None	Rare plant 2B.2	NA	Annual herb that grows in foothill woodlands, valley grasslands, freshwater wetlands in vernal pools (Cal Flora 2016)	Unlikely; Study Area does not support habitat requirements
Erythranthe glaucescens	Shield-Bracted Monkeyflower	None	Rare plant 4.3	NA	Typically found in serpentine seeps and occasionally along streambanks in chaparral, cismontane woodland, lower montane conifer forest, or valley and foothill grassland (CNPS 2021)	Unlikely; the Study Area does not have serpentine geology.
Fritillaria agrestis	Stinkbells	None	Rare plant 4.2	NA	Found in Sacramento and San Joaquin Valleys and inner Coast Ranges and South coast; generally found among grasses in adobe (Roderick 1964)	Unlikely; Study Area does not overlap species range

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Habitat Association	Potential for Occurrence
Hesperevax caulescens	Hogwallow Starfish	None	Rare plant 4.2	NA	Endemic to California; annual herb found in vernal pool habitats throughout the Central Valley. Blooms in March-June (CNPS 2021)	Unlikely; Study Area does not support vernal pool habitats
Juncus leiospermus var. *ahartii*	Ahart's Dwarf Rush	None	Rare plant 1B.2	NA	Found in the northeastern and southeastern Sacramento Valley Vernal Pool regions. Typically found growing in acidic clays around the edges of vernal pools, particularly on gopher and ground squirrel mounds, and in the bottom of intermittent drainages (USFWS 2005). Elevation range between 100 and 300 ft.	Unlikely; Study Area does not support vernal pool habitats.
Legenere limosa	Legenere	None	Rare plant 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
Leptosiphon acicularis	Bristly Leptosiphon	None	Rare Plant 4.2	NA	Annual herb found in valley and foothill grassland, chaparral, and cismontane woodland.	Unlikely; Study Area does not support preferred habitat
Monardella venosa	Veiny Monardella	None	Rare plant 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 2021)	Unlikely; the Study Area does not overlap the range of the species.
Paronychia ahartii	Ahart's Paronychia	None	Rare plant 1B.1	NA	Typically found on rocky soils, often of volcanic origin, on the edges of vernal pools and swales within valley grassland. In Butte, Shasta, and Tehama counties at elevations from 98 to 1673 ft (CNPS 2021)	Unlikely; it has not been observed in Yuba County and Study Area does not contain vernal pool or swale habitat
Plagiobothrys glyptocarpus var *modestus*	Cedar Crest Popcorn Flower	None	Rare plant 3	NA	Annual herb found in Nevada County, may be present in Yuba County (CNPS 2021). Found in cismontane woodland and moist areas in grasslands (CNPS 2021)	Unlikely; Study Area does not contain species habitat
Pseudobahia bahiifolia	Hartweg's Golden Sunburst	Endangered	Endangered; Rare plant 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 2021)	Unlikely; not observed in Study Area during the pre-project vegetation surveys

Scientific Name	Common Name	Federal Status	State Status	Critical Habitat	Habitat Association	Potential for Occurrence
Sagittaria sanfordii	Sanford's Arrowhead	None	Rare plant 1B.2	NA	Perennial herb that grows in shallow edges of marshes, swamps, ponds, and sloughs at elevations below 2100 ft (CNPS 2021)	Unlikely; not observed during pre-project vegetation surveys
Wolffia brasiliensis	Brazilian Watermeal	None	Rare plant 2B.3	NA	Tiny perennial herb that grows in mats on the surface of calm waterbodies including ponds, marshes, and swamps (CNPS 2021). In California it has only been observed along the Sacramento River at elevations from 66 to 328 ft (CNPS 2021).	Unlikely; the Study Area is outside the known species range
Mammals						
Antrozous pallidus	Pallid Bat	None	Species of special concern	NA	Found throughout California. Roosts in horizontal openings, in the open near foliage or in buildings, caves and cracks in rocks (Miller 2000)	Unlikely; Study Area does not support preferred roosting habitat
Corynorhinus townsendii	Townsend's Big-eared Bat	None	Threatened candidate; Species of special concern	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
Eumops perotis californicus	Western Mastiff Bat	None	Species of special concern	NA	Uncommon in California's arid and semiarid lowlands in the lower Sonoran life zone	Unlikely; the Study Area is not within the species known range
Lasionycteris noctivagans	Silver-haired Bat	None	Species of special concern	NA	Distributed in foothill and mountainous areas throughout California (CDFW 2016). Summer habitat includes coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley foothill and montane riparian habitats (CDFW 2016)	Unlikely; species has not been observed near the Study Area.
Myotis yumanensis	Yuma Myotis	None	Species of special concern	NA	The Yuma myotis is a common and widespread bat occurring throughout California at elevation lower than 11,000 ft in open forest and woodlands near a water source (CDFW 2016). The Yuma myotis forages after sunset and can be found roosting in dark places such as crevices, caves, mines, or buildings (Barbour and Davis 1974).	Unlikely, the Study Area does not support roosting habitat.
Taxidea taxus	American Badger	None	Species of special concern	NA	Throughout California in dry shrub, forest, and herbaceous habitats with friable soils (Grinnell et al. 1937)	Unlikely; despite suitable habitat, species not observed along Yuba River (CDFG 1995)

Table 14. Critical periods for special status species that may be affected by the construction activities.

Common Name	Critical Period
Fall-run Chinook Salmon	October through June
Spring-run Chinook Salmon	September through June
California Central Valley steelhead	December through May
Hardhead	April through May
Central California Roach	March through early July
Osprey	March through July
Bald Eagle	November through July
Swainson's Hawk	March through August
Northern Harrier	March through August
White-tailed Kite	February through October
Bats (*Myotis* spp.)	May through July
Western Pond Turtle	March through July
California Red-legged Frog	March through July
Foothill Yellow-legged Frog	April through July
Valley Elderberry Longhorn Beetle	November through June

4.5.4 SPECIAL STATUS PLANTS WITH POTENTIAL TO OCCUR WITHIN ACTION AREA

On 23-24 April, 20-21 May, and 15-16 June 2020, vegetation surveys were performed to identify any special status plants that may be present within the Action Area (SYRCL 2020; Appendix D). No special status plant species were observed during the pre-project vegetation surveys (SYRCL 2020; Appendix D). The following special status plant species have the potential to occur in the Action Area despite not having been observed during pre-project special status plant surveys.

Depauperate Milk-Vetch *Astragalus pauperculus*

Depauperate milk-vetch is an annual herb that is native to valley and foothill regions of northern California. It grows in vernally mesic chaparral, woodland, and grassland habitat. This species was not observed during the pre-project vegetation survey.

Ferris' Milk-Vetch *Astragalus tener* var. *ferrisiae*

Ferris' Milk-vetch is an annual plant with one or more stems measuring up to 26 cm (10.2 in) long. It has pinnately compound leaves with 7 to 15 wedge-shaped leaflets and dense inflorescences containing 3 to 12 pinkish-purple flowers each (USFWS 2005). Ferris' milk-vetch grows on clay soils that are alkaline, moist in the springtime, and level with the elevation of collection localities ranging from 6 to 46 meters (20-150 ft) (USFWS 2005). A historical occurrence was reported in Yuba City, but no populations have been found in Yuba County to date. Because Ferris' Milk-vetch has not been observed in Yuba County and clay soils do not occur near the Action Area, it is not likely that this species occurs on the Action Area.

Mexican Mosquito Fern *Azolla microphylla*

Mexican Mosquito Fern is an aquatic plant found in still water, particularly ponds and marshes, at elevations ranging from 30 to 100 meters (98 to 328 ft). Individual plants range in size from one-two cm in length. Leaves are tiny and overlap like shingles. This species forms extensive green or red mats on the water surface. This species was not observed during the pre-project vegetation survey.

Valley Brodiaea *Brodiaea rosea* ssp. *vallicola*

The Valley Brodiaea is a California endemic perennial bulbiferous herb found associated with vernal pools or swales along the eastern edge of the CV and foothill grassland. It grows in silt, sandy, and gravelly loam, often associated with old alluvial terraces. It is found at elevations from 10 to 335 meters (33 to 1,099 ft). The Action Area does not contain vernal pools or swales therefore species presence is not likely. This species was not observed during the pre-project vegetation survey.

Sierra Foothills Brodiaea *Brodiaea sierra*

The Sierra Foothills Brodiaea is a monocot bulbiferous perennial herb found in the Sierra Nevada foothills of Butte, Yuba, and Nevada counties, typically between 320 and 945 m (1050 to 3100 ft) (Preston 2006). It occurs primarily on basic and ultramafic outcrops and grows within chaparral openings and open areas in foothill woodlands (Preston 2006). The Sierra Foothills Brodiaea is not likely to be found within the Action Area as it is below 1050 ft in elevation and does not have basic or ultramafic geology. This species was not observed during the pre-project vegetation survey.

Brandegee's Clarkia *Clarkia bilba* ssp. *brandegeeae*

Brandegee's Clarkia is a dicot annual herb with stems less than 3.2 ft tall with lavender, wedge shaped flower petals. It is found below 2,800 ft in elevation in dry habitats in six northern Sierra counties (Corps 2014). Brandegee's Clarkia typically grows in foothill woodland habitat, often times in roadcuts and on gravelly slopes above creeks and rivers. This species was not observed during the pre-project vegetation survey.

Red-stemmed Crypantha *Crypantha rostellata*

Red-stemmed Crypantha is an annual herb found growing from 40 to 800 m (131 to 2625 ft) in valley and foothill grassland and cismontane woodland. It grows in open, rocky, dry sites often in gravelly, volcanic openings or along roadsides. This species was not observed during the pre-project vegetation survey.

Recurved Larkspur *Delphinium recurvatum*

Recurved Larkspur is a perennial herb with a 7- to 34-in tall dark purple stem, mainly basal, deeply lobed leaves and with a raceme inflorescence containing 10 to 25 flowers. The flowers have 5 light blue sepals, usually curved back, a spur, and 4 petals with the lower ones being white. It is typically found in poorly drained alkaline soils in valley and foothill grasslands and woodlands up to an elevation of 2400 ft. Recurved Larkspur is not likely to be found within the Action Area as it does not contain grassland. Recurved Larkspur was not observed during the pre-project vegetation survey.

Dwarf Downingia *Downingia pusilla*

Dwarf Downingia is an erect annual plant belonging to the bellflower family (Campanulaceae). Dwarf downingia grows from spiral-lined seeds to a height of 15-27 millimeters (0.6 to 1 in), and its flowers have white or blue, narrowly triangular petals with two yellow spots near the throat. This species is a California endemic and occurs in roadside ditches and vernal pools (Baldwin et al. 2012). This species was not observed during the pre-project vegetation survey and it is not likely to occur in the Action Area.

Shield-Bracted Monkeyflower *Erythranthe glaucescens*

Shield-Bracted Monkeyflower is an annual herb with a maximum height of 2.4 to 31.5 in with hairless and waxy stems and ovate to round leaves (Thompson 2013). Its inflorescence is a raceme of generally greater than 5 flowers with a pair of bracts fused around the stem to form a rounded disc up to 1.8 in in diameter (Thompson 2013). The flowers are up to 1.4 in long with the upper lip containing two notched lobes and a lower lip with three and a yellow corolla (Thompson 2013). The shield-bracted monkeyflower is typically found in serpentinite seeps and occasionally along streambanks in chaparral, cismontane woodland, lower montane conifer forest, or valley and foothill grassland (CNPS 2021). This species was not observed during the pre-project vegetation survey and is not likely to be found within the Action Area as it does not have serpentine geology.

Stinkbells *Fritillaria agrestis*

Stinkbells are an erect annual plant belonging to the lily family (Liliaceae). Stinkbells grow to a height of 5-15 centimeters (2 to 6 in). It has 5-12 alternate leaves crowded below the middle of the stem; its flowers are green-white or yellow and purple-brown, nodding, and ill-scented. This species is a California endemic and occurs in serpentine clay soils in banks and depressions (Baldwin et al. 2012). This species was not observed during the pre-project vegetation survey and it is not likely to occur on the Action Area.

Hogwallow Starfish *Hesperevax caulescens*

Hogwallow Starfish is an annual herb that is typically found on mesic, clay soils on the edges of shallow vernal pools in valley and foothill grassland. Hogwallow Starfish is not likely to occur in the Action Area as no vernal pools occur within the Action Area. Hogwallow Starfish was not observed during the pre-project vegetation survey.

Ahart's Dwarf Rush *Juncus leiospermus* var. *ahartii*

Ahart's Dwarf Rush is a reddish, annual grass-like herb from 0.8 to 2.4 in tall with as many as 100 slender stems (USFWS 2005). The grass-like leaves arise from the base and are about half as long as the stems with each stem producing a tiny flower at its tip (USFWS 2005). Ahart's Dwarf Rush is found in the Northeastern and Southeastern Sacramento Valley Vernal Pool regions. It is typically found growing in acidic clays around the edges of vernal pools, particularly on gopher and ground squirrel mounds, and in the bottom of intermittent drainages (USFWS 2005). The elevation range for Ahart's Dwarf Rush is between 100 and 300 ft. It is not likely to be found within the Action Area because there is no vernal pool habitat. Ahart's Dwarf Rush was not observed during the pre-project vegetation survey.

Legenere *Legenere limosa*

Legenere is an annual herb that is entirely hairless. The main stems are 4 to 12 in long and decumbent while all branches are erect (USFWS 2005). A single flower arises above each bract and flowers may or may not have corollas, a single plant can have both types of flowers (USFWS 2005). Legenere is found in a variety of habitats that include vernal pools, vernal marshes, ponds, sloughs, and floodplains of intermittent streams (USFWS 2005). It is typically found in these habitat types within grassland, open woodland, or hardwood forest from 0 to 2000 ft elevation (USFWS 2005). Legenere was not observed during the pre-project vegetation survey.

Bristly Leptosiphon *Leptosiphon acicularis*

Bristly Leptosiphon is a California endemic annual herb with bright yellow flowers found from 55 to 1500 m (180 to 4921 ft). It is found in a variety of habitats including chaparral, cismontane woodland, and valley and foothill grassland. There are limited occurrences of this species in the CV and Sierra Nevada foothills. This species was not observed during the pre-project vegetation survey.

Veiny Monardella *Monardella venosa*

Veiny Monardella is an annual herb that is 4 to 8 in tall with smooth edged oblong leaves (CNPS 2021). It has flower heads up to 1.5 in in diameter, deep magenta flowers, bracts appearing as ovate windowpanes up to 1.5 in long with the veins of bracts being hairy and perpendicular to the midvein. Veiny Monardella is found in the northern Sierra Nevada foothills on heavy clay soils in the grassland bottom of canyons within a couple of hundred ft of intermittent streams (CNPS 2021). Veiny Monardella was not observed during the pre-project vegetation survey and is unlikely to be found within the Action Area as it does not contain clay soils.

Ahart’s Paronychia *Paronychia ahartii*

Ahart’s Paronychia is a small annual herb that is 0.2 to 0.5 in tall, 0.2 to 0.7 in across, and consists of a tight silvery glomerule dominated by stipules, bracts, and sepals, arising from a slender taproot (Ertter 1985). It is typically found on rocky soils, often of volcanic origin, on the edges of vernal pools and swales within valley grassland. Ahart’s Paronychia is found in Butte, Shasta, and Tehama counties at elevations from 98 to 1673 ft (CNPS 2021). It is not likely to be present in the Action Area as it has not been found in Yuba County and the Action Area does not contain vernal pools or swales. Ahart’s paronychia was not observed during the pre-project vegetation survey.

Cedar Crest Popcorn Flower *Plagiobothrys glyptocarpus* var. *modestus*

Cedar Crest Popcorn Flower is an annual herb that has been found in Nevada County and may be present in Yuba County (CNPS 2021). The Cedar Crest Popcorn Flower is found in cismontane woodland and moist areas in grasslands (CNPS 2021). It is not likely to be found in the Action Area as its occurrence in Yuba County is in question and the habitat it uses is not present in the Action Area. Cedar Crest Popcorn Flower was not observed during the pre-project vegetation survey.

Hartweg's Golden Sunburst *Pseudobahia bahiifolia*

Hartweg's Golden Sunburst, also called Hartweg's Pseudobahia, is a slender, woolly annual in the sunflower family (Asteraceae). It has one or a few stems 2 – 6 in (5 – 15.2 cm) tall, with mostly narrow, undivided leaves. The yellow, or "golden," flowers bloom in March and April. A member of the sneezeweed tribe (Helenieae), the Pseudobahia genus is distinguished from related genera by characteristics of the leaves, flowers, and seeds. Hartweg's Golden Sunburst is distinguished from other members of the genus by the shape of its largest leaves, which are entire or three-lobed. It occurs in open grasslands and grasslands at the margins of blue oak woodland, primarily on shallow, well-drained, fine-textured soils, nearly always on the north or northeast facing of “mima mounds”. These are mounds of earth, of unknown origin, roughly 1 – 6 ft (30 – 182.8 cm) high and 10 – 100 ft (3 – 30.5 m) in diameter at the base, interspersed with basins that may pond water in the rainy season. The species is found only in the CCV. Historically, the range of the species may have extended from Yuba County south to Fresno County, a range of 200 mi (321.9 km). Within this range, the species was only locally abundant. Today, there are 16 populations remaining on the eastern edge of the San Joaquin Valley. Remaining populations are concentrated in the Friant region of Fresno and Madera counties and the La Grange region in Stanislaus County. According to the USFWS, Hartweg's Golden Sunburst has declined because of habitat loss caused by agricultural and urban development, levee construction, pumice mining, cattle grazing, and competition with nonnative weeds, road widening and off-road vehicle use. One population is protected under a conservation agreement between The Nature Conservancy and the U.S. Bureau of Reclamation. The remaining populations continue to be threatened by some or all of the above activities. This species is not likely to be found at the Action Area as no populations are known to remain in Yuba County. In addition, there is a lack of mima mounds within the Action Area, further making it not likely to be present within the Action Area. This species was not observed during the pre-project vegetation survey.

Sanford’s Arrowhead *Sagittaria sanfordii*

Sanford’s Arrowhead is a perennial rhizatomous herb that grows in the shallow edges of marshes, swamps, ponds, and sloughs (CNPS 2021). The emergent leaf blades are five to 10 in long and the flowers are white and in whorls well below the leaf ends. Sanford’s Arrowhead grows at elevations below 2100 ft. It was not observed during the pre-project vegetation survey.

Brazilian Watermeal *Wolffia brasiliensis*

Brazilian Watermeal is a tiny perennial herb that grows in mats on the surface of calm water bodies including ponds, marshes, and swamps (CNPS 2021). Individual fronds are typically less than 0.004 in long and ovoid. In California it has only been observed along the Sacramento River at elevations from 66 to 328 ft (CNPS 2021). Brazilian Watermeal was not observed during the pre-project vegetation survey and is not likely to be found in the Action Area as it does not include the Sacramento River.

4.5.5 SPECIAL STATUS WILDLIFE SPECIES

The Action Area includes a large gravel with infrequently inundated floodplain habitat, a perennially wetted backwater and isolated pools, emergent wetland, and riparian vegetation. There is residual riparian habitat in the Action Area that is used by various wildlife species. Special-status wildlife species are defined as taxa that are: 1) designated as threatened or endangered by the state or federal governments; 2) proposed or petitioned for federal threatened or endangered status; 3) state or federal candidate species; 4) listed as Species of Concern by the USFWS; or, 5) identified by the CDFW as Species of Special Concern. The special-status wildlife species that may potentially occur in the Action Area are described below. Pre-construction surveys would be conducted for these species and if any are found, USFWS and CDFW biologists would be consulted about avoidance and conservation measures.

4.5.5.1 Invertebrates

Conservancy Fairy Shrimp *Branchinecta conservatio*

The Conservancy Fairy Shrimp, an anostracan, is found in cool water ponds with low to moderate amounts of dissolved solids. Pools containing Conservancy Fairy Shrimp are seasonally astatic, filled by winter and spring rains, and usually last into June at the latest (Eriksen and Belk 1999). Individuals have been collected November-April, when temperatures are 5°C – 24°C. Hatching occurs about a week after pool filling at 10°C, and at least 19 days are required to reach maturity if water temperatures slowly increase to 20°C. Individuals may live up to 154 days. Only one cohort is produced each year, so both sexes usually disappear long before their native pools are dry. Cysts are produced in large numbers, and are relatively small (mean diameter of 0.23 mm) compared to other California fairy shrimp (Eriksen and Belk 1999). Conservancy Fairy Shrimp are found in grasslands in the northern two-thirds of the Central Valley, at elevations of 16 – 476 ft (4.9 – 145 m). Within this area, populations are even more restricted and occur in just a few fragmented localities. This limited range is within land forms that are prime areas for agriculture and urban development, which constitute the largest threat to this species (Eriksen and Belk 1999). The Conservancy Fairy Shrimp is a federally listed endangered species. The CNDDB shows no known occurrences of Conservancy Fairy Shrimp in or near the Action Area. This species is dependent upon short grass vernal pool landscapes, so is not likely to occur within or directly adjacent to the Action Area.

Vernal Pool Fairy Shrimp *Branchinecta lynchi*

The Vernal Pool Fairy Shrimp occurs in a wide variety of vernal pool habitats in the coast ranges and Central Valley of California as well as at two locations in southern Oregon’s Jackson County (USFWS 2005). Vernal Pool Fairy Shrimp typically occur in vernal pools but have also been found in alkali pools, ephemeral drainages, stock ponds, roadside ditches, vernal swales, and rock outcrop pools (Helm 1998). The seasonal habitat in which this species is found is usually small and shallow (Helm 1998). It has a fast life cycle, usually completing reproduction within 40 days, thus allowing it to complete reproduction in its ephemeral habitat (Helm 1998). Vernal Pool Fairy Shrimp has been observed to live as long as 147 days (Helm 1998). Like other vernal pool crustaceans, cysts of Vernal Pool Fairy Shrimp remain dormant in the soil when its vernal pool habitats are dry (USFWS 2006b). This species is typically found at elevations from 33 to 4,000 ft (Eng et al. 1990). Mortality has been observed to occur once water temperature reaches 75°F (Helm 1998) and it can survive in water temperatures as low as 40°F (Eriksen and Belk 1999). The Vernal Pool Fairy Shrimp feeds on algae, bacteria, protozoa, rotifers, and bits of detritus (USFWS 2006b). It is federally listed as threatened, and the CNDDB shows no known occurrences of this species in or near the Action Area, with the closest occurrence on Beale Air Force Base. This species is not likely to occur within or adjacent to the Action Area as it does not contain vernal pool habitat.

California Linderiella *Linderiella occidentalis*

The California Linderiella is smaller than members of the Branchinectidae family, has red eyes, and horn-like antennae appendages (USFWS 2006b). Male California Linderiella are about 0.35 in long while females are about 0.39 in long. The California Linderiella is the most widely distributed fairy shrimp in California, it is found in isolated populations in the coast ranges and in the CV from Fresno County north to Shasta County. The California Linderiella has been found in a wide variety of vernal pool habitats, having been observed in vernal pools on most land forms, geologic formations, and soil types. It is the longest lived of the CV fairy shrimp species, being observed to live for 168 days (Helm 1998). The California Linderiella takes an average of 43 days to reproduce with a minimum of 32 days (Helm 1998). It has been observed in vernal pools varying widely in size but tends to be found in deeper pools (USFWS 2006b, Platenkamp 1998) and it is tolerant of a wide range of temperatures, having been observed in pools with temperatures ranging from 41 to 85^{o}F. California Linderiella is typically found in vernal pools with clear to turbid water with pH ranging from 6.1 to 8.5, low alkalinity (13 to 170 parts per million), and low total dissolved solids (33 to 273 parts per million) (Eriksen and Belk 1999). The elevation range where California Linderiella have been observed is from 30 to 3,800 ft (Eriksen and Belk 1999). The CNDDB shows no known occurrences of California Linderiella in or near the Action Area, with the closest occurrence on Beale Air Force Base. The California Linderiella is not likely to be found within or adjacent to the Action Area because there is no vernal pool habitat.

Vernal Pool Tadpole Shrimp *Lepidurus packardi*

Vernal Pool Tadpole Shrimp are poorly understood notostracans characterized by their few, similarly-sized median spines on their supra-anal plate, which are not placed on a keel, and their 35 pairs of legs (Pennack 1989). They are typically found in temporary ponds and swales containing clear to highly turbid water. Pools containing Vernal Pool Tadpole Shrimp are commonly found in unplowed grasslands, and currently exist in vernal pools ranging from the north end of the CV around Redding to the south CV around Visalia, between the Coast Range and the Sierra Nevada. Within this range, distribution is patchy and generally in clustered vernal pool complexes. Vernal Pool Tadpole Shrimp appear in pools filled by fall and winter rains, re-establishing each year from diapaused (resting) cysts (King et al. 1996). Virtually all pools inhabited by this species become inundated even during drought years (King et al. 1996). The majority of the sites where the Vernal Pool Tadpole Shrimp occurs are on flat, developable land that has easy accessibility (Cheatham 1976). As a result, habitat loss constitutes the largest threat to this species. Because this species is dependent upon short grass vernal pool landscapes, it is unlikely that this species occurs within the Action Area.

Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus*

The VELB is a medium-sized (about 0.8 in [2 cm] long) beetle, with dimorphous sexes; the male forewings are primarily red with dark green spots, while the female have dark metallic green with red margins. The entire life cycle is associated with elderberry trees in California's Central Valley. In the Central Valley, elderberry trees are associated with riparian forests (Vaghti et al. 2009, USFWS 2014b), and the VELB appears to be more abundant in dense native plant communities with a mature overstory and a mixed understory (USFWS 1999). The beetle historically ranged throughout the valley, but recent surveys find it persists only in limited localities along the Sacramento, American, San Joaquin, and Kings rivers and their tributaries. Occurrences have been documented from southern Shasta County to Fresno County (USFWS 2014b). Kellner (1992) reported the most observations of VELB along the Merced River and further north. The adult stage is short-lived, and the adults are active from early March to early June; mating occurs in May (Barr 1991). Eggs are laid singly, or in groups, along the elderberry bark's crevices, and hatch in about 10 days. Larvae burrow a cavity inside the bark, roots and branches of the elderberry and pupate. Gestation for this stage is 1 to 2 two years before emerging as adults (Barr 1991). They appear to prefer elderberry of certain size classes, typically larger mature plants (Kellner 1992). The USFWS Conservation Guidelines for the beetle consider plants with one or more stems (>0.98 in [2.5 cm]) at ground level to be potential host plants (USFWS 1999). Elderberry plants are present within the Action Area and some of them may be occupied by the VELB (Figure 3). Formal consultation occurred with the USFWS for impacts to elderberry habitat and USFWS subsequently issued a Biological Opinion for the Proposed Action (Appendix E). With implementation of conservation measures **Mitigation Measure 2 – Protect Elderberry Plants and Special Status Plants with Buffer, Mitigation Measure 3 – Transplant Unavoidable Elderberry Plants to Suitable Locations,** and **Mitigation Measure 4 – Protect and Compensate for Native Trees**, impacts to VELB would be **less than significant**.

4.5.5.2 Amphibians

California Tiger Salamander *Ambystoma californiense*

California Tiger Salamander is an amphibian in the family Ambystomatidae. Adult stages are primarily terrestrial and larval stages are aquatic. It is large and stocky with a broad, rounded snout with small eyes with black irises protruding from their heads. Adult males are about eight in (20 cm) long, females a little less than seven in (18 cm). Coloration consists of white or pale-yellow spots or bars on a black background on the back and sides. The belly varies from almost uniform white or pale yellow to a variegated pattern of white or pale yellow and black. California Tiger Salamanders are restricted to breeding in vernal pools and seasonal ponds, including many constructed stock ponds, in grassland and oak savannah plant communities, predominantly from sea level to 2,000 ft (609.6 m), in central California. Larvae require significantly more time to transform into juvenile adults than other native amphibians. They are relatively poor burrowers, requiring refuges provided by ground squirrels and other burrowing mammals in which they live underground during dry months. The primary cause of California Tiger Salamander decline is the loss and fragmentation of habitat from urban and agricultural development, land conversion, and other human-caused factors. California Tiger Salamanders require large contiguous areas of vernal pools (vernal pool complexes or comparable aquatic breeding habitat) containing multiple breeding ponds to ensure recolonization of individual ponds, in association with extensive upland areas. A strong negative association between bullfrogs and California Tiger Salamanders has been documented (USFWS 2017). Louisiana swamp crayfish, mosquito fish, green sunfish and other introduced fishes also prey on adult or larval salamanders (USFWS 2017). Other impacts to this species include disease, reduction of ground squirrel populations and direct and indirect impacts from pesticides. The introduction of various nonnative Tiger Salamander subspecies may out-compete California Tiger Salamanders, or interbreed with them to create hybrids that may be less adapted to the California climate or are not reproductively viable past the first or second generations. Some hybrid Tiger Salamanders exhibit hybrid vigor. Automobiles and off-road vehicles kill a significant number of migrating California Tiger Salamanders and contaminated runoff from roads, highways and agriculture may adversely affect them. Suitable breeding and upland habitat is not present in the portion of the Action Area to be disturbed. The range of the California Tiger Salamander does not overlap with the Action Area, therefore **no impact** to this species is expected.

Foothill Yellow-legged Frog *Rana boylii*

The Foothill Yellow-legged Frog is a CDFW species of special concern. The Foothill Yellow-legged Frog is currently undergoing a status review to determine if it warrants listing (80 FR 37568). It is a medium-sized frog with grainy skin, long legs, and webbed hind feet. Its coloration tends to match its habitat with it typically being gray, brown, or olive and the underside of the rear legs and lower abdomen being yellow. The Foothill Yellow-legged Frog has experienced significant population declines across its range in California including range contraction (Kupferberg et al. 2012). The current range of Foothill Yellow-legged Frog in California is in the coast ranges from Monterey County north and in the foothills of the Sierra Nevada from Kern County north. It is found from near sea level to around 6,000 ft, typically in or near rocky streams in valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadows (Zeiner et al.1990). Foothill Yellow-legged Frog eats a wide variety of invertebrates including aquatic and terrestrial insects. It is an obligate stream breeder, with females attaching egg masses to substrates in shallow water with low velocities, typically river bars, in the spring to early summer as high flows recede

(Wheeler and Welsh 2008). Foothill Yellow-legged Frog life cycle is synchronized with the seasonal flow regimes of its habitat in California (Yarnell 2008). Altered flow regimes due to dam regulation has been implicated as one of the contributors to population declines as this species is not adapted to these regulated flow regimes (Yarnell et al. 2008, Kupferberg et al 2012). Altered thermal regime in rivers below dams with hypolimnetic releases can also impact the Foothill Yellow-legged Frog by shifting the timing of breeding activity, hatching success, and metamorphosis to later in the season and causing metamorphs to be smaller and leaner compared to metamorphs in unregulated streams (Wheeler et al. 2014). Foothill Yellow-legged Frogs are generally found at elevations greater than that of the Proposed Action (Yarnell et al. 2012); however, this species may be present, therefore there is a potentially significant impact. Pre-project amphibian surveys did not identify any California red-legged frog tadpoles, they were all bullfrog. However, focused amphibian surveys prior to start of construction as part of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts** would reduce this to a **less than significant impact.**

California Red-legged Frog *Rana draytonii*

The California Red-legged Frog is the largest native frog in the western United States, ranging from 1.6 – 5.1 in (4 – 13 cm) long. It is federally listed as threatened, having been extirpated from 70% of its former range (61 FR 25813). The abdomen and hind legs of adults are largely red and the back has small black flecks and larger irregular dark blotches, usually with light centers. Lateral folds are prominent on the back. California Red-legged Frogs inhabit quiet pools of streams, marshes, and occasionally ponds. This species occurs along the Coast Range Mountains from Mendocino County south, and in portions of the Sierra Nevada and Cascade mountain ranges (Barry and Fellers 2013). Sierra populations are highly restricted and generally consist of small numbers of individuals (Barry and Fellers 2013). However, a large population was discovered at Big Gun Diggings near Michigan Bluff in mine tailings ponds and the property is now a private habitat mitigation bank (Barry and Fellers 2013). California Red-legged Frogs prefer habitat in aquatic sites with substantial riparian and aquatic vegetation cover, especially those areas that lack invasive predators such as bullfrogs, bass *Micropterus* spp., and sunfish *Lepomis* spp. (USFWS 1996). Coastal lagoons, marshes, springs, permanent and semi-permanent natural ponds, ponded or backwater portions of streams, and artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds can all be inhabited by California Red-legged Frogs. Breeding occurs from late November to April. Females lay loose masses of eggs attached to the undersides of emergent vegetation near the top of the water, and eggs hatch within 6 – 14 days. Within 14 – 21 weeks tadpoles transform into frogs, and metamorphosis usually occurs in the summer months (USFWS 1997). Human activities that result in habitat destruction and/or the introduction of exotic competitors such as bullfrogs and sunfish may have a negative effect on this species. This species is not listed on the CNDDB as occurring within or near the Action Area (CDFW 2016). The closest known breeding habitat is approximately 19 miles away from the Action Area (Barry and Fellers 2013). Pre-project amphibian surveys did not identify any California red-legged frog tadpoles, they were all bullfrog. Therefore, California Red-legged Frog is not likely to be present within the Action Area, therefore **no impact** is anticipated (Appendix E).

4.5.5.3 Reptiles

Western Pond Turtle *Emys marmorata*

The Western Pond Turtle is a CDFW species of special concern. Its status is currently under review by the USFWS to determine if it warrants listing under the federal ESA (80 FR 19259). The Western Pond Turtle shell length is typically 3.5 to 8.5 in with a marbled carapacial pattern and drab coloration; dark brown, olive brown, or blackish. The Western Pond Turtle is found in California in the coast ranges north of Santa Cruz and in the CV west of the Sierra crest except for isolated populations near Susanville and in the Truckee, Carson, and East Walker rivers (Spinks et al. 2014). The Western Pond Turtle is typically found at elevations from sea level to 5,000 ft in a wide variety of aquatic habitats including rivers, streams, lakes, ponds, and marshes as well as human created habitat such as irrigation ditches and sewage treatment ponds. Structures such as logs, rocks, bedrock outcrops, and exposed banks are required for basking. Their preferred aquatic habitats have access to deep slow water containing underwater refugia (Ashton et al. 1997). In some environments the Western Pond Turtle may spend half the year or more on land (Ashton et al. 1997). In both aquatic and terrestrial environments, this species demonstrates a high degree of site fidelity, with males using a larger aquatic home range than females (Ashton et al. 1997). Mating takes place underwater in the spring and mature females typically oviposit every other year (Ashton et al. 1997). Oviposition occurs on land, from just above the floodplain to a few thousand ft from water, and the nest typically occurs in sparsely vegetated areas of annual grasses and herbs with dry soil, with the clutch size typically from four to seven eggs (Ashton et al. 1997). In northern California, hatching occurs in the fall, and the hatchlings usually remain in the nest chamber over the winter and emerge in spring (Holland 1994). In lakes and ponds, Western Pond Turtle would often over-winter underwater by burying itself in the mud, while turtles in streams and rivers would overwinter on land by burrowing in the duff or soil (Ashton et al. 1997). The Western Pond Turtle is a dietary generalist, feeding on both live prey and browsing on plants as well as scavenging carrion (Ashton et al. 1997). Commonly consumed food items include aquatic macroinvertebrates, crustaceans, annelids, and carcasses of mammals, birds, reptiles, amphibians, and fish (Ashton et al. 1997). The altered flow regime and cold water temperatures in rivers below dams have been found to have negative effects on basking behavior, growth, development, and body condition in pond turtles, which has implications for reproductive output and population fitness (Ashton et al. 2011). There is potential for competitive exclusion by introduced species such as Bullfrogs or Largemouth Bass. Habitat destruction is also noted as a reason for decline

(Jennings et al. 1992). The largest threats to the species are the predation of hatchlings by introduced, non-native Bullfrogs and the loss of habitat due to urbanization. Western Pond Turtles are likely to be present within the Action Area, therefore the Proposed Action has a potentially significant impact to this species. However, implementation of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts** would reduce this to a **less than significant impact.**

Giant Garter Snake *Thamnophis gigas*

The Giant Garter Snake is listed as threatened both federally and state (Fisher et al. 1994). Wood et al. (2015) found levels of inbreeding and evidence of population bottlenecks in about half of populations sampled. The Giant Garter Snake is a large snake with keeled dorsal scales and a head slightly wider than the neck. Ground color is brown or olive to black. There is typically a yellowish dorsal stripe, a light yellowish stripe on each side, and two rows of dark blotches on the sides. Snakes in the Sacramento Valley often have distinct stripes and a dark ground color. The underside is light brown or light grayish. This species is endemic to California and range from Glenn County to the southern edge of the San Francisco Bay-Delta, and from Merced County to northern Fresno County, apparently no longer occurring from south of northern Fresno County. The Giant Garter Snake is found in small, isolated patches of highly modified agricultural wetlands as 93% of historical wetlands in the CV have been lost (Wood et al. 2015). This species is highly aquatic and prefers marsh and wetland type habitat including sloughs, drainage canals, and irrigation ditches associated with rice cultivation (Halstead et al. 2014). Giant Garter Snake is found from sea level to 400 ft, and is not likely found at the Action Area as it does not contain the wetland habitat, therefore **no impact** is expected.

4.5.5.4 Birds

Cooper's Hawk *Accipiter cooperii*

The Cooper's Hawk is a medium-sized hawk with an elongated body. Individuals have a blue-gray back with a light nape and dark crown. The Cooper's Hawk can be distinguished from similar species by their long barred tail with a rounded tip (Dewey and Perepelyuk 2000). Adults range from 13.8 – 19.7 in (35 – 50 cm) in length and average ~1.2 lb (~525 g) in weight (Johnsgard 1990; Peterson and Peterson 2002). The Cooper's Hawk is native to nearctic and neotropical regions and can be found wintering as far north as the northern U.S. and southern Canada and as far south as Costa Rica. The species prefers deciduous and mixed forests, but can also be found in other open woodland habitats (Johnsgard 1990; Dewey and Perepelyuk 2000). Cooper's hawks are monogamous, and breeding begins in March and occurs once each year. Females deposit 3 – 6 eggs in a stick-built nest and hatching occurs in 32 – 36 days (Dewey and Perepelyuk 2000; Peterson and Peterson 2002). Common diet items include birds and small mammals (Dewey and Perepelyuk 2000). Cooper's Hawk may occur in the Action Area; however, with implementation of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**, impacts are expected to be **less than significant.**

Sharp-shinned Hawk *Accipiter striatus*

The Sharp-shinned Hawk is the smallest hawk in North America. Adults range from 9.4 – 13.4 in (24 – 34 cm) in length and average ~0.3 lb (~150 g) in weight. Individuals are blue-gray in color with a dark head and white underside with brown bars (Camfield 2004). The Sharp-shinned Hawk is primarily found throughout forested regions of North America, but can also be found in suburban and agricultural areas (Snyder and Snyder 1991; Bildstein and Meyer 2000). Breeding corresponds to maximum prey availability and usually occurs from March through June. Nests are built below the forest canopy in trees and re-used in multiple years. The species is territorial and actively defends nest sites during the breeding season (Camfield 2004). Home range size varies and is typically 222 – 692 ac (0.9 – 2.8 km2) (Bildstein and Meyer 2000). Common diet items include small birds, small mammals, and large insects (Bildstein and Meyer 2000; Camfield 2004). Sharp-shinned Hawk may occur in the Action Area; however, with implementation of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**, impacts are expected to be **less than significant.**

Tri-color Blackbird *Agelaius tricolor*

The Tri-colored Blackbird ranges from Northern California in the U.S. (with occasional strays into Oregon and Washington) to upper Baja California in Mexico. The USFWS is currently performing a status review of this species to determine if it warrants listing under the ESA (80 FR 56423). The Tri-colored Blackbird forms the largest colonies of North American landbirds, as it is highly social and gregarious. Nesting colonies may consist of tens of thousands of individuals. This social nature makes the bird vulnerable to impacts from urban and agricultural land uses. Native freshwater marshes consisting of cattails and bulrushes once used for nesting and feeding have been lost to urban and agricultural development (Schuford and Gardali 2008). Birds adapting to nesting in agricultural fields have been disturbed by harvesting during the breeding season. **No impacts** to this species are anticipated since typical nesting habitat is not present in the Action Area.

Long-eared Owl *Asio otus*

The Long-eared Owl is broadly distributed throughout the Holarctic with breeding in North America occurring from central Canada south to northern Baja (Shuford and Gardali 2008). The Long-eared Owl is resident throughout the state except it is scarce in the Central Valley, where it breeds irregularly (CDFG 2005, 2008). Population declines in the CV have likely resulted as a large loss in riparian habitat (Shuford and Gardali 2008). Long-eared Owl typically nests in conifer, oak, or riparian woodlands that are open or next to grasslands, meadows, or shrublands

(Shuford and Gardali 2008). They forage at night over open ground and eat mostly small mammals (Shuford and Gardali 2008). Long-eared Owl breeds from early March to late July (CDFG 2005). This species is not likely to nest within the Action Area as the dense riparian forest it requires is not present. **No impacts** are expected due to the Proposed Action.

Burrowing Owl *Athene cunicularia*

The Burrowing Owl is a small, long-legged owl with bright yellow eyes. The beak can be yellowish or greenish depending on the subspecies. The owls have prominent white eyebrows and a white chin patch. The breast and belly are white with variable brown spotting or barring. Populations in California have been greatly reduced over the past fifty years due to urban development in prime habitat areas. This species has not been observed in the Action Area and the sandy substrate it requires for burrowing are not present at the site. **No impacts** are expected as a result of the Proposed Action.

Golden Eagle *Aquila chrysaetos*

The Golden Eagle is a large dark brown raptor with a wide distribution throughout the Northern Hemisphere. In California they are uncommon except for an area in the CCV where they are more common (CDFG 2005). The Golden Eagle is typically found in rolling foothills, mountainous areas, sage-juniper flats, and deserts, and require open terrain for hunting small mammals that make up most of their diet (CDFG 2005). Nesting takes place on cliffs and in large trees with nest sites being reused in successive years (CDFG 2005). Breeding occurs from late January through August (CDFG 2005). Golden eagles are unlikely to be nesting within the Action Area, as cliffs are absent and large trees are scarce, therefore **no impact** is expected.

Swainson's Hawk *Buteo swainsoni*

The Swainson's Hawk is a medium-sized hawk that breeds in California and may migrate to Mexico and South America in the winter. The hawk often nests adjacent to riparian systems of the valley and in lone trees or groves of trees in agricultural fields. Valley Oak, Fremont Cottonwood, Black Walnut and large willows are the most commonly used nest trees in the Central Valley. This species also requires large open grasslands with suitable nest trees and abundant prey. Migrating individuals move south through the southern and central interior of California in September and October, and north March through May. Breeding occurs late March to late August. Nesting occurs primarily in the southern Sacramento Valley and northern San Joaquin Valley regions (Stillwater Sciences 2005). Although Swainson's Hawk would nest in trees located in upland areas, their strong association with riparian forests suggests that protection and restoration of these habitats may provide nesting habitat superior to other sources of trees such as those on roadsides or along field margins. Additionally, other bird species that occupy the mature tree and gallery forest component of riparian systems would also benefit from conservation or restoration of the river landscape (Woodbridge 1998). This species may occur in the Action Area; therefore, implementation of the Proposed Action would have a potentially significant impact on this species. However, with implementation of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**, impacts are expected to be **less than significant.**

Northern Harrier *Circus cyaneus*

The Northern Harrier is an accipiter hawk. Individuals have specialized feathers in the shape of a disk to focus sound into their ears, a white rump patch visible in flight, and wings that form a dihedral when gliding (Wheeler and Clark 1987). Adults range from 16.1 – 19.7 in (41 – 50 cm) in length and average ~1 lb (~450 g) in weight (Limas 2001). The Northern Harrier is found throughout the northern hemisphere and is known to breed from Alaska and Canada in northern North America to Baja California in southern North America. North American populations winter from southern Canada to Central America (Macwhirter and Bildstein 1996). The species prefers open habitats, such as fields, meadows, and marshes, but is also found in agricultural areas and riparian zones (Wheeler and Clark 1987; Macwhirter and Bildstein 1996). The Northern Harrier nests in loose colonies and breeding occurs from March through August. Nests are built on the ground on raised mounds (Limas 2001). Home range sizes vary and average 642 ac (~2.6 km^2) (Macwhirter and Bildstein 1996). Common diet items include small mammals, birds, reptiles, and amphibians (Wheeler and Clark 1987; Macwhirter and Bildstein 1996). This species may occur within the action area; therefore, implementation of the Proposed Action would have a potentially significant impact on this species. However, with implementation of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**, impacts are expected to be less than significant.

Western Yellow-billed Cuckoo *Coccyzus americanus*

The Western Yellow-billed Cuckoo is federally listed as threatened (79 FR 59991) and CESA listed as endangered (CDFW 2016). This species is a fairly large and slim bird with a slightly downcurved yellow bill. The Western Yellow-billed Cuckoo spends winter in South America east of the Andes and migrates to the U.S. west of the Rocky Mountains to breed in the summer. It usually arrives at breeding areas in June and departs by late August or early September (CDFG 2005). The range of the Western Yellow-billed Cuckoo has contracted and it is now a rare breeder in California, Arizona, New Mexico, and west Texas. Breeding populations in California are now largely confined to the Sacramento River Valley, the South Fork Kern River Valley, and the Colorado River Valley (CDFG 2005). In California this species is found in large patches (>37 acres) of riparian thickets or forests with a dense understory, willow a dominant component, and which is next to a water body such as a river, backwater, or seep (CDFG 2005, Dettling et al. 2015). In the Sacramento Valley, Western Yellow-billed Cuckoo are almost always found in cottonwood, willow riparian forests along the Sacramento and Feather rivers (USFWS 2014a). Restoration efforts have increased the amount of riparian habitat along the Sacramento and Feather rivers over the last 30 years (Dettling et al. 2015). However, the numbers detected during recent survey efforts have been very low, with 10 or fewer detected along the Sacramento River and none along the Feather River. The Western Yellow-billed Cuckoo is not likely to be found in the Action Area as it does not contain extensive patches of riparian vegetation that meet its habitat needs, therefore **no impact** is expected.

Yellow Warbler *Dendroica petechia*

The Yellow Warbler is a CDFW species of special concern. The Yellow Warbler is primarily a migrant and summer resident in California and is present from late March through early October and breeds from April to late July (Shuford and Gardali 2008). Breeding populations are found throughout California except for in the Mojave Desert and are nearly extirpated in the CV (Schuford and Gardali 2008). They are found breeding up to 8,500 ft in the Sierra Nevada mountains (Schuford and Gardali 2008). Yellow Warbler primarily occupies open riparian woodlands, including cottonwoods, willows, and alders, close to streams and in wet meadows (Schuford and Gardali 2008). They feed primarily on insects. The Yellow Warbler is not likely to be present in the Action Area as they are nearly absent from the Central Valley, therefore is **no impact** expected from the Proposed Action.

Fulvous Whistling-Duck *Dendrocygna bicolor*

The Fulvous Whistling-Duck is a CDFW species of special concern. Populations are found throughout the world, but this species is nearly extirpated as a breeder in California (Schuford and Gardali 2008). It inhabits freshwater and coastal marshes with a preference for dense emergent wetland as well as flooded rice fields and tall grass (CDFG 2005). Most recent observations have occurred in the San Joaquin and Imperial valleys (Schuford and Gardali 2008). Fulvous Whistling-Duck is not likely to be present in the Action Area as it is very rare in California and the wetland habitat it uses is not present within the Action Area, therefore **no impact** is expected from The Proposed Action.

White-tailed Kite *Elanus leucurus*

The White-tailed Kite is a resident of coastal and valley lowlands west of the Sierra Nevada Mountains. The monogamous raptor breeds from February to October. Nests are built in loosely piled sticks near the tops of tree stands (Dixon et al. 1957) and a single clutch may contain four to eight eggs. The species preys on small mammals, and other birds, insects and reptiles. They are solitary hunters, but may roost communally (Dunk 1995). Essential habitats include herbaceous lowlands with limited tree growth and dense tree groves for perching and nesting. Urbanization of agricultural lands may have contributed to the decline of the White-tailed Kite (Kalinowski and Johnson 2010). White-tailed Kite is known to nest along the Yuba River, therefore The Proposed Action may result in a potentially significant impact. However, Action Area wildlife surveys would be performed before construction activities to determine if there are nesting sites on or nearby the site (**Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**). If White-tailed Kite nesting is confirmed, a no-disturbance buffer would be created a minimum of 0.25 mi (0.40 km) around the nest. CDFW would also be contacted to discuss implementation changes and/or additional avoidance measures. With these measures in place, the impact is expected to be **less than significant.**

Bald Eagle *Haliaeetus leucocephalus*

The Bald Eagle is a large accipiter with a brown body and white head and tail. Adults can have wingspans up to 7.5 ft (2.3 m) and average ~6.8 lb (~3.1 kg) in weight. Historically, the Bald Eagle was found throughout North America, from Alaska and northern Canada to Baja California and the Gulf of Mexico. Currently, most populations are limited to the northern portion of their historic range. The Bald Eagle can live anywhere in North America with adequate nesting sites and open water (Snyder and Snyder 1991). The Bald Eagle requires large bodies of water or free-flowing rivers. No impacts are expected due to Proposed Action activities because no large trees suitable for nesting would be disturbed. However, wildlife surveys would be performed before construction activities to determine if there are nesting sites on or nearby the site (**Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**). If Bald Eagle nesting is confirmed, a no-disturbance buffer would be created a minimum of 0.25 mi (0.40 km) around the nest. CDFW would also be contacted to discuss implementation changes and/or additional avoidance measures. With these measures in place, the impact is expected to be **less than significant.**

Yellow-breasted Chat *Icteria virens*

The Yellow-breasted Chat is a very large, aberrant warbler with distinctive plumage. It has olive green to grayish upper parts with lemon-yellow chin, throat, and breast; the large bill is strongly curved. The face of this species is grayish with black lores, white supercilium, and white eye-crescent on lower eyelid (Eckerle and Thompson 2001). It is an uncommon summer resident and migrant in coastal California and in foothills of the Sierra Nevada. The Yellow-breasted Chat is present in portions of the northern Sacramento Valley (Schuford and Gardali 2008). The breeding and nesting period extends from late April through September. Nesting Yellow-breasted Chat select early successional riparian habitat with a mature shrub layer and open canopy with nesting habitat typically only found along streams and rivers (Schuford and Gardali 2008). Yellow-breasted Chat may occur in the Action Area, therefore The Proposed Action may result in a potentially significant impact. However, areas containing thick riparian vegetation would not be disturbed by the Proposed Action, and wildlife surveys would be performed before construction activities to determine if there are nesting sites on or nearby the site (**Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**). If nesting is confirmed, a no-disturbance buffer would be created a minimum of 250 ft around the nest. CDFW would also be contacted to discuss implementation changes and/or additional avoidance measures. With these measures in place, the impact is expected to be **less than significant.**

California Black Rail *Laterallus jamaicensis coturniculus*

The California Black Rail is a CDFW threatened species. It is a rare, secretive species that is a resident of saline, brackish, and fresh emergent wetlands (CDFG 2005). It is 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, and the northern Sierra Nevada foothills (CDFG 2005, Richmond et al. 2008, 2010). The California Black Rail eats terrestrial invertebrates and vegetation (CDFG 2005). It generally selects wetland vegetation that is dense and tall and with shallow water depths (Tsao et al. 2009). The mean home range of California Black Rails in San Francisco Bay habitat is 0.59 ha, with males having significantly larger home ranges than females (Tsao et al. 2009). It breeds in the spring and has a clutch size between three and eight (CDFG 2005). The California Black Rail is not likely to be found within the Action Area as it only contains small patches of freshwater emergent wetland habitat which are not conducive to the species, therefore there is **no impact** anticipated.

Modesto Song Sparrow *Melospiza melodia mailliardi*

The Modesto Song Sparrow is a CDFW species of special concern. It is a year round resident of the north-central portion of the CV from Colusa County to Stanislaus County (Schuford and Gardali 2008). The population of Modesto Song Sparrow has likely declined substantially in response to the over 90% loss in CV wetlands and riparian forests (Schuford and Gardali 2008). This species is currently most abundant in the Delta and the Butte Sink areas. It is very rare in riparian vegetation along the Sacramento River and its tributaries north of Sacramento. The Modesto Song Sparrow is a riparian habitat obligate, being found in emergent freshwater wetlands containing tules and cattails as well as in willow thickets. It has been observed nesting in Valley Oak riparian forests with a blackberry understory, along vegetated irrigation canals and levees, and in new Valley Oak restoration sites. The lack of early successional riparian habitat appears to be one of the main limiting factors. In addition, nest predation by Black Rats and Brown-headed Cowbirds have been documented (Hammond 2008) and may be a limiting factor is some locations. The Modesto Song Sparrow is not likely to be found within the Action Area as it is very rare along tributaries to the Sacramento River. Therefore, **no impact** is expected.

Osprey *Pandion haliaetus*

The Osprey is a large bird of prey in the Accipiter family. Adults range from 21.7 – 22.8 in (55 – 58 cm) in length and 2.6 – 4.4 lb (1.2 – 2.0 kg) in weight, with wingspans ranging from 57.1 – 66.9 in (145 – 170 cm) (Kirschbaum and Watkins 2000). On average, the female Osprey weighs 20% more than the male and has a 5% – 10% greater wingspan (Poole 1994). Individuals have a dark stripe through each eye, a dark brown back, and a white underside with dark brown patches at the carpal joints (Poole 1989; Poole 1994). The Osprey has a worldwide distribution, with four sub-species that winter or breed on every continent except Antarctica. Of the four sub-species, *Pandion haliaetus carolinensis* is the only sub-species common in North America. This sub-species winters in South America and can be found breeding throughout North American and the Caribbean (Kirschbaum and Watkins 2000). Osprey are able to survive anywhere with adequate nesting sites and abundant fish. Nest sites are typically within 1.9 – 3.1 mi (3 – 5 km) of water and are commonly found near marshes, swamps, lakes, or rivers (Poole 1989; Poole 1994). In North America, Osprey are migratory and typically begin breeding in April or May (Poole 1989). Females lay an average of three eggs per year, and eggs hatch within 32 – 43 days (Kirschbaum and Watkins 2000). Home range size varies from 2,471 – 3,459 ac (10 – 14 km^2), depending on the season (Poole et al. 2002). Osprey are almost exclusively piscivorous (Kirschbaum and Watkins 2000), and have been observed foraging in the LYR within the Action Area (CFS personal observation). No impacts are expected due to Proposed Action activities because no large trees suitable for nesting would be disturbed by Proposed Action activities. However, wildlife surveys would be performed before construction activities to determine if there are nesting sites on or nearby the site (**Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**). If Osprey nesting is confirmed, a no-disturbance buffer would be created a minimum of 0.25 mi (0.40 km) around the nest. CDFW would also be contacted to discuss implementation changes and/or additional avoidance measures. With these measures in place, the impact is expected to be **less than significant.**

Double-crested Cormorant *Phalacrocorax auritus*

The Double-crested Cormorant is a large, dark waterbird with orange-yellow throat and eye regions. It is a year-round resident found along the coast of California as well as inland lakes, rivers, and estuaries (CDFG 2005). This species mainly consumes fish, and in the CV it rests and roosts overnight on steep cliffs and in dead tree branches and snags near water. In California it breeds primarily from April to July using nests on cliffs or in trees besides water (CDFG 2005). The Double-crested Cormorant is a colonial nester. Before Dichlorodiphenyltrichloroethane (DDT) was banned, Double-crested Cormorants in southern California suffered extensive reproductive failure; however, the Double-crested Cormorant breeding population in California appears to be stable when comparing estimates from 1989-1991 to 2008 (Adkins and Roby 2010). The Double-crested Cormorant may be found within the Action Area, but no impacts are expected due to Proposed Action activities because no large trees suitable for nesting would be disturbed. However, wildlife surveys would be performed before construction activities to determine if there are nesting sites on or nearby the site (**Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**). If **Double-crested Cormorant** nesting is confirmed, a no-disturbance buffer would be created a minimum of 0.25 mi (0.40 km) around the nest. CDFW would also be contacted to discuss implementation changes and/or additional avoidance measures.

Purple Martin *Progne subis*

The Purple Martin is the largest swallow in North America. It is a CDFW species of special concern. The Purple Martin is a spring/summer resident throughout the United States, with three recognized subspecies. In California, it is a summer resident and migrant typically from mid-March to late September with breeding occurring from May to mid-August (Schuford and Gardali 2008). The Purple Martin is widely distributed throughout California in forest and woodland areas at low to intermediate elevations (up to 6,000 ft) but only occur in very small, local populations. Its range has contracted substantially in portions of California, including the Central Valley. Purple Martins were extirpated from nearly the entire Central Valley, except for in the City of Sacramento, following the introduction of the European Starling. Purple Martins are not likely to be found within the Action Area as the only remaining population in the CV occurs in the city of Sacramento, therefore **no impacts** are expected.

Bank Swallow *Riparia riparia*

The Bank Swallow is the smallest North American swallow and is listed as threatened by CDFW. It is a neotropical migrant present in California from spring to the fall with breeding occurring in early May through July (CDFG 2005). The Bank Swallow is found primarily in riparian areas, which it uses for breeding and capturing the insects it feeds on. The Bank Swallow is a colonial breeder that digs a horizontal nest burrow in fine-textured banks or cliffs near water (CDFG 2005, BSTAC 2013). There are nesting colonies found throughout northern California but 70-90% of the population in California occurs along the Sacramento River and its tributaries (BSTAC 2013). The Bank Swallow range in California has undergone a large reduction on the order of 50% (CDFG 2005). Along the Sacramento and Feather rivers, the Bank Swallow builds nests in the alluvial soil in vertical, eroding river banks created by natural river processes of meandering and erosion in response to flood flows (BSTAC 2013). Two of the main threats to Bank Swallow are bank stabilization and the loss of dynamic river processes due to flow regulation (BSTAC 2013). The Bank Swallow is not likely to be present within the Action Area as the river banks do not contain the substrate type necessary for nest tunnels. Therefore, **no impact** to this species is anticipated.

Least Bell's Vireo *Vireo bellii pusillus*

The Least Bell's Vireo is both state and federally listed as Endangered. It was once a common breeder in riparian areas throughout the CV and southern California. Currently, almost all breeding records are restricted to southern California with breeding records being very rare in the CV and entirely absent from the Sacramento Valley portion (USFWS 2006a, Howell et al. 2010). The primary factors for the decline of Least Bell's Vireo are cowbird parasitism and habitat loss and degradation (Kus 2002). Recently, breeding and attempted breeding by the Least Bell's Vireo has been documented in a riparian restoration area on the San Joaquin River National Wildlife Refuge near Modesto (Howell et al. 2010). Prior to these recent observations, no nesting pairs had been confirmed in the San Joaquin Valley for 50 years (Howell et al. 2010). The Least Bell's Vireo spends its winter in southern Baja California and starts arriving in California for breeding in mid to late March (Kus 2002). This species usually leaves its breeding grounds by September (Kus 2002). The Least Bell's Vireo eats insects from leaves or bark (Kus 2002). Nesting typically occurs in early to mid-successional riparian vegetation, which provides dense shrub cover for hiding the nest and foraging within the structurally diverse canopy (Kus 2002). The Least Bell's Vireo is not likely to be found within the Action Area as it is very rarely observed within the Sacramento Valley, therefore **no impact** is anticipated.

4.5.5.5 Mammals

Pallid Bat *Antrozous pallidus*

The Pallid Bat is a large, light colored bat with large prominent ears. It is common in desert and grassland habitats throughout the southwestern U.S., especially in areas near water (Hermanson and O'Shea 1983). The pallid bat roosts in small colonies in rock crevices and man-made structures, and rarely in caves. Diurnal roosts may be shared with other bat species such as the Brazilian Free-tailed Bat (*Tadarida brasiliensis*) and Yuma Myotis ([*Myotis yumanensis*] Hermanson and O'Shea 1983). The Pallid Bat forages between 0.5 and 2.5 km from the day roost. Although locally common, populations are very sensitive to disturbance of roosting sites. Pallid Bat has been documented within the Proposed Action quadrants in the CNDDB. Neighboring bridges may serve as a summer maternity roost for this species, and the adjacent riparian corridor served as summer foraging habitat. This species may be impacted by the construction and operation of the Proposed Action; however, **Mitigation Measure 4** would minimize impacts to riparian foraging habitat. Since the Proposed Action would result in an increase in riparian habitat, the Proposed Action would result in long-term benefits to this species. In addition, bat surveys would be conducted prior to Proposed Action initiation and, if roosting bats are observed, a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged (**Mitigation Measure 6. Monitor for Bats to Prevent Impacts**). With these measures in place, the expected impact would be **less than significant.**

Townsend's Big-eared Bat *Corynorhinus townsendii*

Townsend's Big-eared Bat is a medium-sized, light brown bat with very large ears. This species specializes in eating moths and other insects. They have been known to occur throughout California, but the details of its distribution are not well known. Once considered common, this species is now considered uncommon in California. It is most abundant in mesic habitats, prefers cave habitat, and is easily disturbed by human encroachment. No caves occur in the Action Area, therefore **no impact** to this species is expected.

Western Mastiff Bat *Eumops perotis californicus*

The Western Mastiff Bat is a very large free tailed bat. Two of its distinguishing characteristics are long narrow wings and large rounded ears that are joined at the mid-line across the forehead and project forward, extending beyond the nose. An additional characteristic is the tail, which extends far beyond the interfemoral membrane. The color of the body and membranes are dark to brownish gray while slightly paler below. This is an uncommon bat in California's arid and semiarid lowlands in the lower Sonoran life zone. This bat is not known to occur in the Action Area, therefore **no impact** is expected.

Silver-haired Bat *Lasionycteris noctivagans*

The Silver-haired Bat is dark in color with white-tipped dense fur, giving it a silver or frosty appearance. The Silver-haired Bat is distributed in foothill and mountainous areas throughout California (CDFG 2005). Summer habitat includes coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley foothill and montane riparian habitats (CDFG 2005). This bat typically forages in or near coniferous and/or mixed deciduous forests adjacent to ponds or other sources of water (Davis and Schmidly 1994). The Silver-haired Bat is known to roost in tree cavities or in crevices on tree trunks. This species has not been noted in the Proposed Action quadrants within the CNDDB, and no trees large enough to be used by the Silver-haired Bat would be affected by the Proposed Action activities. Therefore, **no impact** is expected.

Western Red Bat *Lasiurus blossevillii*

The Western Red Bat has an upper body that is brick red to rusty red washed with white; males are usually more brightly colored than females. The Red Bat is locally common in some areas of California, occurring from Shasta County to the Mexican border, west of the Sierra Nevada/Cascades Crest, and deserts. Roosting habitat includes forests and woodlands between sea level and mixed coniferous forest. Preferred roost sites are in edge habitat adjacent to streams, fields, or urban areas. Roost sites are usually solitary, and can be between 2 ft and 40 ft (0.6 m and 12.2 m) from the ground. The Western Red Bat has been noted in the Proposed Action quadrants within the CNDDB. Cottonwood riparian habitat associated with the Yuba River provides significant roosting and foraging habitat for reproductive female Western Red Bats during the summer. This species may be impacted by the construction and operation of the Proposed Action; however, **Mitigation Measure 4** would minimize impacts to riparian foraging habitat. Since the Proposed Action would result in an increase in riparian habitat, it would result in long-term benefits to this species. In addition, bat surveys would be conducted prior to Proposed Action initiation and, if roosting bats are observed, a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged (**Mitigation Measure 6. Monitor for Bats to Prevent Impacts**). With these measures in place, the expected impact would be **less than significant.**

Hoary Bat *Lasiurus cinereus*

The Hoary Bat is a large (approx. 134.5 mm in length) bat, dark brown and grey in color, tinged with white resulting in a frosted effect. This species has a patch on the throat that is unmistakably yellow (Shump and Shump 1982; and Barbour and Davis 1974). The Hoary Bat is the most widespread North American bat and can be found anywhere in California. It roosts in large trees with medium to dense foliage and emerges 3-5 hours after sunset to feed (CDFG 1995). This species may be impacted by the construction and operation of the Proposed Action; however, no large trees would be impacted (**Mitigation Measure 7 Use Special Transportation Routes and Work Areas**). In addition, bat surveys would be conducted prior to Proposed Action initiation and, if roosting bats are observed, a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged (**Mitigation Measure 6. Monitor for Bats to Prevent Impacts**). With these measures in place, the expected impact would be **less than significant.**

Yuma Myotis *Myotis yumanensis*

The Yuma Myotis is a common and widespread bat occurring throughout California at elevation lower than 11,000 ft in open forest and woodlands near a water source (Zeiner et al. 1990). This species is light to dark brown in color with light underparts and is approximately 73 to 91 mm in total body length (CDFG 1995). The Yuma Myotis forages after sunset and can be found roosting in dark places such as crevices, caves, mines, or buildings (Barbour and Davis 1974 and CDFG 1995). No caves occur in the Action Area; therefore**, no impacts** to this species are expected.

American Badger *Taxidea taxus*

The American Badger is a large, gray to reddish colored member of the weasel family (Mustelidae). This species is short and stout with a flattened body that is built for digging. Adults range from 20.5 – 34.4 in (52.0 – 87.5 cm) in length and may weigh up to 26.5 lb (12 kg) (Shefferly 1999). The American Badger is common in the Great Plains region of North America, but can be found throughout central and western Canada, the western U.S., and northern Mexico. The eastern limit of the species' range is Ontario, Canada (Kurta 1995; Long 1999). The American Badger prefers dry, open grasslands, but can be found in mountain and desert regions (Long 1999). This species is primarily active at night when it digs burrows in search of rodent prey (Shefferly 1999). Dens are up to 9.8 ft (3 m) below the surface and may contain up to 32.8 ft (10 m) of tunnels (Kurta 1995; Long 1999). Home ranges are typically small (males = 593 ac [2.4 km^2] and females = 395 ac [1.6 km^2]; Shefferly 1999) but are expanded during mating season in late summer through early autumn (Long 1999). The Proposed Action has the potential to impact American Badgers and their habitat. Pre-construction surveys would be conducted by qualified wildlife biologists to determine the use of the Action Area by the American Badger; surveys would focus on identification of potential dens within, and a minimum 250 ft (76.2 m) buffer around, the Action Area where construction will occur. If dens are located within the Action Area or buffer, prior to initiation of construction CDFG would be consulted for further instructions on methods to avoid direct impacts to this species (**Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts**).

4.5.6 SPECIAL STATUS FISH SPECIES

Fish habitat in the Yuba River below Englebright Dam has been impacted by many factors. Rearing habitat in the LYR is degraded by regulated flows, channel confinement, and the disconnection from floodplains at lower flows due to incising through mining deposited sediment. In addition, riparian vegetation along the LYR has been reduced in extent and diversity. The reservoirs in the Yuba River watershed have reduced the amplitude and frequency of flood flows and reduced the recruitment of sediment, particularly fines, and large woody material from upstream sources into the LYR. Without frequent inundation, the floodplains cannot provide terrestrial food for juvenile salmon or organic matter that helps produce more food within the river. The confinement of the LYR by training walls and levees and the channel incision have reduced the channel complexity that creates high quality rearing habitat for juvenile salmonids such as side channels, swales, and backwaters. In addition, reduced quality and extent of riparian vegetation and a lack of large woody material reduce habitat heterogeneity and complex channel forming mechanisms important for creating and maintaining high quality rearing habitat. Species of fish that have been observed or are likely present in the Action Area include spring-run Chinook Salmon, fall-run Chinook Salmon, CCV steelhead/rainbow trout, Sacramento Pikeminnow (*Ptychocheilus grandis)*, Sacramento Sucker (*Catostomus occidentalis occidentalis)*, Riffle Sculpin, Hardhead, California Roach (*Lavinia symmetricus*), and sunfish species (CFS, unpublished data).

Special-status fish species are defined as taxa that are: 1) designated as threatened or endangered by the state or federal governments; 2) proposed or petitioned for federal threatened or endangered status; 3) state or federal candidate species; or 4) identified by the CDFW as Species of Special Concern. Of the special-status species identified by the USFWS or from the California Natural Diversity Data Base, only spring-run Chinook Salmon, fall-run Chinook Salmon, CCV steelhead, Riffle Sculpin, and Hardhead may occur in the Action Area. Species' life histories are described below and mitigation measures to protect fish species from specific potential impacts are described in the Discussion section.

Riffle Sculpin *Cottus gulosus*

The Riffle Sculpin is a CDFW species of special concern. The population present in the Sacramento River and its tributaries is genetically distinct from other populations (Baumsteiger 2013). In the Sacramento River watershed the Riffle Sculpin is found in Putah Creek and in most tributaries on the east side of the valley from the American River north to the upper Sacramento River (Moyle et al. 2015). Riffle Sculpin are only found in permanent cold water streams (Moyle et al. 2015). Individuals can reach 16 cm in total length and live for 4 or more years, but most adults are 6 to 8 cm long and 2 to 3 years old (Moyle et al. 2015). Riffle Sculpin spawn in February, March, and April; spawning occurs under rocks in riffles or in the cavities of submerged logs (Moyle et al. 2015). Both larvae and adults have poor dispersal ability, with larvae being benthic and remaining close to where they were born (Moyle et al. 2015). Due to poor dispersal, riffle sculpins are found in increasingly isolated watersheds in the CV (Moyle et al. 2015). The Riffle Sculpin feeds mostly at night, primarily consuming benthic invertebrates, particularly mayflies, caddisflies, and stoneflies (Moyle et al. 2015).

The Riffle Sculpin is present in the LYR and was captured by rotary screw trap downstream from the Action Area in all years that it was operated (2003-2004 to 2008-2009) (Campos and Massa 2010).

Hardhead *Mylopharodon conocephalus*

The Hardhead is a special status freshwater fish native to California and limited to the Sacramento-San Joaquin and Russian river systems (Moyle 2002). This species is a large minnow with a slender, deeper body and pointier snout compared to the Sacramento Pikeminnow. They are brown or dusky bronze in color. Hardhead are typically found in small to large streams in a low to mid-elevation environment. They are omnivores and eat benthic invertebrates, aquatic plants, and algae, in general. Juvenile Hardhead may be found at various temperature gradients, in shallow regions and deeper lake habitats. Spawning occurs in May and June in the sand, gravel and rocky areas of pools and side pools. Juveniles feed on plankton, insects, and small snails (Reeves 1964). Moyle and Nichols (1973) reported that the overall population of Hardhead has been declining rapidly. Hardhead are present in the LYR, having been captured in the rotary screw trap (Campos and Massa 2010).

California Central Valley Steelhead *Oncorhynchus mykiss*

Steelhead, the anadromous form of Rainbow Trout, have the greatest diversity of life history patterns of any Pacific salmonid, including varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations (Kendall et al. 2015). Only winter-run CCV steelhead currently occur in CV streams (McEwan and Jackson 1996). They prefer cold water between 55°F – 70°F (13°C – 21°C) that is saturated with DO. In the Yuba

River, two forms of *O. mykiss* exist: the resident form that remains in the river its entire life, and the anadromous form (steelhead) that migrates to the ocean and returns to the river to spawn, multiple times. The relationship between resident and anadromous forms is still being studied, but evidence suggests the two forms interbreed and produce juveniles of the alternate form and that individuals exhibit life history plasticity in variable environments (Shapovalov and Taft 1954; Burgner et al. 1992; Hallock 1989; Kendall et al. 2015). Additionally, it has been demonstrated that female resident *O. mykiss* can produce anadromous offspring and some years may produce a large proportion of the observed steelhead (Zimmerman et al. 2009; Courter et al. 2013). No genetic differentiation has been found between forms, supporting this hypothesis (Busby et al. 1993; Nielsen 1994). However, a large genomic region on O. mykiss chromosome Omy5 is strongly associated with life history of O. mykiss populations (Pearse et al. 2014). The frequency of alleles at the linked Omy5 loci indicate resident and anadromous associated haplotypes (Pearse et al. 2014). The CCV steelhead DPS is listed as threatened by federal ESA (71 FR 834) and the LYR below Englebright Dam is included in the designated critical habitat (70 FR 52488). Critical habitat is defined by ESA as specific areas within a geographic region where the habitat values are essential for conserving the species. This designation includes river and adjacent riparian areas (NMFS 2000), and restoring rearing areas may be important for conservation (NMFS 2014). In the Sacramento River, adult winter CCV steelhead migrate upstream during most years from July to March (Bailey 1954; Hallock et al. 1961). Spawning occurs from January to March. CCV steelhead typically return from the ocean at ages two or three, weighing 2 – 12 lbs (0.9 – 5.4 kg) (Reynolds et al. 1993). Adult CCV steelhead immigration and holding in the LYR occurs from August through March with spawning occurring from January through April (Yuba Accord RMT 2013). Adipose fin-clipped hatchery steelhead have been observed to stray into the Yuba River by the Vaki Riverwatcher system at Daguerre Point Dam (Yuba Accord RMT 2013). In 2010/2011 43% of upstream migrating steelhead were adipose fin-clipped while in 2011/2012 it was 63% (Yuba Accord RMT 2013). CCV steelhead in the LYR use riffle transitions, riffles, fast glides, slow glides, and point bars for spawning, depending on the discharge (Kammel and Pasternack 2014). Spawning CCV steelhead in the LYR prefer areas with mean water column velocity of 1.18 to 2.25 cfs, water depths of 1.25 to 2.76 ft, and the medium gravel/small cobble (32-90 mm) substrate size class (Kammel and Pasternack 2014). CCV steelhead embryo incubation occurs from January through May (Yuba Accord RMT 2013). Juvenile CCV steelhead rearing and downstream migration occurs year-round while emigrating smolts have been observed from October through mid-April (Yuba Accord RMT 2013).

Chinook Salmon *Oncorhynchus tshawytscha*

There are four races of Chinook Salmon in California: fall-, late-fall, winter-, and spring-run. Life history difference among species is mostly the timing of return to freshwater for spawning (Moyle 2002). Historically, both spring- and fall-run/late fall-run Chinook Salmon were known to exist in the Yuba River, with spring-run Chinook Salmon found up to elevations of ~5,000 ft (Yoshiyama et al. 2000). The 15-ft high Daguerre Point Dam was constructed in 1910 with fishways, which were destroyed by floods in 1927-28, and created a partial barrier to salmon (Yoshiyama et al. 2000). Adequate fish ladders were added to Daguerre Point Dam later. Construction of Bullards Bar Dam began in 1921 and blocked salmon from migrating further up the North Fork of the Yuba River (Yoshiyama et al. 1996). Englebright Dam was completed in 1941 and is a complete barrier to salmon and the current upstream limit for anadromous salmonids. However, in 2015 the Yuba Salmon Partnership Initiative agreed to a framework for an agreement to guide negotiations for reintroducing spring-run Chinook Salmon into the North Fork of the Yuba River above New Bullards Bar Dam. Spring-run and fall-run Chinook Salmon populations are still present in the LYR and have been studied intensively in recent years as a result of the Lower Yuba Accord (Yuba Accord RMT 2013). The Central Valley spring-run Chinook Salmon ESU is listed as threatened under the ESA (64 FR 50394) and CESA and critical habitat was designated in 2005 (70 FR 52488) which includes the LYR below Englebright Dam. Central Valley fall-run/late fall-run Chinook Salmon are designated as a Federal species of concern and by CDFW as a species of special concern. Fall-run Chinook Salmon escapement estimates were extremely low for all Sacramento River tributaries, including the Yuba River, in 2007 and 2008 (Bergman and Massa 2011), increasing the importance of understanding current population dynamics, targeting restoration efforts to improve conditions, and monitoring the effectiveness of all efforts. Fall-run Chinook Salmon escapement between 2009 and 2016 averaged 9,083 and has ranged between 4,057 in 2016 to 14,880 in 2013 (CDFW 2017).

The majority of spring-run Chinook Salmon spawning occurs upstream of the Highway 20 bridge. Fall-run Chinook Salmon spawn throughout the Yuba River upstream of the Simpson Lane Bridge, with the highest redd concentrations in the Timbuctoo and Parks Bar reaches (Yuba Accord RMT 2013). The Final Restoration Plan for the AFRP (USFWS 2001) calls for a fall-run Chinook Salmon production target of 66,000 fish for the Yuba River. Spring-run Chinook Salmon migrate into the LYR from April to June (Yuba Accord RMT 2013). A portion of the spring-run Chinook Salmon run hold during the summer below Daguerre Point Dam before migrating upstream of the Highway 20 bridge to spawn by the end of September (Yuba Accord RMT 2013). The other portion of the spring-run Chinook Salmon run hold over summer upstream of the Highway 20 Bridge (Yuba Accord RMT 2013). Spring-run Chinook Salmon spawning generally occurs from the beginning of September to the middle of October (Yuba Accord RMT 2013). Redds incubate and alevin hatch in the gravel between September and December, depending on time of spawning and water temperature (Yuba Accord RMT 2013). The annual fall-run Chinook Salmon migration in the Yuba River begins in early September, peaks in November, and tapers off in December (Yuba Accord RMT 2013). Spawning generally occurs shortly after migration, primarily from early October through mid-December. Redds incubate and alevin hatch in the gravel between

October and March, depending on time of spawning and water temperature. Late fall-run Chinook Salmon generally spawn in late December and January (Moyle et al. 2015).

Chinook Salmon spawn in moderately-sized cobble in riffles, riffle transitions, run, and fast glide (Cram et al. 2017; Merz and Setka 2004). Spawning distribution and incubation success are important factors controlled by substrate size and intergravel flow (Harrison 1923; Hobbs 1937; McNeil 1964; Cooper 1965; Platts 1979). Female Chinook Salmon excavate a redd that is typically 111 – 189 ft^2 (10.3 – 17.6 m^2) in size (Healey 1991). The female defends the redd until death, and fertilized eggs incubate for about 13 weeks, depending on water temperature (Bjornn and Reiser 1991). Larvae hatch with yolk sacs and remain in substrate until the sac is absorbed, about 2 – 3 weeks.

Spring-run Chinook Salmon fry begin to emerge from the gravel starting in November and continuing until February, while fall-run Chinook Salmon emerge from the gravel from December through April (Yuba Accord RMT 2013). Late fall-run Chinook Salmon emerge from the gravel from April through June (Moyle et al. 2015). After emerging, fry disperse downstream or to lateral margins of the river. Large numbers of fry have been captured at the mouth of the river in wet years (Yuba Accord RMT 2013). Spring-run Chinook Salmon fry rearing occurs in the LYR from mid-November to mid-February and young-of-year emigration occurs from mid-November through June (Yuba Accord RMT 2013). Some spring-run Chinook Salmon in the LYR rear for a year before emigrating as smolts between October and March (Yuba Accord RMT 2013). However, the majority of Chinook Salmon (both spring and fall-run) emigration occurs as fry (30-49 mm) with peak emigration generally occurring in late January and 95% of emigration occurring prior to April 30th (Yuba Accord RMT 2013). Late fall-run Chinook Salmon juvenile emigration is not well understood in the LYR (Yuba RMT 2013). Late fall-run Chinook Salmon juvenile may hold for seven to 13 months before emigrating with peak emigration in October (Moyle et al. 2015). However, many late fall-run Chinook Salmon juveniles may emigrate earlier in the year at smaller sizes (Moyle et al. 2015).

4.5.6.1 Wetlands and Other Waters of the U.S.

The Corps has primary federal responsibility for administering regulations that concern jurisdictional Waters of the U.S., including wetlands, under Section 404 of the CWA. Section 404 regulates the discharge of dredged and fill material into Waters of the U.S. The Corps requires that a permit be obtained if a Proposed Action proposes placing structures within, over, or under navigable waters and/or discharging dredged or fill material into waters below the OHWM. Waters of the U.S. are defined as “all waters used in interstate or foreign commerce; all interstate waters including interstate wetlands; all other waters such as intrastate lakes, rivers, streams (including intermittent and ephemeral streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, where the use, degradation, or destruction of which could affect interstate commerce; impoundments of these waters; tributaries of these waters; or wetlands adjacent to these waters" (Section 404 of the CWA; 33 CFR Part 328). The limit of Corps jurisdiction for non-tidal waters (including non-tidal perennial and intermittent watercourses and tributaries to such watercourses) in the absence of adjacent wetlands is defined by the OHWM. The OHWM is defined as "the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (Section 404 of the CWA; 33 CFR Part 328).

Wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Section 404 of the CWA; 33 CFR Part 328).

A formal aquatic resources delineation of the Action Area was conducted by CFS on 8 October 2019. Emergent and riparian wetlands, ponds, and perennial channel were identified as potentially jurisdictional under Section 404 of the CWA (Figure 7; Appendix G).

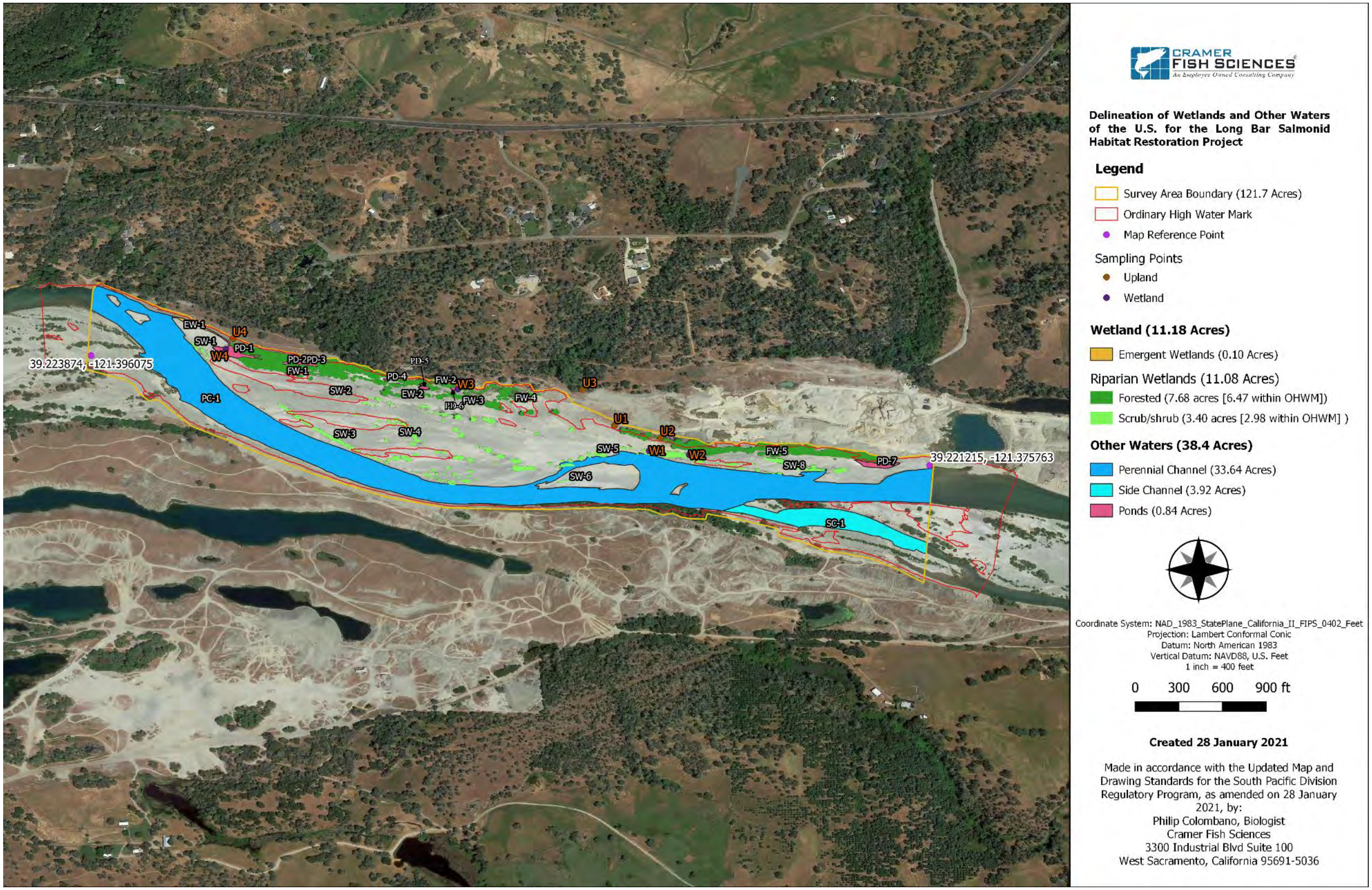

Figure 7. Delineation of wetlands and other waters of the U.S. for the Proposed Action.

4.5.7 SPECIAL STATUS NATURAL COMMUNITIES

Special status natural communities are those that have limited statewide or regional distribution, provide important wildlife habitat, or are of special concern to local, state, or federal agencies and can be vulnerable to environmental effects of projects. Most types of wetlands and riparian communities are considered special status natural communities due to their limited distribution. Special status natural communities include: areas of special concern to federal, state, or local resource agencies, areas regulated under Section 404 or 402 of the CWA, and areas protected by local and state regulations or policies. Natural communities within the Action Area considered special status by regulatory agencies include wetland and riparian communities and riverine habitat. There are extensive areas of riparian vegetation within the Action Area with wetlands found in select locations (Figure 3). There are only four elderberry shrubs with stem diameter greater than one inch at ground level found within the site (Figure 3).

The CDFW's Natural Communities List (CDFG 2010) ranks vegetation alliances according to their degree of imperilment (as measured by rarity, trends, and threats) using a global (G) and state (S) rank. Alliances with CDFW ranks of S1-S3, including all associations within them, are considered highly imperiled and of special status for CEQA. The riparian vegetation alliances found in the Action Area are part of Great Valley riparian forest and Great Valley willow scrub. The wetland alliances within the Action Area belong to the Coastal and Valley Freshwater Marsh.

4.5.8 DISCUSSION

4.5.8.1 No Action Alternative

Under the No-Action Alternative, there would be no impacts to biological resources as Proposed Action restoration activities would not occur. The beneficial impacts of restoration activities would not occur. In particular, the quality and quantity of rearing habitat for juvenile Chinook Salmon and CCV steelhead within the site would not be increased. Likewise, the quality and quantity of riparian habitat, including for elderberry shrubs, would not be increased.

4.5.8.2 Proposed Action

4.5.8.2.1 *Special Status Plants*

Twenty one special status plant species were identified as having the potential to occur within the Action Area: Depauperate Milk-vetch, Ferris' Milk-vetch, Mexican Mosquito Fern, Valley Brodiaea, Sierra Foothills Brodiaea, Brandegee's Clarkia, Red-stemmed Cryptantha *Cryptantha rostellata*, Recurved Larkspur, Dwarf Downingia, Shield-bracted Monkeyflower, Stinkbells, Hogwallow Starfish, Ahart's Dwarf Rush, Legenere, Bristly Leptosiphon, Veiny Monardella, Ahart's Paronychia, Cedar Crest Popcorn Flower, Hartweg's Golden Sunburst (*Pseudobahia bahiifolia*), Sanford's Arrowhead, and Brazilian Watermeal. None of these species were observed within the action area during pre-project vegetation surveys (SYRCL 2020). If any of these species are found, resource agency biologists (CDFW, USFWS) would be contacted to develop appropriate avoidance and conservation measures. Implementing these measures would avoid adverse effects on special status species and associated habitats. **No impacts** to special status plant species are expected to result from grading and excavation activities or to provide access routes for heavy equipment to the site.

4.5.8.2.2 Valley Elderberry Longhorn Beetle

The VELB may use elderberry shrubs within the Action Area (Figure 3). If VELB are present then restoration activities could cause harassment, injury, or mortality from restoration activities. This is a **potentially significant** impact. Implementation of the terms and conditions in the USFWS BiOP (Appendix E) and **Mitigation Measure 2 – Protect Elderberry Plants and Special Status Plants with Buffer, Mitigation Measure 3 – Transplant Unavoidable Elderberry Plants to Suitable Locations,** and **Mitigation Measure 4 – Protect and Compensate for Native Trees** would reduce impacts to the VELB to **less than significant**.

4.5.8.2.3 Foothill Yellow-legged Frog

The Action Area contains potentially suitable habitat for the Foothill Yellow-legged Frog. The Foothill Yellow-legged Frog may use the aquatic habitat present within the Action Area in the LYR, the perennially wet portions of the backwater complex, and the basking habitat in adjacent terrestrial areas. The Proposed Action restoration activities, particularly grading and topographic modification, have the potential to cause harassment, injury, or mortality to foothill yellow legged frogs if they are present. This would be a **potentially significant** impact; however, implementation of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts** would reduce impacts to Foothill Yellow-legged Frog to **less than significant**.

4.5.8.2.4 Western Pond Turtle

The Action Area contains potentially suitable habitat for the Western Pond Turtle. The Western Pond Turtle may use the aquatic habitat in present within the Action Area in the LYR and the perennially wet portions of the backwater complex. However, Western Pond Turtles have not been observed in the site during pre-project snorkel surveys (CFS unpublished data). The Proposed Action restoration activities, particularly topographic modification of the isolated ponds and backwater, have the potential to cause harassment, injury, or mortality to the Western Pond Turtle if present. This would be a **potentially significant** impact. Implementation of **Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts** would reduce impacts to Western Pond Turtle to **less than significant**.

4.5.8.2.5 Special Status Birds

The riparian habitat within the Action Area may be used by nesting raptors and migratory birds. Proposed Action restoration activities (16 April – 31 October) would overlap with the breeding season for raptors and migratory birds (1 February – 31 August), resulting in the potential for adverse impacts. The potential impacts include removal of habitat serving as nesting, roosting, or foraging locations and disturbance from construction equipment, including noise, and human presence during restoration activities. These adverse impacts are potentially significant. However, implementation of **Mitigation Measure 4 – Protect and Compensate for Native Trees, Mitigation Measure 5 – Monitor for Wildlife to Prevent Impacts,** and **Mitigation Measure 8 - Work Outside of Critical Periods for Sensitive Species** would reduce impacts to special status birds to **less than significant**.

4.5.8.2.6 Special Status Bats

Riparian vegetation in the Action Area may provide roosting and foraging habitat for special status bat species, including the Pallid Bat, the Western Red Bat, and the Hoary Bat. Proposed Action restoration activities (16 April – 31 October) would overlap with the bat breeding season (1 April – 15 August) resulting in the potential for adverse impacts. The potential adverse impacts include removal of roosting habitat and disturbance from construction equipment, including noise and light, and human presence during restoration activities. It is not anticipated that any trees that could potentially be used by bats for roosting would be removed as the Proposed Action would make all effort to avoid removing large riparian trees. However, disturbance of roosting special status bats could be a **potentially significant** impact. Implementation of **Mitigation Measure 6 - Monitor for Bats to Prevent Impacts** and **Mitigation Measure 8 - Work Outside of Critical Periods for Sensitive Species** would reduce impacts to special status bats to **less than significant.**

4.5.8.2.7 Special Status Fish

The following special status fish species are likely to occur in the Action Area; spring-run Chinook Salmon, fall-run Chinook Salmon, CCV steelhead, Riffle Sculpin, and Hardhead. Proposed Action restoration activities have the potential to adversely impact these special status fish species and their habitat. The special status salmonids (spring-run and fall-run Chinook Salmon and CCV steelhead) have similar habitat requirements therefore they are considered together in the impact analysis of the Proposed Action. The potentially adverse effects expected during Proposed Action restoration activities are fish relocation, temporary loss of benthic macroinvertebrates, unintentional spread of non-native invasive species, sediment mobilization and increase in turbidity, temporary loss of riparian vegetation, disturbance or harassment from construction equipment including noise, and potential spills of toxic substances. Additionally, there are potentially adverse effects on special status fish from restoration monitoring activities.

4.5.8.2.7.1 Turbidity and Sedimentation

Construction activities related to restoration actions would temporarily disturb soil and riverbed sediments, resulting in the potential for temporary increases in turbidity and suspended sediments in the main channel of the Yuba River and the backwater, ponds, and groundwater fed complex within the Action Area. Construction-related increases in sedimentation and siltation above the background level could potentially affect fish species and their habitat by reducing egg and juvenile survival, interfering with feeding activities, causing breakdown of social organization, and reducing primary and secondary productivity. The magnitude of potential effects on fish depends on the timing and extent of sediment loading and flow in the river before, during, and immediately following construction.

High concentrations of suspended sediment can have both direct and indirect effects on salmonids and other special status fishes. The severity of these effects depends on the sediment concentration, duration of exposure, and sensitivity of the affected life stage. Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat. Juvenile salmonids have been observed to avoid streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler et al. 1984). Bisson and Bilby (1982) reported that juvenile coho salmon (*Oncorhynchus kisutch*) avoid turbidities exceeding 70 Nephelometric Turbidity Units (NTUs). Sigler et al. (1984) found that prolonged exposure to turbidities between 25 and 50 NTUs resulted in reduced growth and increased emigration rates of juvenile coho salmon and steelhead compared to controls. These findings are generally attributed to reductions in the ability of salmon to see and capture prey in turbid water (Waters 1995). Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995). Berg and Northcote (1985) observed changes in social and foraging behavior and increased gill flaring (an indicator of stress) in juvenile coho salmon at moderate turbidity (30-60 NTUs). In this study, behavior returned to normal quickly after turbidity was reduced to lower levels (0-20 NTU). In addition to direct behavioral and physical effects on fish, increased sedimentation can alter downstream substrate conditions, as suspended sediment settles and increases the proportion of fine particles in the system. Adult salmonids require coarse substrate (gravel and small cobbles) to construct redds, and deposition of fine substrate may reduce egg and alevin survival and lead to decreased production of the macroinvertebrate prey of juvenile salmonids (Wu 2000, Chapman 1988; Phillips et al. 1975; Colas et al. 2013). Deposited fine sediment can impair growth and survival of juvenile salmonids (Suttle et al. 2004; Harvey et al. 2009). However, minor accumulations of deposited sediment downstream of construction zones are generally removed during normal annual high flow events (Anderson et al. 1996).

Any increase in turbidity associated with in-stream work is likely to be brief and occur only in the vicinity of the site, attenuating downstream as suspended sediment settles out of the water column. In-stream projects with a larger footprint than the Proposed Action have created turbidity plumes of 25-75 NTU extending up to 1,000 ft downstream from construction activities (NMFS 2006). These temporary spikes in suspended sediment may result in behavioral avoidance of the site by fish; several studies have documented active avoidance of turbid areas by juvenile and adult salmonids (Bisson and Bilby 1982; Lloyd 1987; Servizi and Martens 1992; Sigler et al. 1984).

The number of juvenile salmonids and other special status fishes potentially residing in the Action Area during in-water construction is expected to be low because of the time of year (CFS unpublished data). Individual fish that encounter increased turbidity or sediment concentrations would be expected to move laterally, downstream, or upstream of the affected areas. For juveniles, this may increase their exposure to predators if they are forced to leave protective habitat. Water quality, including measurements of turbidity would be performed on a regular basis during construction to track the response of water quality to construction activities as required in the Section 401 water quality certification. An onsite biologist would report these measurements to the Construction Manager, who would be aware of federal and state water quality requirements. If turbidity exceeds the thresholds identified in the 401 water quality certification, work will cease until turbidity returns to background levels. Such activities would minimize water quality impacts. Even so, turbidity plumes would be expected to affect only a portion of the channel width and extend up to 1,000 ft downstream of the site. These plumes would occur intermittently during daylight construction hours, resulting in daily periods (at least 12 hours) in which water quality would return to background levels.

The impacts of sedimentation and turbidity from site construction on fish species are potentially adverse. However, the Proposed Action 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. The amount of sediment generated by construction would be minimized by erosion and sediment control measures associated with the SWPPP that are designed to minimize erosion and sediment entering the channel. During the period following construction, before vegetation is fully established, there is some potential for indirect effects on water quality via erosion of Proposed Action features (e.g., inset floodplain benches and slopes) and associated increases in sediment loading and sedimentation. However, all Proposed Action features with exposed fine sediment would be treated as prescribed in the SWPPP and design plans to prevent erosion and sedimentation. The impacts of sedimentation and turbidity from construction on fish species are **potentially significant.** However, with implementation of **Mitigation Measure 8 - Work Outside of Critical Periods for Sensitive Species** including conducting all in-water restoration activities during the dry season between July 15 and September 30 and **Mitigation Measure 9 - Monitor Water Quality and Prevent Impacts,** the Proposed Action's sedimentation and turbidity impacts on special status fish species and their habitat would be **less than significant**.

Mercury

The Proposed Actions restoration activities have the potential to expose clay and silt sized particles which have elevated mercury levels. These finer sized sediments with elevated mercury could then be transported into the wetted channel of the Yuba River during high flow events. A fraction of the mercury may then methylate and become toxic to fishes and other biota in the Yuba River. The inundation of floodplains 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. Methylmercury caused altered behavior and pathological damage in Atlantic salmon (*Salmo salar*; Berntssen et al. 2003). Fall-run Chinook Salmon that spent time rearing in the Yolo Bypass accumulated more methylmercury than salmon that remained in the Sacramento River (Henery et al. 2010). However, juvenile salmon rearing in the Yolo Bypass grew faster (0.7% more per day) than fish that remained in the Sacramento River (Henery et al. 2010).

The Hallwood Side Channel and Floodplain Habitat Restoration Project, located 4 mi (6.4 km) downstream from the Proposed Action, conducted mercury sampling in fine sediment recently exposed following restoration activities similar to the Proposed Action. The California Regional Water Quality Control Board considers sediment total mercury to be elevated when concentration exceeds 0.1 mg/kg. Slightly elevated mercury levels were observed in some samples from within the construction footprint, with a maximum value of 0.42 mg/kg (USFWS, unpublished data). Hunerlach et al. (2004) sampled sediment total mercury by particle size fraction in locations upstream from Daguerre Point Dam. Sediment total mercury concentrations in the sandy fraction were up to 0.08 mg/kg (not elevated) and in the clay-silt fraction up to 1.1 mg/kg (elevated). While some sediment total mercury samples collected within five miles of the Proposed Action were elevated (Hunerlach et al. 2004; USFWS unpublished data) all of them were well below levels considered hazardous by the California Regional Water Quality Control Board (20 mg/kg; Marshack 1986).

Mercury impacts to special status fish species are **potentially significant**. Implementation of **Mitigation Measure 9 - Monitor Water Quality and Prevent Impacts** and **Mitigation Measure 10 - Monitor Mercury Levels and Minimize Impacts** would reduce the impact of mercury on special status fish species to **less than significant**.

4.5.8.2.7.2 Contaminants

During restoration activities, the potential exists for spills or leakage of toxic substances that could enter the Yuba River. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (e.g., fuels, lubricants, concrete, sealants, and oil).

High concentrations of contaminants can cause adverse direct (sublethal to lethal) and indirect effects on fish. Direct effects include mortality from exposure or increased susceptibility to disease that reduces the overall health and survival of the exposed fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. A potential indirect effect of contamination is reduced prey availability; invertebrate prey survival could be reduced following exposure, therefore making food less available for fish. Fish consuming infected prey may also absorb toxins directly. For special status fishes, potential direct and indirect effects of reduced water quality during construction would be addressed by avoiding construction during times when fish are most likely to be present, utilization of vegetable-based lubricants and hydraulic fluids in equipment operated in the wet channel, and by implementing the construction site housekeeping measures incorporated in the SWPPP. These measures include provisions to control erosion and sedimentation, as well as a Spill Prevention and Response Plan to avoid, and if necessary, clean up accidental releases of hazardous materials. The construction contractor would be responsible for complying with all conditions of these commitments. Implementation of the measures discussed above and **Mitigation Measure 11 - Use Clean Equipment and Biodegradable Lubricants,** the direct and indirect impacts of contaminants on special status fish species would be **less than significant**.

4.5.8.2.7.3 Non-native species

There is potential for introducing non-native invasive species to the Action Area if equipment used for the Proposed Action was used in other watersheds. Non-native invasive species can be considered a biological contaminant because many species have adverse impacts on the community that they invade. For example, the thick, filamentous algae Didymo (*Didymosphenia geminata*) is thought to have a significant effect on ecosystems due to its ability to alter abundance and distribution of organisms at the base of the aquatic food web (e.g., Gillis and Chalifour 2010; Anderson et al. 2014). In waters where Didymo is abundant, macroinvertebrate taxonomic composition tends to shift from a highly diverse assemblage of large-bodied taxa to a less diverse assemblage of smaller-bodied taxa such as Diptera, especially Chironomidae (Mundie and Crabtree 1997; Blanco and Ector 2009; Gillis and Chalifour 2010; James et al. 2010). Likewise, molluscs such as the Overbite Clam (*Corbula amurensis*) and New Zealand Mud Snail can out-compete native benthic invertebrates that dominate the diets of juvenile salmonids and other salmonids (Feyrer et al. 2003; Brenneis et al. 2011; Merz et al. 2016). These species are often spread by aquatic vehicles or other equipment, which carry propagules from one watershed to another. Because equipment would be working within the river channel during Proposed Action construction, this is a potentially significant impact. However, with implementation of **Mitigation Measure 12 - Prevent Spread of Aquatic Invasive Species**, there would be an extremely low probability of spread of invasive species and this impact would be **less than significant.**

4.5.8.2.7.4 *Noise*

Noise generated by heavy equipment and personnel during construction activities could adversely affect special status fish species. The potential direct effects of underwater noise on fish depend on a number of biological characteristics (e.g., fish size, hearing sensitivity, behavior) and the physical characteristics of the sound (e.g., frequency, intensity, duration) to which fish are exposed. Potential direct effects include behavioral effects, physiological stress, physical injury (including hearing loss), and mortality. The loudest noise generated at the site is expected from heavy equipment diesel. No diesel engines or their exhaust systems would come in contact with the flowing channel. No indirect effects are anticipated as a result of construction noise.

Noise and disturbance would be limited to the immediate Action Area and, at any given time, the area immediately surrounding the construction activity. Once construction is underway, individual fish approaching the current construction area from upstream or downstream are likely to detect the sounds and avoid the immediate area.

Implementation of the following mitigation measures; **Mitigation Measure 13 - Construction Approach to Minimize Impacts to Fish, Mitigation Measure 14 - Fish Relocation to Minimize Impact to Fish from Construction Activities, Mitigation Measure 15 - Exclusion of Fish from Construction Areas to Prevent Impacts.** and **Mitigation Measure 16 - Reduce Impacts from Noise**, would reduce the impact of noise on special status fish to **less than significant**.

4.5.8.2.7.5 In-water Construction Activities

In-water construction activities are expected to cause juvenile salmonids and other special status fish species to migrate downstream to avoid construction impacts in areas where fish relocation does not occur. In-stream construction activities would only affect pre-smolt juvenile CCV steelhead as the work would be performed during the summer low flow period, after emigrating smolts have left and before adults have immigrated to or through the Action Area. In-stream construction activities may affect juvenile Chinook Salmon, particularly those demonstrating the yearling life history strategy. However, the yearling life history strategy is uncommon for spring-run Chinook Salmon in the Yuba River (Yuba RMT 2013). The majority of the in-stream work areas are not holding or migration habitat for spring-run Chinook Salmon adults and the work would be performed after the majority of the juvenile spring-run Chinook Salmon have emigrated out of the Yuba River.

Fish that migrate downstream in response to in-stream construction activities may endure short term stress from being forced to migrate away from their rearing area and needing to locate a new rearing area downstream. Fish may endure some short-term stress from crowding and competition with resident fish for food and habitat. Fish may be subject to increased predation risk while they are locating a new rearing area. However, displaced fish would likely locate areas downstream that have suitable habitat and low competition. Fish displaced into the main channel of the Yuba River would find suitable habitat and water quality as the water temperature in the Action Area rarely reaches levels that are stressful to rearing juvenile salmonids during the period when fish could be displaced (15 July to 30 September; Yuba RMT 2013). A small number of juvenile CCV steelhead and Chinook Salmon are likely to be displaced as low densities in the in-stream work areas were observed during pre-project snorkel surveys within the in-water work window (CFS unpublished data). It is not expected that the temporary displacement of fish or the competition they endure would affect the survival chances of individual fish or cascade through the population based on the size of the area that would likely be affected and the small number of juvenile salmonids and other special status fish species likely to be displaced. Fish that are displaced would be able to access the newly created habitat after construction has progressed past the area through upstream migration. CFS (unpublished data) has observed juvenile salmonids feeding immediately downstream of gravel placement activity and returning to placement sites immediately after equipment activity has ceased.

To avoid direct and indirect mortality of fishes from construction activities, fish would be relocated, if necessary, away from areas where in-stream work occurs. Fish would be relocated either through herding and excluding them out of the work area or through capture and relocation. Data to precisely quantify the number of CCV steelhead, Chinook Salmon, and other special status fish species that would be relocated prior to construction are not available. Relocation would only affect pre-smolt juvenile CCV steelhead as the work would be performed during the summer low flow period, after emigrating smolts have left and before adults have immigrated to or through the Action Area. Relocation is not likely to affect adult spring-run Chinook Salmon as the in-stream work areas are not holding or migration habitat for adult spring-run Chinook Salmon. Fish relocation may affect juvenile spring-run Chinook Salmon however, the work would be performed after the majority of juvenile spring-run Chinook Salmon have emigrated out of the Yuba River. It is possible that juvenile spring-run Chinook Salmon that are demonstrating the yearling rearing strategy could be present and would therefore be affected by relocation. However, the yearling life history strategy is uncommon in Yuba River CV spring-run Chinook Salmon (Yuba RMT 2013).

Fish relocation activities pose a risk of injury or mortality to rearing juvenile CCV steelhead and spring-run Chinook Salmon. Any fish relocation or collection gear has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish relocation varies widely depending on the method used, ambient conditions, and the experience of the field crew. Since fish relocation activities would be conducted by qualified fisheries biologists following both the CDFW and NMFS guidelines, direct effects to and mortality of juvenile CCV steelhead, Chinook Salmon, and other special status fish species during relocation activities is not likely. In addition, if feasible, fish relocation would be attempted using herding since this method is expected to have a lower impact on the species because fish would not be handled and would not be subject to holding and transport stress.

Fish collection or herding is unlikely to be 100 percent effective at removing all individuals, but experienced biologists are expected to remove greater than 95 percent of the fish present. Juvenile

CCV steelhead and spring-run Chinook Salmon that evade capture and remain in the construction area may be injured or killed from construction activities. Recent snorkel surveys within the in-stream work areas have not observed juvenile Chinook Salmon or *O. mykiss* during the in-water construction window (July 15 -September 30) in places where relocation may occur (CFS unpublished data). The length of the channels where in-water work would occur that may require fish relocation is approximately 360 meters (1,181 feet) long at its maximum extent when it has a downstream surface connection to the main channel. However, during the summer it typically becomes isolated and is only 230 m (755 ft) long. It is anticipated that special status fish species would be either absent or present in low densities in channels where in-water work would occur during the summer construction period.

Sites selected for relocating fish would have similar water temperature as the capture site and would have suitable habitat. However, relocated fish may endure short term stress from crowding at the relocation site. Relocated fish may also have to compete with resident fish for available resources such as food and habitat. Some of the fish released at the relocation site would likely move upstream or downstream to areas that have more habitat and a lower density of fish. As each fish disperses, competition diminishes and remains localized in a small area. The number of fish affected by competition cannot be accurately estimated but it is unlikely that this impact would affect the survival chances of individuals or cascade through the population within the watershed based on the small area that would be affected and the small number of CCV steelhead, Chinook Salmon, and other special status fish juveniles likely to be relocated.

The majority of adult and juvenile salmonid migration occurs in low light to dark hours (dusk until dawn) during which construction activities would not be occurring and adequate fish passage conditions would be maintained for all special status fish species within the Action Area for the duration of the Proposed Action. In-stream construction activities are therefore unlikely to impede migration of special status fish species within the Action Area.

In-stream construction activities are expected to cause mortality or abundance reduction of benthic aquatic macroinvertebrates within the immediate sediment placement areas due to catastrophic drift downstream or direct mortality when they are covered with coarse sediment. However, not all invertebrates would be smothered and many would move up through the material to colonize the new surface layer (Merz and Chan 2005). Furthermore, effects to aquatic macroinvertebrates from coarse sediment smothering would be temporary because construction activities would be relatively short in duration and rapid recolonization (about two weeks to two months) of the new sediment is expected (Merz and Chan 2005; CFS unpublished data). Furthermore, downstream drift is expected to temporarily benefit any downstream, drift-feeding organisms, including juvenile salmonids. The benthic macroinvertebrate production within the site is expected to increase when the Proposed Action is complete as there would be an increase in area of perennial habitat. The amount of food available for juvenile salmonids and other native fishes is therefore expected to increase relative to pre-project conditions.

The implementation of **Mitigation Measure 13 - Construction Approach to Minimize Impacts to Fish, Mitigation Measure 14 - Fish Relocation to Minimize Impact to Fish from Construction Activities,** and **Mitigation Measure 15 - Exclusion of Fish from Construction Areas to Prevent Impacts** would result in a **less than significant** impact of in-stream construction activities on special status fish species.

4.5.8.2.7.6 Physical Habitat Modification

The suitability of aquatic habitat for juvenile salmonids and other special status fishes depends on the presence of nearshore areas with shallow water, in-stream woody material or other types of cover, and aquatic and riparian vegetation. These attributes provide juvenile salmonids and other fishes with valuable feeding and resting habitat, concealment from predators, and refuge during high flows (Jeffres et al. 2008; McCormick and Harrison 2011). Creation of floodplains, side channels, and other off-channel areas that increase habitat complexity and inundate more frequently would function as high quality juvenile salmonid rearing habitat. The creation and enhancement of high quality juvenile salmonid rearing habitat is the primary goal of the Proposed Action and is expected to have measurable benefits to special status fish, particularly Chinook Salmon and CCV steelhead and the streamside environment in general.

Construction activities would modify bank habitat through the removal of nonnative and native vegetation along the bank, grading and excavation of banks to create side channel entrances and exits, and grading of banks to create floodplain terraces. To the maximum extent practicable, existing riparian habitat would be retained and disturbance would be minimized. Some short-term losses of mature riparian vegetation may occur during construction however, strategic plantings will occur and natural riparian vegetation recruitment would establish and mature following construction thereby resulting in an increase in the amount and extent of riparian habitat within the site. This increase in riparian habitat is expected to provide increased rearing habitat, complexity, and cover for spring-run Chinook Salmon, CCV steelhead, and other native fishes in the Action Area.

The Proposed Action has been designed to avoid creating a fish stranding risk. The main floodplain area would contain perennial and seasonal side channels and backwaters, with the floodplains graded to have gentle slopes positively draining back into these channels as flows recede. These channels would be designed to provide a natural floodplain drainage point and egress route for juvenile salmonids during the receding limb of the hydrograph. The backwaters would be constructed in such a way that they would drain downstream back into the LYR main channel as flows recede. Fish stranding is not expected as the Proposed Action has been designed to minimize stranding risk.

When complete, the Proposed Action is not expected to affect migration conditions for fish in the Main Channel of the Yuba River. Upon Proposed Action completion, during certain times of the year there would be slightly less water travelling down the LYR main channel compared to current conditions because some of the flow would be routed down the floodplain and side channels. The Proposed Action is designed to minimize its effect on migration conditions for salmonids and sturgeon. There would be sufficient flow in the LYR main channel all year to allow for migration of salmonids and other native fishes. The Proposed Action is designed to not have a direct surface connection at the upstream end during base flows (500-1000 cfs), which typically occur from July to November and correspond to the latter part of the adult spring-run Chinook Salmon immigration and beginning to middle of the fall-run Chinook Salmon immigration. During this period, it is not desirable to spread out the limited surface water in order to provide for colder, deeper habitat in the LYR main channel for adult Chinook Salmon immigration.

Overall, completion of the Proposed Action is expected to provide higher quality and quantity of habitat for juvenile salmonids and other native fishes. Creation of complex side channels and naturally vegetated floodplains would increase habitat complexity; the area of high-quality rearing habitat including floodplains, the number and length of side channels, and backwaters; the duration of floodplain inundation; and decrease erosion. Quality and quantity of riparian vegetation within the Action Area would increase over time. Vegetated floodplain terraces would provide velocity refugia and more overhead cover. Salmonid rearing habitat would be created through reduced flow velocities, appropriate water depths, and decreased erosion. Although some short-term disturbance may occur when the floodplain and side channels are graded, these effects would be minimized by implementing **Mitigation Measure 13 - Construction Approach to Minimize Impacts to Fish**. Therefore, impacts on special status fish species would be **less than significant**. Long-term impacts on salmonids and their habitat would be beneficial.

4.5.8.2.7.7 Relocation during In-water Work

To avoid direct and indirect mortality of fishes from in-water construction activities, fish will be relocated, if necessary, away from areas where work occurs. Active relocation will only occur if it is not possible to maintain a path of egress for fish during Proposed Action in-water construction. Fish will be relocated either through herding and excluding them out of the work area, or through capture and relocation. Data to precisely quantify the number of CCV steelhead and CV spring-run Chinook Salmon that will be relocated prior to construction are not available. However, relocation only has the potential to affect pre-smolt juvenile steelhead because the work will be performed during the summer low flow period after out-migrating smolts have left and before adults have immigrated to or through the Action Area. Relocation is not likely to affect adult spring-run Chinook Salmon, as the in-stream work areas are not holding or migration habitat for adult spring-run Chinook Salmon. Fish relocation may affect juvenile spring-run Chinook Salmon, but the work will be performed after the majority of juvenile spring-run Chinook Salmon have out-migrated from the LYR. It is possible that juvenile spring-run Chinook Salmon that are demonstrating the yearling rearing strategy could be present and would therefore be affected by relocation. However, the yearling life history strategy is uncommon in LYR CV spring-run Chinook Salmon (Yuba RMT 2013).

Fish relocation activities pose a risk of injury or mortality to rearing juvenile CCV steelhead and CV spring-run Chinook Salmon and other special status fish. The amount of unintentional injury and mortality attributable to fish relocation varies widely depending on the method used, ambient conditions, and the experience of the field crew. However, fish relocation activities will be conducted by qualified fisheries biologists following both the CDFW and NMFS guidelines. Therefore, direct effects to and mortality of juvenile CCV steelhead and CV spring-run Chinook Salmon and other special status fish during relocation activities are not likely. Whenever feasible, fish relocation will be attempted using herding, as this method is expected to have a lower impact on the species relative to active relocation methods (e.g., seining or electro-fishing), because fish will not be handled and will not be subject to holding and transport stress.

Fish collection or herding is unlikely to be 100 percent effective at removing all individuals, but experienced biologists are expected to remove at least 95 percent of the fish present. Juvenile CCV steelhead and CV spring-run Chinook Salmon and other special status species that evade capture and remain in the construction area may be injured or killed from construction activities. But as described above, it is anticipated that juvenile Chinook Salmon and steelhead and other special status species will be present in very low densities or absent during the summer construction period in the backwater complex.

The anticipated take of CCV steelhead and CV spring-run Chinook Salmon due to relocation activities is minimal, as no CCV steelhead or CV spring-run Chinook Salmon were observed in the Action Area during pre-project surveys that took place during the months when construction would occur. However, we request take of up to 100 of each species to address the possibility that these species could be present and require relocation (see Table 15 below).

Sites selected for relocating fish will have similar water temperatures to the capture site and will have suitable habitat area. However, relocated fish may endure short term stress from crowding at the relocation site. Relocated fish may also have to compete with resident fish for available resources such as food and habitat. Some of the fish released at the relocation site will likely move upstream or downstream to areas that have more habitat and a lower density of fish. As each fish disperses, competition diminishes and remains localized in a small area. The number of fish affected by competition cannot be accurately estimated but it is unlikely that this impact will affect the survival of individuals or the population given the small number of individuals likely to be relocated (Table 15).

Table 15: Expected take of juvenile CCV steelhead and CV spring-run Chinook Salmon due to fish relocation activities during Proposed Action construction.

Species	Method	Take Action	Life Stage	Expected Take	Indirect Mortality
CCV steelhead	Fish Relocation	Capture/Handle/ Release Fish	Juvenile	~ 100	3
CV spring-run Chinook Salmon	Fish Relocation	Capture/Handle/ Release Fish	Juvenile	~ 100	3

While relocation of CCV steelhead and CV spring-run Chinook Salmon is unlikely, if it occurs, it is likely to adversely affect fish; and if the capture and relocation method is used, it may reach a level where fish injury or mortality occurs.

4.5.8.2.7.8 Restoration Monitoring Activities

The long-term monitoring efforts accompanying the Proposed Action aim to measure changes in hydrology, geomorphology, and river ecosystem related to CCV steelhead and CV spring- and fall-run Chinook Salmon habitat use (CFS 2020). Pre-project monitoring began under an existing 4(d) permit held by CFS and was performed in 2017, 2018, and 2020. Post-project monitoring will be performed for up to three years following construction. The specific monitoring methods and anticipated effects are described below.

4.5.8.2.7.9 Macroinvertebrate Sampling

As detailed in the Proposed Action Monitoring section, changes to macroinvertebrates (juvenile salmonid prey-base) will be assessed before and after implementation using drift and Schindler sampling. Sampling efforts will require minor disturbance of benthic substrate through wading to perform the sampling. Care will be taken to avoid areas being used by adult salmonids (e.g., active redds). If juvenile or adult salmonids are observed during macroinvertebrate sampling, effort will be made to avoid disturbing them by not sampling or wading in their vicinity. Juvenile and adult salmonids can easily avoid staff and equipment associated with these sampling activities, and individuals that are spooked away from their holding/rearing area during invertebrate sampling will return to the area when the disturbance from sampling has ceased. Biological impacts from macroinvertebrate sampling are considered temporary and are not likely to adversely impact salmonids.

4.5.8.2.7.10 Snorkel Surveys

Snorkel surveys will require survey staff to observe and enumerate rearing juvenile salmonids within the Action Area and record the Global Positioning System (GPS) coordinates and depth and velocity in the locations in which juvenile salmonids are observed. Snorkel surveys will typically be performed monthly from January through October to capture the breadth of juvenile rearing, including over-summer habitat use. Adult CCV steelhead may be observed during juvenile salmonid snorkel surveys during January through April, as these months overlap with the migration, holding, and spawning of steelhead in the LYR (Table 5). Adult CV spring-run Chinook Salmon may be observed from April to October as these months overlap with the migration, holding, and spawning of spring-run Chinook Salmon in the LYR (Table 5). Effort will be made to avoid actively spawning adult salmonids during snorkel surveys by not wading or surveying in their vicinity.

The presence of individuals conducting the snorkel surveys will have short-term impacts on fish behavior and habitat use. Performing snorkel surveys is likely to result in "take" of CV spring-run Chinook Salmon and CCV steelhead through observation and harassment. During pre-project snorkel surveys of selected transects, which were covered under a 4(d) permit, 1-131 juvenile *O. mykiss* (Figure 8) and 0-16,869 juvenile Chinook Salmon (Figure 9) were observed per year. Post-project monitoring snorkel surveys will be conducted from January to October, which is a similar timeframe to snorkel surveys conducted in 2020. Assuming the restoration project improves juvenile salmonid habitat and resulting occupancy as intended, we estimated predicted post-project monitoring take by increasing 2020 counts by a factor of six. Based on this conservative assumption, juvenile *O. mykiss* snorkel observations post-project may be as high as approximately 800 annually. Assuming approximately one third of juvenile Chinook Salmon observed during snorkel surveys in 2020 were spring-run (resulting in a total of 5,623 CV spring-run Chinook Salmon), post-project observations are predicted to be approximately 34,000 annually. Following post-project sampling, the actual number of juvenile spring-run Chinook Salmon observed during snorkel surveys will be estimated for reporting purposes by applying the ratio of spring-run to fall-run juveniles observed in the genetic analysis of PIT tagged fish (see below).

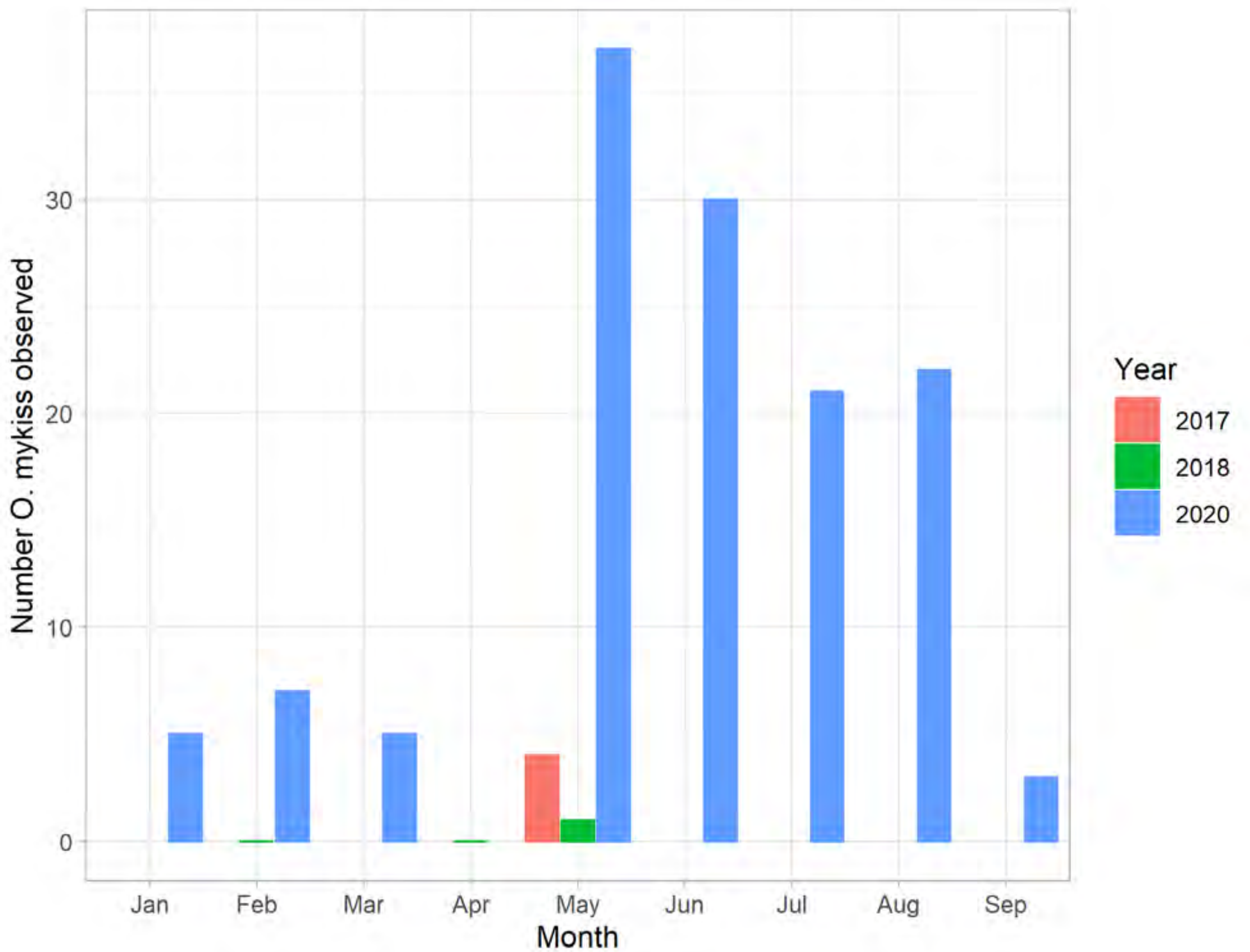

Figure 8. Number of juvenile O. mykiss observed by month during snorkel surveys in 2017, 2018, and 2020 as part of pre-restoration monitoring for the Proposed Action.

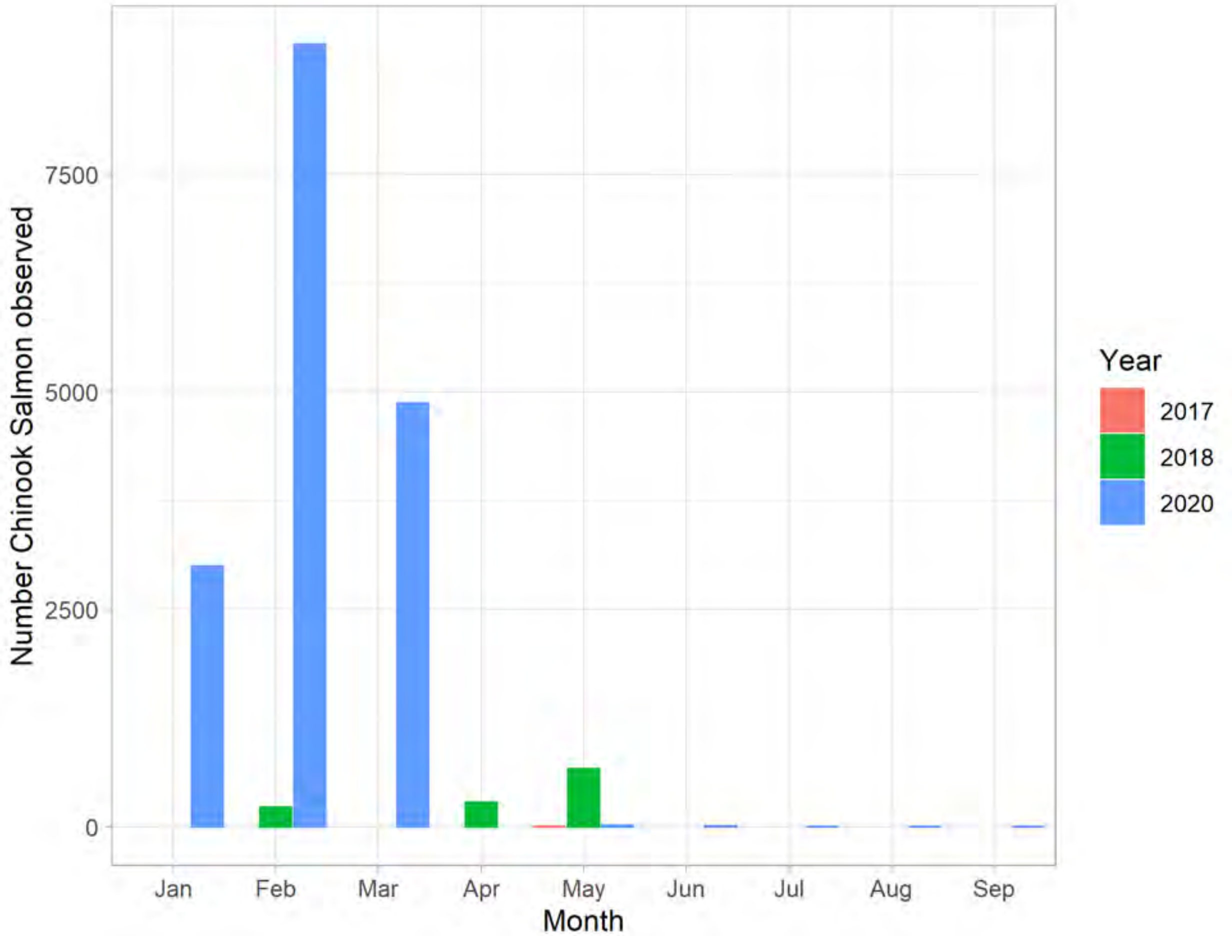

Figure 9. Number of juvenile Chinook Salmon observed by month during snorkel surveys in 2017, 2018, and 2020 as part of pre-restoration monitoring for the Proposed Action.

4.5.8.2.7.11 Juvenile Salmonid Seine and Fyke-Net Sampling

Beach seine sampling will be performed to capture juvenile Chinook Salmon for use in the rearing study in the spring (April/May) and to monitor juvenile salmonid habitat use within the main channel, side-channel, and floodplain in the Action Area. Up to four locations will be seined within each habitat type (main channel, side channel, and floodplain) with up to three seine hauls per location. Seine sampling will occur monthly from February through June. The seine size used will be based on the configuration of the seine location with a larger seine used in the main channel and a smaller seine used in the side channel. Seining will require wading by individuals operating the seine net and the net will agitate stream bottom substrate where it is deployed.

Fyke-net sampling will be used to test the hypothesis that juvenile salmon rearing in restored off-channel habitats will exhibit greater growth rate and health condition than those that rear in unrestored backwater habitats. The fyke net(s) will be installed in the downstream end of Project

Backwater and Control Backwater sites. The fyke net will be "fished" continuously for the duration of the experiment, approximately four weeks in the spring (April/May). However, the fyke-nets would be temporarily removed if a flow event is predicted that may damage or destroy the nets. The fyke-nets will be checked up to twice a day to process fish in the live boxes and to clean debris from the traps and live boxes.

Chinook Salmon captured by beach seine for the pre- and post-project juvenile rearing experiment will be weighed and measured, PIT tagged, and genetic fin-clip/swab collected, and placed in a recovery bucket. For all other captured fish, up to 20 of each species measured and the rest enumerated and placed in an aerated recovery bucket. Once fish in the recovery buckets are behaving normally, the fish will be returned to a proper release location within the area from which they were captured, except for the PIT-tagged fish which will be transported to the selected experimental release location.

All juvenile Chinook Salmon captured by the fyke-net will be anesthetized, scanned for a PIT-tag, weighed and measured, and then placed in a recovery bucket. For all other fish, up to 20 of each species measured and the rest enumerated and placed in an aerated recovery bucket. All fish will be released downstream of the fyke-net except for a sub-sample of 100 recaptured PIT-tagged fall-run Chinook Salmon, which will be sacrificed for otolith and diet analysis. Run of PIT-tagged juvenile Chinook Salmon will be determined through genetic analysis within a week of PIT-tagging. This will allow sacrifice of juvenile CV spring-run Chinook Salmon to be avoided. No adult CV spring-run Chinook Salmon or CCV steelhead are expected to be capture by beach seine or fyke-net due to the sampling locations. Beach seining will be performed in shallow, edge habitat along the bank where adult salmonids are not expected to occur. The area to be seined will be visually surveyed for redds prior to commencing. If redds are observed, then the seine location will be moved to avoid them. Fyke-nets will not be operated in salmonid spawning habitat. Potential effects of seine and fyke sampling on juvenile salmonids include minor abrasions from the seine or fyke net and short-term effects from the anesthetic and handling.

Juvenile Chinook Salmon PIT-tagging and genetic fin-clip sampling will result in additional handling stress and injury. However, only experienced personnel will perform PIT-tagging and fin-clipping to minimize injury/mortality from these actions. PIT-tagging mortality of an experienced tagger is expected to be around 3%. Assuming one third of the beach seine captured juvenile Chinook Salmon PIT tagged for the juvenile rearing experiment are spring-run, this would result in take of approximately 333 CV spring-run Chinook Salmon. A more accurate estimate of the actual number of PIT-tagged juvenile spring-run Chinook Salmon for reporting will be determined through genetic analysis.

The Proposed Action restoration effectiveness monitoring activities may result in short term adverse effects to special status fish species through capture and handling as well as through observation and harassment. However, the amount of handling mortality is expected to be minimal for all special status fish species and would not result in population level impacts. Directed mortality of juvenile fall-run Chinook Salmon as part of the juvenile rearing experiment for diet and otolith analysis would be a maximum of 200 (100 pre-project and 100 post-project). This limited direct mortality of juvenile fall-run Chinook Salmon would not have population level effects. NMFS issued a non-jeopardy biological opinion for the Proposed Action, including monitoring, indicating that the Proposed Action would not jeopardize the continued existence of the ESA listed CV spring-run Chinook Salmon ESU or CCV steelhead DPS. The monitoring efforts will have no effect on salmonid critical habitat or EFH and may result in long-term benefits, because the information collected will allow for adaptive management and improve design criteria for future restoration efforts. The limited mortality resulting from restoration monitoring activities would not have population level effects on any special status fish species, including ESA listed CV spring-run Chinook Salmon and CCV steelhead, resulting in a **less than significant** impact.

4.5.8.2.8 Critical Habitat and Essential Fish Habitat

The Proposed Action is expected to have direct short- and long-term effects on the designated Critical Habitat of CCV steelhead and CV spring-run Chinook Salmon, and EFH of Chinook Salmon. Construction activities are expected to result in short term disturbance to the channel and streambank areas as described above. Localized impacts to water quality may occur due to temporary increases in turbidity and suspended sediment but these effects are expected to be minor and short-term. A release of contaminants during construction has the potential to occur but with implementation of a SWPPP and associated Spill Prevention and Response Plan, including the use of vegetable oil as a lubricant, and locating the equipment staging area in an upland area well away from the Yuba River, a spill is not likely and if one does occur then it would be cleaned up and remediated rapidly such that its effects are expected to be **less than significant**.

The in-stream construction is expected to have short term effects on the Critical Habitat PBF of freshwater rearing habitat and the EFH Habitat Areas of Particular Concern (HAPC) of complex channels and floodplain habitats through construction disturbance and modification as well as the removal of some riparian trees and shrubs. However, the disturbance from construction activities would be short term and upon Proposed Action completion would result in an increase in the quality and quantity of juvenile rearing habitat and complex channels and floodplains and therefore the effect on Critical Habitat and EFH is **less than significant** and not likely to reduce their conservation value. The Proposed Action would have long term beneficial effects on Critical Habitat and the EFH HAPC of complex channels and floodplain habitats.

The removal of riparian trees and shrubs would be localized and short term as the Proposed Action is designed to minimize impact to existing riparian habitat. High quality riparian habitat would be created through strategic planting and natural recruitment and therefore the effect on Critical

Habitat is **less than significant** and not likely to reduce its conservation value. The overall quality and quantity of riparian habitat would improve over time upon Proposed Action completion as planted and naturally recruited trees grow and mature.

The Proposed Action is expected to have little to no effect on the salmonid Critical Habitat PBF of freshwater migration corridors and will increase Chinook Salmon spawning habitat by 0.1 acres and CCV steelhead by 7.9 acres or more. The potential impacts that could occur to these PBFs of salmon and CCV steelhead are temporary increases to turbidity and suspended sediment as well as release of contaminants which are expected to be localized, minor, and short term and therefore the effects to Critical Habitat are **less than significant** and not likely to reduce its conservation value.

Similar to the salmon and CCV steelhead PBFs that exist in the main channel, the EFH HAPCs of thermal refugia and spawning habitat could be impacted by temporary increases to turbidity and suspended sediment as well as release of contaminants which are expected to be localized, minor, and short term. The amount of thermal refugia habitat may increase upon Proposed Action completion because the Backwater Channel would be fed partly by groundwater which could be cooler than the main channel of the Yuba River during the summer months when thermal refugia may be needed.

Long-term direct effects on designated Critical Habitat and EFH are beneficial, including: increased channel complexity and shallow water salmonid rearing habitat, increased rearing temperatures to enhance primary productivity and juvenile growth, and increased native riparian vegetation. These modifications would result in a beneficial effect on special status fish by converting existing low quality nearshore and riparian habitat in the Action Area to high quality restored side channel and floodplain habitat. The main channel adjacent to the Action Area would continue to function as a freshwater migration corridor by providing adequate passage for adults and juvenile salmonids. Restoration activities would provide additional high quality rearing habitat for CCV steelhead and Chinook Salmon.

4.5.8.3 Sensitive natural communities

The Action Area supports Great Valley Cottonwood Riparian Forest, Great Valley Mixed Riparian Forest, and Great Valley Willow Scrub which are considered sensitive natural communities by CDFW. In addition, the Proposed Action supports elderberry shrubs, which are considered sensitive by the USFWS since they are obligate habitat for the VELB. The Proposed Action restoration activities would have temporary impacts which are **potentially significant** on these sensitive natural communities. The Proposed Action includes the development of roughness features where riparian planting would occur (Figure 3) with the plants used being part of these sensitive communities including Fremont cottonwood, elderberry, alder, and willow. In addition, the topographic manipulations are expected to improve recruitment of native riparian vegetation within the Action Area. Predicted natural recruitment and **Mitigation Measure 2 – Protect**

Elderberry Plants and Special Status Plants with Buffer, Mitigation Measure 3 – Transplant Unavoidable Elderberry Plants to Suitable Locations, and **Mitigation Measure 4 – Protect and Compensate for Native Trees** would reduce impacts to sensitive natural communities to **less than significant**. Overall, implementation of the Proposed Action is expected to improve quality and quantity of riparian vegetation, including within the vegetation alliances of Great Valley Cottonwood Riparian Forest, Great Valley Mixed Riparian Forest, and Great Valley Willow Scrub, within the Action Area.

4.5.8.4 Wetlands

Implementation of the Proposed Action would result in floodplain and riparian restoration in approximately 43 acres (17.4 ha) of the LYR to improve habitat for CV spring-run Chinook Salmon, CCV steelhead, and other native fish. Implementation of the Proposed Project would have temporary impacts to 0.08 acres of emergent wetland, 3.62 acres of riparian wetland (3.24 acres below the OHWM), 1.24 acres of perennial channel, and 0.76 acres of ponds (Table 16). The Proposed Project would also create 10.2 acres of intermittent channel (side channels), and 3.86 acres of perennial channel (Table 16). Creation of perennial side channel would result in permanent conversion of 0.95 acres of riparian wetland below OHWM (Table 16). The Proposed Action would have some small permanent change to Waters of the U.S. as well as some temporary impacts but overall, implementation of the Proposed Action would result in the restoration of aquatic critical habitat and EFH within the OHWM of the LYR (Table 16). Therefore, the impact on jurisdictional Waters of the U.S. would be **less than significant**.

Table 16: The temporary impacts, permanent conversion, and new acres with implementation of the Proposed Action for the aquatic resource types found within the survey area.

Aquatic Resource Type	Temporary Impact (Acres)	Permanent Conversion to Perennial Side Channel (Acres)	New (Acres)
Emergent Wetland	0.08	0	0
Riparian Wetland above OHWM	0.38	0	0
Riparian Wetland below OHWM	3.24	0.95	0
Perennial Channel	1.24	0	3.86
Intermittent Channel (Side Channel)	0	0	10.2
Ponds	0.76	0	0
Total	5.70	0.95	14.06

4.5.8.5 Migratory Corridors

The LYR and the adjacent gravel bar and riparian areas within the Proposed Action Area serve as a migration corridor for wildlife. Likewise, the river serves as a migratory corridor for resident and anadromous fish. Wildlife may experience some temporary disturbance to movement corridors from the restoration activities, but would be able to move through the Action Area outside of working hours. In-stream construction activities may cause temporary disturbance to migrating special status fish species. Adult and juvenile anadromous salmonids generally migrate during low and no light hours (dusk until dawn) which generally do not overlap with Proposed Action work hours. Implementation of the Proposed Action would have long term beneficial impacts on riparian habitat and in-stream habitat for special status fish species. Therefore, adverse impacts to wildlife or fish movement or wildlife migration corridors would be **less than significant**.

4.5.8.6 Local ordinances

Yuba County does not have a tree protection ordinance. Therefore, there would be **no impact**. Implementation of the Proposed Action would have long term benefits for quality and quantity of riparian vegetation within the Action Area.

4.5.8.7 Conservation plans

The Proposed Action does not include any area that is covered by an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. Therefore, there would be **no impact**.

4.6 CULTURAL RESOURCES

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Cause a substantial adverse change in the significance of a historical resource pursuant to § 15064.5?	0	0	0	X
Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	0	0	0	X
Disturb any human remains, including those interred outside of dedicated cemeteries?	0	0	0	X

As part of the preparation for the Proposed Action, a cultural resource study was conducted by Horizon Water and Environment (2020). Compliance with Section 106 of the NHPA of 1966 (16 United State Code [USC] § 470f [2008]) is required, whereby any federal undertaking must "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." The implementing regulations for Section 106 are found under 36 CFR § 800, as amended (2001). Cultural resources may also be considered separately under the National Environmental Protection Act (42 USC) Section 4321-4327, whereby federal agencies are required to consider potential environmental impacts and appropriate mitigation measures for projects with federal involvement. Also, impacts to cultural resources are considered if the resource is "significant" or "important" or "unique archaeological resource" under the provisions of CEQA Sections 15064.5 and 15126.4.
In addition to cultural resources identified prior to Proposed Action implementation, it is possible that during earthmoving activities additional cultural resources could be discovered. However, this is unlikely due to the highly disturbed nature of the Action Area.

4.6.1 **DISCUSSION**

4.6.1.1 No Action Alternative

Under the No-action Alternative there would be **no impact** to cultural resources.

4.6.1.2 Proposed Action

A cultural resources assessment report for the Proposed Action was completed in 2020 (Horizon 2020; Appendix H). No archaeological resources were identified (Horizon 2020). The cobble field within the Area of Potential Effects is likely comprised of material resulting from the degradation and erosion of dredge tailings but the cobble field is not a cultural resource (Horizon 2020). The Proposed Action occurs within the area identified as the Yuba Goldfields Historic Mining District, which has been determined eligible for listing on the National Register of Historic Places (NRHP) and California Register of Historical Resources (CRHR; Horizon 2016). However, the cobble field in the APE does not represent elements of the historic district due to a lack of integrity (Horizon 2020). Therefore, the Proposed Action would have **no impact** on historic or archaeological resources pursuant to § 15064.5 and will not have a significant impact on cultural resources under CEQA (Horizon 2020).

To address the potential for inadvertent discoveries the Proposed Action the following would be implemented. If buried cultural resources or human remains are discovered then all ground disturbing activities within 100 feet would be halted, **Mitigation Measure 17 - Inadvertent Discoveries of Objects of Cultural Significance** would be implemented and the USFWS Regional archeologist notified immediately. With implementation of this mitigation measure, potential impacts to cultural resources would be **less than significant**.

4.7 ENERGY

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	0	0	X	0
Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	0	0	0	X

4.7.1 DISCUSSION

4.7.1.1 No Action Alternative

No energy would be consumed under the No-Action alternative. Therefore, there would be no impact.

4.7.1.2 Proposed Action

Energy consumption during Proposed Action construction would be minimal and restricted to that required for operating heavy machinery to move material to construct the habitat features. The impact would be **less than significant.** The Proposed Action would not interfere with a state or local plan for renewable energy or energy efficiency. There would be **no impact**.

4.8 GEOLOGY AND SOILS

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation	Less Than Significant Impact	No Impact
Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:	0	0	0	X
Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	0	0	0	X
Strong seismic ground shaking?	0	0	0	X
Seismic-related ground failure, including liquefaction?	0	0	0	X
Landslides?	0	0	0	X
Result in substantial soil erosion or the loss of topsoil?	0	0	X	0
Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	0	0	0	X
Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	0	0	0	X
Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	0	0	0	X
Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	0	0	0	X

4.8.1 REGIONAL AND SITE GEOLOGY

The Proposed Action is located in the foothills of the Sierra Nevada geomorphic province of California. The Sierra Nevada Range is a nearly 400-mile long northwest trending tilted fault block with a gently sloping western face and a steep eastern escarpment. Much of the range is a massive granitic batholith. Volcanic deposits cover areas in the northern half of the Sierra Nevada. Outcrops of metamorphic and sedimentary rock are scattered throughout the range. Deep river canyons are cut into the western slope. The Sierra Nevada foothills are at the western edge of the range, up to 2,000 feet in elevation in the northern portion. The Sierra Nevada foothills transitions to the west into the Great Valley geomorphic province. The Great Valley consists of deep marine basins filled with large volumes of sediment eroded during the Jurassic to Quaternary periods from the eastern Sierra Nevada Range and western Coast Range.

The Action Area consists of alluvial cobbles, gravels, and sand deposited by the LYR. The LYR within the Action Area is confined on the south by a training wall made of river rock dredge spoils from the Yuba Goldfields and on the north by hill side. Elevations within the site range from approximately 150 to 180 feet above mean sea level. Fluvial erosion is the main site geomorphic process.

4.8.2 FAULTS AND SEISMICITY

The Action Area is located in east-central California, which is an area of relatively low seismic activity. No active faults or Earthquake Fault Zones are located within or adjacent to the Action Area (CDC 2020). The Action Area is located in between two inactive faults; Prairie Creek Fault to the west and Swain Ravine Fault to the east (CDC 2020). The nearest active fault is the Cleveland Hill Fault which is located about 17 miles northwest of the Action Area (20 miles northeast of Marysville; CDC 2020). The Foothills Fault System is a continuation of the Cleveland Hill Fault. Seismic activity in the area is estimated to have a very long recurrence interval.

4.8.3 DISCUSSION

4.8.3.1 No Action Alternative

Under this alternative, there would be no adverse impacts to geology or soils as no restoration activities would occur within the Action Area. Therefore, there would be **no impact**.

4.8.3.2 Proposed Action

The Proposed Action is located in an area of relatively low seismic risk and is not located within an active earthquake fault zone or landslide and liquefaction zone. The Proposed Action would not construct new structures or facilities. Therefore, the Proposed Action is not expected to expose people or structures to earthquake and related hazards. Therefore, the Proposed Action would have **no impact**.

The Action Area is comprised of cobble and gravel alluvial river rocks which are resistant to erosion. The northern edge of the Action Area is bordered by a vegetated hill side that is less than 15% slope. Erosion potential in Yuba County on land that is less than 15% slope is rated as low to moderate by the U.S. Department of Agriculture, Soil Conservation Service. Proposed Action restoration activities would not change the erosion potential of the northern hillside. The USFWS would prepare a SWPPP as required to obtain a Storm Water Construction General Permit from the CVRWQCB. The SWPPP contains BMPs to minimize impacts to surface water quality from erosion or contaminants. The construction contractor would be required to implement the erosion and sediment control BMPs in the SWPPP to minimize erosion related impacts. With these measures in place, the impact of the Proposed Action is **less than significant**.

The Proposed Action would modify the topography of the large gravel bar within the site including floodplain lowering and creation of floodplain terraces and side channels and backwaters. These topographic manipulations would alter the drainage pattern and channel morphology within the site. These topographic modifications are aimed at improving the quantity and quality of juvenile salmonid rearing habitat within the site.

The Action Area is not located on strata or soil that is unstable or would become unstable as a result of the Proposed Action. Likewise, the Proposed Action is not located on expansive soil. The Action Area is located on low relief, stable, and non-expansive alluvial sediments that are mostly of gravel and cobble sized (1/4 inch to 8 inch diameter). Therefore, there would be **no impact**.

The Proposed Action consists entirely of river restoration activities and there would be no activities related to waste water disposal systems. Therefore, there would be **no impact**.

While the Proposed Action would alter the morphology of the LYR within the site, it would not result in the loss of a unique geologic feature. Therefore, there would be **no impact.**

4.9 GREENHOUSE GAS EMISSIONS

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation	Less Than Significant Impact	No Impact
Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	0	0	X	0
Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	0	0	0	X

Greenhouse gases (GHGs) are gases which trap heat in the atmosphere by allowing sunlight to enter the atmosphere while trapping a portion of the exiting infrared radiation, which increases air temperature. Global climate change, particularly increases in global temperature, has been linked to the increasing concentration of GHGs in the atmosphere primarily as a result of anthropogenic combustion of fossil fuels. The primary GHGs are carbon dioxide (CO_2), methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, perfluorocarbons, and water vapor. Carbon dioxide is the reference gas for climate change with GHG emissions typically quantified and reported as CO_2 equivalents (CO_{2e}) for standardization.

Climate change impacts in California are predicted to include increasing average air temperature, greater temperature extremes, more precipitation falling as rain rather than snow, more extreme variability in precipitation, and sea level rise.

4.9.1 DISCUSSION

4.9.1.1 No Action Alternative

Greenhouse gases would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.9.1.2 Proposed Action

The Proposed Project would emit greenhouse gases from the heavy equipment used for the restoration activities. Table 11 contains the estimated amount of CO_{2e} emissions by the Proposed Project. The total amount of CO_{2e} estimated to be produced by the Proposed Projects restoration activities is 653.38 metric tons (720.23 tons). However, the implementation of the Proposed Project also has the potential to store a significant amount of carbon through an increase in the quality and quantity of riparian vegetation (Matzek et al. 2015, Gorte 2009) and salmon (Merz and Moyle 2006) and macroinvertebrate production (Duffy and Kahara 2011). Over the life of the

Proposed Project, we predict a substantial amount of carbon would be sequestered in tree production alone through increased natural recruitment of riparian vegetation (Sellheim et al. 2016).

The FRAQMD has not established a significance threshold for GHG emissions but when estimated Proposed Project GHG emissions (653.38 metric tons of CO_{2e}) are compared to the SMAQMD significance threshold of 1,100 metric tons per year (1,213 tons) of CO_{2e} the threshold is not exceeded. The Proposed Projects GHG emissions would not exceed the significance criteria (for the SMAQMD surrogate) and a substantial amount of carbon sequestration is predicted as a result of Proposed Project implementation; therefore, the Proposed Projects emissions of GHG would be **less than significant**.

4.10 HAZARDS AND HAZARDOUS MATERIALS

Would the project:	**Potentially Significant Impact**	**Less than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	0	0	0	X
Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment?	0	0	0	X
Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	0	0	0	X
Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code § 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	0	0	0	X
For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	0	0	0	X
Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	0	0	0	X
Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?	0	0	0	X

4.10.1 DISCUSSION

4.10.1.1 No Action Alternative

Hazards and hazardous materials would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.10.1.2 *Proposed Action*

The heavy equipment necessary for material removal, transport, and placement require fuel, oil and equivalent substances to operate. There is a less than significant risk of fire, explosion, or release of hazardous substances because all state and federal regulations concerning hazardous materials and health and safety would be followed. No unregulated hazardous substances are used as part of the Proposed Action. The Proposed Action does not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. The Proposed Action does not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment. The Action Area is not within one-quarter mile of an existing or proposed school; therefore, the Proposed Action is not reasonably anticipated to emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school. The Action Area is not located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would not create a significant hazard to the public or the environment. The Action Area is not located within two miles of a public airport or public use airport. The Proposed Action would not result in a safety hazard for people residing or working in the Action Area. The Proposed Action would not affect airport activities. The Proposed Action does not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. The Proposed Action does not expose people or structures to the risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands. The Action Area is located in a rural area of Yuba County, and there is little risk of hazardous materials escaping into the environment due to Proposed Action activities. The Proposed Action would have **no impact** on hazards and hazardous materials.

4.11 HYDROLOGY AND WATER QUALITY

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation	Less Than Significant Impact	No Impact
Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	0	0	X	0
Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	0	0	0	X
Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
result in a substantial erosion or siltation on- or off-site;	0	0	X	0
substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	0	0	X	0
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; or	0	0	0	X
impede or redirect flood flows?	0	0	X	0
In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	0	0	0	X
Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	0	0	0	X

The Regional Water Quality Control Board and the California Department of Health Services regulate water quality levels and maximum contaminant levels for primary drinking water supplies. State water quality standards are more stringent than the federal standards. The following potential water quality impacts have been identified as part of the Proposed Action:

- exceedance of state water quality objectives for any given parameters;

- discharge of oils, grease, or any other material that would result in a film on the water or objects in the water;
- alteration of the suspended sediment load and suspended sediment discharge rate that causes a nuisance or adversely affects beneficial uses;
- alteration of surface water temperatures unless demonstrated to the Regional Water Quality Control Board that no impacts to beneficial uses would occur; and,
- changes in turbidity that cause a nuisance or adversely affect beneficial uses.

4.11.1 WATER QUALITY

The LYR provides water for agricultural uses, municipal and domestic supply, recreation, and fish and wildlife habitat. The LYR has overall good water quality which has improved in recent decades following controls on hydraulic and dredge mining and the establishment of minimum in-stream flows (Beak Consultants, Inc. 1989). Dissolved oxygen concentrations, total dissolved solids, pH, hardness, alkalinity, and turbidity are within acceptable or preferred ranges for salmonids and other aquatic organisms (Corps 2012). The minimum, maximum, and mean levels of pH, turbidity, DO, total organic carbon, nitrogen, phosphorus, and electrical conductivity are presented below (Table 17) (Corps 2012).

Table 17. Water quality parameters measured in the LYR near Marysville, CA (Corps 2012).

Parameter	Minimum	Maximum	Mean
pH	7	7.8	7.5
Turbidity (mg/L)	1	153	30
Dissolved Oxygen (mg/L)	8	12.4	11.4
Total Organic Carbon (mg/L)	0.7	2.4	1.1
Nitrogen (mg/L)	0.05	0.14	0.07
Phosphorus (mg/L)	0.01	0.02	0.01
Electrical Conductivity (µS/cm)	44	105	73

Work for the Proposed Action may temporarily increase suspended sediment in the LYR for short periods of time. However, the majority of the work would be outside of the main channel of the LYR. Construction activities would be closely monitored to ensure that water quality in the LYR is not affected during implementation. Temperature loggers would be installed to constantly monitor river water temperature. Data would be downloaded and reviewed frequently during the construction process, and monthly following restoration. Turbidity would also be monitored on site. Turbidity samples would be collected and processed frequently during construction, and monthly following Proposed Action implementation.

4.11.2 SURFACE WATER HYDROLOGY

The Yuba River has an approximately 1,300 square mile watershed with elevations ranging from 9,100 at the crest of the Sierra Nevada to 30 ft at the Feather River confluence. The LYR flows for approximately 24 miles from below Englebright Dam to its confluence with the Feather River. Historic gold mining and water regulation from upstream reservoirs have altered the hydrology and fluvial geomorphology of the LYR (cbec 2014). The hydrologic regime in the LYR is characterized as a mixed rain and snowmelt system (cbec 2013a). Peak flows occur during the winter and spring in response to precipitation events, particularly rain on snow. Snowmelt runoff in the LYR occurs from March through the end of May and recedes in June and July to summer baseflows in August and September (cbec 2013a). The upstream reservoir water regulation has reduced monthly flow variation and has shifted the pattern of peak and minimum flows (Corps 2012). Water regulation has reduced the magnitude of floods that occur with 1.5- and 5-year recurrence intervals and has increased summer baseflows (cbec 2013a; cbec 2021).

The flow in the LYR is partially controlled by New Bullards Bar Reservoir, the largest reservoir in the watershed, with the capacity to store 966,000 acre-ft of the total watershed storage of 1,377,000 acre-ft (Corps 2012; cbec 2013a). During the summer and fall, after snowmelt has ceased, the majority of the flow in the LYR is regulated by releases from New Bullards Bar through the New Colgate powerhouse. Releases into the LYR below Englebright Dam are made by the Narrows I and II powerhouses. Water that is released from New Bullards Bar generally passes through Englebright Reservoir without altering the water surface elevation (Corps 2012). Brown’s Valley Irrigation District operates Collins Reservoir, which regulates flows in Dry Creek. Dry Creek flows for approximately 8 miles below Collins Reservoir before it enters the LYR approximately 0.8 miles downstream of the Action Area.

4.11.3 GROUNDWATER HYDROLOGY

The LYR serves as the boundary between the North Yuba Groundwater Basin and the South Yuba Groundwater Basin (YCWA 2005). The YWA manages groundwater in these basins through the YWA groundwater management plan (YCWA 2005). Groundwater and surface water are managed conjunctively. The groundwater levels in the South Yuba Groundwater Basin declined substantially between 1948 and 1981, prompting YCWA in 1984 to begin delivering surface water from New Bullards Bar Reservoir to the basin to offset groundwater use (YCWA 2005). The surface water deliveries have resulted in the return of groundwater levels in the South Yuba Groundwater Basin to near historic levels (YCWA 2005). YWA participates in temporary water transfers to other parts of California when there is a need for additional supply and when available Yuba River water is greater than the need of its member units (YCWA 2005). These temporary transfers can be in the form of groundwater substitution in which participating member units use groundwater in lieu of surface water, thereby allowing surface water to be transferred (YCWA

2005). Along the LYR in a band up to three and a half miles wide are alluvial deposits of coarse sand and gravel which act as a large intake area for recharge of the sub-basin (YCWA 2005). The Proposed Action site consists of these alluvial sand and gravel deposits with relatively shallow depth to groundwater (less than 12 ft) over a substantial portion of the site (cbec 2013a; cbec 2021; Figure 4).

4.11.4 **DISCUSSION**

4.11.4.1 No Action Alternative

If the Proposed Action is not implemented, there would be no changes to existing water quality. Hydrologic processes would continue as they are now and available habitat for salmonids would continue to degrade as the channel continues to be disconnected from the natural floodplain. Native riparian vegetation recruitment and floodplain function in relation to juvenile salmonid habitat would continue to be degraded. LYR water resources and hydrology within the site would not change. There would be **no impact** with respect to the criteria.

4.11.4.2 Proposed Action

The Proposed Action has the potential to affect water quality in the Action Area. Chemical constituents would be limited to those present at the site. The pH would not be changed, and no pesticides would be used or mobilized during Proposed Action activities. Salinity and radioactivity would not be changed due to the Proposed Action. Water temperature conditions would not be elevated during construction activities; however, water temperature may be improved (reduced) as a result of the Proposed Action. The DO levels would not be reduced below levels specified in the water quality objectives (CRWQCB 1998). The Proposed Action must comply with the water quality and waste discharge requirements of the CVRWQCB. Complying with water quality standards and implementing **Mitigation Measure 9 - Monitor Water Quality and Prevent Impacts** would reduce water quality impacts to **less than significant**.

The Proposed Action's restoration activities may temporarily increase or contribute to the amount of suspended sediment in the Yuba River. Actions likely to temporarily impact turbidity include: creating side channel and backwater connections, grading for floodplain terraces, and placing native substrate in the backwater and ponds. In-stream construction would be performed in a manner that minimizes sediment discharge. Turbidity associated with Proposed Action construction activities would not exceed turbidity objectives in the Sacramento River Basin (CRWQCB 1998). Where feasible, a silt curtain or other turbidity control would be installed in the channel to capture floating material or sediment mobilized during construction activity to minimize water quality impacts. However, a channel-spanning silt curtain is not likely to be possible due to high flow velocities.

Dewatering would generally not be logistically feasible for in-channel work; however, if there are situations in which dewatering is possible, we would use water bladder dams, or river sediment to redirect water around our construction area.

To minimize construction related water quality impacts, the Proposed Action's proponents would obtain and implement a SWPPP prepared in accordance with NPDES. All access and staging areas would be treated with erosion control measures at the end of each construction season. Erosion control measures may include erosion control fabric, coir logs, hydroseeding, and hay or straw spreading. At the end of the Proposed Action, native riparian vegetation would be planted in select locations including locations disturbed by the restoration activities. The contractor would be required to follow all construction BMPs in the SWPPP to minimize water quality impacts. The Proposed Action must comply with the water quality and waste discharge requirements of the CVRWQCB, which would be outlined in the Section 401 Water Quality Certification for the Proposed Action. Complying with water quality standards and implementing **Mitigation Measure 9 - Monitor Water Quality and Prevent Impacts** would reduce water quality impacts to **less than significant**.

Oil and grease used in equipment would be vegetable based, or another material that does not affect beneficial uses. All equipment working within the stream corridor would be inspected daily for fuel, lubrication, and coolant leaks and for leak potentials. All equipment would be free of fuel, lubrication, and coolant leaks before working. A Spill Prevention and Response Plan would be prepared for the Proposed Action and spill prevention kits would be kept close to construction areas and workers would be trained in their use. With implementation of these measures and **Mitigation Measure 9 – Monitor Water Quality and Prevent Impacts,** this impact would be **less than significant.**

The Proposed Action does not violate regional water quality objectives for inland surface waters. The Proposed Action would have little effect on bacteria levels, and no biostimulatory substances would be used. The Proposed Action does not deplete groundwater supplies or interfere with groundwater recharge. No net deficit in aquifer volume or a lowering of the local groundwater table level (i.e., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted) would occur because of the Proposed Action. Proposed Action activities would likely improve groundwater recharge as floodplain function is improved. The Proposed Action would not pump any groundwater or cause any groundwater to be pumped. Therefore, the Proposed Action would have **no impact** with respect to groundwater resources.

The Proposed Action would not substantially alter the existing drainage pattern. The drainage pattern would be altered slightly by creating seasonal side channels, perennial side channels, backwaters, and enhancing floodplain areas. In general, the Proposed Action restoration activities would increase the wetted channel surface area within the site at all flows above baseflow (700 cfs) which would increase juvenile salmonid rearing habitat. Implementation of the Proposed Action would decrease the elevation of the floodplain within the site by as much as 12 feet. The hydraulic result of this excavation is a decrease in flood stage across all flow events in excess of 1,000 cfs. As a result, the water surface elevation in all flood events, including the 100-year event, will be lower than that produced at the same discharge prior to the proposed restoration actions. The Proposed Action would not substantially alter the existing drainage pattern or increase the flood risk therefore the impact is **less than significant**.

The Proposed Action would not modify or construct any facility or features that could expose people or structures to loss, injury, or death as a result of flooding. There are no buildings or structures within the Action Area or within the FEMA 100-year floodplain according to the most recent map [FEMA FIRM #06115C0375D, effective on 02/18/2011]. The Proposed Action will decrease the elevation of the floodplain within the Action Area by as much as 12 ft. The hydraulic result of this excavation is a decrease in flood stage across all flow events in excess of 1,000 cfs. As a result, the water surface elevation in all flood events, including the 100-year event, will be lower than that produced at the same discharge prior to the Proposed Action. Thus, there is a decrease in flood risk to the structures adjacent to the Action Area and outside the current FEMA 100-year flood extent. Therefore, the Proposed Action would have **no impact**.

4.12 LAND USE AND PLANNING

Will the project:	**Potentially Significant Impact**	**Less than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
Physically divide an established community?	0	0	0	X
Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	0	0	0	X

4.12.1 DISCUSSION

4.12.1.1 No Action Alternative

Land use and planning would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.12.1.2 Proposed Action

The Proposed Action does not physically divide an established community. The Proposed Action does not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Proposed Action (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect. The Proposed Action would not have an adverse impact on land use and planning.

4.13 MINERAL RESOURCES

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation	Less Than Significant Impact	No Impact
Result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state?	0	0	0	X
Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	0	0	0	X

4.13.1 DISCUSSION

4.13.1.1 No Action Alternative

Mineral resources would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.13.1.2 Proposed Action

The Proposed Action does not result in the loss of availability of a known mineral resource classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state. The Proposed Action does not result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan. The aggregate companies that lease or own the land would obtain aggregate through implementation of the Proposed Action that it would then process and sale. The Proposed Action would not have an adverse impact on mineral resources for the reasons stated above.

4.14 NOISE

Would the project result in:	Potentially Significant Impact	Less than Significant with Mitigation	Less Than Significant Impact	No Impact
Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	0	0	X	0
Generation of excessive ground-borne vibration or ground-borne noise levels?	0	0	X	0
For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	0	0	0	X

The Proposed Action would support a temporary increase in noise levels, as material is removed from the training wall and floodplains and then processed at the processing plant adjacent to the site. Material would also be transported within the site to fill in specific areas within the site. These noise levels would be higher than the current ambient noise levels in the area, but would be temporary in nature and not excessive. The maximum noise levels allowed by industrial activity in the Yuba County General Plan are 75 decibels. This Proposed Action may create noise at or near this level for brief periods during site construction (6 months over a period of 1 to 2 years). A limited number of individuals would be impacted by the change in noise, as the area is mostly rural and there are limited numbers of individuals and businesses in the immediate Action Area. The Proposed Action would not create a noise impact greater than the existing aggregate plant which is adjacent to the Action Area. There is not a public airport within two miles of the Action Area. The Proposed Action would have no impact on air traffic or airport activity. The Proposed Action would have a limited and temporary impact on noise levels in the immediate area, with the closest home over 900 ft away from the nearest location where Proposed Action activity would occur so there would not be a significant impact to surrounding people and businesses for the reasons stated above. The Proposed Action would implement mitigation measures to ensure any changes in noise level do not have a significant impact (see Section 5.0).

The Proposed Action Area is rural and is adjacent to a currently operating aggregate plant. The Action Area abuts the SRI Stringer Pit aggregate plant on its north eastern edge. The SRI Stringer

Pit currently generates industrial noise. The Proposed Action Area is designated as Agriculture/Rural Residential in the Yuba County General Plan (Yuba County 2011).

4.14.1 DISCUSSION

4.14.1.1 No Action Alternative

Existing noise levels from the operation of the aggregate plant would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.14.1.2 Proposed Action

The Proposed Action would operate construction equipment (e.g., excavators, bulldozers, back-hoes, rubber-tired front-end loaders, end-dump haulers, etc.) in the Action Area as part of the restoration activities. The construction equipment would generate noise during their operation. The types of construction equipment used for the Proposed Action would typically generate noise levels ~75 decibels above the reference noise at a distance of 50 ft (15.2 m). Construction equipment would be properly equipped and maintained to reduce noise levels. The Proposed Action would not expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance (75 decibels maximum for Heavy Manufacturing; Yuba County General Plan, Yuba County 1996), or applicable standards of other agencies. Vibration would increase during operation of construction equipment for restoration activities but no construction equipment would be used that is known to cause excessive vibration levels (impact and vibratory pile drivers, vibratory rollers, large bulldozers, hydraulic breakers, and jackhammers). All changes in noise and vibration levels would occur in a mostly rural and relatively unpopulated area. The majority of restoration activities would occur on the large gravel bar away from water’s edge resulting in less noise (due to distance buffering) reaching the public fishing alongside or in the LYR. The impact is still considered potentially significant because there would be increases in noise levels at the Action Area. However, there is limited housing within 1 mi (1.6 km) of the Action Area and there is minimal recreational (fishing) use during much of the construction season. The impact would be mitigated to a **less than significant** level with implementation of **Mitigation Measure 16 - Reduce Impacts from Noise.**

The Proposed Action would not support a substantial permanent increase in ambient noise levels in the Proposed Action vicinity above levels existing without the Proposed Action, because construction activities associated with the Proposed Action would only occur during a limited period of time in one (or possibly two years). During construction there would be temporary increases in ambient noise levels but this increase in ambient noise level would not exceed Yuba County noise standards and would be consistent with construction projects. The increase in ambient noise would be temporary and would only occur during the limited construction season (16 April to 31 October) for one year (possibly two). There is limited housing within 1 mi (1.6 km) of the Action Area, minimal recreational use for much of the construction window, and the noise during restoration activities would be similar to the noise that is already produced by the SRI Stringer Pit. Any increases above the ambient noise level would be addressed by **Mitigation Measure 16 - Reduce Impacts from Noise.** Therefore, this impact would be **less than significant**.

The Action Area is not located within an airport land use plan, within two miles of a public airport, or within the vicinity of a private airstrip. The nearest public airport is in Marysville which is approximately 13 miles southwest of the Action Area. Beale air force base is approximately 5 miles southwest of the Action Area. The nearest private airstrip appears to be outside Loma Rica, approximately 5 miles north of the Action Area. The Proposed Action consists of restoration activities for native fishes and riparian vegetation and would not change the land use thereby exposing people residing or working in the Action Area to excessive noise levels. Therefore, there is **no impact**.

4.15 POPULATION AND HOUSING

Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigated	Less Than Significant Impact	No Impact
Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	0	0	0	X
Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	0	0	0	X

4.15.1 DISCUSSION

4.15.1.1 No Action Alternative

Populations and housing would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.15.1.2 Proposed Action

The Proposed Action would not create housing or attract a new development; therefore, the Proposed Action does not have a direct or indirect effect on substantial population growth. Implementation of the Proposed Action in the LYR does not displace housing or residents or cause the construction of replacement housing in another location.

4.16 PUBLIC SERVICES

Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	**Potentially Significant Impact**	**Less than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
a) Fire protection?	0	0	0	X
b) Police protection?	0	0	0	X
c) Schools?	0	0	0	X
d) Parks?	0	0	0	X
e) Other public facilities?	0	0	0	X

4.16.1 DISCUSSION

4.16.1.1 No Action Alternative

Public services would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.16.1.2 Proposed Action

The Proposed Action has no impact on fire protection for the area. The Proposed Action has no impact on police protection for the area. The Proposed Action has no impact on schools in the area. The Proposed Action would increase the recreational potential in the area by improving visual access to a less confined river channel and rehabilitated riparian and salmonid rearing habitat within the site. The Proposed Action has no impact on any other public facilities. The Proposed Action has no impact on public services, other than the improvement of the river environment.

4.17 RECREATION

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	0	0	0	X
Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	0	0	0	X

The Action Area is on private land owned by Long Bar Mine LLC and Western Aggregates. Currently, public access to the area proposed for restoration is only available through boats floating downstream from a public put-in (Parks Bar just downstream of Highway 20 bridge) or through wading across the river from public access west of the Action Area, Hammon Grove Park, and south of the Action Area via rough gravel roads. Wading across the river to the gravel bar within the Action Area is only possible at low flows, ~2,000 cfs and lower. The primary public use of the site is *O. mykiss* fishing by boat or on foot, with practitioners remaining in or adjacent to the LYR below the OHWM. There are no developed regional or city parks or other recreational facilities within or directly adjacent to the Action Area.

4.17.1 **DISCUSSION**

4.17.1.1 No Action Alternative

The recreational opportunities and public safety concerns would not be affected under the No-Action Alternative.

4.17.1.2 Proposed Action

The Proposed Action would enhance salmonid populations, improving recreational fishing opportunities on the mainstem Yuba River. Restoration actions would occur exclusively on private land however, the public are able to access the site via boat or wading (at low flows) and are legally allowed to walk on the banks below the OHWM. The primary public use of the site is for *O. mykiss* fishing. The most intensive angler public use is during the fall and winter when other California rivers/creeks are closed by regulation but the LYR provides quality *O. mykiss* fishing. Particularly popular fishing times are during the fall (October – November) when Chinook Salmon are spawning and *O. mykiss* are consuming their eggs (Smith 2020) and the Skwala stonefly

(*Skwala curvata*) hatch which occurs from January through March (Baiocchi 2020). Therefore, the time of highest public use does not overlap with the in-water work window (15 July to 30 September) when potential Proposed Action implementation disturbance to fishing and public use would be the greatest. During in-water work in the LYR main channel, signs will be posted upstream and downstream of the work zone to warn river users of the potential hazards created by heavy equipment and how to avoid the work zone (**Mitigation Measure 18 – Public Safety**). Construction personnel will be trained to monitor for the presence of members of the public, particularly during in-stream construction work. Additionally, a biological and water quality monitor will be on-site during in-water work and will inform any public users to avoid the in-water work zone. In-water work in the LYR main channel would only occur for creation of side channel inlets and exits and for the floodplain terraces. The in-water work for these activities would take a total of approximately seven days therefore there will be a minimal impact from turbidity to anglers on the LYR. **Mitigation Measure 9 - Monitor Water Quality and Prevent Impacts** also limits on turbidity increases compared to the background level. Any turbidity plume is expected to settle out within 1,000 feet, resulting in spatially limited turbidity impacts to fishing. With implementation of **Mitigation Measures 9 - Monitor Water Quality and Prevent Impacts** and **Mitigation Measure 18 – Public Safety,** impacts on recreation and public safety would be reduced to **less than significant**.

4.18 TRANSPORTATION

Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:	**Potentially Significant Impact**	**Less than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	0	0	0	X
Conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?	0	0	0	X
Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	0	0	0	X
Result in inadequate emergency access?	0	0	0	X

4.18.1 DISCUSSION

4.18.1.1 No Action Alternative

Transportation would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.18.1.2 Proposed Action

The Proposed Action is not expected to cause a substantial increase in traffic in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections), because no transport would occur outside of the Action Area. Construction of the Proposed Action would only require the use of a few pieces of heavy equipment at a time, all remaining onsite. The Proposed Action would not affect air traffic patterns because there are no airports or airstrips located within two miles of the Action Area. The Proposed Action would have no impact on intersections or cause interruption with other uses (e.g., farm equipment). The Proposed Action is not anticipated to create any roadway safety hazards. The Proposed Action would not result in inadequate emergency access. The Proposed Action would not impact parking capacity. The Proposed Action has no impact on policies supporting alternative transportation (e.g., bus turnouts, bicycle racks). The equipment used for the Proposed Action would be equipment that is already used at the aggregate processing plant immediately adjacent to the Action Area. A temporary, slight increase in traffic is expected during construction as additional workers and some equipment will be transported to and from the plant. However, impacts related to transportation are expected to be **less than significant.**

4.19 TRIBAL CULTURAL RESOURCES

Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code § 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:	0	0	0	X
Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	0	0	0	X
A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code § 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code § 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	0	0	0	X

As part of the preparation for the Proposed Action, a cultural resource study was conducted by Horizon Water and Environment (2020). Compliance with Section 106 of the NHPA of 1966 (16 United State Code [USC] § 470f [2008]) is required, whereby any federal undertaking must "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." The implementing regulations for Section 106 are found under 36 CFR § 800, as amended (2001). Cultural resources may also be considered separately under the National Environmental Protection Act (42 USC) Section 4321-4327, whereby federal agencies are required to consider potential environmental impacts and appropriate mitigation measures for projects with federal involvement. Also, impacts to cultural resources are considered if the resource is "significant" or "important" or "unique archaeological resource" under the provisions of CEQA Sections 15064.5 and 15126.4.

Based on the list provided by the Native American Heritage Council, Yuba County initiated consultation with nine interested tribes and individuals (Auburn Rancheria, Colfax-Todds, Enterprise Rancheria, Mooretown Rancheria, Strawberry Valley Rancheria, Tsi Akim Maidu) in spring 2020 in accordance with Public Resources Code Section 21080.3.1 subd. (b), otherwise known as Assembly Bill 52 (AB 52). The Auburn Rancheria indicated that they did not need to conduct a field review but shared a document with language for mitigation of inadvertent discoveries. The Mooretown Rancheria Tribal Historic Preservation Officer responded that they were not aware of any resources in the area, but they would like to be notified if any cultural or human remains were discovered during Proposed Action implementation. No other responses were received.

4.19.1 DISCUSSION

4.19.1.1 No Action Alternative

Tribal cultural resources would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.19.1.2 Proposed Action

No cultural resources considered to be historic properties or historical resources were recorded in the Action Area as a result of the records search and field survey. However, the Proposed Action construction activities would include grading and excavation of areas, primarily dredge tailings, covered by cobble and gravel. Subsurface cultural objects could be unearthed during the grading and excavation activities which is a potentially significant impact. If any objects with potential cultural significance are unearthed during the construction process, work would be halted within the vicinity of the inadvertent discovery until a qualified archeologist (and Native American representative if the find is potentially pre-historic) can assess the significance of the new find (**Mitigation Measure 17 - Inadvertent Discoveries of Objects of Cultural Significance**) and prescribe measures to reduce potential impacts to be **less than significant**. The final disposition of archaeological, historical, and paleontological resources recovered on State lands under the jurisdiction of the State Lands Commission must be approved by the Commission.

No known unique paleontological resources, sites, ore unique geological features are present within the Action Area. Therefore, **no impact** is expected.

No potential burial grounds were determined to be present in the Action Area during the records search and field survey. Construction activities for the Proposed Action would include excavation and grading which have the potential to unearth subsurface human remains which is a potentially significant impact. If human remains are unearthed during the construction process, the Proposed Action team would comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98. In addition, **Mitigation Measure 17 - Inadvertent Discoveries of Objects of Cultural Significance** would be implemented and the USFWS Regional archeologist notified immediately. With implementation of this measure**,** potential impacts to cultural resources would be **less than significant**.

4.20 UTILITIES AND SERVICE SYSTEMS

Would the project:	Potentially Significant Impact	Less than Significant with Mitigation	Less Than Significant Impact	No Impact
Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	0	0	0	X
Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?	0	0	0	X
Result in a determination by the waste water treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	0	0	0	X
Generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	0	0	0	X
Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	0	0	0	X

4.20.1 DISCUSSION

4.20.1.1 No Action Alternative

Utilities and service systems would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.20.1.2 Proposed Action

The Proposed Action would comply with Section 401 of the CWA and obtain certification from the Regional Water Quality Control Board. Water quality would be maintained within the Action Area and downstream. The impact is considered **less than significant**. The Proposed Action does not require a water supply beyond a small amount required to water roads, a BMP to protect air quality during construction. It does not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects. The Proposed Action does not require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects. The Proposed Action does not require increased wastewater treatment capacity or a landfill. The Proposed Action has **no impact** on utilities and service systems.

4.21 WILDFIRE

If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:	**Potentially Significant Impact**	**Potentially Significant Unless Mitigated**	**Less Than Significant Impact**	**No Impact**
Substantially impair an adopted emergency response plan or emergency evacuation plan?	0	0	0	X
Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	0	0	X	0
Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	0	0	0	X
Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	0	0	0	X

4.21.1 DISCUSSION

4.21.1.1 No Action Alternative

Wildfire risk would not be affected under the No-Action alternative. Therefore, there would be no impact.

4.21.1.2 Proposed Action

The Action Area is in a rural area and there are no adopted emergency response or emergency evacuation plans. There would be **no impact.**

The Proposed Action construction would create a wildfire ignition risk. However, the majority of the Action Area is comprised of cobbles and contains minimal dead or dry vegetation, resulting in a low wildfire risk due to lack of fuel. The majority of vegetation within the Action Area is riparian vegetation which are relatively moist areas with green vegetation resulting in a low ignition risk. If riparian areas do ignite, the wildlife usually spreads slowly as an underburn due to the relatively moist, green vegetation. The Action Area is designated as a moderate fire hazard severity zone (CalFire 2007). Fire extinguishers would be present onsite in vehicles to quickly put out any vegetation that ignites as a result of a spark from heavy equipment. Any tall, dried grass present on the staging areas or temporary access roads would be cleared prior to being used by vehicles or heavy equipment. In the long-term the Proposed Action would not alter the existing fire hazard conditions. The Proposed Action would result in additional areas of riparian vegetation which have low fire hazard risk. These additional areas of riparian vegetation would not change the overall wildfire risk. Therefore, the impact of the Proposed Action on wildfire risk is **less than significant**.

The Proposed Action would not require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment. There would be **no impact.**

4.22 MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	0	0	0	X
Does the project have impacts that are individually limited, but cumulatively considerable? (“Cumulatively considerable” means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	0	0	0	X
Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	0	0	0	X

4.22.1 DISCUSSION

The Proposed Action does not have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory. In contrast, the Proposed Action is designed to enhance fish and wildlife species by recovering a functional river landscape. Mitigation measures have been included to reduce all potential Proposed Action impacts to less than significant. The Proposed Action would result in short-term impacts from construction related activities. The cumulative impacts from the Proposed Action are less than significant. The impacts of the Proposed Action would improve the environmental conditions in the area by recovering functioning floodplain habitat.

4.23 CONCLUSION

There is a potentially significant impact from Proposed Action implementation on air quality, biological resources, and noise. Therefore, the Proposed Action includes measures to mitigate these potential impacts. These mitigation measures are outlined in the following section (Section 5.0). These measures would be followed throughout Proposed Action implementation and would reduce any potential impacts to **less than significant**.

5 MITIGATION MEASURES

The Proposed Action would implement appropriate mitigation measures to reduce the impacts to the surrounding environment to less than significant levels. The Proposed Action would use accepted Best Management Practices associated with using large construction equipment in sensitive environments (see above) and flagging and/or fencing of sensitive plant species to prevent harm. The mitigation measures are summarized below.

Mitigation Measure 1. **Reduce Dust Impacts**.

The following dust reduction measures will be implemented during movement of materials from the construction area to the processing plant to reduce construction-related emissions:

- wet materials to limit visible dust emissions using water;
- provide at least 6 in (15.2 cm) of freeboard space from the top of the container; or,
- cover the container.
- Implement the following dust reduction measure during cobble placement to reduce construction-related emissions:
- limit or promptly remove any of mud or dirt on construction equipment and vehicles at the end of each workday, or once every 24 hours.

Water trucks would be used to wet down construction access roads, staging areas, and restoration activity zones to minimize dust production.

Mitigation Measure 2. **Protect Elderberry Plants and Special Status Plants with Buffer.**

Before beginning construction activities, a pre-project special status plant survey will be conducted of the Action Area. If elderberry shrubs (or other special status plants) are identified in subsequent surveys they will be avoided. Complete avoidance of elderberry plants may be assumed when there is at least a 100-ft (30.5 m) buffer around the plant. However, 20 ft buffers will be established and maintained for all elderberry plants with stems measuring 1 in or greater in diameter at ground level which will be retained in situ (1 plant; Figure 5). All buffer zones will be flagged and fenced and Proposed Action activities will be adjusted to ensure no activities occur in the buffer area, thereby minimizing any negative effects on VELB. No insecticides, herbicides, fertilizers, or other chemicals that might harm VELB or its host plant will be used for the Proposed Action (USFWS 1999).

***Mitigation Measure 3*.** **Transplant Unavoidable Elderberry Plants to Suitable Locations.**

Elderberries that were transplanted pre-project, following consultation with U.S. Fish and Wildlife Service, will be monitored in years 1, 2, and 3 and 10 with a target minimum survival rate of at least 60%. If necessary, replacement plants will be added to the restoration area to maintain survival above 60%.

Mitigation Measure 4. **Protect and Compensate for Native Trees.**

Native trees, such as Fremont cottonwood, willows, and Alder with a Diameter-at-Breast-Height (DBH) of 6 in (15.2 cm) or greater will be protected with 30-ft (9.1-m), 10-ft (3-m), and 10-ft (3-m) buffers, respectively. Native trees will be marked with flagging if close to the work area to prevent disturbance. To compensate for the removal of riparian shrubs and trees during Proposed Action implementation, measures to be taken to ensure a minimum performance criteria of 60% survival of any trees planted for mitigation for a period of three consecutive years (Appendix A). Irrigation will not be used, but the return of inundation to the floodplain is expected to promote growth of native riparian species. The tree plantings will be based on native tree species compensated for in the following manner:

- Oaks having a DBH of 3 – 5 in (7.6 – 12.7 cm) will be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a DBH of greater than 5 in will be replaced in-kind at a ratio of 5:1.
- Riparian trees (i.e., willow, cottonwood, sycamore, alder, ash, etc.) and shrubs with DBH of 6 inch to 23 inch will be replaced in-kind and on site, at a ratio of 3:1, and planted in the nearest suitable location to the area where they were removed. Riparian trees with DBH of 24 inches or greater will be replaced in-kind and on site, at a ratio of 10:1.

Mitigation Measure 5. **Monitor for Wildlife to Prevent Impacts.**

Pre-construction surveys by qualified biologists will be conducted no more than 10 days prior to the start of construction.

Pre-construction surveys will be conducted by qualified wildlife biologists, who will determine the use of the Action Area by American badgers; surveys will focus on identification of potential badger dens within, and a minimum 250 ft (76.2 m) buffer, around the Action Area. If badger dens are located within the construction or buffer area, prior to initiation of construction CDFW will be consulted for further instructions on methods to avoid direct impacts to this species.

Protocol-level surveys will also be implemented for other state and federally-listed species such as Foothill Yellow-legged Frog, Swainson’s Hawk, White-tailed Kite, Bald Eagle, Chinook Salmon, CCV steelhead, and Western Pond Turtle, which may be impacted by restoration activities (Swainson’s Hawk Technical Advisory Committee 2000). This includes pre-construction surveys conducted no more than 15 days before Proposed Action construction activities by qualified wildlife and fisheries biologists. Surveys for active nests will be performed using qualified biologists no more than 10 days prior to the start of disturbance activities. A minimum no-disturbance buffer of 250 ft around active nests of non-listed bird species; a 500-ft no-disturbance buffer around migratory bird species; and a half mile buffer for nest of listed species and fully protected species (including White-tailed Kite and Bald Eagle) will be established until breeding season is over or young have fledged. If such a buffer cannot be accomplished, CDFW will be consulted. If Foothill Yellow Legged Frog or Western Pond Turtle are present in Action Areas that will be disturbed then CDFW will be consulted for further instructions on methods to avoid direct impacts to these species.

Mitigation Measure 6. **Monitor for Bats to Prevent Impacts.**

For bat species, before any ground disturbing activities, a qualified biologist will survey for the presence of associated habitat types for the bat species of concern. If bats are present, suitable avoidance and conservation measures will be implemented, including a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged

Mitigation Measure 7**. Use Special Transportation Routes and Work Areas.**

Special transportation routes and work areas will be designated to avoid damaging trees and shrubs in riparian habitats, especially those sensitive species described above. Potential impacts to the riparian vegetation could occur during heavy equipment operation. These impacts will be minimized to the greatest extent practicable by selecting travel routes that avoid or minimize damage. Heritage size trees (i.e., greater than 24 in [40.6 cm] in diameter) near the work area will be identified, flagged and fenced prior to construction to prevent unintended damage. If damage cannot be avoided, these trees will be replaced at a ratio prescribed in **Mitigation Measure 4 - Protect and Compensate for Native Trees.**

Mitigation Measure 8. **Work Outside of Critical Periods for Sensitive Species.**

To avoid impacts to individuals or populations of special status species, all Proposed Action in-water activities will be conducted during the period 15 July through 30 September, which is outside the listed critical periods for the majority of the species. Surveys will be performed for species which have critical periods overlapping with the in-water work window or dry-ground work window (16 April to 31 October) which may be impacted by the Proposed Action activities. If special status or sensitive species are identified within the area which may be impacted by Proposed Action activities, then buffers will be established and/or CDFW and USFWS will be consulted. Nesting birds and raptors are protected under the MBTA and California Fish and Game Code, and trees and shrubs within the Action Area likely provide nesting habitat for songbirds and raptors. If tree removal is unavoidable, it will occur during the non-breeding season (mid-September). If other construction activities must occur during the potential breeding season (1 February- 31 August) surveys for active nests and/or roosts will be conducted by a qualified biologist no more than 10 days prior to the start of construction. A minimum no disturbance buffer will be delineated around active nests (note, size of buffer depends on species encountered) until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.

Mitigation Measure 9. **Monitor Water Quality and Prevent Impacts.**

During in-water work, turbidity will be monitored with intermittent grab samples from the river, and construction curtailed if turbidity exceeds criteria established by the Regional Water Quality Control Board in its CWA §401 Water Quality Certification. Only clean native sediment from within the Action Area will be used to create riffles and perform other topographic modification. As appropriate, silt curtains will be used along the river corridor to capture floating materials or sediments mobilized during construction activities and prevent water quality impacts. Stream bank impacts will be isolated and minimized to reduce bank sloughing. Banks will be stabilized with revegetation following Proposed Action activities, as appropriate.

A Spill Prevention and Response Plan will also be developed as part of the Long Bar Best Management Practices Plan (BMP Plan), as well as a SWPPP. All pertinent staff will be trained on and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them will be made available at the site and staff will be trained in its use. Spill prevention kits will be in close proximity to construction areas, and workers will be trained in their proper use.

Mitigation Measure 10. **Monitor Mercury Levels and Mitigate for Impacts.**

Sediment and aqueous total mercury levels will be measured before, during, and after restoration activities in the Action Area. Following methods in the Stillwater Sciences (2004) Mercury Assessment, total mercury from areas of Proposed Action exposed fine sediments (<63 µm) will be evaluated to determine if they are considered elevated by the CVRWQCB (0.10 mg/kg or greater). Aqueous raw total mercury will also be tested to ensure that it is below the California Toxics Rule for a drinking water source of 50 ng/L. It is unlikely that excavation and regrading activities may uncover mercury hot spots and or mobilize mercury in the aquatic food web; however, if samples are found with mercury levels above established standards, work will be halted in the vicinity of the elevated mercury area to assess contamination potential. If, sediment total mercury levels meet the elevated criteria then the mitigation action(s) defined in the Proposed Action 401 water quality certification will be implemented.

Mitigation Measure 11. **Use Clean Equipment and Biodegradable Lubricants.**

All equipment will be clean and those performing in-water work will use biodegradable lubricants and hydraulic fluids. All equipment will be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs). Vehicles are to be fueled and lubricated in a designated staging area located outside the stream channel and banks.

Front-end loaders will be wheeled (rubber tire) to minimize impacts. Construction specifications will require that any equipment used in or near the river is properly cleaned to prevent any hazardous materials from entering the river, and containment material will be on site in case of an accident. Contracted personnel will regularly monitor contractors to ensure environmental compliance. Spill prevention kits will be located close to construction areas, with workers trained in their use.

***Mitigation Measure 12.* Prevent Spread of Aquatic Invasive Species**

To minimize the chance that aquatic invasive plants and invertebrates will be transported and spread to other sections of the Yuba River or other water bodies on equipment, construction specifications will require that equipment be steam cleaned immediately after the work is completed and before being used in other water bodies. An Invasive Species Risk Assessment and Planning (ISRAP) protocol will be developed, and all appropriate staff will be trained as to its purpose and implementation before construction begins. The plan will be used to prevent the spread of invasive species during construction. Additional measures may be taken at the recommendation of CDFW.

***Mitigation Measure 13.* Construction Approach to Minimize Impacts to Fish.**

The construction approach will allow fish to move progressively downstream and away from the impact area as construction moves from upstream to downstream through the backwater channel. The majority of the in-water work will involve the filling in and creation of a side channel through the ponds and backwater.

Before in-water work starts in a section of the channel a qualified fisheries biologist will survey the area and determine whether there is a suitable egress route for fish to move downstream and away from the construction area. If a suitable downstream egress route is not present, most likely because an area is deemed too shallow, then the problem area will be altered such that it becomes suitable. An excavator would likely be used to deepen the problem area and would work from downstream to upstream to discourage fish from migrating downstream until the egress route is completed. Once suitable downstream egress has been established, in-stream construction will begin at the most upstream section of the channel and work progressively downstream and across the channel. The listed fish species most likely to be present are juvenile CCV Steelhead from 7 to 30 cm (3 – 12 in) fork length and possibly juvenile CV spring-run Chinook Salmon that are demonstrating the yearling life history strategy from 7 to 12 cm (3 – 5 in) fork length. Juvenile CCV steelhead and Chinook Salmon are highly mobile and would be expected to easily move downstream and away from the impact area with a suitable egress route. Juvenile CCV steelhead and Chinook Salmon are not likely to be present in the ponds or the majority of the backwater, since they are not juvenile salmonid habitat. During pre-project surveys juvenile Chinook Salmon were only observed in the observed in the backwater in winter and spring when flows were sufficient to allow access (CFS unpublished data). Juvenile *O. mykiss* were never observed in the backwater (CFS unpublished data). Once work proceeds past an area, fish will be able to return to use the newly created habitat through upstream migration.

If a qualified fisheries biologist, with input from the contractor, determines that in-stream work in an area cannot be performed using the construction approach then fish relocation will be performed to avoid fish injury and mortality and minimize disturbance.

***Mitigation Measure 14*. Fish Relocation to Minimize Impact to Fish from Construction Activities.**

If fish relocation needs to be performed, a qualified fisheries biologist will determine which fish relocation method is most appropriate for the area. Fish relocation will most likely initially be attempted by trying to herd the fish out of the work area as this would minimize impacts to fish as they would not be handled and transported. The following guidelines will apply to fish relocation through herding.

- Before fish relocation through herding begins, a qualified fisheries biologist will identify the most appropriate method and approach. Prior to beginning the fisheries biologist will ensure that the location to which fish are herded contains suitable habitat.
- The fish relocation through herding will be conducted under the supervision of a qualified fisheries biologist. The method that will most likely be used will be to install an exclusion screen or block-net above the upstream most work area. An appropriately sized seine that covers the width of the channel, operated by qualified personnel, will be pulled in the downstream direction until it is below the bottom of the work area. The net will then be fastened in place, blocking the entire channel until a temporary block net can be installed. The temporary block-net will be installed immediately upstream of the seine net such that fish have been herded downstream and cannot return upstream. A minimum of three seine hauls will be performed. For each haul, when the seine approaches the block-net, the block-net will be removed until the seine has passed downstream of its location and will then be re-installed immediately upstream of the seine. After the final pass, as determined by the fisheries biologist, the block-net will be left in place or replaced with an exclusion screen to prevent fish from moving upstream.
- After the area has been adequately seined, based on the judgement of a qualified fish biologist, the area will once again be surveyed for fish. The fisheries biologist will determine the most appropriate method to survey the area for remaining fish.
- If the survey results in an estimate of greater than 95% of individuals that were present prior to relocation efforts being absent after relocation efforts and no listed species are observed, the fish relocation effort will be considered successful and construction activities can commence. If initial relocation efforts are deemed unsuccessful, the fisheries biologist

will determine whether further herding with a seine should be conducted until the success criteria is met or relocation using a capture method will be employed.

- If fish relocation using herding is not successful or the fisheries biologist decides it is not feasible, then fish capture and relocation will be used. The following guidelines will apply to fish capture and relocation.
- Before fish relocation begins, a qualified fisheries biologist will identify the most appropriate release location(s). Release locations will have water temperatures within 2°C of the capture location, offer suitable habitat for released fish, and will be selected to minimize the likelihood that fish will re-enter the work area or become impinged on the exclusion net or screen.
- The method used to capture fish will depend on the nature of the work site and will be selected by a qualified fisheries biologist who is experienced with fish capture and handling. Areas of complex habitat may require the use of electrofishing equipment, whereas in other areas fish may be captured through seining or dip netting. Electrofishing will only be performed by properly trained personnel following NMFS guidelines (2000). Electrofishing will only be performed if seining and/or dip netting is not feasible.
- Handling of salmonids will be minimized. When it is necessary, personnel will only handle fish with wet hands or nets.
- Fish will be held temporarily in cool, shaded water. Overcrowding in buckets will be avoided by using at least two buckets and no more than 25 fish will be kept in a five-gallon bucket. Aeration will be provided with a battery powered external bubbler. Fish will be protected from jostling and noise and will not be removed from the bucket until the time of release. The water temperature in each bucket will be monitored and partial water changes or the addition of ice will be conducted as necessary to maintain a stable water temperature (within 2°C of initial water temperature). Fish will not be held for more than 30 minutes. If water temperature reaches or exceeds NMFS limits, fish will be released, and relocation operations will cease.
- If fish are abundant, capture will cease periodically to allow release and minimize the time fish are held in containers.
- Fish will not be anesthetized or measured. However, they will be visually identified to species level, and year classes will be estimated and recorded.
- When feasible, initial fish relocation efforts will occur several days prior to the scheduled start of construction. The fisheries biologist will perform a final survey on the day before or the day of construction.
- Reports on fish relocation activities will be submitted to CDFW and NMFS within 6 months of the relocation effort.

- If mortality during relocation exceeds 2%, relocation will cease and CDFW and NMFS will be contacted as soon as possible.

***Mitigation Measure 15.* Exclusion of Fish from Construction Areas to Prevent Impacts.**

Fish exclusion screens or nets may be used in strategic locations at various times to prevent fish from being impacted by construction activities. Exclusion will prevent fish from accessing areas from which they were relocated.

***Mitigation Measure 16.* Reduce Impacts from Noise.**

To mitigate noise related impacts, the Proposed Action will require all contractors to comply with the following operational parameters:

- restrict construction activities to time periods under which the aggregate plant is allowed to operate;
- install and maintain sound-reducing equipment and muffled exhaust on all construction equipment.

***Mitigation Measure 17.* Inadvertent Discoveries of Objects of Cultural Significance.**

The following mitigation measure would be implemented as the Proposed Action would not have a Tribal or Archeological Monitor present during ground disturbing activities. Cultural items include darkened soil (midden), shell fragments, faunal bone fragments, fire affected rock and clay, isolated artifacts, bowl mortars, handstones and pestles, flaked stone, and human remains. Recommendations of the treatment of a Tribal Cultural Resource (TCR) will be documented in the project record. For any recommendations made by traditionally and culturally affiliated Native American Tribes that are not implemented, a justification for why the recommendation was not followed will be provided in the project record. If adverse impacts to a TCR, unique archeological, or other cultural resources occurs, then consultation with the United Auburn Indian Community of the Auburn Rancheria (UAIC) and other by traditionally and culturally affiliated Native American Tribes regarding mitigation contained in the Public Resources Code sections 21084.3(a) and (b) and CEQA guidelines section 15370 will occur.

- If potentially significant TCRs, cultural or archeological resources are discovered during ground disturbing construction activities, all work will cease within 100 feet of the find. UAIC’s Tribal Historic Preservation Department and Mooretown Rancheria Tribal Historic Preservation Officer will be immediately contacted to assess the significance of the find, according to Section 15064.5 of the CEQA Guidelines, and make recommendations for appropriate treatment.
- A qualified cultural resources specialist meeting the Secretary of the Interior’s Standards and Qualifications for Archeology, may also assess the significance of the find in join consultation

with Tribal Representatives from UAIC and Mooretown Rancheria to ensure that Tribal values are considered. Work will remain suspended or slowed within 100 feet of the find until the resource is evaluated, which will occur within one day, but no more than two days, of the find.

- The Proposed Action applicant will coordinate with UAIC's Tribal Historic Preservation Department and Mooretown Rancheria Tribal Historic Preservation Officer all necessary investigations and treatment of the discovery under the requirements of CEQA, including AB 52. Preservation in place would be the preferred alternative under CEQA and Tribal protocols, and every effort will be made to preserve the resources in place, including through project redesign.
- The contractor will implement any measures deemed by Yuba County to be necessary and feasible to preserve in place, avoid, or minimize impacts to the resource, including, but not limited to, the use of a paid Tribal Monitor, and facilitating the appropriate Tribal treatment of the find, as necessary.

The final disposition of archaeological, historical, and paleontological resources recovered on State lands under the jurisdiction of the State Lands Commission must be approved by the Commission.

***Mitigation Measure 18*. Public Safety**

During construction, signs will be posted upstream and downstream of the work zone to warn river users of the potential hazards created by heavy equipment and how to safely avoid the work zone. The importance of monitoring for the presence of rafters and boaters will be part of the initial construction crew safety training and this will be reiterated during weekly BMP meetings.

6 CUMULATIVE IMPACTS

There would be temporary and minor adverse effects that would occur within the construction area; however, the overall improvement to the environment would outweigh these effects. The Proposed Action would not contribute to the accumulation of impacts in the watershed. However, cumulative actions to improve stream habitats in the watershed are expected to provide long-term benefits to associated vegetation, wildlife, and fish. Because vegetation communities and wildlife habitats within the Yuba River watershed have been substantially modified to suit human land uses and would likely continue to be modified as human populations increase, cumulative benefits from proposed actions over time may be partially offset with new adverse impacts in the watershed.

Other related activities aimed at salmonid production, enhancement, restoration, and mitigation are being planned and implemented for the Yuba River system and CV under directives of the CVPIA, USFWS AFRP, LYR Accord, FERC relicensing of the Yuba River Development Project, Corps' Yuba River Ecosystem Restoration and Voluntary Conservation Measures. These activities include gravel and large woody material additions, water acquisition, water year type-based flow schedules, improving fish passage, riparian habitat restoration, and other enhancement actions. The magnitude of cumulative effects under all current and proposed salmonid habitat improvement actions is undetermined at this time.

Together, this Proposed Action and the reasonably foreseeable projects and actions would improve environmental quality in the long term. Therefore, **no cumulatively considerable contributions to significant cumulative impacts to the environment are expected** if the Proposed Action is implemented.

6.1 RELATED ACTIVITIES

6.1.1 RESTORATION ACTIVITIES IN THE YUBA RIVER

The Proposed Action is one of several projects in the Yuba River aimed at restoring ecosystem processes within the watershed. These projects would enhance spawning and rearing areas within the Yuba River and eventually contribute to the increase in population abundance for imperiled salmonids.

6.1.2 U.S. ARMY CORPS OF ENGINEERS ACTIVITIES

The Corps has performed gravel augmentation and monitoring in the LYR immediately downstream of Englebright Dam since 2007 and plans to continue to do so until 2024 (Corps 2014). The Corps placed 15,500 tons of gravel and cobble into the Englebright Dam Reach between 2007 and 2013 (Corps 2014). The Corps plans to implement a Large Woody Material Management Plan that would place large woody material back into the LYR at selected sites until

2024 (Corps 2014). A pilot large woody material placement was completed at Lower Gilt Edge Bar in 2013 (Corps 2014). The Corps is currently performing a feasibility study for performing Yuba River Ecosystem Restoration (Corps 2014).

7 CONSULTATION AND COORDINATION

The USFWS is the lead federal agency under NEPA and Yuba County is the lead state agency under CEQA. SYRCL, cbec, and CFS are responsible for the development of the proposal, design, permitting, outreach, and implementation of the Proposed Action with the guidance of USFWS. The SYRCL,CFS, and cbec team prepared the EA/IS on behalf of the two lead agencies, which assessed the impacts of the Proposed Action as required by CEQA and NEPA. This environmental document was reviewed by the lead agencies prior to public release, by other appropriate regulatory agencies, and will be available for public review and comment.

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APPENDIX A. BASIS OF DESIGN REPORT

LONG BAR ENCHANCEMENT PROJECT
65% BASIS OF DESIGN REPORT

YUBA RIVER, CALIFORNIA

Prepared for
U.S. Fish & Wildlife Service
On behalf of
South Yuba River Citizen's League

Prepared by
cbec, inc.

February 2021

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GLOSSARY OF ACRONYMS

Acronym	Meaning
2-D	Two Dimensional
AFRP	Anadromous Fish Restoration Program
BOD	Basis of Design
CAD	AutoCAD Civil 3D Software
CFS	Cramer Fish Sciences
cfs	Cubic Feet per Second
DPD	Daguerre Point Dam
EFR	Ecosystem Function Relationships
EFM	Ecosystem Functions Model
HSI	Habitat Suitability Index
HEC	Hydrologic Engineering Center
LWM	Large Woody Material
LYR	Lower Yuba River
NMFS	National Marine Fisheries Service
RM	River Mile
RMT	Lower Yuba River Accord River Management Team
RTK GPS	Real Time Kinematic Global Positioning System
SfM	Structure from Motion
SMS	Surface-water Modeling System Software
SRH-2D	Sedimentation and River Hydraulics Two-Dimensional Model Software
SYRCL	South Yuba River Citizens League
UAV	Unmanned Aerial Vehicle
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WSE	Water Surface Elevation
WUA	Weighted Usable Area
YCWA	Yuba County Water Agency
YWA	Yuba Water Agency (formerly YCWA)
YRDP	Yuba River Development Project

1 INTRODUCTION

This Basis of Design (BOD) report is intended to support the broader objectives of the Long Bar Enhancement Project (Project) by providing background information and descriptions of each proposed design element within the overall restoration concept as envisioned and completed to the 65% level of design.

1.1 PROJECT LOCATION AND OVERVIEW

The Long Bar Enhancement Project (Project) is located on the north bank of the lower Yuba River (LYR) in Yuba County, approximately 9 river miles (RMs) downstream of Englebright Dam in the Parks Bar geomorphic reach (see Wyrick and Pasternack 2012) (Figure 1). The Project is situated at the eastern edge of the Yuba Goldfields on private lands owned by Long Bar Mine LLC. This area of the Yuba River has a history of massive aggradation of hydraulic mining sediment during the late 1800s and early 1900s followed by rapid channel incision (Adler 1980). This history was followed by dredging and mining activity within the river corridor (James et al. 2009). Silica Resources currently mines and sells fine aggregate from Long Bar Mine's lands and the Project site is included in the reclamation plan for the mine. The Project aims to work with Long Bar Mine LLC and Silica Resources, Inc. (SRI) to remove a portion of the legacy hydraulic mining substrate on Long Bar to increase the frequency and duration of floodplain inundation and habitat heterogeneity to promote riparian vegetation recruitment and salmonid rearing habitat. By removing sediment from the Project area according to a design plan to achieve these habitat enhancement goals, Silica Resources will fulfill their reclamation plan obligations for Long Bar Mine and will also be allowed to process and sell the removed material. Proposed project actions include grading 40.1 acres on the 56.7 acre gravel/cobble bar (Figure 1). The restoration design will include features that benefit seasonal and perennial habitat for juvenile salmonid rearing to support United States Fish and Wildlife (USFWS) Anadromous Fish Restoration Program (AFRP) doubling goals.

1.2 PROJECT OBJECTIVES

The Project will support the USFWS AFRP's doubling goal for fall-run and spring-run Chinook Salmon and steelhead by increasing seasonal and perennial salmonid rearing habitat (AFRP 2001). Specifically, the Project will restore[1] and enhance ecosystem processes with a primary goal of augmenting/rehabilitating productive salmonid rearing habitat to increase natural production of fall-run and spring-run Chinook Salmon and Central Valley steelhead in the LYR. To achieve this goal, the Project objectives are to:

[1] For this effort, the terms restore and restoration to describe the Project work are defined as: "assisting the establishment of improved hydrologic, geomorphic, and ecological processes in a degraded watershed system and replacing lost, damaged, or compromised elements of the natural system" (Wohl et al. 2005). Rehabilitation and enhancement are additional descriptors pertaining to reestablishment of processes and habitat features, respectively, which "restoration" is intended to encompass.

1. Incorporate the Project into an ecologically-sound, ecosystem context by designing the Project to function under current water management constraints (i.e., timing, frequency, magnitude and duration of elevated flows);
2. Reestablish main channel and off-channel connectivity and complexity to restore ecological processes at the Project site that increase availability and maintenance of off-channel rearing habitats;
3. Create habitat conditions suitable for salmonid rearing (i.e., fry and sub-yearling smolts) in late-winter and spring;
4. As possible, create habitat conditions suitable for summer rearing of spring-run Chinook Salmon and steelhead;
5. Create conditions suitable for natural riparian vegetation recruitment and survival [i.e., willows (*Salix* spp), Fremont cottonwood (*Populus fremontii*), alders (*Alnus* spp), etc.];
6. Do no harm to existing habitat features (e.g., main channel spawning and incubation habitat)

The Project will also test hypotheses regarding a variety of habitat enhancement techniques and assess subsequent utilization of restored off-channel habitats by juvenile salmonids and non-native predatory species. Hypotheses to be tested after Project implementation include (USFWS 2001; CFS 2020):

1. Will restored habitat support greater densities of juvenile salmonids compared to unrestored habitats?
2. When off channel habitat is fully restored, will more complex side channel and backwater habitats support greater densities of juvenile salmonids than floodplain habitat?
3. Which off channel habitats (side channels, backwater, floodplain) support greater densities of juvenile salmonids over the duration of the rearing season?
4. Will cover features (e.g. large wood, boulders) increase the probability of juvenile salmonid habitat occupancy?
5. Will area, depth, and volume of deposited sediments be greater downstream of constructed floodplain roughness features?
6. Will vegetation recruitment, growth, and survival be greater downstream of constructed floodplain roughness features?
7. Will restored habitats support greater drift macroinvertebrate density relative to unrestored habitats and pre-restoration conditions? Will densities differ between off channel habitats?
8. Will drift macroinvertebrate diversity correlate with off channel habitat diversity?
9. Will restored habitats support greater primary productivity relative to unrestored habitats and pre-pre-restoration conditions? Will primary productivity differ between restored off channel habitats?
10. Will temperatures within backwater habitats remain within an optimum range for juvenile salmonids for a greater portion of the year following restoration? Will increased solar radiation in the winter and increased subsurface flow contribute to more hospitable thermal conditions?
11. Will mercury levels within restored sites remain at or below pre-restoration levels following implementation?

Overall habitat complexity and suitable juvenile rearing habitat is currently thought to be limited in the LYR (NMFS 2009; CDWR 2015). Many areas within the LYR's historic corridor are now hydrologically disconnected from the main channel during more frequent flood flows (1.5 to 5-year recurrence interval) due to anthropogenic impacts including, but not limited to, the construction of training walls and deposition of mining tailings in the channel that reduce floodplain availability, and reduction in flood flows due to flow regulation (cbec et al. 2010). The Project aims to significantly increase habitat complexity and suitable rearing habitat acreage through the restoration of natural ecosystem processes associated with a well-connected, frequently inundated side channel and floodplain complex. This will be achieved by topographically modifying a uniform 62.4-acre gravel bar that inundates during infrequent high flows to develop a 42.8-acre complex of perennial and seasonal off-channel habitats that inundate at over a range of common, ecologically important flows. This off-channel habitat complex will increase the area containing both suitable depth and velocity for rearing juvenile salmonids at these common flows. The project will also include surface roughness features that promote fine sediment deposition and woody vegetation recruitment to provide juvenile salmonid cover and velocity refugia when inundated.

2 BACKGROUND

2.1 GEOMORPHOLOGY

2.1.1 YUBA GOLDFIELDS

The Project Area is located at the upstream end of an area known as the Yuba Goldfields, which is a large depositional region within LYR that was subsequently dredged and sorted for gold and aggregate mining. The Yuba Goldfields region developed as a result of significant morphological and ecological changes that occurred within the Yuba watershed over the past ~150 years, beginning with the discovery of gold in California in 1848. The most influential of these changes to current channel conditions are:

- ***vast influx of hydraulic mining sediment*** - It is estimated that from 1849 – 1909, the Yuba River received roughly 685 million cubic yards of sediment, more than the Upper Feather, Bear, and American rivers combined (Gilbert 1917). This influx caused such severe aggradation of the Yuba River that by 1868 the channel bed had risen 20 ft and was higher than the streets of Marysville (Ayres Associates 1997). Flooding in Marysville in 1875 prompted the prohibition of in-stream disposal of hydraulic mining sediments.

- ***shifting and confinement of the river's course*** - In the early 1900s, the California Debris Commission sanctioned the re-alignment of the LYR to the north of the historic alignment and the construction of large linear "training walls" consisting of steeply mounded tailings piles along both banks and, in some areas, in the center of the straightened river corridor. The training walls were piled to substantial heights above the 100-yr flood elevation and with dramatically varying top widths of up to 500 ft (AECOM 2015). The training walls were intended to laterally confine the river to allow for additional widespread dredging operations (gold mining) of the naturally occurring and hydraulic mining-derived sediments deposited in the valley.

- ***river regulation and coarse sediment control*** - In 1906, DPD was constructed as a partial sediment barrier and base-level control point. Subsequently, Englebright Dam was raised in 1941 to control mining debris and New Bullards Bar Dam was constructed in 1971 for water supply and power generation (Pasternack 2009a). As a result, the influx of sediment and frequency and magnitude of major flood events have been significantly altered, affecting the hydrologic regime and sediment supply and recruitment in the system. Large woody debris still passes over the dams but is often greatly weathered or simplified from residence time in the reservoirs upstream and through passage over the dams (i.e., branches and rootwad removed). This most likely reduces the ability of key pieces to lock in place within the channel and therefore its value as habitat for salmonids.

- ***recent and ongoing aggregate mining*** - Widespread processing of the remaining Yuba Goldfields sediment continues today through surface and dredge mining to produce aggregate and other construction materials. Uncertainties related to physical parcel boundaries and contentious mining interests/claims have influenced the development of an irregular landscape characterized by long, linear, gravel/cobble mounds, steep ravines, isolated ponds, and loss of fine sediment required for riparian vegetation establishment. Dredger ponds support invasive predatory fish and other fish species that compete for resources with juvenile salmonids.

2.1.2 PARKS BAR REACH

The Project is located within the Parks Bar geomorphic reach. The Parks Bar reach marks the beginning of a wider alluvial valley, whereas the preceding Timbuctoo Bend reach is confined by steep valley walls (Wyrick and Pasternack 2012). Lateral migration is the dominant topographic change process in the Parks Bar reach, as observed from topographic change detection surveys between 1999 to 2017 (Carley et al. 2012; Weber and Pasternack 2017). Using the Parker (1976) classification scheme, the reach is "transitional" and using Rosgen's (1996) classification system the reach is a C3 stream type. The median (D_{50}) substrate size is 118 mm, which is classified as a "cobble" (Jackson et al., 2013).

At Long Bar, which is the medial bar upstream of the Project, historical aerial imagery shows that the current island and side channel configuration have been somewhat persistent since between 1964 and 1970 (cbec 2013b). Several rock spur dikes were constructed after the December 1964 flood of 180,000 cfs to protect the left bank and deflect flow toward river right. The side channel functioned as a moderate flow side channel before the 1997 flood which peaked at 161,000 cfs. In aerials taken between 1970 and the 1997 flood, taken at or near baseflow conditions, the side channel was not inundated; however after 1997, the side channel appears well defined and perennially connected likely due to topographic changes at the head of the island. Riparian vegetation (likely primarily narrowleaf willow) has been persistent on the margins of the side channel since the 1975 aerial.

The Project bar, which is downstream of Long Bar and located on river right, has a large stand of existing riparian vegetation near the toe of the valley wall on the downstream half of the bar. A groundwater-fed pond sits elevated above the channel and connects above approximately 7,500 cfs. The main portion of the bar inundates around 26,000 cfs.

2.2 HYDROLOGY

Despite the presence of several significant dams in the watershed (e.g., New Bullards Bar), the LYR still experiences moderate and major floods capable of inducing geomorphic changes to the mainstem (Pasternack, 2009b; Wyrick and Pasternack, 2012). Table 2 provides an overview of the major dams within the Yuba River watershed.

Table 1. Major dams in the Yuba River watershed

Major Dams	Operating Agency	Date of Completion[1]	Storage (TAF)[2]	Drainage Sub Basin	Drainage Area (mi^2)
Spaulding	PG&E	~1913	75	South Yuba	118
Bowman	NID	1926	68	Canyon Creek[3]	28
Fordyce	PG&E	~1926	50	Fordyce Creek[3]	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.

2.2.1 PEAK FLOWS

The Sierra Nevada mountains in Northern California experience a Mediterranean climate with hot-dry summers and cool-wet winters. Large flood events typically occur in winter or spring during rain-on-snow events. For the LYR, recent high flow events have occurred on 19 February 1986 (111,000 cfs), 2 January 1997 (161,000 cfs), and 31 December 2005 (110,400 cfs). These recent instantaneous peak flows translate to approximately 20 to 50-yr recurrence interval events (Table 3 and 4).

Discharge data collected from USGS gages #11419000 (Yuba River at Smartsville, pre-Englebright Dam construction) and #11418000 (Yuba River below Englebright Dam near Smartsville), located on the mainstem provide insight into the past and present flood regime of the LYR. cbec et al. (2010) conducted a flood flow frequency analysis for the 106-year period of record of the two United States Geological Survey (USGS) Yuba River at/or near Smartsville gages. The data were divided into two meaningful hydrologic periods: a transitional period, water years (WYs) 1904-1969, and the contemporary, regulated period, WYs 1970-2009, the period following the completion of all major storage projects within the basin. The transitional period includes the completion of some storage projects within the basin, and it is important to note that this period does not fully reflect unregulated conditions. Storage facilities were in place prior to the beginning of transitional period and additional facilities were built during its range (Table 2), all potentially affecting peak flood values in some way. The regulated period follows the completion of all major storage projects within the basin and is reflective of the current flood regime. This analysis shows that the modern storage projects and flow management standards have reduced the 1.5-year event by 67%, from 20,100 cfs to 6,700 cfs at the Smartsville gage location. Floods with a 5-year return period were reduced 40% from 61,400 cfs to 36,900 cfs. However, larger, less frequent flood flows (i.e., 20-year return period and larger) do not show clear change between the two periods (cbec et al., 2010).

Table 2. Flow Frequency Analysis for Smartsville USGS gages on the lower Yuba River

Return Period (yrs)	Exceedance Probability (1 / yrs)	Transitional Period WY 1904-1969 Discharge (cfs)	Regulated Period WY 1970-2009 Discharge (cfs)
20	0.05	121,700	108,200
10	0.1	89,500	66,500
5	0.2	61,400	36,900
2	0.5	29,500	11,900
1.5	0.67	20,100	6,700

[1] Flood flow frequency analysis performed with HEC-SSP 1.1 (USACE, 2009) following Bulletin 17B procedures (USGS, 1982), using maximum annual instantaneous discharge data for USGS Smartsville Gages: #1141900 (1904-1941), #1141800 (1942-2009).

In addition to the flow frequency analysis for the Smartsville Gages, a flow frequency analysis was completed for the Marysville USGS gage (Table 4). The Marysville gage includes flow contributions from Dry Creek and irrigation diversions at DPD.

Table 3. Bulletin 17B HEC-SSP flow frequency analysis for Yuba River near Marysville

Recurrence Interval (years)	Full Period of Record[1] (1943-2017) Flow (cfs)	Regulated Period[1] (1970-2017) Flow (cfs)	Lower Feather River Floodplain Mapping Study (2005)[2] Flow (cfs)
100	232,811	218,756	155,000
50	183,322	167,378	150,000
20	126,173	110,876	--
10	88,984	75,884	92,400
5	57,069	47,173	--
2	22,675	17,877	--
1.25	8,062	6,123	--

[1]HEC-SSP Results for USGS Gage # 11421000, also referred to as MRY

[2] Design event hydrographs obtained from MBK and reflect the Lower Feather River Floodplain Mapping Study (2005).

2.2.2 TYPICAL FLOWS

Table 5 shows the monthly duration exceedance values for the lower Yuba River below Deer Creek from the Yuba Water Agency's (YWA) Yuba River Development Project Model (YRDPM) version 1.48, which simulations historical flows under current water infrastructure operations. This table shows the range of typical flows by month.

Table 4. Monthly duration exceedance values for the lower Yuba below Deer Creek

Month	Duration Exceedance Flow (cfs)				
	95%	80%	50%	20%	5%
Jan.	735	753	1,498	4,534	11,808
Feb.	737	834	2,683	4,925	10,891
Mar.	751	967	3,233	5,772	11,622
Apr.	755	1,172	2,224	4,335	8,603
May	1,312	1,726	3,184	4,286	9,837
Jun.	1,299	1,472	2,521	4,382	8,160
Jul.	1,393	1,484	1,735	3,047	3,900
Aug.	966	1,212	1,459	2,001	3,560
Sep.	732	757	908	997	1,172
Oct.	785	847	927	983	1,045
Nov.	845	861	899	933	3,255
Dec.	733	746	831	2,364	6,301

[1]Based upon WY 1970-2010 daily averaged flow results from YRDPM v1.48.

2.3 BIOLOGY

Anadromous Pacific salmonids have evolved over millennia in diverse streams of Western North America. These streams were historically defined by a variable hydrograph, stream temperature and habitat complexity, including primary and secondary channels and floodplains. These complex channel forms naturally segregated sediments and supported diverse riparian plant communities. These riparian plant communities were most likely under variable successional stages, not only temporally, but also along the stream's longitudinal profile. Variability was greatly influenced by natural disturbance, such as plate tectonics, floods, fire and windthrow (Resh et al. 1988; Bisson 1997; Waples et al. 2009). This was further influenced by watershed size, gradient and the amount and type of precipitation occurring within the stream's boundaries and how that precipitation was passed through the watershed, including flood frequency, and annual hydrograph variability. This, in turn, affected the amount and size range of bed sediment and woody material input to the channel, which are key components of salmonid habitat quality in the lotic environment (Buffington et al. 2004; Fausch and Northcote 1992).

Anthropogenic activities have altered the riverine processes that create and maintain a diversity of habitats that support robust populations of anadromous pacific salmon. In California, historical gold mining activities reduced the diversity and complexity of riverine, floodplain, and riparian habitats within many Central Valley streams. Within the Yuba Goldfields, river confinement by massive cobble and gravel deposits derived from hydraulic and dredge mining activities resulted in a relatively simple river corridor dominated by a single main channel and large cobble-dominated bars, with little riparian and floodplain habitat (as summarized in cbec et al. 2010). Stream regulation greatly reduces the variability of the diverse stream, not only in form but also function, often simplifying the channel, hydrograph and ecosystem and excluding migratory fish from accessing upper reaches that historically provided spawning and rearing habitat and floodplains and secondary channels that supported important rearing habitat. Englebright

Dam has contributed to reductions in habitat complexity and diversity by preventing the transport of sediment, woody material, and nutrients from upstream sources to the lower river.

It has been hypothesized that low habitat complexity and diversity are limiting factors for Chinook Salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*) production in the LYR, primarily through their effect on juvenile rearing success (Lower Yuba River Fisheries Technical Group 2005). Loss of off-channel habitats, such as side channels, floodplains, riparian forests and wetlands has substantially reduced the productive capacity of the Central Valley for many native fish and wildlife species, and evidence is growing that such habitats were once of major importance for the growth and survival of juvenile salmon (Sommer et al. 2001; Moyle 2002; Jeffres et al. 2008; Limm and Marchetti 2009). Furthermore, stream regulation sets the stage for invasion by non-native organisms that may flourish under a dampened hydrology and channelized river corridor (Kiernan et al. 2012; Moyle and Light 1996). The synergistic effect of habitat modification and nonnative predators can exacerbate juvenile salmonid mortality, highlighting the importance of considering stressor interactions when planning management strategies and assessing population-level impacts on salmon (Sabal et al. 2015).

2.3.1 TARGET SPECIES LIFE CYCLE

Pacific salmon and trout are of the genus *Oncorhynchus* spp. Anadromous species, such as Chinook Salmon and steelhead, hatch in freshwater and spend a portion of their lives rearing in the ocean before returning to freshwater to spawn. Chinook Salmon typically spend from 1-3 years in the marine environment and are semelparous, meaning that after spawning once, the adults die. Unlike Chinook Salmon, steelhead are iteroparous, meaning they can survive spawning and repeat the migration to the ocean and return to freshwater to spawn more than once. While each salmonid species is unique and genetic diversity across drainages may be as significant as those found across different species, certain fundamental biological requirements are the basis for all management, recovery, or protection initiatives for salmonid streams.

Chinook Salmon can be divided into two life-history strategies: stream- or ocean-type (Healey 1991). Adult stream-type Chinook Salmon immigrate into natal streams before they reach full maturity, from late winter to summer and mature in pools before making short migrations to spawning grounds in the late-summer and early fall. Their juveniles may spend a relatively long time (usually >1 year) in fresh water before emigrating to the marine environment, requiring over-summer rearing habitat. Within the LYR, spring-run Chinook Salmon may have historically had a stream-type life-history when they were able to migrate higher in the watershed. Available data shows that most LYR spring-run Chinook Salmon emigrate to the ocean in their first spring at less than a year old (Yuba Accord RMT 2013). Fall-run Chinook Salmon are an ocean-type with adults typically spawning soon after entering fresh water, in early-fall to early winter, and juveniles that spend a relatively short time (3-12 months) rearing in fresh water (Table 1).

Within the LYR, steelhead tend to follow a stream-type life-history with juveniles spending a year or more in freshwater before emigrating to the ocean (Table 1). A portion of the population, especially some males, may not demonstrate an anadromous life history and remain within the natal stream for their entire life cycle (Kendall et al. 2014).

Table 5. Seasonality of spring- and fall-run Chinook Salmon and steelhead lifestages on the lower Yuba River

Species/ Life Stage	Month Present											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Central Valley Spring-Run Chinook Salmon[1]												
Adult migration/ holding												
Adult spawning												
Embryo Incubation												
Juvenile rearing and outmigration												
LYR Fall-Run Chinook Salmon[2]												
Adult migration												
Adult spawning												
Embryo Incubation												
Juvenile rearing and outmigration												
LYR Steelhead[2]												
Adult migration												
Adult spawning												
Embryo Incubation												
Juvenile rearing and outmigration												

[1]Adapted from ESA (2015)

[2]Adapted from LYR Accord River Management Team (RMT) (2013)

2.3.2 TARGET SPECIES HABITAT NEEDS

In general, Chinook Salmon and steelhead require cool clear gravel/small cobble reaches to support spawning and incubation. Quality spawning reaches typically demonstrate relatively high sequences of pools and riffles (Montgomery et al. 1999). Juveniles tend to emerge from the incubation substrate during the cool/wet period of the California Mediterranean climate. Winter and early spring rearing habitat, in the form of relatively shallow, slow floodplains and secondary habitats (side channels, backwaters) provide refuge from cold, swift, turbid waters where less energy is spent fighting currents, and clearer, warmer and more productive waters increase feeding opportunities. An important aspect of these ephemeral habitats is that they desiccate during the dry season (Merz et al. 2015; Jeffres et al. 2008; Moyle et al. 2007). Most fall-run Chinook Salmon and some spring-run Chinook Salmon and steelhead juveniles emigrate before the hot/dry season approaches (Table 1). However, many steelhead and spring-run Chinook Salmon remain in the LYR, requiring relatively cool water with cover that provides flow refuge to conserve energy and visual protection from predators, especially introduced, deep-bodied piscivores, until the following winter (YCWA 2013; CFS 2016).

Within the LYR, both ephemeral and perennial rearing habitats are considered a limiting factor for meeting Chinook Salmon and steelhead production targets (NMFS 2009; CDWR 2015).

2.3.3 ADDITIONAL NATIVE AND NON-NATIVE AQUATIC SPECIES

It is not anticipated that the Long Bar site will host an abundance of non-native piscivorous fish. The Long Bar site is upstream of Daguerre Point Dam (DPD), which may hinder upstream movement of non-native fish. Two data sets are available to document the potential for upstream movement of non-native fish above DPD: the Yuba RMT Vaki Riverwatcher system, which has been in operation since 2008, and snorkel and video monitoring from Cramer Fish Sciences (CFS). Data from the Vaki Riverwatcher system employed by the Yuba RMT at DPD indicate the upstream movement of very few striped bass (*Morone saxatilis*) and sunfish (*Centrarchidae*) – one of each over the period of record. Observations made by CFS of the area immediately upstream of DPD included Sacramento Pikeminnow (*Ptychocheilus grandis*) as the only predatory species. In spring snorkel surveys in the Long Bar site, bullfrogs (*Lithobates catesbeianus*) have been observed, but no non-native fish species (P. Colombano, personal communication, 11/08/2019). However, it is probable that sunfish, bullfrogs and other taxa migrate downstream to the Long Bar site from Englebright Reservoir (K. Selheim, personal communication, 01/02/18). Although predatory fish are likely present in the Project area, their abundance has not been observed as a significant threat to rearing salmonids.

3 DESIGN METHODOLOGY

To effectively rehabilitate and enhance juvenile Chinook Salmon and steelhead rearing habitat within the LYR, this Project was designed to function under current water management constraints (i.e., magnitude, timing, and duration). This includes the following ecological considerations:

1. Determine species-specific and life-history target periods (Table 1).
2. To support the goal of increased habitat complexity, create/enhance ephemeral juvenile salmonid rearing habitat that will inundate more frequently, up to three contiguous weeks annually during the winter/spring rearing season. This sustained inundation allows for water clearing and warming and phytoplankton and macroinvertebrate colonization (Ahearn et al. 2006; Grosholtz and Gallo 2006; Heady and Merz 2007; Sellheim et al. *in prep*). Pulsed flood flows are important for moving nutrients through the system (Ahearn et al., 2006), but prolonged continuous inundation (i.e., high residence time of water) is thought to be critical for creating productive rearing conditions (Moyle et al. 2007).
3. Enhance summer/low flow juvenile salmonid rearing habitat that will reduce metabolic needs and conflict between conspecifics.
4. Reduce potential non-native fish predator holding, spawning, and rearing habitats.
5. Design habitat enhancement that considers the variability of California's climate and the generational component of California salmonids. This includes the addition of seasonal rearing habitat that functions at the 1-2, 3-5 and 10-year recurrence intervals. This will support annual benefits but also provide for precipitation variability expected during the 3-year life history that dominates California Chinook Salmon (Fisher 1994; Dettinger et al. 1998).

A literature review was performed to establish the geomorphic condition of the LYR in the Project reach. A desktop analysis of previous and current aerial photography yielded information on channel evolution and response to significant flow events. A review of current literature (Carley et al. 2012; Weber and Pasternack 2017) was compared to cbec's own assessment (cbec 2013b) of channel migration and rate of change to provide insight on which to base an estimation of future channel evolution. These considerations help to shape the design approach with respect to resilience and sustainability of design features.

3.1 TOPOGRAPHY AND BATHYMETRY

The channel morphology changed significantly in the winter of 2017, so an updated existing conditions surface model was essential for understanding current topographic and river hydraulic conditions. The topography of the Project reach was surveyed using an unmanned aerial vehicle (UAV – drone). Orthorectified images were collected and a surface was prepared from them using Structure from Motion (SfM) software. Updated channel bathymetry was collected in a boat-based single-beam sonar survey, in which the sonar device was coupled to a Real Time Kinematic Global Positioning System (RTK GPS) antenna. Ground truthing for the UAV surface and additional topography and bathymetry data were collected using RTK GPS survey equipment. Topographic and bathymetric data from the 2017 survey were compiled with the Lower Yuba River Accord River Management Team's (RMT) 2008 dataset to create a terrain model using AutoCAD Civil 3D (CAD) (Autodesk, Inc., San Rafael, CA) and ArcGIS® 9.3.1 (ESRI, Redlands, CA). The updated terrain provided the basis for developing grading designs and comparison of existing conditions to designed habitat features (Figure 2). Figure 3 shows an overview of the design elements, which are discussed in more detail in Section 5.

3.2 HYDRODYNAMIC MODELING AND SURFACE REVISIONS

The process for creating and refining the design was iterative and involved developing a design surface, testing the design with a hydrodynamic model, evaluating results, then continuing to refine and evaluate the design. The design concept was developed using CAD to create grading changes to meet habitat goals. The CAD surface was converted using ArcGIS into a surface compatible with the hydrodynamic model development software, SRH-2D (Lai, 2008) via SMS (Aquaveo, LLC, Provo, UT). A two-dimensional (2-D) mesh was developed to comply with river and design features to preserve their integrity in the hydraulic model. The surface model and mesh provided the base input to the hydraulic models, along with flow and water surface elevation data at the upstream and downstream ends of the Project reach.

Hydrodynamic model simulations were evaluated for a range of flows to assess the development of habitat suitable for the life stage and species – rearing juvenile salmonids – that the Project is intended to benefit. Habitat suitability indices (HSI) for juvenile salmonids on the LYR defined design targets and governed optimal depth and velocity combinations over a variety of flows. The hydrodynamic model results were processed to assess changes in weighted usable area (WUA) created by the design. Project features were refined to target depth and velocity HSI and maximize WUA throughout the Project footprint.

4 DESIGN CONSIDERATIONS AND CRITERIA

4.1 HYDROLOGY

4.1.1 TARGET ECOLOGICALLY SIGNIFICANT DESIGN FLOWS

Quality habitat was assessed with the understanding that the habitat must:

1. Activate at the appropriate time, including facilitation of access and egress for target species/lifestages.
2. Function for a duration that provides benefit to the target organisms.
3. Function under the present or proposed regime of the river so that the habitat and the benefits it provides are sustainable.

We used the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center - Ecosystem Functions Model (HEC-EFM) to choose ecologically significant flows to analyze. Furthermore, ecosystem function relationships (EFRs) were previously developed for LYR using available information regarding LYR specific life history characteristics and fisheries use datasets (cbec 2013a).

4.1.1.1 *SPECIES AND LIFE STAGE SELECTION*

The target species for design are fall-run Chinook Salmon, spring-run Chinook Salmon, and steelhead. The Project seeks to benefit the fry and juvenile lifestages for these species, while doing no harm to existing spawning habitat.

4.1.1.2 *TARGET ECOLOGICALLY SIGNIFICANT PERIODS*

Under the California Mediterranean Climate template, two seasonal salmonid rearing periods occur (Merz et al., 2016) and represent the two ecologically significant periods analyzed herein:

1. Winter/Spring Wet Season (January to June) – Rearing salmonids require refuge from high flows, cold temperatures, turbidity, and relief from predators and competition.

   - At 3°C critical swimming speed of juvenile salmonids can be significantly less than that at summer temperatures (18-23°C) (McMahon and Hartman 1989). Young fish often become more nocturnal and hide in substrate (Bradford and Higgins 2001).
   - Cold, fast, turbid waters may hinder food production (Grosholz and Gallo 2006). Therefore, secondary habitats with higher water residence time benefit both food production and fish metabolism (Ahearn et al. 2006; Jeffres et al. 2008).
   - Juvenile salmonids occupy off-channel and undercut banks containing large woody material (LWM); generally, they are absent from main-channel thalweg habitats lacking such cover (Bustard and Narver 1975; Tschaplinski and Hartman 1983; Heifetz et al. 1986; Brown and McMahon 1988).

2. Summer/Fall Dry Season (July to October) – Over-summer rearing salmonids require refuge from heat, low dissolved oxygen, and relief from competition and predators.

   - Juveniles occupy a wide range of stream habitats, including pools, main and side channel beaver ponds, main channel glides, and riffle edges if temperature meet the species' needs (Bisson et al. 1988; McMahon 1983; Murphy et al. 1989; Pollock et al. 2004).
   - Steelhead and Chinook Salmon both demonstrate transitional responses to the dry season, with juveniles often leaving off-channel habitats by midsummer. This movement corresponds to flow recession, increasing water temperatures, salmonid growth and the end of the emigration period. Main-channel steelhead observations continue until the following storm season, when cool flood flows reconnect off-channels and the next juvenile cohort of both species recruit to the river (Merz et al. 2016). Although this pattern of seasonal movement has been observed in other California Rivers (e.g. the Mokelumne River), it may not be applicable to the LYR due to differences in their thermal regime (i.e., the LYR in the vicinity of Long Bar stays relatively cool during the dummer months) . It has been assumed that a portion of the spring-run Chinook Salmon population follows the steelhead pattern in the Yuba River, but this is not fully understood.
   - Current velocity is often considered the primary variable governing microhabitat selection during summer (Shirvell and Dungey 1983; deGraaf and Bain 1986).
   - Because aggression increases during summer, visual barriers may reduce conflict and energy expenditure (Chapman and Bjornn 1969).
   - In warmer months, young Chinook Salmon and steelhead are associated with velocities and depths in proportion to body size, shifting to faster and deeper waters as body growth occurs (Cramer and Ackerman 2009). Competition for space and resources between species is minimal due to differing times of fry emergence (Chapman and Bjornn 1969).

While not the primary focus of the Project design, spawning habitat was considered to ensure no habitat loss resulted from Project implementation. The target species spawn in the LYR from early fall through mid-spring (Table 1). Fall-run and spring-run Chinook Salmon spawn during the baseflow period from early September to late December (Table 1). Flows during steelhead spawning and incubation period are highly variable due to the winter/spring wet season hydrology from early January through May. Pre- and post-project salmonid spawning suitability for a range of representative flows for Chinook Salmon and steelhead were evaluated (see Table 8). Model results predicted no reduction in main channel spawning suitability over this flow range due to project implementation.

4.1.1.3 ***INUNDATION DURATION***

The optimal floodplain inundation duration to benefit rearing salmonid growth is still under study and appears to be highly location specific. The Project will provide a means to investigate questions related to growth rates, diet composition, and health condition in a juvenile rearing experiment (CFS 2020). Thus, the design aims to facilitate continuous inundation duration in the range of 14 to 24 days, with a target of 21 days to promote food production, providing the opportunity for invertebrates (key salmonid prey items) to colonize off-channel areas (Merz and Ochikubo-Chan 2005; Ahearn et al. 2006). Studies on the lower American River, a system analogous to the LYR, have shown that floodplain invertebrate densities approach main channel densities after 2 to 4 weeks of inundation (Sellheim et al. *in prep*). A shorter flow pulse (e.g., 3-day) may be beneficial to the LYR by providing an influx of terrestrial invertebrates from the floodplain to the main channel as hypothesized by Ahearn et al. (2006). Although at present there is limited evidence to support the benefits of a short pulse, the 3-day pulse flow values are also provided in Table 2 for context in the LYR setting.

4.1.1.4 INUNDATION FREQUENCY

Inundation frequency determines the likelihood that any year-class will have the opportunity to utilize floodplain habitats. Central Valley Chinook Salmon adults generally return to spawn at age 3 (Fisher 1994, Willmes et al. 2018) with variations in each brood year. As such, the population may be continually supported by a benefit to juveniles that occurs as seldom as 1 in 3 years. Three frequencies were used for the Project design: 1) 33% exceedance probability, or the event for the specified duration during the specified rearing period occurring in 1 of every 3 years, 2) 50% exceedance probability, occurring every other year, and 3) 67% exceedance probability, occurring 2 of 3 years, on average.

4.1.1.5 ECOLOGICALLY SIGNIFICANT DESIGN FLOWS

To develop habitat that is inundated for the preferred duration at an expected frequency over the target ecological period, the following flow values were selected to guide the design (Tables 6 and 7).

Table 6. Summary of ecologically significant flows guiding Project design

Dataset	January to June			January to June			July to October
	21-day Duration Flow (cfs)			3-day Duration Flow (cfs)			Baseflow (cfs)
	33%	50%	67%	33%	50%	67%	
Yuba River Development Project (YRDP) Model[1]	5,000	4,100	2,000	10,400	6,900	3,800	700

[1]YRDP Operations Model (FERC No. 2246) accessed from http://www.ycwa-relicensing.com

Based on the ecological flow evaluation above, design flows were developed to govern the development of habitat enhancements. Table 7 lists the various design flows along with their ecological importance, and their significance related to physical processes.

Table 7. Design flows based on EFM results from the YRDP model

Flow (cfs)	Ecological Significance	Physical Process Significance
700	Minimum required flow September 1st – April 15th	Baseflow
880	Typical fall-run spawning flow	Main channel spawner bed modification (Hassan et al. 2008; DeVries 2012)
1,000	Upper end of fall-run spawning flow	Surface water flow disconnection to all floodplain features (cbec design)
2,000	21-day duration occurring almost every year (January to June); lower end of rearing range	Channel defining flow for Secondary Channel geometry (cbec design)
3,500	21-day duration about every other year; activates riparian corridor	Potential for vegetation and sediment recruitment feedbacks (cbec design)
5,000	21-day duration every third year to support yearly broods; upper end of steelhead spawning	LYR bankfull (Wyrick and Pasternack 2012)
7,500	Occurs for ~3 days every other year; provides access to floodplain	Potential for vegetation and sediment recruitment feedbacks (cbec design)
10,000	Upper end of rearing range	~1.5-year recurrence interval flood; Secondary Channel riffle-pool maintenance
40,000	Linked to implications for the floodway	~5-year recurrence interval flood; material critical grain size threshold (cbec design) for riffle crests, inlets and roughness features
70,000	Linked to implications for the floodway (scour and vegetation regeneration); vegetation recruitment assumptions	~10-year recurrence interval flood

4.1.2 TARGET FLOOD DESIGN FLOWS

We used the ~5-year event of approximately 40,000 cfs and the ~10-year event of approximately 70,000 cfs to analyze for geomorphic stability of design features.

4.1.3 SUB-SURFACE FLOW AND GROUNDWATER

Sub-surface flow was important to characterize because it sustains riparian plants on bars and floodplain areas. Riparian plants that have access to soil moisture at their roots during the driest portion of the year are most likely to become established and thrive (Mahoney and Rood 1998; Amlin and Rood 2002; Stella and Battles 2010). Additionally, to maintain appropriate water temperature to support over-summer salmonid rearing, the low flow portion of the Secondary Channel and the Backwater Channel[2] are designed to convey groundwater input in late summer and fall when the channels are disconnected from

[2] Project elements are shown in Figure 3 and described in Section 5.

surface flow. To determine appropriate elevations for floodplain and bar grading and to quantify potential groundwater inputs to the Secondary and Backwater Channels, an approximation was made of the water table during the driest portion of the year.

A groundwater surface was developed by incorporating data from cbec's topographic survey of September 2017. Water surface elevation (WSE) data were collected along the bank of Long Bar and in the Backwater Channel where standing water was visible. A groundwater elevation surface was developed by interpolating between data points collected on the north and south sides of Long Bar at a flow of approximately 880 cfs, approximately the baseflow (700 cfs) for the main channel. The surface developed from these data was then projected laterally to the margins of the river corridor to provide coverage below Project design elements. This yielded a comprehensive map of the water table in the vicinity of the Project during low flow conditions. To determine depth to groundwater at all graded areas in the design, elevation values of this groundwater surface were subtracted from the existing and finished grade surface elevations in GIS to create a map of elevation differences. Figures 4 and 5 show depth to groundwater maps for existing and Project conditions, respectively.

4.2 RIPARIAN HABITAT

Riparian vegetation can benefit rearing salmonids both directly and indirectly. Direct benefits include cover from predation and high velocities, while indirect benefits include shading impacts on water temperature, allochthonous nutrient and prey (invertebrate) contributions, and woody material inputs for cover and habitat complexity (Bisson et al. 1987; Kawaguchi et al. 2003; Eberle and Standford 2010; Sellheim et al. 2016). However, these mechanisms have not been well tested in large Mediterranean climate streams similar to the LYR.

Floodplain grading was designed according to the hydrology that will support both rearing juvenile salmonids and vegetation recruitment and establishment. Riparian plants are constrained by the availability of soil moisture at their roots, and they are limited by exposure to high velocity flows (Mahoney and Rood 1998; Amlin and Rood 2002; Stella and Battles 2010; Bywater-Reyes et al. 2015). Soil moisture availability is influenced by substrate texture, plant distance from a flowing channel and/or relative elevation above groundwater (e.g., Vaghti et al. 2009). Fine sediment particle sizes help to increase pore pressure, slow drainage and also increase capillary action that draws moisture up from a lower water table to increase soil moisture retention (Selheim, K.L. et al. 2016). High velocity exposure relates primarily to extant plant root strength and position with respect to scouring velocities (Bywater-Reyes et al. 2015).

As summarized in Table 6, there is a 50% likelihood in any year that flows of approximately 4,100 cfs would persist for at least 21 consecutive days during January-June. Thus, some riparian areas that were graded to begin inundating between 2,000 and 3,000 cfs are anticipated to be partially inundated when flows reach or exceed 4,100 cfs. Proposed floodplain grading will remove material from higher elevation areas such that these features are anticipated to inundate above 2,000 cfs (Upstream Side Channel, Secondary Channel and Backwater Channel) or above 3,000 cfs (Flood Runners). Floodplains adjacent to the Upstream Side Channel, Secondary Channel and Backwater Channel features are anticipated to inundate incrementally above 2,000 cfs. Enhanced Floodplain areas adjacent to the Flood Runners that cover a majority of Long Bar are anticipated to inundate above 5,000 cfs. The resulting gradient of elevations, inundation frequencies, groundwater depths and flood energy are intended to generate a diverse mosaic of habitat types for juvenile salmonid rearing and riparian vegetation.

4.2.1 VEGETATION RECRUITMENT

Given the mining and dredging legacy in the LYR, several factors influence the success, or hypothesized lack thereof (e.g., cbec et al. 2010), of riparian vegetation recruitment. Dredging activities altered the character and distribution of the sediment in the river corridor. Prior to the influx of hydraulic mining sediment, historical accounts describe cultivated “bottom lands” along the Yuba with dark fertile soils, presumably representing floodplains in frequent connectivity with the river (Gilbert 1905 as described in James et al. 2009). Because of dredging, the modern channel alluvium is a mix of hydraulic-mining sediment and Quaternary alluvium (James et al. 2009, Hunerlach et al. 2004). In the process of dredging, the mined sediment was separated into fine and coarse fractions, with a mixture of clay, silt and sand typically tens of feet thick, with the coarse fraction (gravel and larger) stacked above 40-100+ ft in thickness. Such dredger tailings hinder vegetation recruitment due to detachment from groundwater, relatively high porosity due to larger sediment sizes, and lack of soil horizon (e.g., cbec et al. 2010).

When tailings are re-contoured to inundate more frequently, and sediment size classes are reduced, native recruitment of riparian vegetation can be rapid (Sellheim et al. 2016b). Although it is expected that flood disturbance will keep vegetation in earlier successional stages for many areas of the Project site, young willows, cottonwoods, alders etc. provide important rearing habitat (Sellheim et al. 2016a). Mature vegetation will require a longer time to develop but will support temperature control and provide allochthonous inputs such as arthropods and woody material.

Shallow groundwater depths from 0-2 ft are expected to support herbaceous vegetation and shrubs (e.g., willows and California buttonbush). Moderate groundwater depths from 2-6 ft would are expected to support similar shrubs to shallow groundwater depths and trees such as white alder. Moderate groundwater depths may support establishment of elderberry and Fremont cottonwood. High groundwater depths from 6-12 ft are expected to support establishment of elderberry, Fremont cottonwood, and western sycamore (Cramer Fish Sciences 2021).

4.2.1.1 FLOODPLAIN AREAS

Funding availability limits Project revegetation efforts. Therefore, the floodplain area grading was designed with consideration for promoting natural vegetation recruitment. Vegetation success is related to availability of soil matrix, groundwater and exposure to high flows. Reducing floodplain elevation increases potential for available groundwater by reducing the distance to the water table, but it also increases the frequency of inundation that could expose plants to higher velocities/scour, so a balance was established between the opposing constraints.

Floodplains were primarily designed as rearing habitat, and as such, were designed for initial inundation at 2,000 to 5,000 cfs total river flow to provide habitat at the upper range of ecological flows. At elevations corresponding with 2,000 to 5,000 cfs total river flow, floodplains are typically within 2 and 12 ft of estimated groundwater to support a variety of vegetation. Flows exceeding 5,000 cfs typically occur between December and March, during which the floodplains receive water, fine sediment deposits, and seeds. After June, flows typically diminish and vegetation becomes established in the floodplain into late October, supported by available groundwater. Figure 5 shows the ranges of Project condition depth to groundwater beneath graded floodplain areas and compatibility with the vegetation types that are anticipated to recruit within them.

Recruited floodplain vegetation is expected to create hydraulic roughness, reduce flow velocity, and encourage sediment deposition that will promote this natural recruitment process (Bendix and Hupp 2000; Nepf 2012; Yager and Schmeeckle 2013; Manners et al. 2015). Established floodplain vegetation roots are expected to stabilize the soil and help sustain the form of the floodplains and channels designed to convey water through them.

A secondary goal of floodplain grading is to increase edge contact with vegetation. Where it was possible, floodplain grading was extended to meet existing vegetation as interpreted from a 2017 aerial orthophoto. Provision will be made for adaptive grading during construction to preserve existing vegetation and to maximize shaded edge habitat. Floodplain grading will require removal of existing vegetation in some instances; the resulting woody debris will be utilized within the Project as appropriate to provide cover for juvenile salmonids.

4.3 GEOMORPHOLOGY

Hydrodynamic model results were post-processed to calculate bed shear and to assess incipient motion among the native material during a flood. Bed shear stress (τ_b) was calculated using:

$$\tau_b = \rho_w \left(\bar{u} / \left(5.75 \log \left(\frac{12.2H}{2D_{90}} \right) \right) \right)^2 \qquad (1)$$

Where ρ_w is the density of water (kg/m^3), $\bar{u}$ is the nodal depth-averaged velocity (m/s), H is the nodal water depth (m), and D_{90} is the grain size (m) for which 90% of the grains are smaller (Brown and Pasternack 2009).

Bed shear stress was then processed to determine a critical particle diameter (D_c) that would become mobilized under a particular flow.

$$D_c = \frac{\tau_b}{(\rho_s - \rho_w)\tau_c^* g} \qquad (2)$$

Where ρ_s is the density of sediment (kg/m^3), τ^*_c is critical shear stress (dimensionless), and g is the gravitational constant (m/s^2). A critical shear stress of 0.03 was used to model the beginning of partial transport. Design features such as riffles, inlets and floodplain roughness features were assessed for durability in light of the 5- and 10-year event flows. A flow of 40,000, corresponding to the ~5-year event generated the highest shear stresses across the Project area due to relatively shallower flow depths, and was therefore used as the basis for assessing particle mobility at key Project element locations.

4.4 BIOLOGICAL METRICS

Enhancing the form and function of the existing river cooridor requires qualification and quantification of habitat available presently compared to what is proposed for the species targeted within the restoration program (Poff et al. 1997; Palmer et al., 2005). Choosing a clear and precise definition of habitat for the target organism and life stage allows the application of habitat suitability criteria necessary to identify what is presently available and set goals to meet the vision of the restoration program, given the prescribed flow regime for the system.

To assess the effectiveness of the Project, the combined (or global) habitat suitability index (gHSI) and the total weighted useable area (WUA) within the Project area were calculated using the following equations:

$$gHSI_{cell} = \sqrt{VHSI * DHSI} \tag{3}$$

$$WUA = \sum(gHSI_{cell} \times Area_{cell}) \tag{4}$$

where VHSI, and DHSI are velocity and depth habitat suitability indices, respectively, taken from bioverified curves for fry and juvenile Chinook Salmon and steelhead trout (Moniz and Pasternack 2019a; Moniz and Pasternack 2019b), shown in Figures 6 and 7. The gHSI is the geometric mean of VHSI and DHSI (equation 3) and represents hydraulic habitat suitability. Cover was not included in the analysis because it is too difficult and subjective to predict vegetation recruitment within a limited area and the planting plan was not complete at this time. Cover habitat may be revisited during the 100 percent design BOD. To calculate WUA, the value of each cell in the gHSI raster was multiplied by the cell area and summed across all the cells in the model domain to calculate the total WUA (equation 4). gHSI was then binned into habitat suitability ranges for display in Figures 10 through 37.

4.4.1 HABITAT SUITABILITY INDICES

HSI values for depth and velocity for fry and juvenile Chinook Salmon and steelhead trout are shown in Figures 6 and 7. Depth and velocity HSI curves were developed for YWA (Moniz and Pasternack 2019b) based on data collected on the LYR in 2012, 2014 and 2015. The HSI curves were bioverified using a 2D hydraulic model based on 2014 river topo-bathymetry and comparing predicted preferential habitat areas to observations of fry and juvenile salmonid presence (Moniz and Pasternack 2019a). Spawning HSI curves were also used to confirm that the Project did not cause a reduction in spawning habitat. Spawning HSI curves for the LYR developed using field-measured hydraulics at Chinook Salmon redds were used for this assessment (Beak Consultants 1989). Steelhead spawning curves were also assessed for existing and Project conditions (Kammel et al. 2016). Figure 8 shows the spawning HSI curves and Table 8 shows the full range of flows assessed for spawning and rearing habitat.

Table 8. Flows analyzed for salmonid spawning and rearing habitat

Discharge (cfs)	Chinook Spawning	Steelhead Spawning	Chinook/Steelhead Fry and Juv. Rearing
700	X	X	X
880	X		
1,000	X	X	X
2,000		X	X
3,500		X	X
5,000		X	X
7,500			X
10,000			X

5 DESIGN OF PROJECT ELEMENTS

Channel and floodplain grading designs were based on site hydrology and geomorphic considerations (i.e., evolution and persistence). Hydrology was evaluated to determine ecologically significant flows that occur during the juvenile salmonid rearing period. The goal of floodplain and channel grading was to provide inundation throughout the range of ecological flows, so WSEs associated with those flows were used as grading design criteria. Table 9 lists the various channel and floodplain types included in the design and the ranges of ecological flows under which they were designed to function. The functional range column intends to highlight the target range for which habitat is optimized in each feature, but this is not to imply that habitat stops functioning outside of that range.

Table 9. Summary of design features and flow criteria

Feature	Length / Area	Flow (cfs)		Inundation Regime[1]			
		Initiation	Functional Range	Analysis Flow (cfs)	Timing	Duration (days)	% Exceedance
Secondary Channel	1,135 ft / 2.1 Ac	2,000	2,000-5,000	2,000	Jan - June	21	67%
Backwater Channel	2,841 ft / 4.5 Ac	700	700-5,000	2,000	Jan - June	21	67%
Upstream Side Channel	1,674 ft / 3.9 Ac	2,000	2,000-10,000	2,000	Jan - June	21	67%
Flood Runner Channels (frequent flows)	2,168 ft	3,000	3,500-10,000	3,500	Jan - June	21	50%
Riparian Terraces[2] (seasonally inundated, off-channel habitat)	2.9 Ac	2,000	5,000-10,000	3,500 / 5,000	Jan - June	21	33 – 50%
Backwaters	2,010 ft	700	700-5,000	2,000	Jan - June	21	67%
Enhanced Floodplain	23.6 Ac	5,000	5,000-26,000	10,000	Jan - June	3	33%
Main Channel Terraces	7.9 Ac	1,000	2,000-10,000	2,000	Oct - June	21	67%

[1]See Table 6 for summary of ecologically significant flows.
[2]Includes terracing north of the Secondary Channel and the Connector Channel.

Habitat features were designed to "initiate" or begin to inundate at the approximate flows listed in Table 9 to develop inundation depths that would satisfy the needs of juvenile salmonids over the rearing period according to selected habitat suitability indices. The grading designs for the features identified in Table 9 were refined through an iterative process of evaluation and redesign to target juvenile salmonid HSI and to maximize WUA.

Included in the target performance ranges for evaluated flows identified in Table 9, it should be noted that the Backwater Channel and Secondary Channel bed elevations were designed to maintain a minimum of 1 ft depth throughout the driest months in about half of all years to provide over-summer habitat for rearing juvenile salmonids.

5.1 SECONDARY CHANNEL FEATURES

During baseflow conditions, when total LYR flow upstream of DPD is around 700 to 1,000 cfs, the Secondary Channel will not exhibit a direct surface connection to the main river at the upstream connection. Baseflows occur in most years from mid-August to October corresponding to the latter portion of the adult immigration period. During this period, there is a focus on providing deeper, colder, main channel habitat and it is not desirable to distribute the limited surface water flows onto the floodplain or Secondary Channel.

The sectional design geometry of the Secondary Channel is planned as a combination of four different functional elements: 1) Inlet, 2) Riffles, 3) Low Flow Channel, 4) Floodplain Terraces. A description of the geometric considerations for the components follows. Specific attention is placed on the hydrologic flow criteria used to inform and refine restoration concept geometry.

5.1.1 INLETS

Secondary Channel and Upstream Side Channel inlet elevations were set to approximate the 2,000 cfs WSE to correspond with the habitat goals for the channels. Because the inlets were designed to divert flows from the main channel when total river flows exceed 2,000 cfs, spawning habitat in the main channel should not be affected, since spawning typically occurs when main channel flows are below 1,000 cfs. Inlet mouth sections are narrow by design to maintain their form by inducing sediment-clearing flow velocities. To the extent possible, inlets were located outside of geomorphically active areas to avoid sediment deposition or scour. However, locating inlets was balanced with goals for maximizing channel length to enhance habitat and aligning the inlets with the channel form to conduct flow more effectively.

5.1.2 RIFFLES

Riffles were included in the design in the pattern and form identified by Newbury and Gadboury (1993) (also known as Newbury riffles) to provide habitat variability, increase floodplain connectivity, and to provide grade control in the Low Flow Channel. Three distinct habitat units are created by the inclusion of Newbury riffles in the Project: an upstream glide/pool section, a riffle section, and a downstream transition section. Riffle spacing was designed so that the downstream riffle backwaters the majority of the riffle upstream, creating a series of pools 1 to 2.5 ft in depth to target rearing juvenile salmonid HSI and to provide dry season groundwater-fed habitat. The backwater created by the pools will reduce the hydraulic slope and flow velocity in the Secondary Channel to help maintain velocity within target HSI values. As flows approach the riffle crest, the channel conveyance is reduced, encouraging flows to disperse laterally onto the adjacent floodplain.

Newbury riffles are intended to resist erosion and headcutting, thereby providing grade control. The riffles will be composed of well-graded (i.e., not uniform in size) sediment that will adjust to fill voids caused by such erosion. Riffle rocks will be placed in a mound with a relatively steep upstream face and a milder slope on the downstream side. Riffle crests will be keyed into the banks of the Low Flow Channel to resist lateral flanking. Rock gradations for the riffles will be as described in Section 4.3 to resist transport during a 5-year event.

The Low Flow Channel riffles are anticipated to be a self-sustaining feature that will maintain channel form by facilitating the flushing out of finer pool sediments during relatively high recurrence flow events. In low flows, velocity in the pools is slower than over the riffles due to the relatively larger cross-sectional area. In higher flows, the cross-sectional area of the riffles can exceed that of the pools, as flows spread out over the riffle (Lane and Borland 1954). This leads to a "flow reversal" (MacWilliams, et al. 2006; Keller and Florsheim 1993) in which the pool velocities are higher than those over the riffle. This may assist in maintaining pool depth and riffle form by removing sediment from the pools and distributing it to the floodplain adjacent to the riffles, or to the riffles downstream (Lane and Borland 1954). The Floodplain Terraces allow flows to spread onto a wider floodplain and slow down, reducing the shear stress, or erosive power. The Secondary Channel flows required to activate this process are associated with ~1.75-year recurrence interval flow.

5.1.3 LOW FLOW CHANNEL

The channel that serves as a connection between the upstream end of the Backwater Channel and the main channel is a two-stage design, with a Low Flow Channel and shallow Floodplain Terraces. The Low Flow Channel profile elevation varies to allow for perennial, groundwater-fed, trickle flows through a series of shallow riffle habitats separated by deeper pool and glide habitats. The Low Flow Channel was designed as a patterned (constructible) sequence of deeper and narrower areas (pools) followed by wider and shallower areas (riffles) imitative of natural, gravel bedded river forms. It is important to note that these are *not* uniformly-trapezoidal channels with unchanging widths and fixed slopes.

The Low Flow Channel was designed to maintain full depth during dry year baseflow conditions, when it is disconnected from surface flow to provide habitat for over-summering juvenile spring-run Chinook Salmon and steelhead. The Low Flow Channel geometry design is based on the estimated depth to groundwater at 880 cfs main channel flow (the 98% exceedance baseflow in June-August, and the 55% exceedance baseflow in September-October) to provide a continuous, wetted channel in the dry months of approximately half of all years. The Secondary Channel riffle crest elevations were set 6 inches below the estimated groundwater elevation to provide egress from the pools they form, and pool depths were set to 2.5 ft to discourage occurrence of predatory species. Water temperatures will be monitored to inform the hypothesis that temperatures will support over-summer rearing habitat for juvenile spring-run Chinook and steelhead.

The Low Flow Channel is designed to provide habitat to support extended juvenile rearing without providing favorable habitat for predatory and invasive species that are known to use and benefit from deeper, slow-moving water (Brown and Moyle 1991; Gelwick et al. 1997). Optimal depth and velocity for juvenile salmonids are approximately 0.9 to 2.5 ft deep and 0 to 1 ft/s, according to the HSIs shown in Figure 7. The varying slope and elevation in the riffle pattern is intended to provide a range of appropriate depths, and velocities are anticipated to be appropriately low when the Secondary Channel is disconnected from the main channel, and fed by groundwater inputs.

5.1.4 FLOODPLAIN TERRACES

The Low Flow Channel is set into broad and shallow Floodplain Terraces, as shown on sheet C10 of the construction drawings. The alignment of the Low Flow Channel moves with respect to the Floodplain Terraces, swinging left and right to move to the outside of bends. As the Low Flow Channel position moves to the outside of the bend, the Floodplain Terraces area increases on the inside of the bend. This design mimics natural channel morphology promoting helical flow patterns and floodplain activation.

The Floodplain Terraces of the Secondary Channel are designed to disperse flows out of the Low Flow Channel, creating a broader refuge area with reduced velocity. The Floodplain Terraces connect to Riparian Terrace features on the north and south sides of the Secondary Channel.

5.1.4.1 RIPARIAN TERRACES

A significant Riparian Terrace feature that contributes to the performance of the Backwater Channel is the Connector Channel. The Connector Channel is intended to divert water away from the Backwater Channel as main channel flows increase, thereby reducing depth and velocity in the Backwater Channel and extending its function as a refuge for rearing fish. The Connector Channel is a wide, shallow channel that extends from the top of bank on the south side of the Secondary Channel to the Overflow Channel. While it serves to divert water away from the Backwater Channel, it also provides expanded floodplain habitat over the upper range of ecological flows associated with salmonid rearing (5,000 to 10,000 cfs).

A Riparian Terrace was included on the north side of the Secondary Channel to disperse flows and reduce velocity. This Riparian Terrace slopes up from the top of bank of the Secondary Channel Floodplain Terrace, activating around 5,000 cfs. This feature is intended to disperse flows on the higher end of the range of ecological flows to maintain the effectiveness of the Secondary Channel and Backwater Channel to provide habitat value to rearing juvenile salmonids at these flows.

5.2 BACKWATER CHANNEL

The Backwater Channel is an existing feature on the north side of Long Bar that this Project seeks to enhance through opportunistic grading, and to develop perennial access to high quality edge habitat. Perennial access to the channel will be provided by removing existing higher elevation areas that currently divide the area into separate pools. Existing vegetation will be preserved to the extent practicable to maintain existing habitat value and grading will be designed to increase edge length and to bring the channel edges closer to overhanging vegetation. Because the area is spatially small and narrow, it is anticipated that it will function best as rearing habitat over the lower end of the range of ecological flows associated with salmonid rearing (2,000 to 5,000 cfs), which occur as often as 2 out of 3 years, but not less than 1 out of 3 years. The enhanced perennial access will also provide increased opportunity for over-summering juvenile spring-run Chinook Salmon and steelhead.

Perennial access will be provided by maintaining a minimum depth in the channel and lowering local high spots to provide continuous egress to the outlet at the downstream end. The bed of the Backwater Channel grading was designed to provide 1 ft of depth during the low water period, based on the estimated groundwater elevation surface described previously. The downstream end of the backwater will be modified to create a perennial connection to the river.

Enhanced edge habitat was provided by widening the channel, opportunistically, to bring the edges of the feature into contact with existing vegetation. Grading extents were based on vegetation observed in cbec's 2017 aerial orthophoto. A varied bank line was established to increase edge length and to incorporate flow diversity in the design to provide habitat variability. Design grading elevations along the edges of the Backwater Channel were set to provide topographic heterogeneity such that the feature functions over the lower end of the range of ecological flows.

By enhancing pool connectivity and communication of groundwater inflows throughout the Backwater Channel, the design is intended to reduce water temperatures in summer. This should reduce bullfrog habitat suitability in the Backwater Channel.

5.3 UPSTREAM SIDE CHANNEL

Like the Backwater Channel, the Upstream Side Channel is an existing feature that will be enhanced to provide increased access to and egress from the floodplain. Flow connection was enhanced by extending a small channel upstream to connect to the main channel and to activate at 2,000 cfs. A narrow, shallow central channel was included to convey flows from the upstream inlet to the downstream outlet, providing constant slope and drainage to minimize fish stranding potential. The central channel was designed with a minimum depth of 6 inches to encourage spreading of flows onto the broad floodplains adjacent to it. Floodplain grading around the central channel was designed to activate just above 2,000 cfs. Main channel flow and floodplain elevations were varied to provide suitable depth and velocity over the range of ecological flows associated with salmonid rearing (2,000 cfs to 10,000 cfs). A varied bank line was established to increase proximity to vegetation and edge length, and to create flow diversity. Grading extents were based on vegetation observed in cbec's 2017 aerial orthophoto.

Isolated pools exist in the area where the Upstream Side Channel will be constructed. Similar to the Backwater Channel, Upstream Side Channel grading will connect these pools with the intention of enhancing circulation of groundwater in the summer and lowering water temperatures, which will reduce bullfrog habitat suitability.

5.4 FLOOD RUNNER CHANNELS

The Flood Runner channels are intended to mimic natural features that form on bars due to scour during elevated flows. The Flood Runner channels will provide off-channel rearing habitat through regular and sustained shallow inundation of these channel features in most years. Main channel flows are expected to exceed 2,000 cfs for a duration of 21 days in two out of three years (i.e., 66% exceedance) and to exceed 4,100 cfs for a duration of 21 days in one out of 2 years (i.e., 50% exceedance). The Flood Runner channels were designed to activate at 3,000 cfs, meaning it should be inundated for a 21-day period at least every other year.

The Flood Runners are designed to provide shallow-water habitat within their banks, and access to the larger, open floodplain areas that surround them as flows increase. The channels have a 30 ft bottom width, are 9 inches deep, and are anticipated to be full at main channel flows of 3,500 cfs. As main channel flows increase to 5,000 cfs, the banks of the Flood Runners are anticipated to be covered by 6 inches of water, and flows should spread out onto the larger Enhanced Floodplain.

5.4.1 BACKWATERS

Backwaters, defined as partially enclosed, low-velocity areas separated from the main channel, were designed to create shallow, slackwater areas that salmonids have shown preference for over higher velocity in-channel habitats (Beechie, et al. 2005). The perennial Backwaters will provide habitat diversity, and increased edge habitat during the fall-run Chinook Salmon rearing period, and are hypothesized to provide beneficial habitat for over-summering juvenile spring-run Chinook Salmon and steelhead. Backwaters were designed to perform during main channel flows ranging from base flow to 5,000 cfs. Backwater bed elevations were set for shallow inundation (less than 1 ft) during main channel flows of 1,000 cfs and less than 3 ft depth at 5,000 cfs. The Backwaters, located at the downstream extent of Flood Runner Channels were sloped toward the downstream ends to allow escapement from the upstream end of the Backwaters and adjacent floodplain areas. Inundation depths and seasonality were reviewed with respect to predator habitat preferences to confirm the Backwaters do not provide favorable conditions.

5.5 ENHANCED FLOODPLAIN

In addition to the riparian terraces surrounding the Secondary Channel, and the fringes of the Backwater Channel and Upstream Side Channel, the habitat restoration design also includes several larger areas of restored floodplain habitats. These are located on the larger degraded portion of Long Bar, adjacent to the Flood Runners. Enhanced Floodplain elevations were set to provide inundation of the entire graded floodplain area for a period of 21 days in 1 out of 3 years (i.e., 33% exceedance), which corresponds to a main channel flow of approximately 5,000 cfs. These floodplain areas are intended to provide additional inundated acreage at the upper end of the targeted range of ecological flows (5,000 cfs to 10,000 cfs), and to provide a depth to groundwater that will promote vegetation establishment and recruitment.

5.6 MAIN CHANNEL TERRACES

Large areas of more frequently inundated floodplain were added to the design adjacent to the main channel. The elevations of these large terraces were designed to maintain in-channel flows during the spawning season, but to potentially activate during all other times of the year, to provide a significant addition to available shallow edge habitat in the Project area. The terraces slope gently toward the main channel at variable slopes. The edges adjacent to the main channel are anticipated to inundate around 1,000 cfs and the backs of the terraces are anticipated to become wet at 2,000 cfs main channel flow. The variation in elevation in the terraces was intended to promote utilization over the range of ecological flows associated with salmonid rearing (2,000 cfs to 10,000 cfs).

5.7 ROUGHNESS FEATURES

Inorganic roughness features were added to areas of broadly graded floodplain (Enhanced Floodplain, Main Channel Terraces) to add hydraulic variability and to promote fine sediment accretion. These features will be oriented to form ridges perpendicular to flow to encourage sediment deposition on the downstream side. They will be constructed of locally available, well-graded, rounded rock stacked approximately 3 to 6 ft high, with 3:1 slopes.

5.8 UPLANDS

Areas of uplands to be preserved were selected based on the value of existing vegetation to provide shade and habitat for other species adjacent to the graded Project areas, and to preserve vegetation species of concern (i.e., Valley Elderberry).

6 DESIGN PERFORMANCE

Design performance was assessed by comparing the Existing and Project conditions for inundated acreage (Table 10), Chinook Salmon fry and juvenile rearing habitat (Tables 11 and 12), steelhead fry and juvenile rearing habitat (Tables 13 and 14), and Chinook Salmon (Table 15) and steelhead (Table 16) spawning habitat.

6.1 HABITAT SUITABILITY

The Project seeks to increase salmonid fry and juvenile rearing habitat while not impacting current Chinook Salmon and steelhead spawning habitat. Table 10 shows the amounts of the inundated area (i.e., wetted extent). The Project increases the wetted area by 5% at the baseflow of 700 cfs, 29% at 2,000 cfs, and a maximum of 51% at 5,000 cfs. Figure 9 shows respective inundation footprints of the flows in Table 10 for Project conditions.

Table 10. Inundated acreage for Existing and Project conditions

Flow (cfs)	Existing (Acres)	Project (Acres)	Difference	
			Acres	(%)
700	32.6	34.2	1.6	5%
1,000	34.7	36.5	1.8	5%
2,000	39.9	51.5	11.6	29%
3,500	44.9	64.8	19.9	44%
5,000	50.2	75.8	25.6	51%
7,500	62.3	92.2	29.9	48%
10,000	69.2	99.2	30.0	43%

Tables 11 and 12 show the WUA comparison between Existing and Project conditions for Chinook Salmon fry and juvenile rearing habitat conditions. The Project increases the available habitat by 10-22% at the baseflow of 700 cfs, 131-182% at 2,000 cfs, and a maximum of 264-320% at 3,500 cfs (see Figures 10 through 23 for the HSI comparisons).

Table 11. Chinook Salmon fry rearing WUA

Flow (cfs)	Existing (acres)	Project (acres)	Difference	
			Acres	(%)
700	5.1	6.2	1.1	22%
1,000	3.9	5.5	1.6	40%
2,000	3.2	9.0	5.8	182%
3,500	2.9	12.2	9.3	320%
5,000	3.3	11.8	8.5	254%
7,500	5.6	11.1	5.5	99%
10,000	7.6	9.7	2.1	27%

Table 12. Chinook Salmon juvenile rearing WUA

Flow (cfs)	Existing (acres)	Project (acres)	Difference	
			Acres	(%)
700	8.0	8.8	0.8	10%
1,000	6.4	7.5	1.1	17%
2,000	4.4	10.2	5.8	131%
3,500	3.8	13.8	10.0	264%
5,000	4.2	14.7	10.5	251%
7,500	6.1	14.8	8.7	143%
10,000	7.9	13.4	5.5	70%

Tables 13 and 14 show the WUA comparison between Existing and Project conditions for Steelhead fry and juvenile rearing habitat conditions. The Project increases the available habitat by 3-26% at the baseflow of 700 cfs, 102-213% at 2,000 cfs, and a maximum of 260-338% at 3,500 cfs (see Figures 24 – 37 for the HSI comparisons).

Table 13. Steelhead fry rearing WUA

Flow (cfs)	Existing (acres)	Project (acres)	Difference	
			Acres	(%)
700	4.8	6.0	1.2	26%
1,000	3.8	5.5	1.7	46%
2,000	3.1	9.7	6.6	213%
3,500	2.8	12.1	9.4	338%
5,000	3.2	11.3	8.1	257%
7,500	5.6	10.8	5.3	94%
10,000	7.5	9.1	1.6	21%

Table 14. Steelhead juvenile rearing WUA

Flow (cfs)	Existing (acres)	Project (acres)	Difference	
			Acres	(%)
700	8.5	8.8	0.3	3%
1,000	6.8	7.7	1.0	14%
2,000	4.3	8.7	4.4	102%
3,500	3.7	13.2	9.5	260%
5,000	3.8	14.0	10.2	270%
7,500	5.3	14.3	9.0	171%
10,000	7.4	14.3	6.9	92%

Table 15 shows the WUA comparisons between Existing and Project conditions for Chinook Salmon spawning habitat conditions. The Project has negligible impact to Chinook spawning habitat with increases of 0.1 acres for all the flows analyzed.

Table 15. Chinook Salmon spawning WUA comparison

Flow (cfs)	Existing (Acres)	Project (Acres)	Difference	
			Acres	(%)
700	14.1	14.2	0.1	1%
880	13.7	13.8	0.1	1%
1,000	13.3	13.4	0.1	1%

[1]Note that substrate was not considered in this evaluation; hydraulic variables (depth and velocity) only.

Table 16 shows the WUA comparisons between Existing and Project conditions for steelhead spawning habitat conditions. The Project has negligible impact to steelhead spawning habitat from 700 to 1,000 cfs, but increases spawning habitat by 33% at 2,000 cfs and up to 271% at 5,000 cfs.

Table 16. Steelhead spawning WUA comparison

Flow (cfs)	Existing (Acres)	Project (Acres)	Difference	
			Acres	(%)
700	14.6	14.7	0.1	1%
1,000	12.5	12.7	0.1	1%
2,000	7.0	9.3	0.1	33%
3,500	4.8	12.7	2.3	164%
5,000	4.1	15.1	7.9	271%

[1]Note that substrate was not considered in this evaluation; hydraulic variables (depth and velocity) only.

7 ASSUMPTIONS AND LIMITATIONS

The Project design includes the following assumptions and limitations.

- Given the river's partially unregulated flood regime, abundant local sediment supply and corridor width, there is considerable uncertainty regarding the geomorphic persistence of engineered Project features. It cannot be guaranteed that all Project features will persist through major flood events. The river is highly dynamic, exhibiting a variety of erosional and depositional mechanisms. As such, some components of designs should be expected to evolve through time. This is an appropriate expectation, as alluvial rivers are dynamic in nature. Approaching the overall Project with an understanding that significant geomorphic adjustments following large events are indicative of a dynamic gravel-bedded river is advisable, and that changes to designed features does not constitute failure of the Project. The main goal is to put the river on a recovery trajectory so that ecological function can be sustained regardless of the persistence of certain features.
- By re-grading the floodplain as prescribed in the Project design, natural sediment and vegetation recruitment processes will also be re-initiated (Sellheim et al. 2016). Sediment for vegetation recruitment and establishment can be expected to increase over time without the introduction of imported fine material (e.g., topsoil). Thus, imported topsoil was not included in the design.
- Mitigation for flood impacts: The ~5 and ~10-year recurrence interval floods (i.e., 40,000 and 70,000 cfs events) were analyzed to understand shear stresses and rock sizing for the design features. Since the Project removes sediment from the floodway and increases the conveyance within the Project Area, developing a larger flood model for higher discharges was not warranted.

8 REFERENCES

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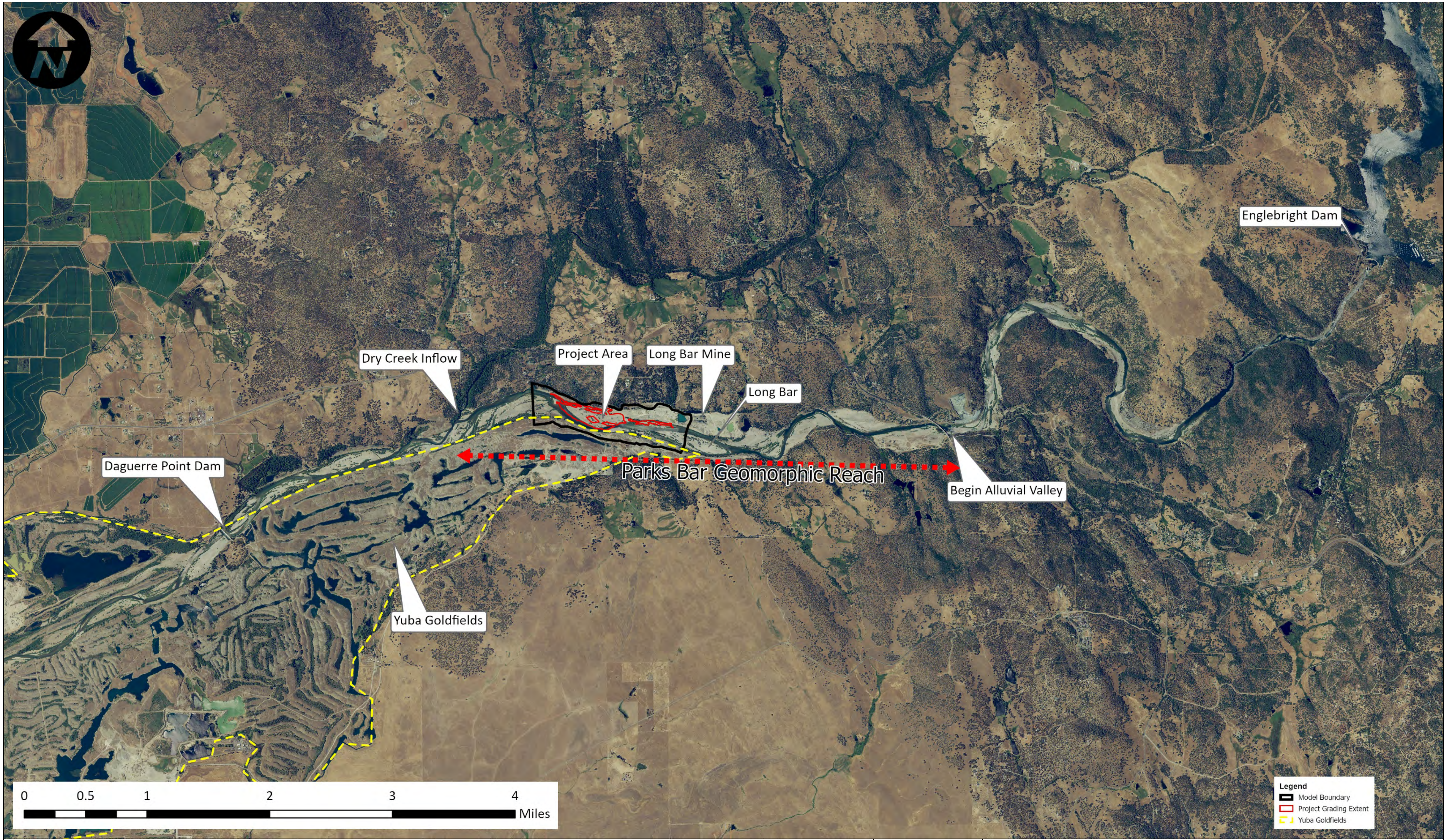
FIGURES

Attachment 1



Notes:

cbec

Lower Yuba River Long Bar Enhancement Project

Long Bar Project Site Location

Project No.17-1012 | Created By: MDW | **Figure 1**

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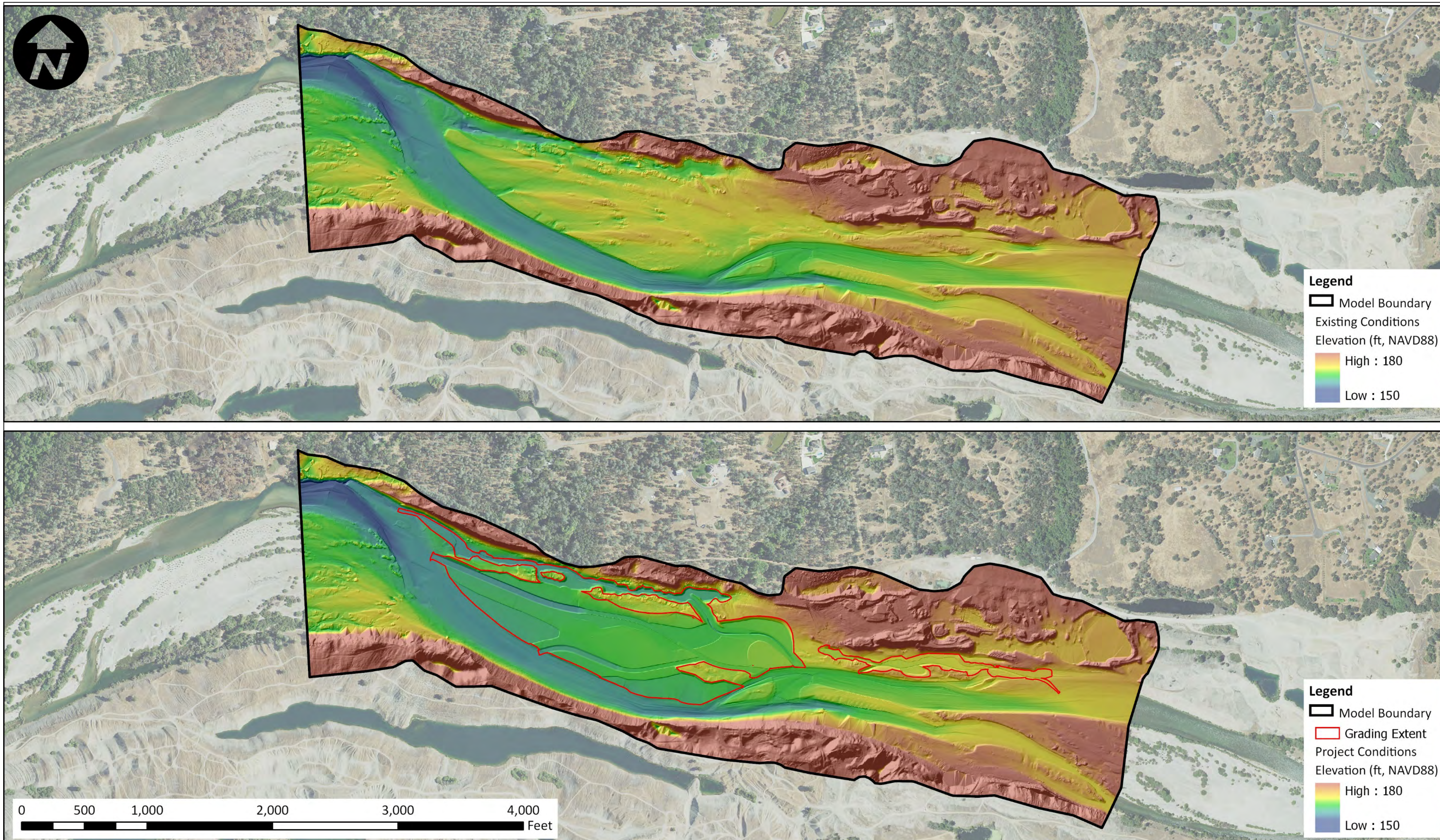

Notes:

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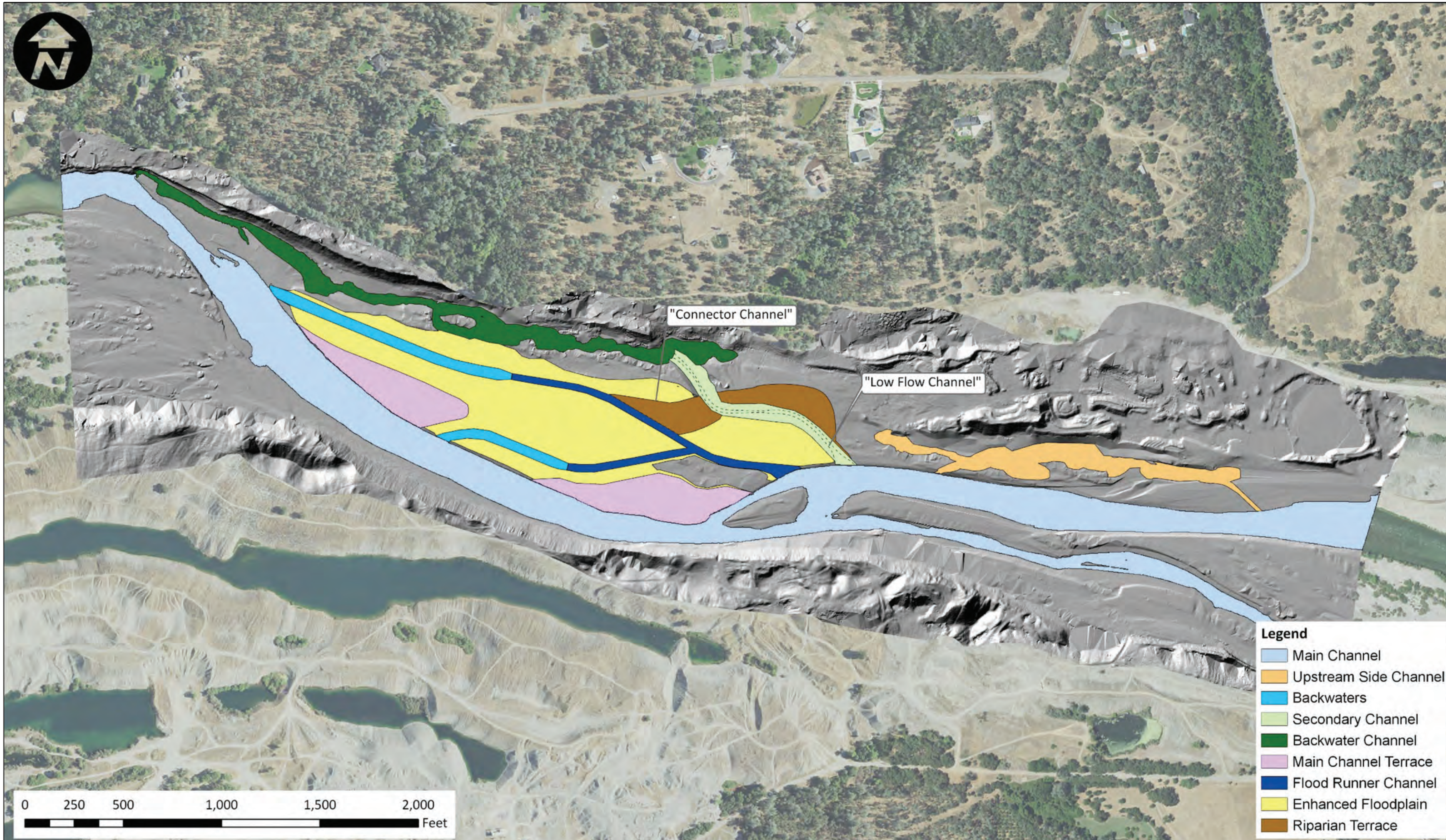
Lower Yuba River Long Bar Enhancement Project

Topography and Bathymetry – Existing and Project Conditions

Project No. 17-1012	Created By: MDW	**Figure 2**

Attachment 1



Notes:	cbec	*Lower Yuba River Long Bar Enhancement Project* **Project Elements**		
		Project No. 17-1012	Created By: MDW	**Figure 3**

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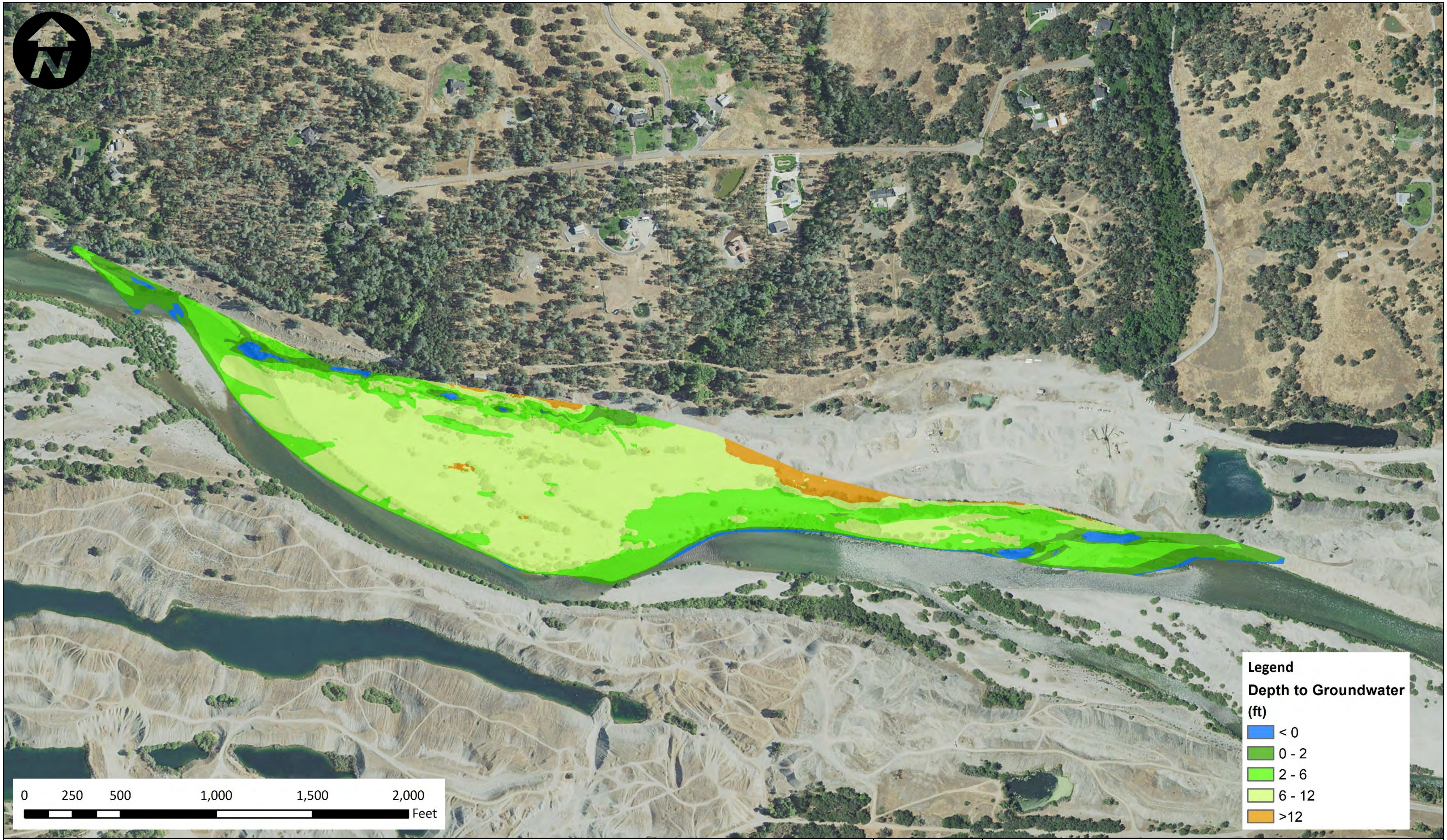


Notes: Depth to groundwater for existing condition. Vegetation establishment success, as determined by groundwater depth, is expected to fall within three categories:

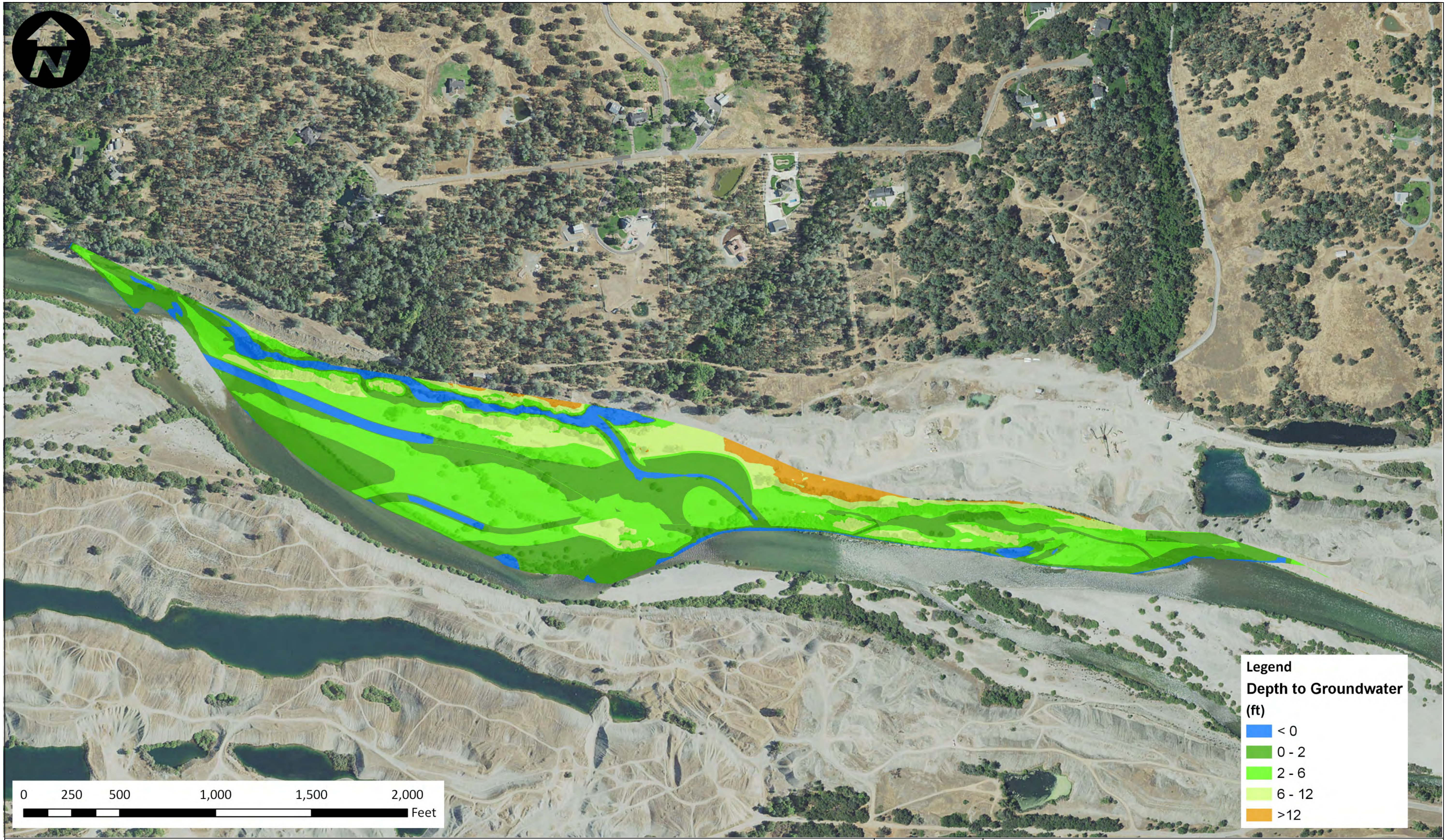
1. Shallow: 0-2 feet (too wet for elderberries and cottonwood, herbaceous vegetation and shrubs likely),
2. Moderate: 2-6 feet (moderate confidence that elderberry and cottonwood would establish successfully), and
3. High: 6-12 feet (high confidence that elderberry and cottonwood would establish successfully).

cbec

Lower Yuba River Long Bar Enhancement Project

Depth to Groundwater – Existing Conditions

Project No. 17-1012	Created By: MDW	**Figure 4**



Notes: Depth to groundwater for Project condition. Vegetation establishment success, as determined by groundwater depth, is expected to fall within three categories:

1. Shallow: 0-2 feet (too wet for elderberries and cottonwood, herbaceous vegetation and shrubs likely),
2. Moderate: 2-6 feet (moderate confidence that elderberry and cottonwood would establish successfully), and
3. High: 6-12 feet (high confidence that elderberry and cottonwood would establish successfully).

cbec

Lower Yuba River Long Bar Enhancement Project

Depth to Groundwater – Project Conditions

Project No. 17-1012	Created By: MDW	**Figure 5**

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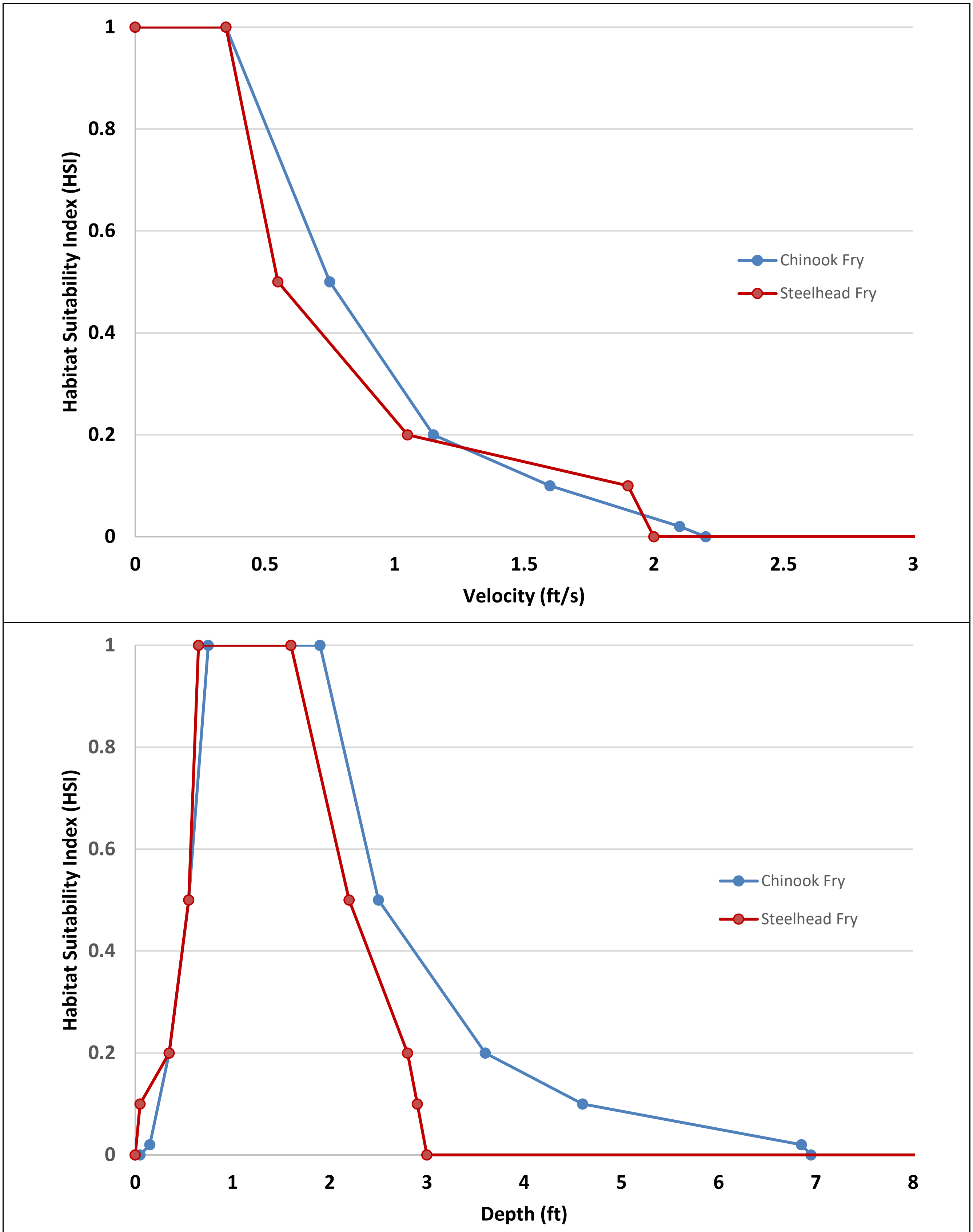

Notes:	cbec	*Lower Yuba River Long Bar Enhancement Project* **Depth and Velocity HSI – Chinook and Steelhead Fry Rearing**		
		Project No. 17-1012	Created By: MDW	**Figure 6**

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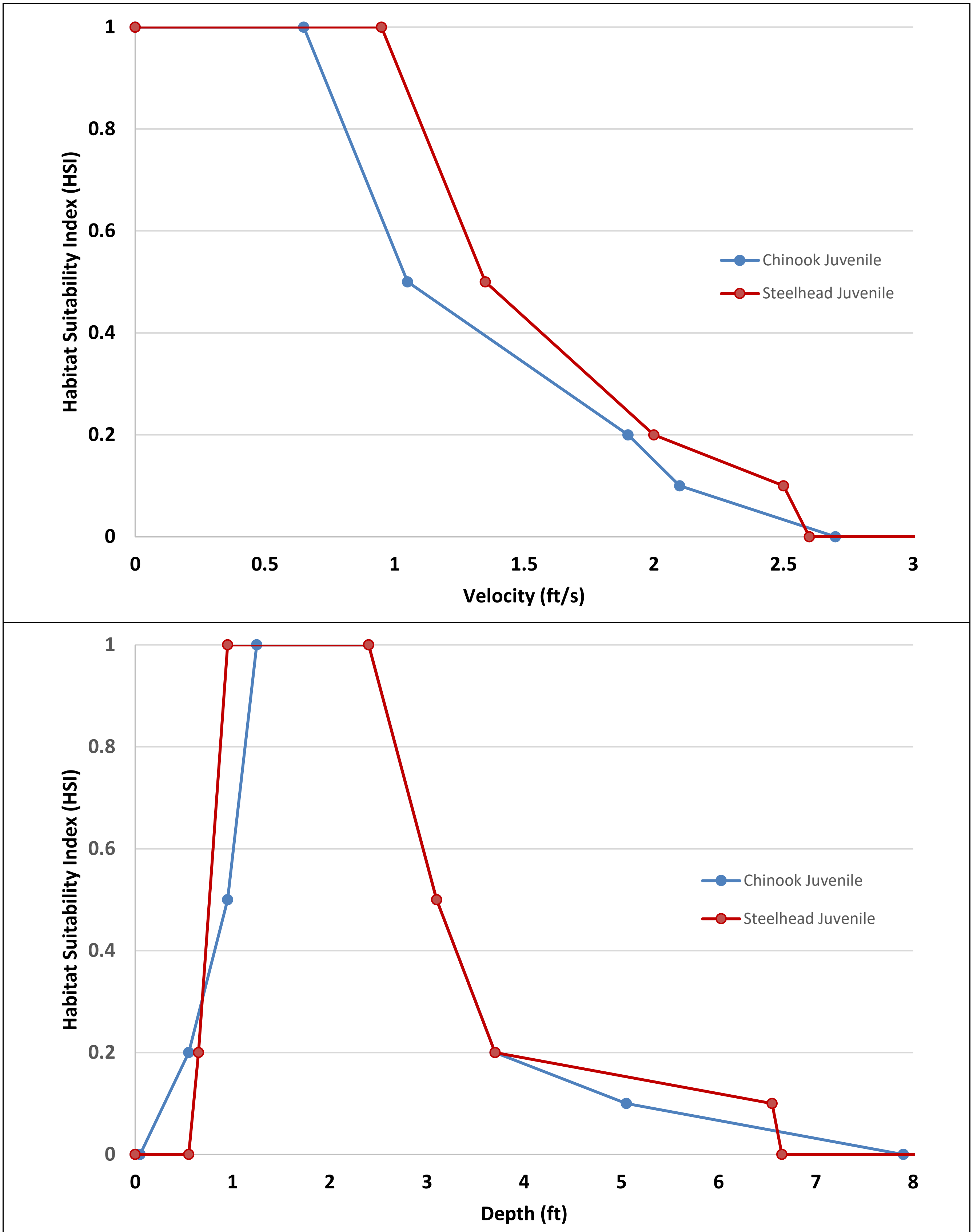

Notes:

Lower Yuba River Long Bar Enhancement Project

Depth and Velocity HSI – Chinook and Steelhead Juvenile Rearing

Project No. 17-1012	Created By: LL	**Figure 7**

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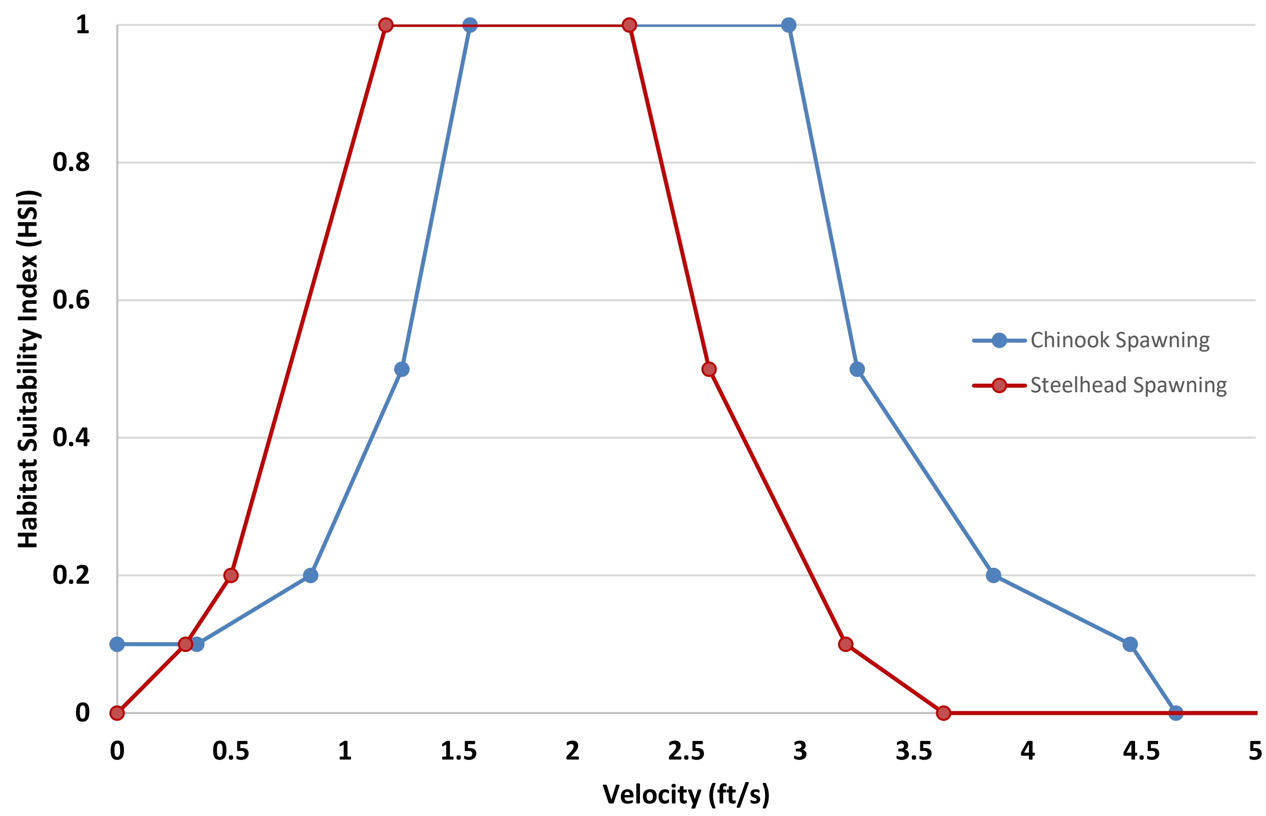
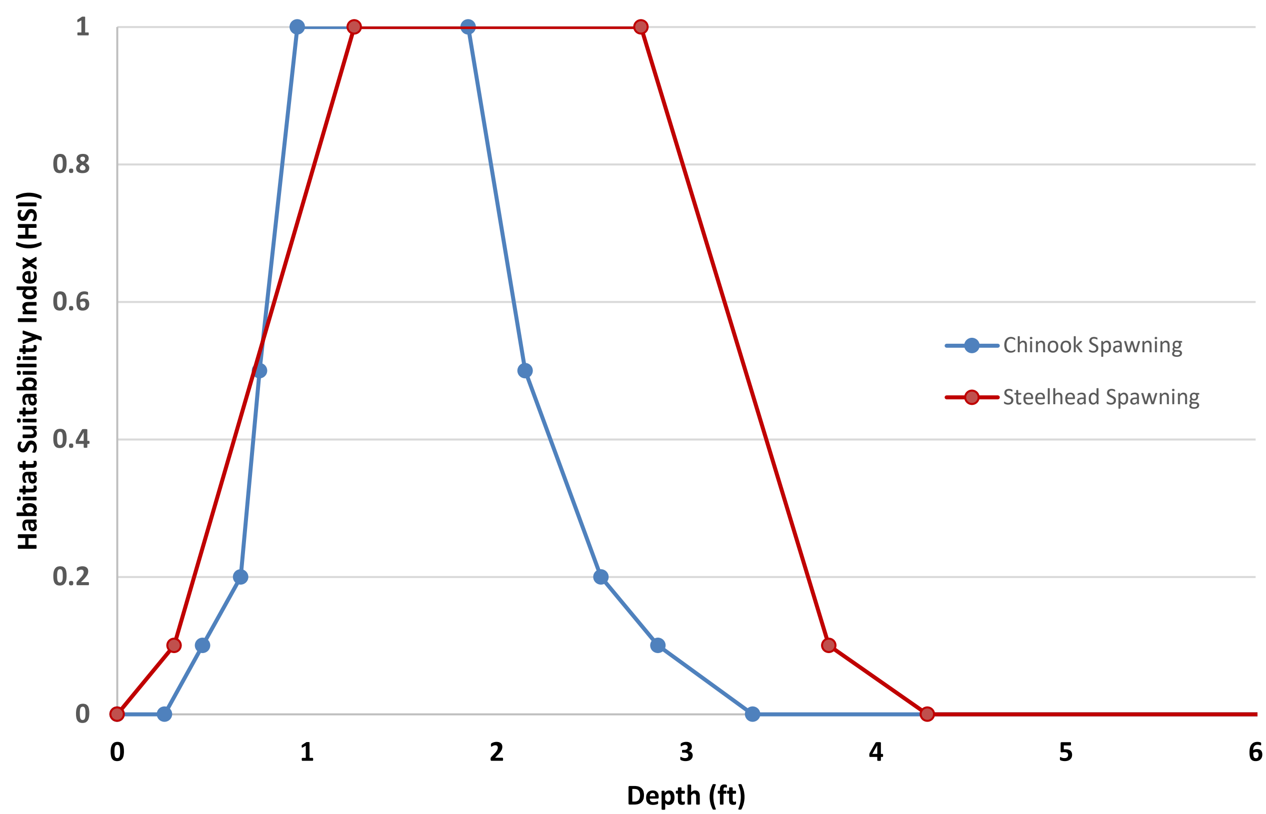


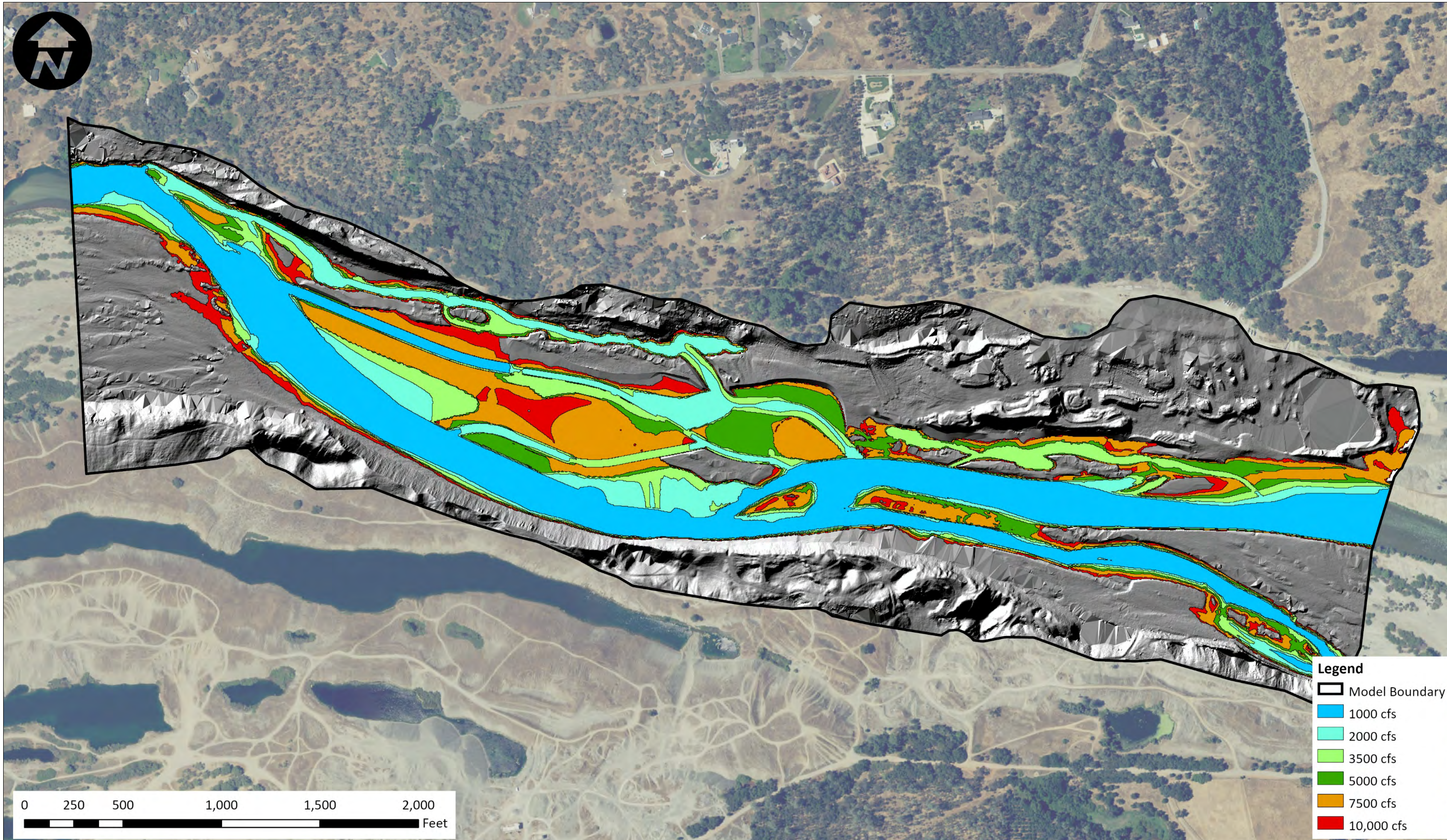


Notes:

Lower Yuba River Long Bar Enhancement Project

Depth and Velocity HSI – Salmonid Spawning

Project No. 17-1012	Created By: MDW	**Figure 8**



Notes:

Lower Yuba River Long Bar Enhancement Project

Inundation Footprint – Project Conditions

Project No. 17-1012	Created By: MDW	**Figure 9**

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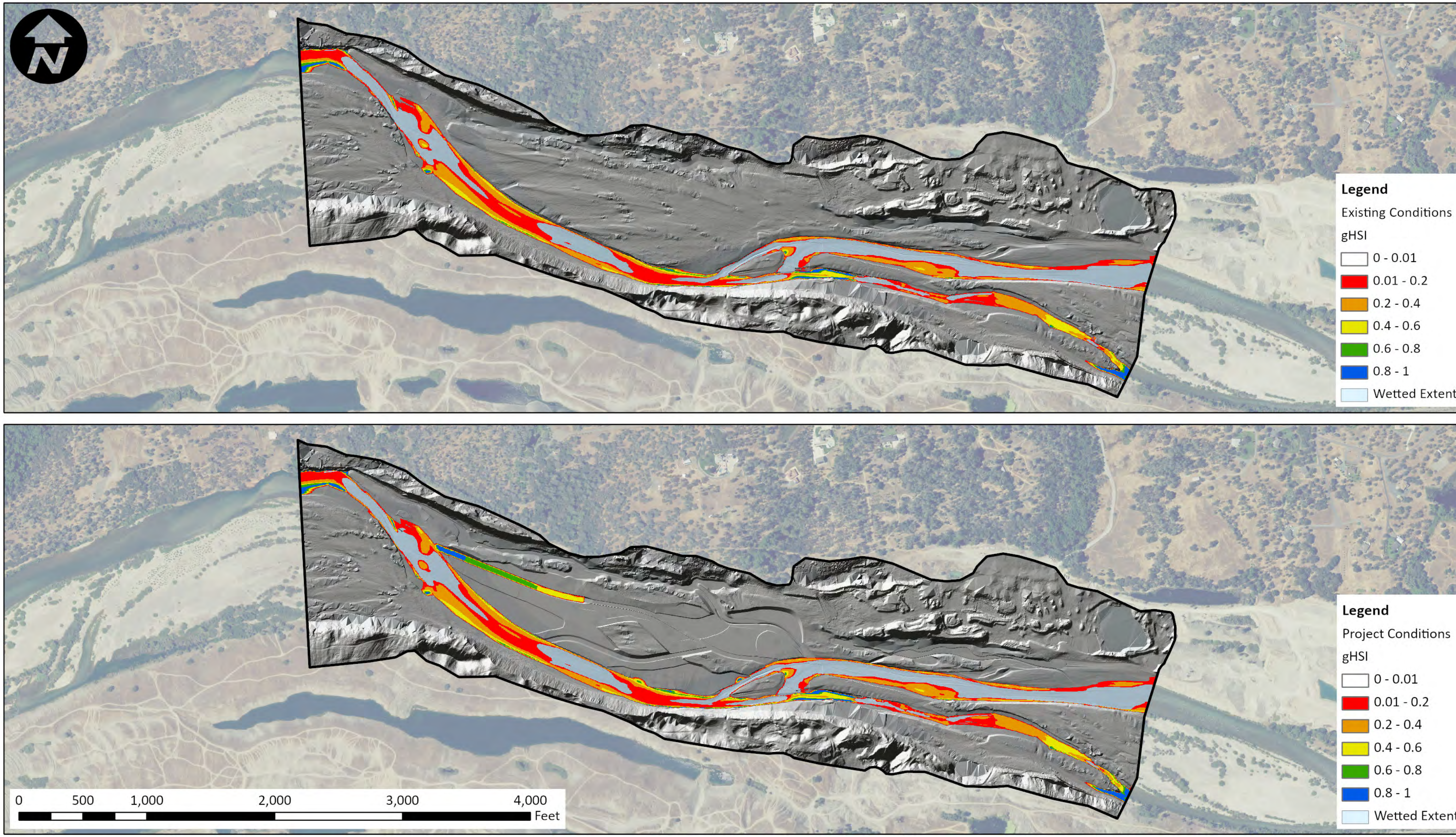

Notes:

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Long Bar Enhancement Project

Chinook Fry Hydraulic Habitat Suitability – 700 cfs

Project No. 17−1012	Created By: LL	**Figure 10**

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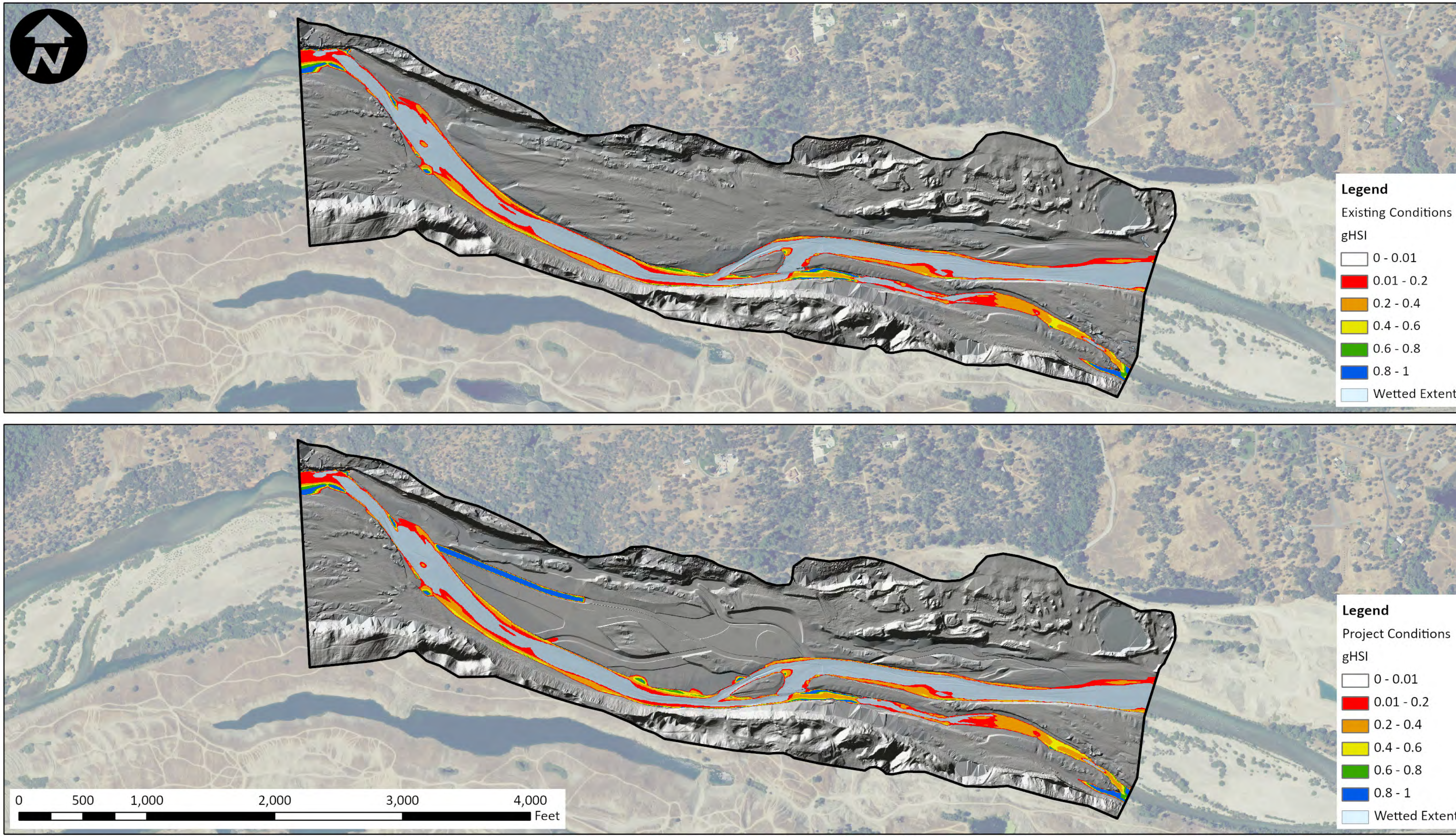


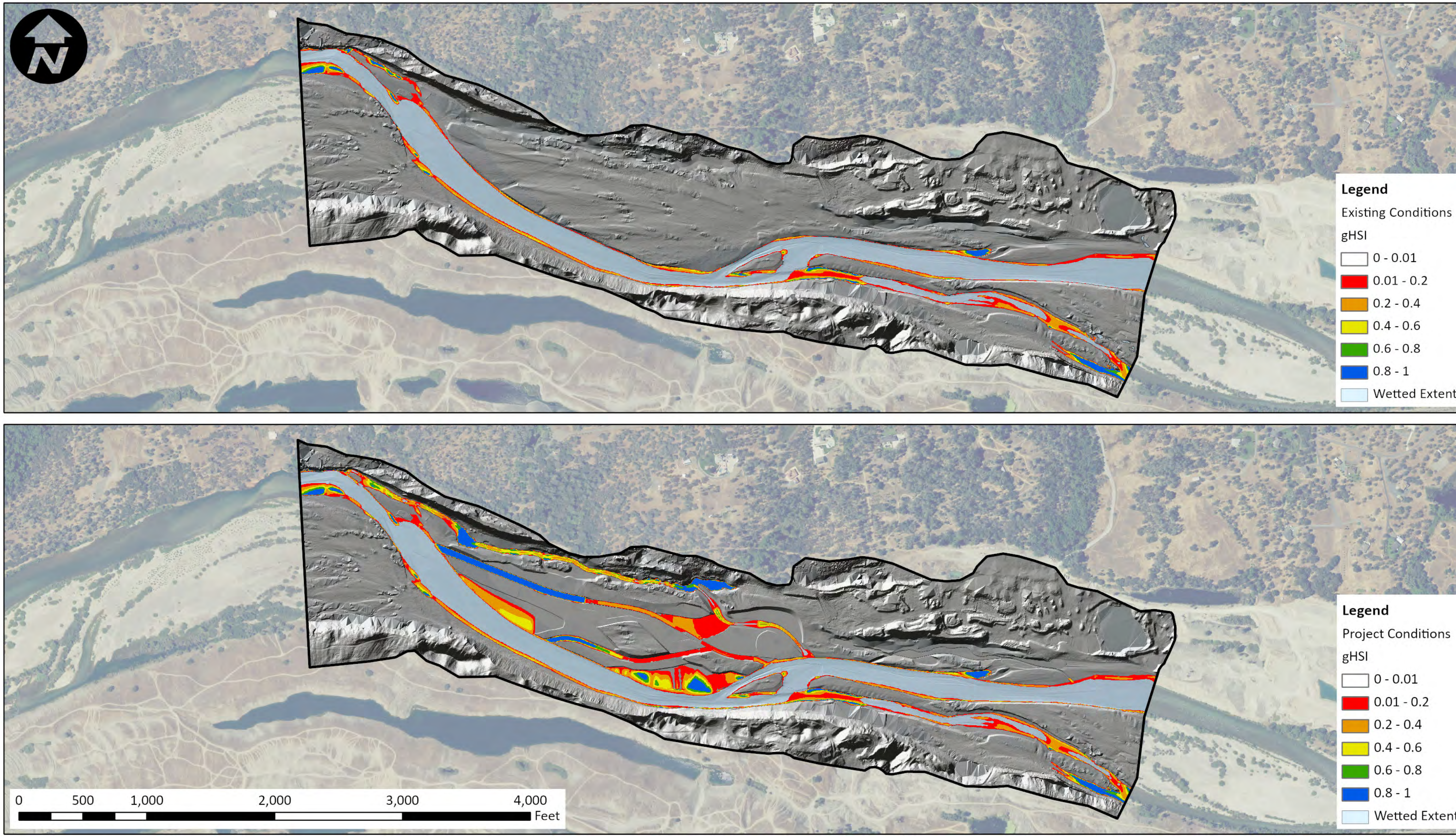
Notes:

Long Bar Enhancement Project

Chinook Fry Hydraulic Habitat Suitability – 1000 cfs

Project No. 17−1012	Created By: LL	**Figure 11**

Attachment 1



Notes:

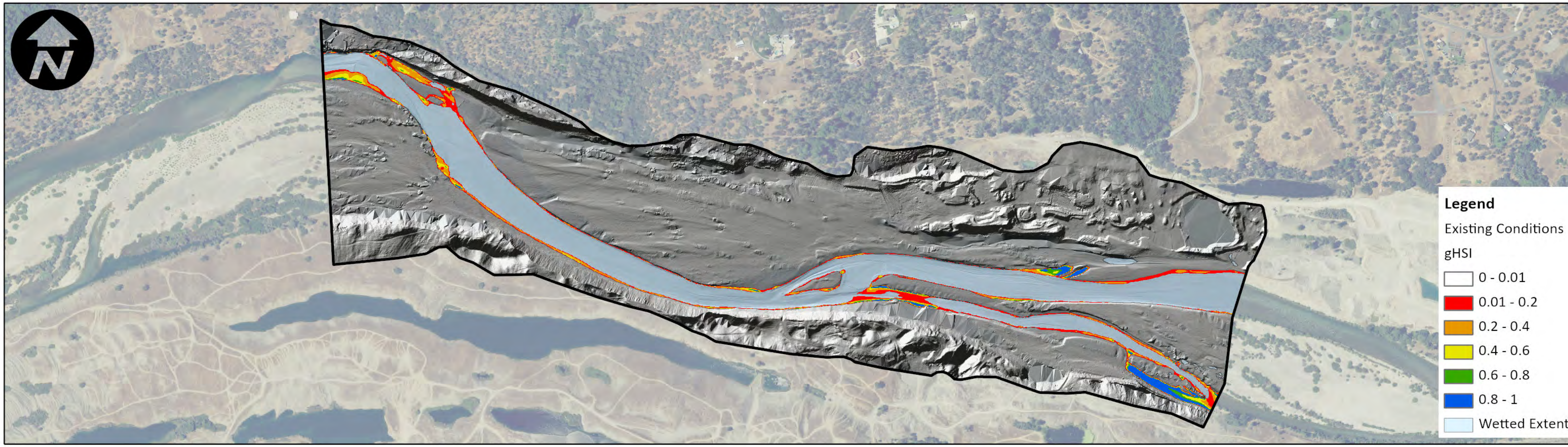
cbec eco engineering

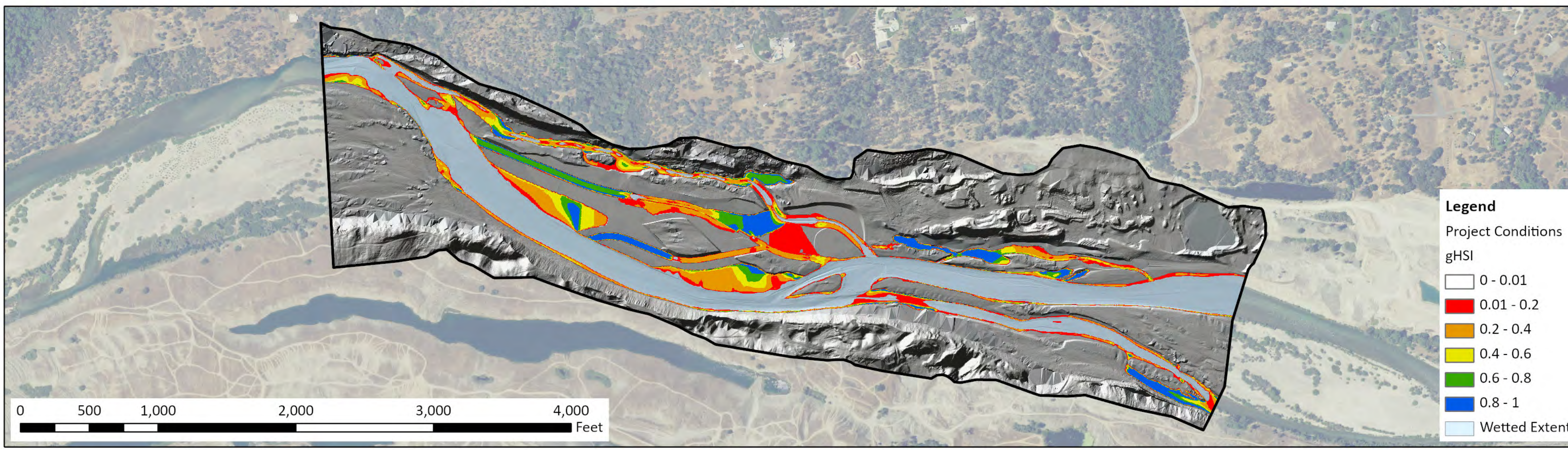
Long Bar Enhancement Project

Chinook Fry Hydraulic Habitat Suitability – 2000 cfs

Project No. 17–1012	Created By: LL	**Figure 12**

Attachment 1





Notes:

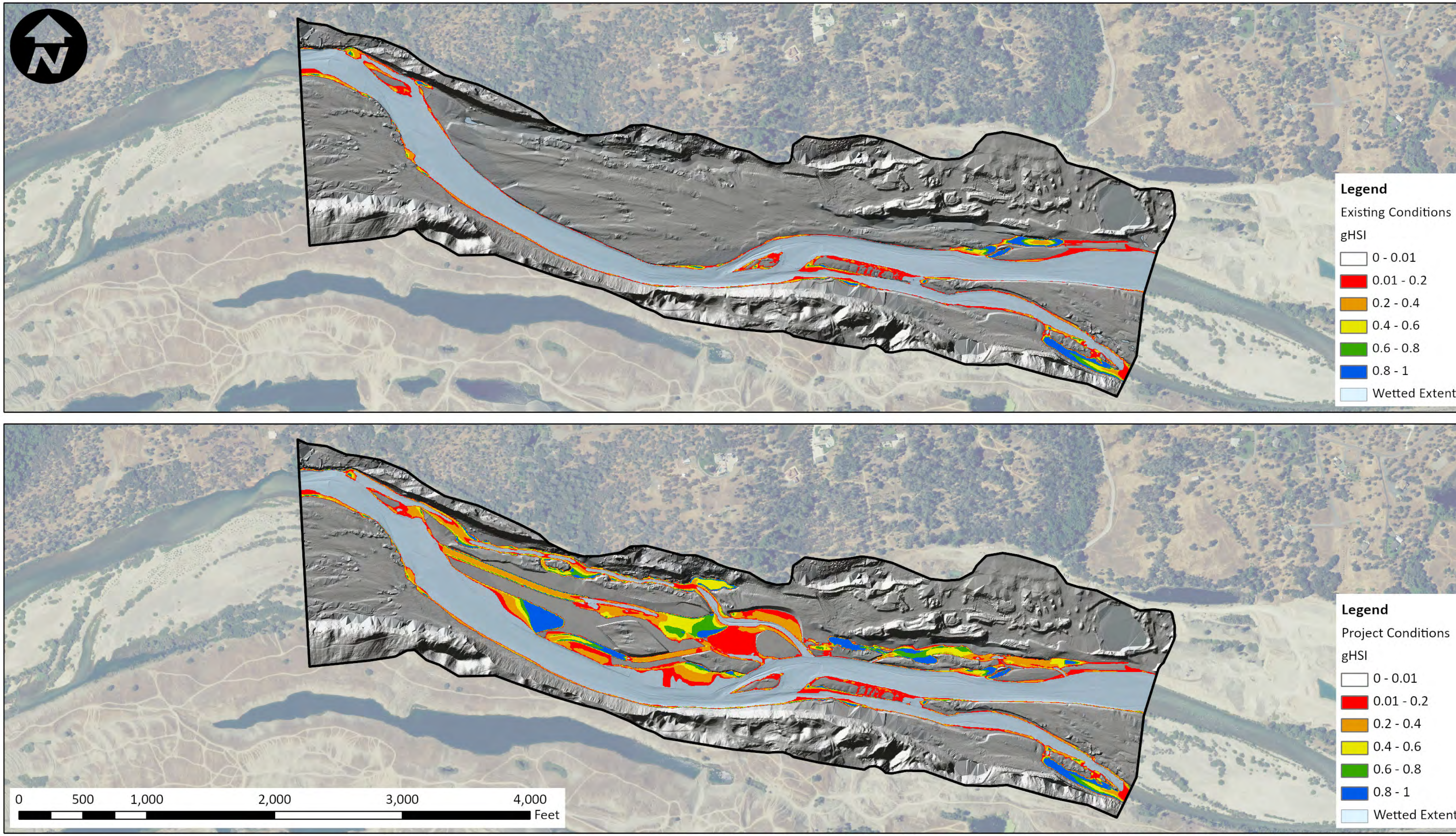
cbec eco engineering

Long Bar Enhancement Project

Chinook Fry Hydraulic Habitat Suitability – 3500 cfs

Project No. 17−1012	Created By: LL	**Figure 13**

Attachment 1



Notes:

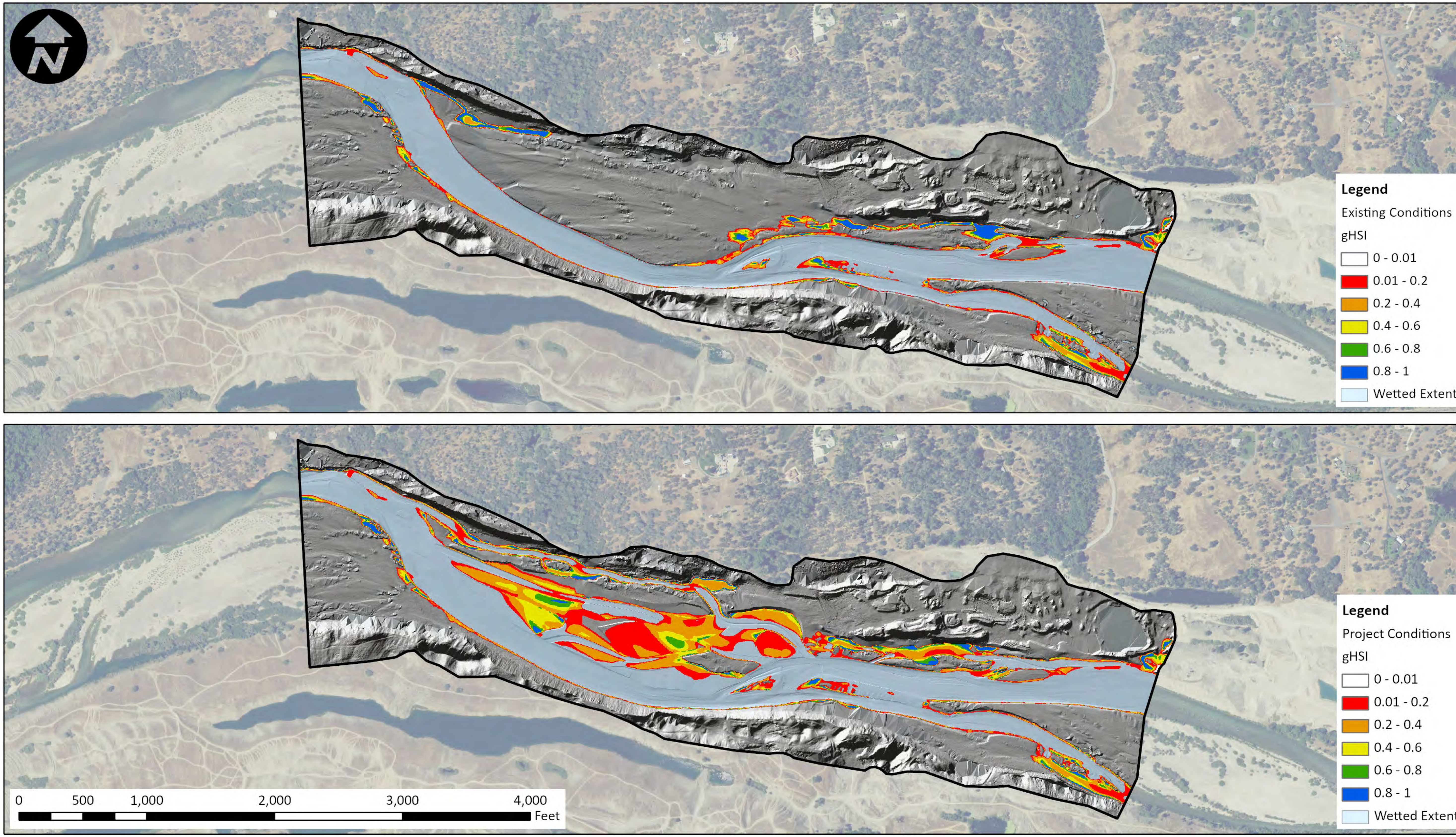
cbec eco engineering

Long Bar Enhancement Project

Chinook Fry Hydraulic Habitat Suitability – 5000 cfs

Project No. 17−1012 | Created By: LL | **Figure 14**

Attachment 1



Notes:

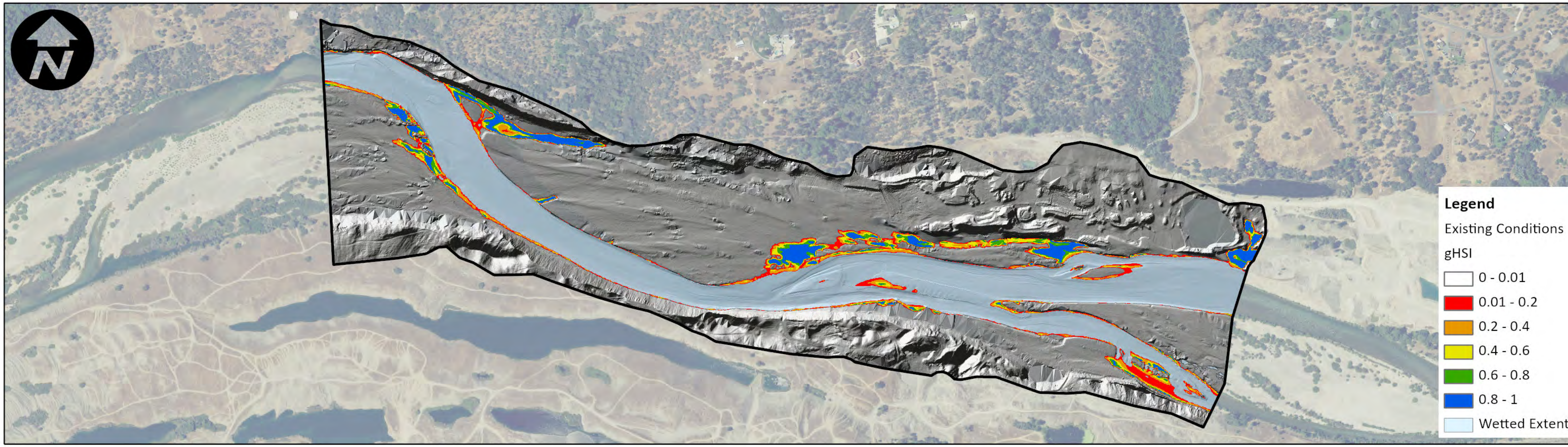
cbec eco engineering

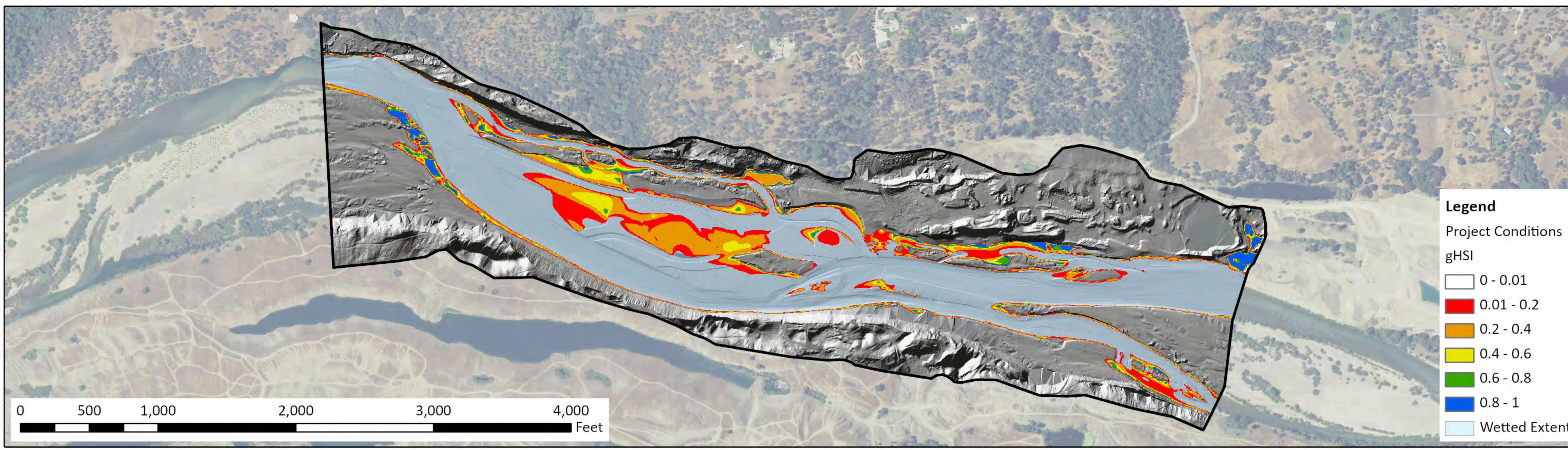
Long Bar Enhancement Project

Chinook Fry Hydraulic Habitat Suitability – 7500 cfs

Project No. 17−1012	Created By: LL	**Figure 15**

Attachment 1





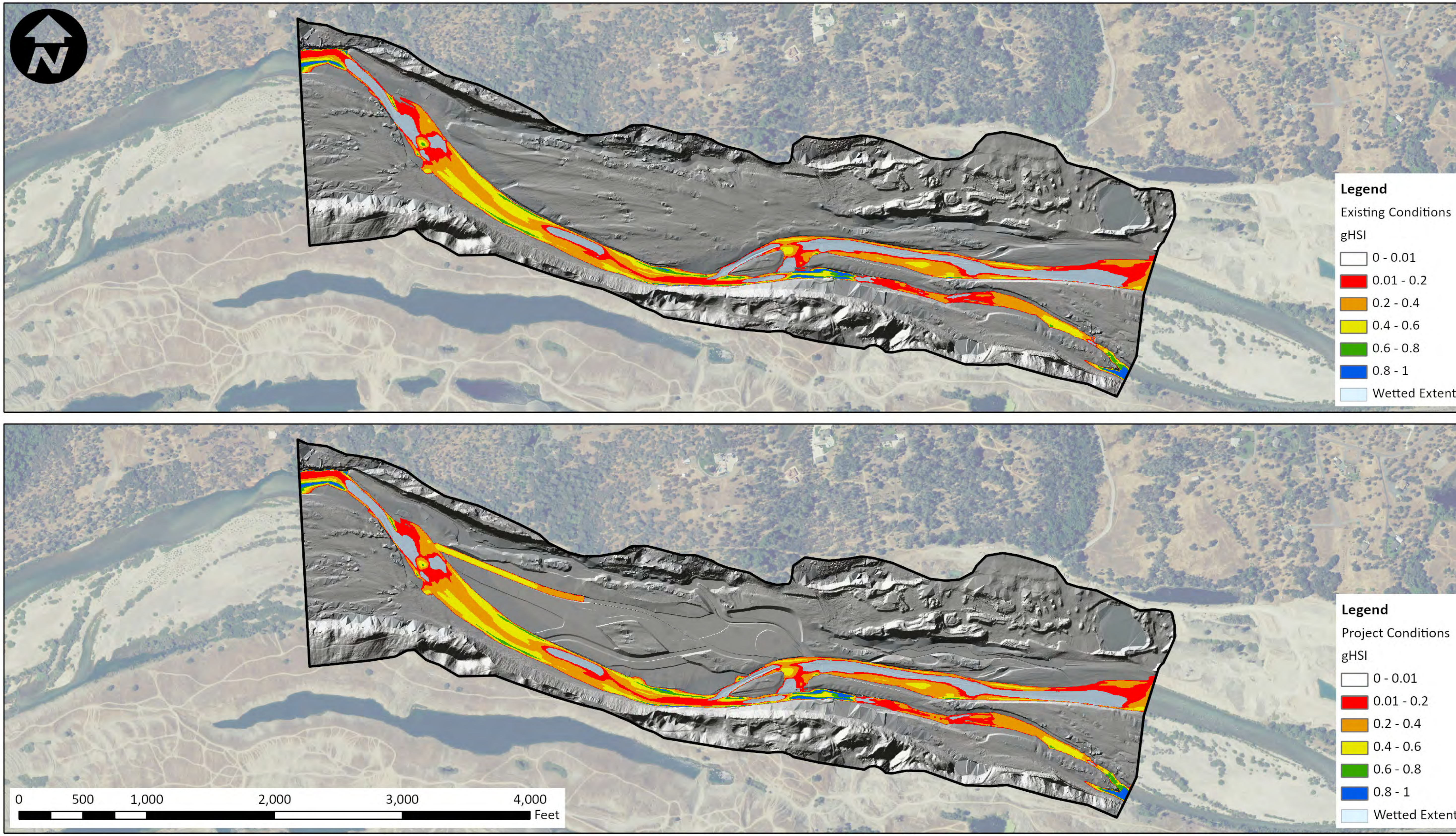
Notes:

cbec eco engineering

Long Bar Enhancement Project
Chinook Fry Hydraulic Habitat Suitability – 10000 cfs

Project No. 17−1012 | Created By: LL | **Figure 16**

Attachment 1



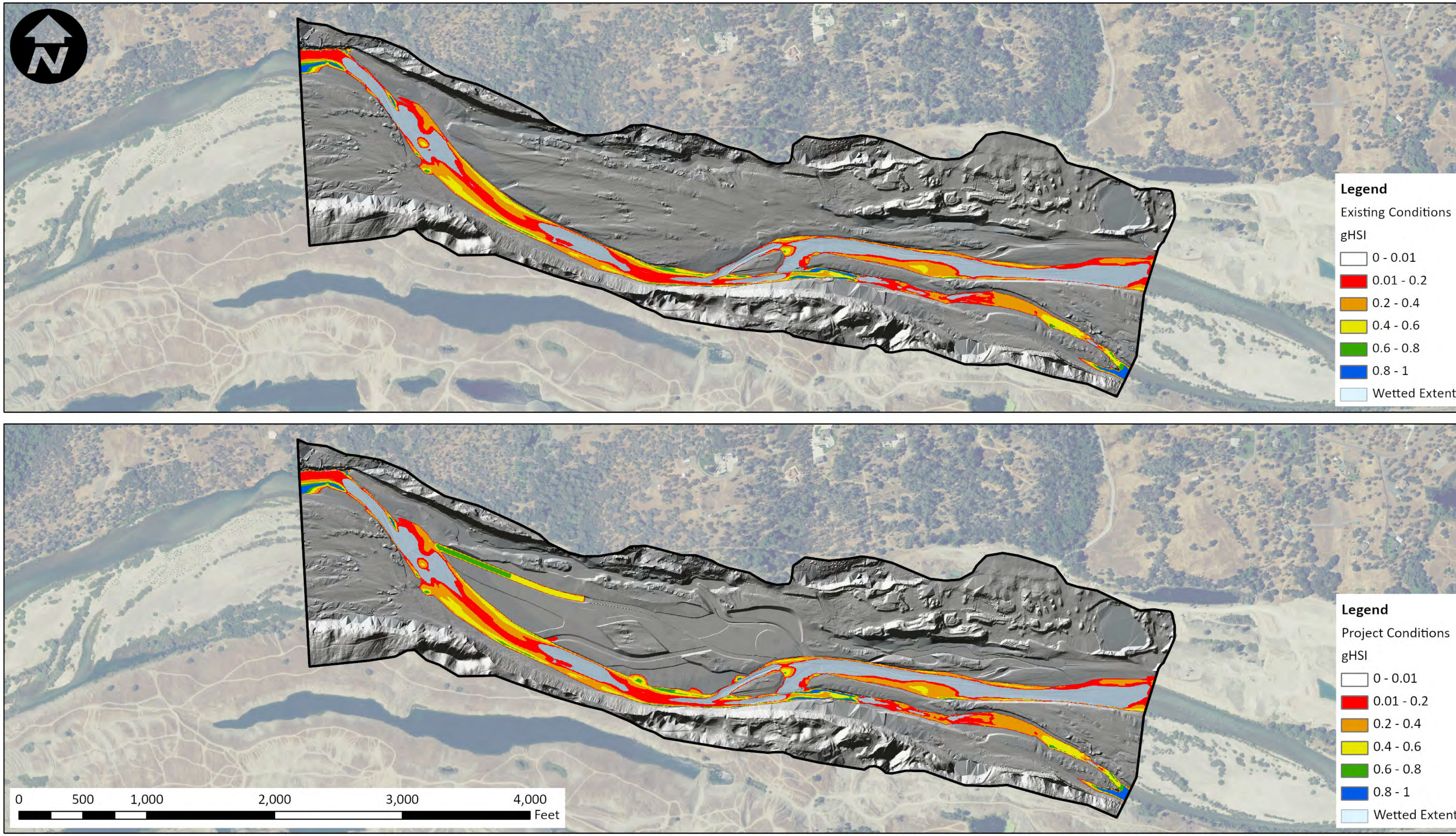
Notes:

Long Bar Enhancement Project

Chinook Juvenile Hydraulic Habitat Suitability – 700 cfs

Project No. 17−1012	Created By: LL	**Figure 17**

Attachment 1



Notes:

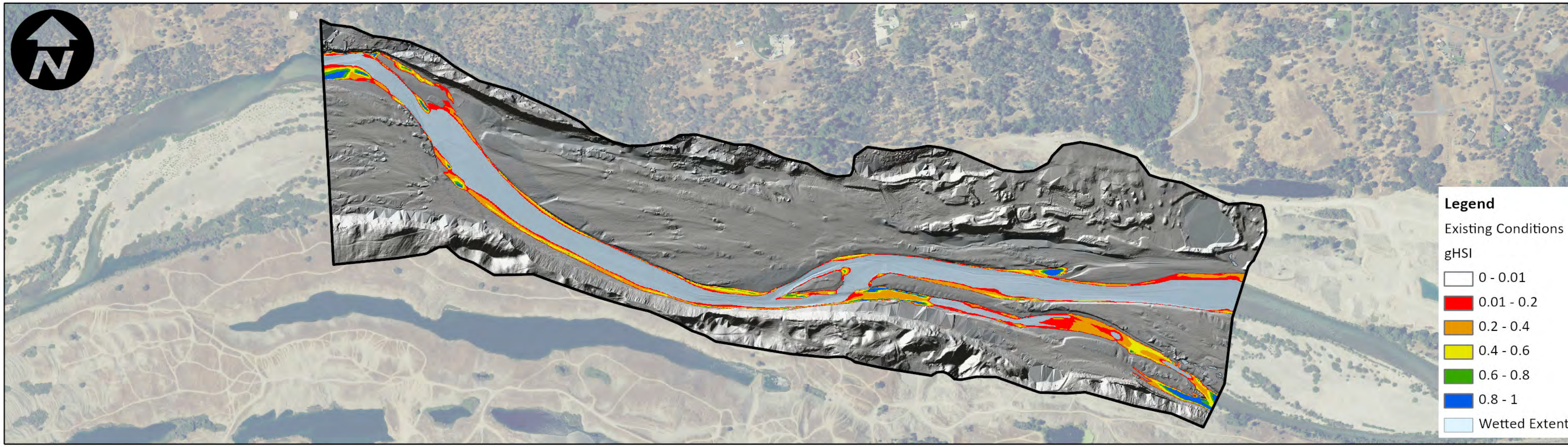
cbec eco engineering

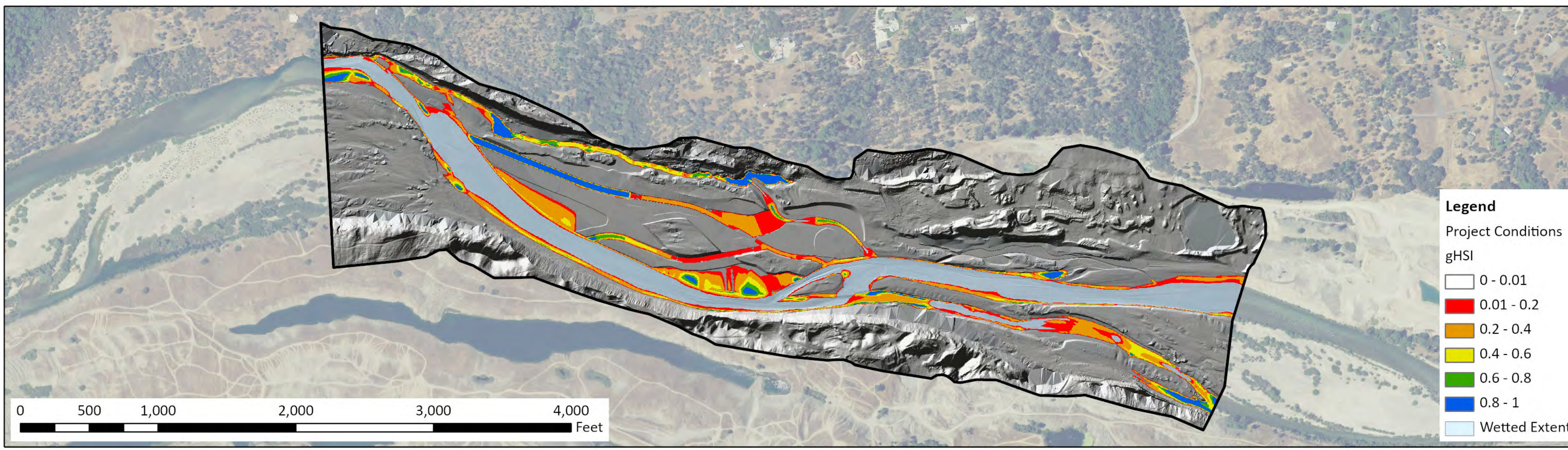
Long Bar Enhancement Project

Chinook Juvenile Hydraulic Habitat Suitability – 1000 cfs

Project No. 17−1012	Created By: LL	**Figure 18**

Attachment 1





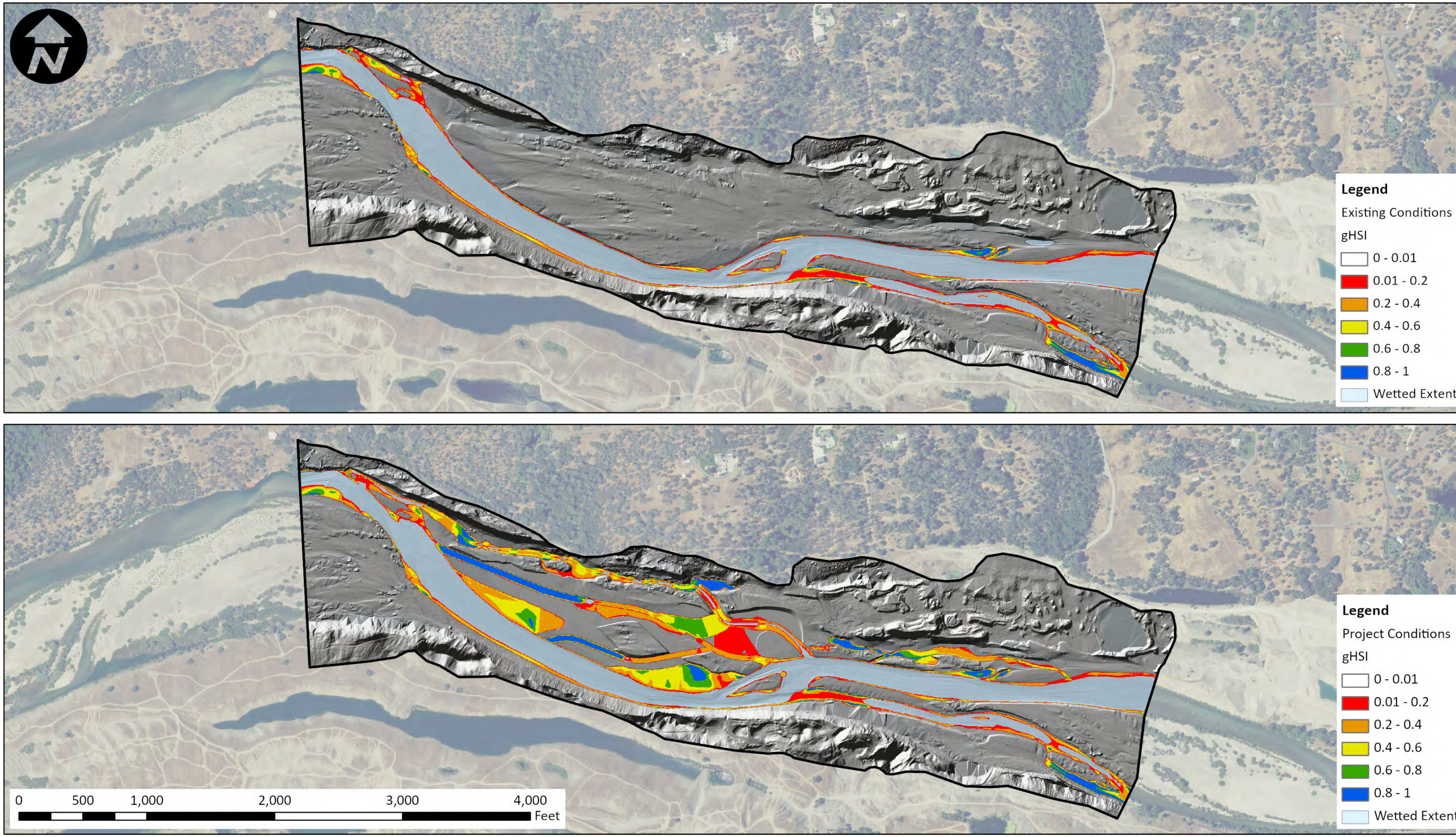
Notes:

Long Bar Enhancement Project

Chinook Juvenile Hydraulic Habitat Suitability – 2000 cfs

Project No. 17−1012	Created By: LL	**Figure 19**

Attachment 1



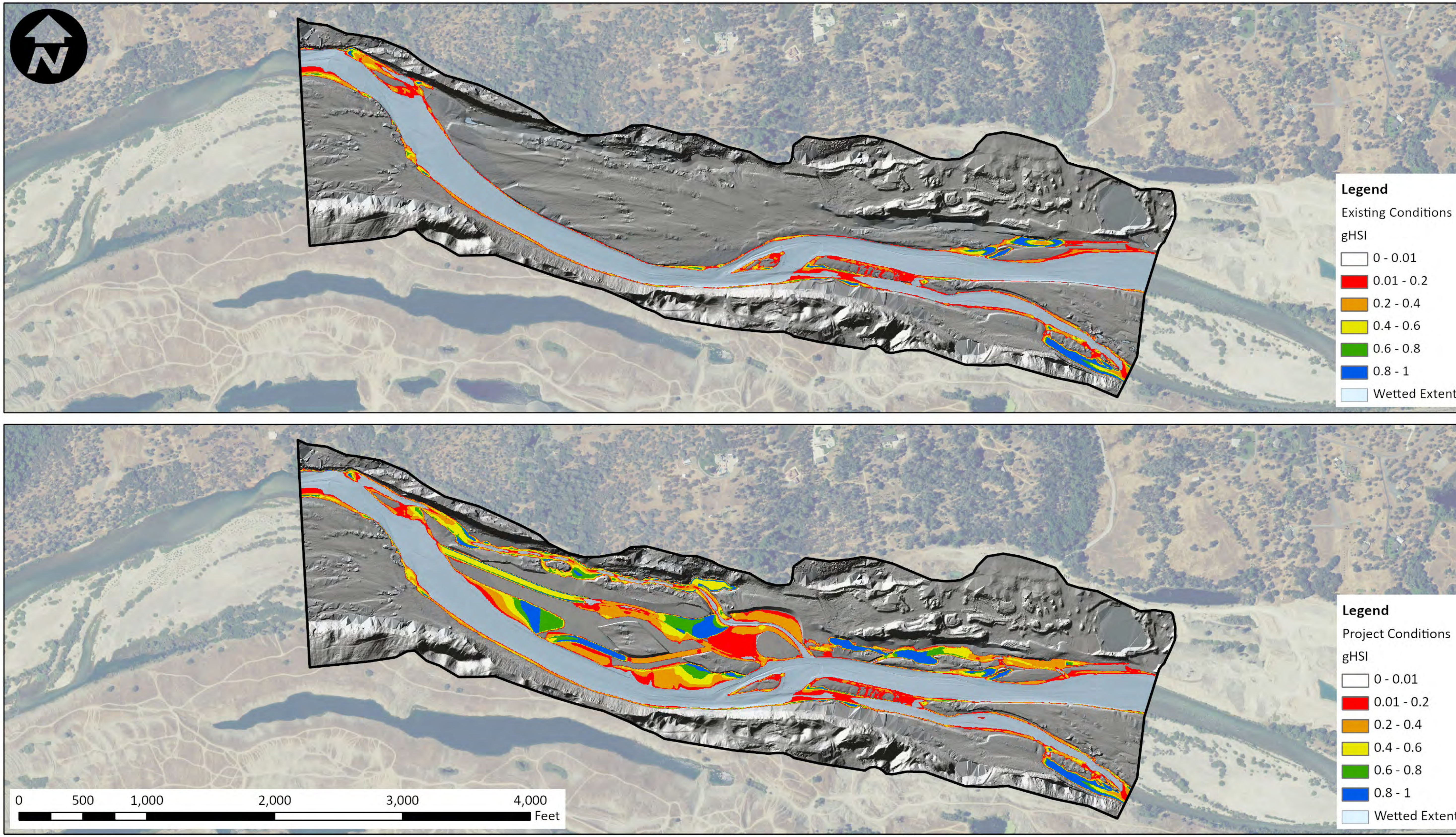
Notes:

Long Bar Enhancement Project

Chinook Juvenile Hydraulic Habitat Suitability – 3500 cfs

Project No. 17−1012	Created By: LL	**Figure 20**

Attachment 1



Notes:

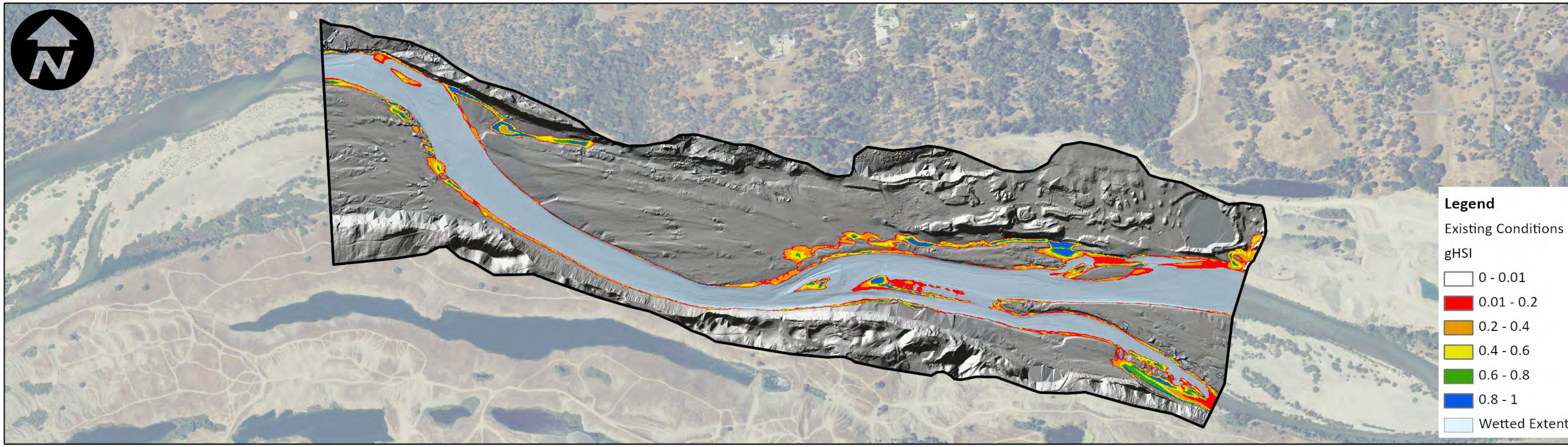
cbec eco engineering

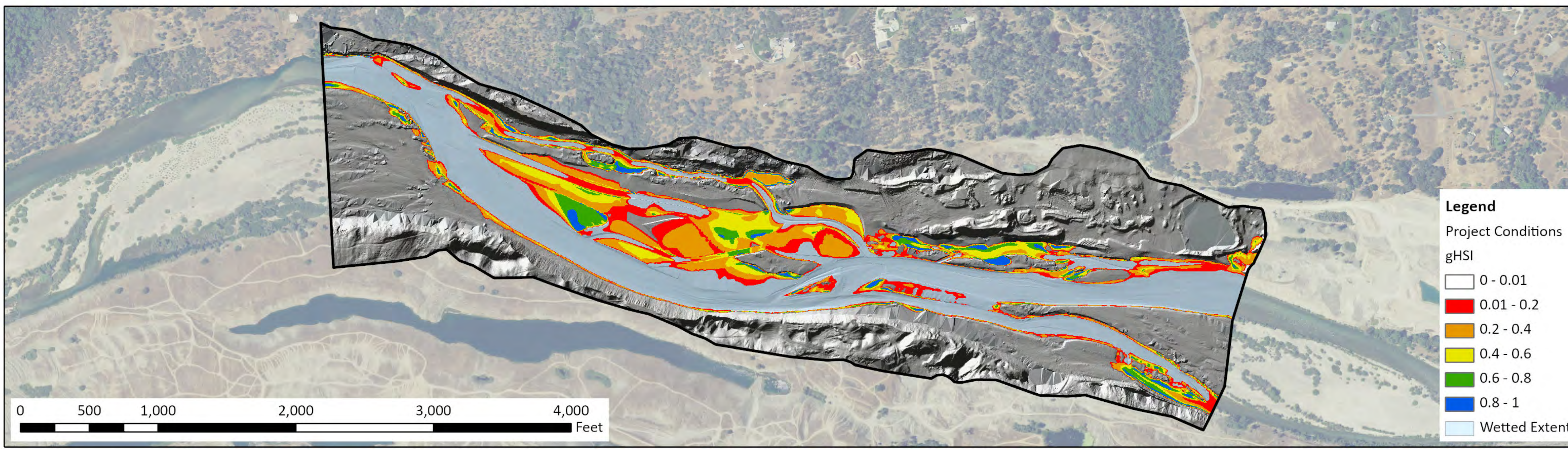
Long Bar Enhancement Project

Chinook Juvenile Hydraulic Habitat Suitability – 5000 cfs

Project No. 17–1012	Created By: LL	**Figure 21**

Attachment 1



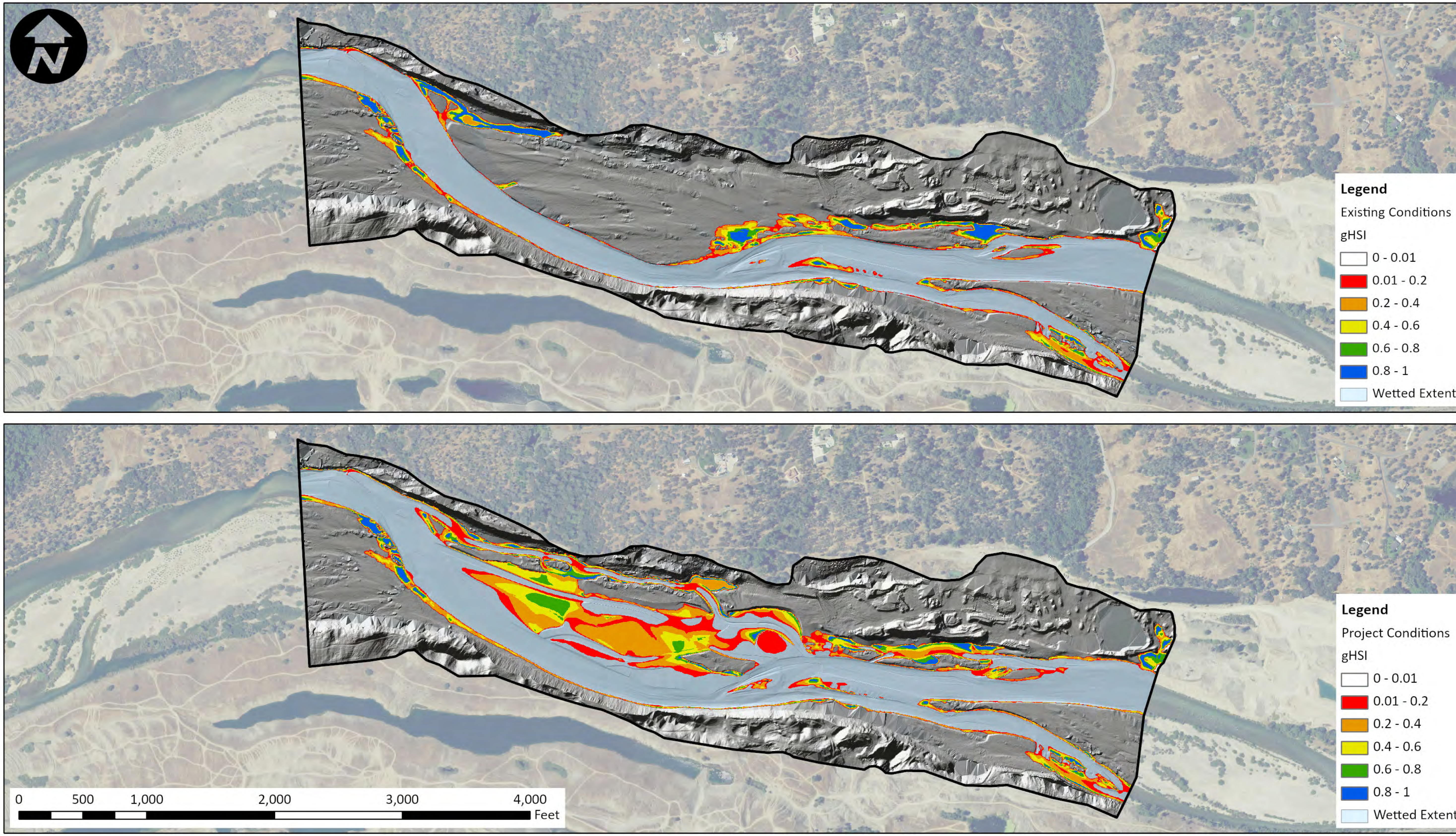


Notes:

Long Bar Enhancement Project

Chinook Juvenile Hydraulic Habitat Suitability – 7500 cfs

Project No. 17–1012	Created By: LL	**Figure 22**



Notes:

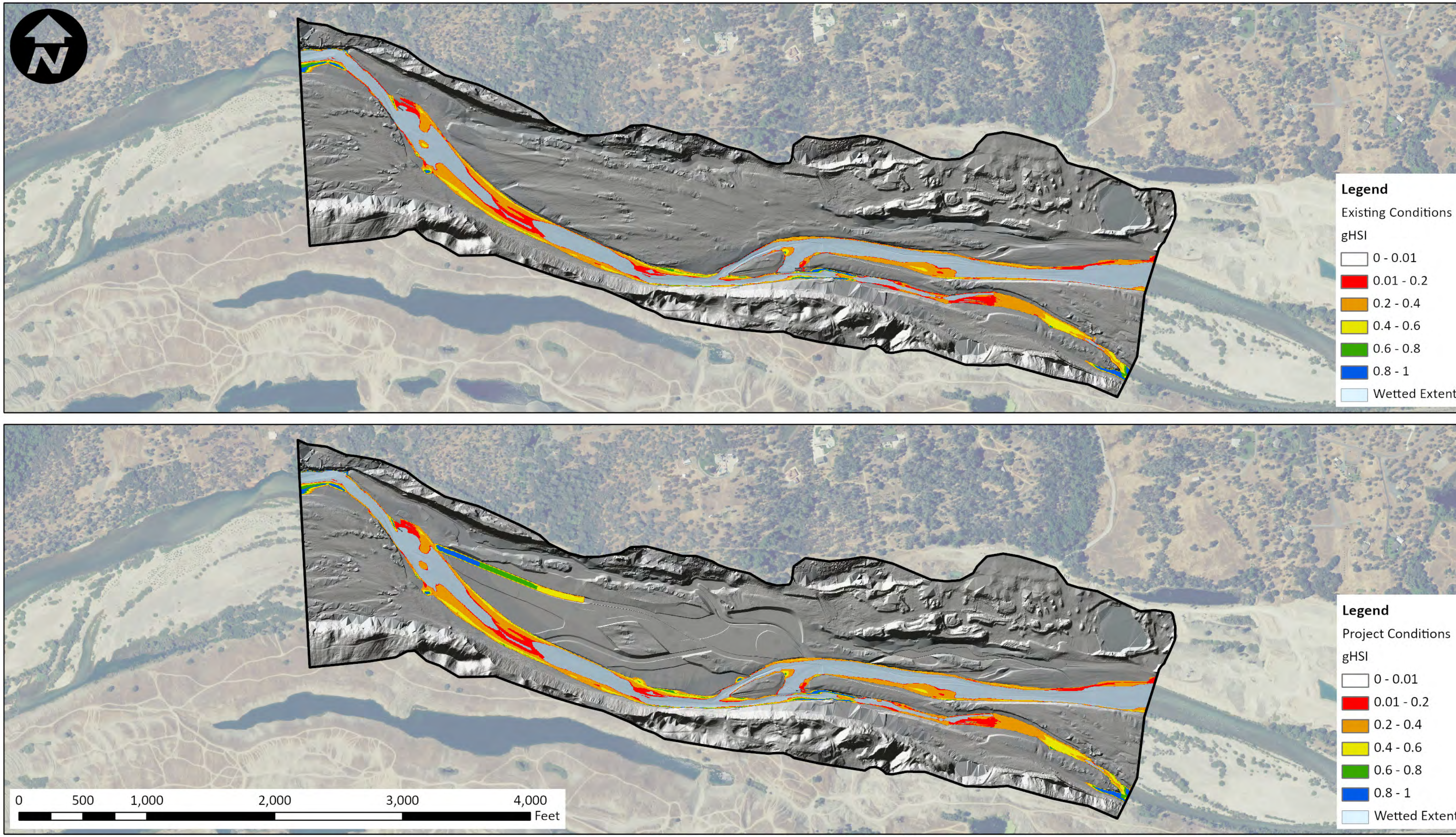
cbec eco engineering

Long Bar Enhancement Project

Chinook Juvenile Hydraulic Habitat Suitability – 10000 cfs

Project No. 17−1012	Created By: LL	**Figure 23**

Attachment 1



Notes:

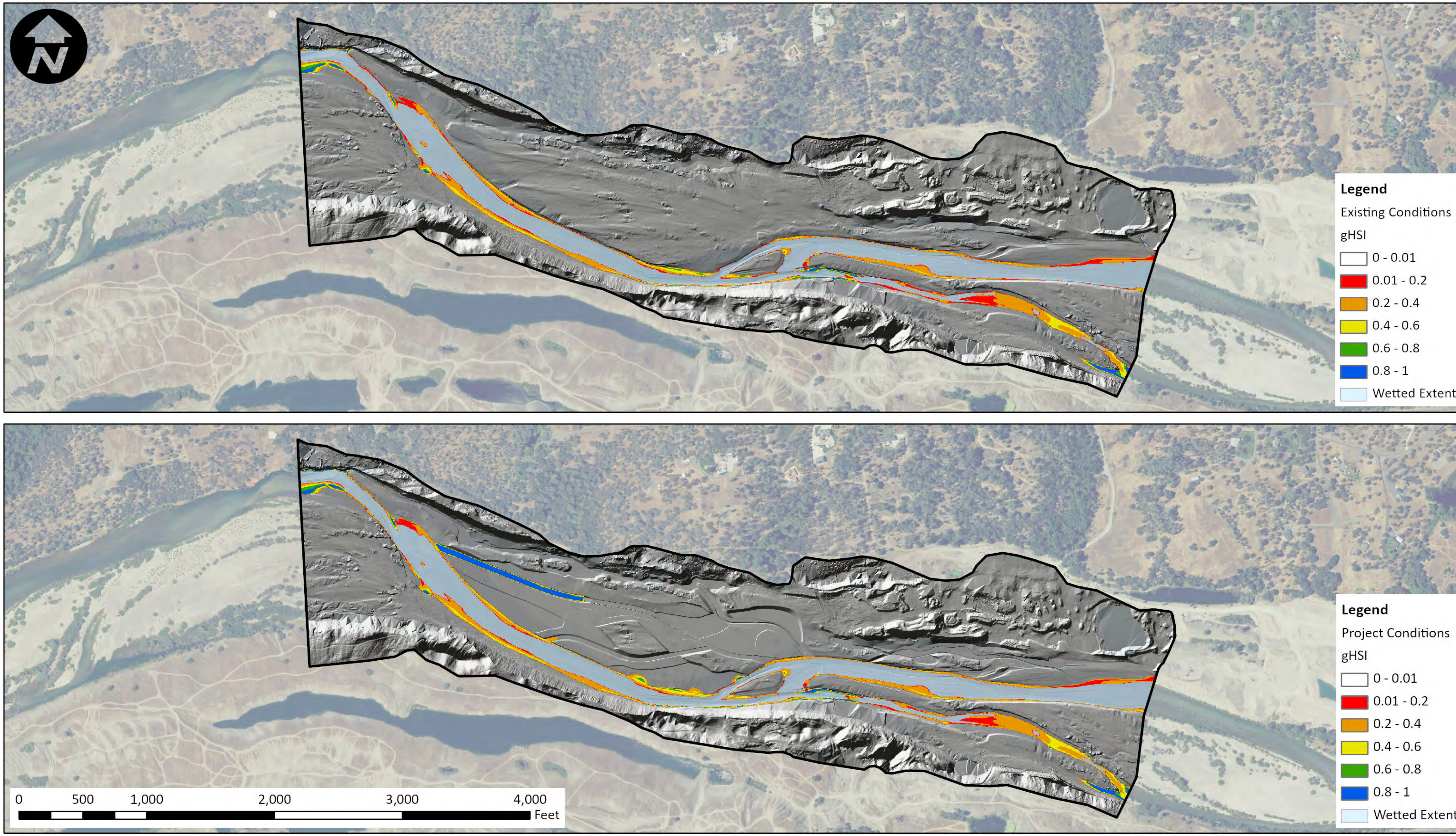
cbec eco engineering

Long Bar Enhancement Project

Steelhead Fry Hydraulic Habitat Suitability – 700 cfs

Project No. 17−1012	Created By: LL	**Figure 24**

Attachment 1



Notes:

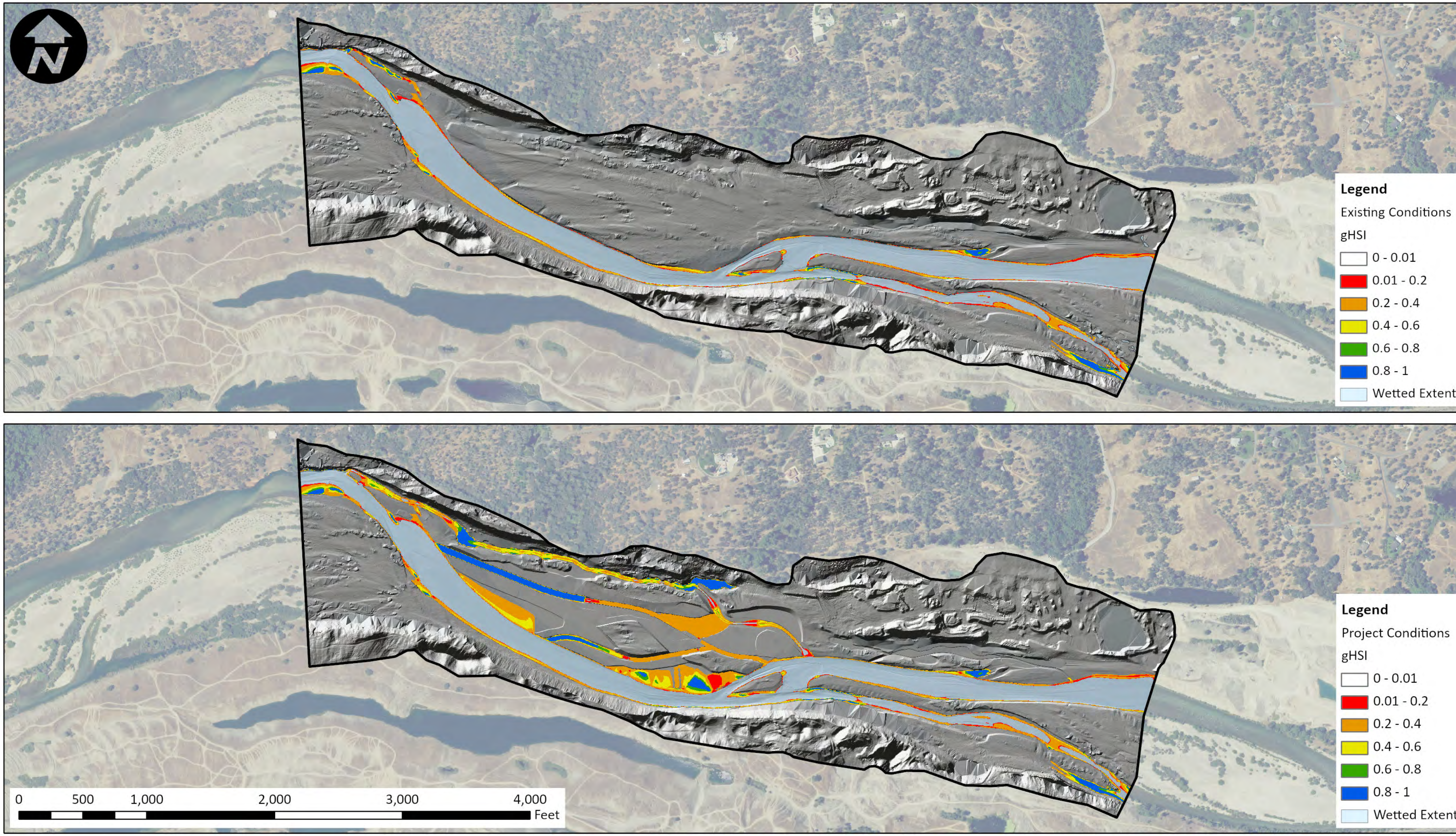
cbec eco engineering

Long Bar Enhancement Project

Steelhead Fry Hydraulic Habitat Suitability – 1000 cfs

Project No. 17−1012	Created By: LL	**Figure 25**

Attachment 1



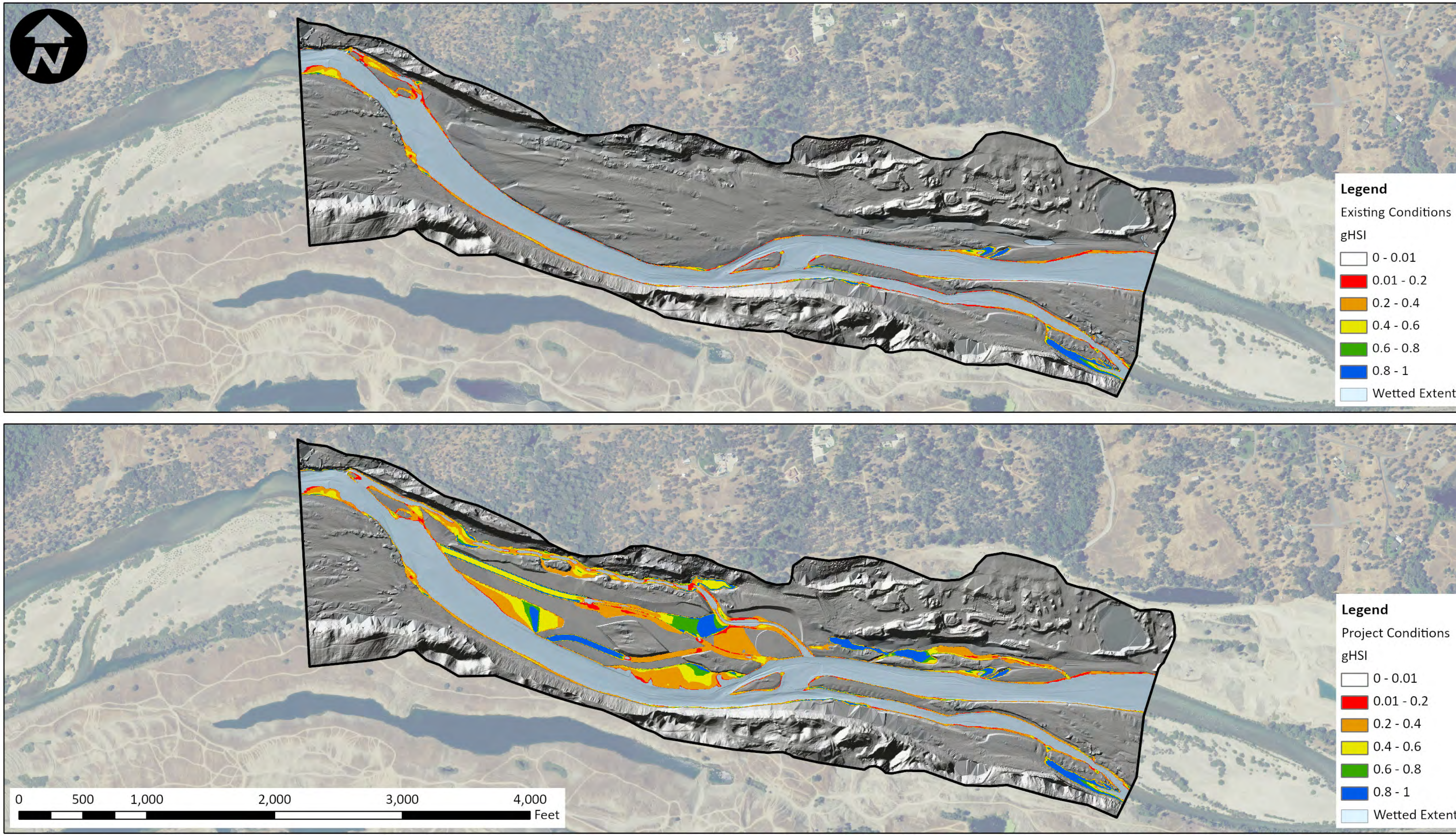
Notes:

cbec eco engineering

Long Bar Enhancement Project

Steelhead Fry Hydraulic Habitat Suitability – 2000 cfs

Project No. 17−1012	Created By: LL	**Figure 26**



Notes:

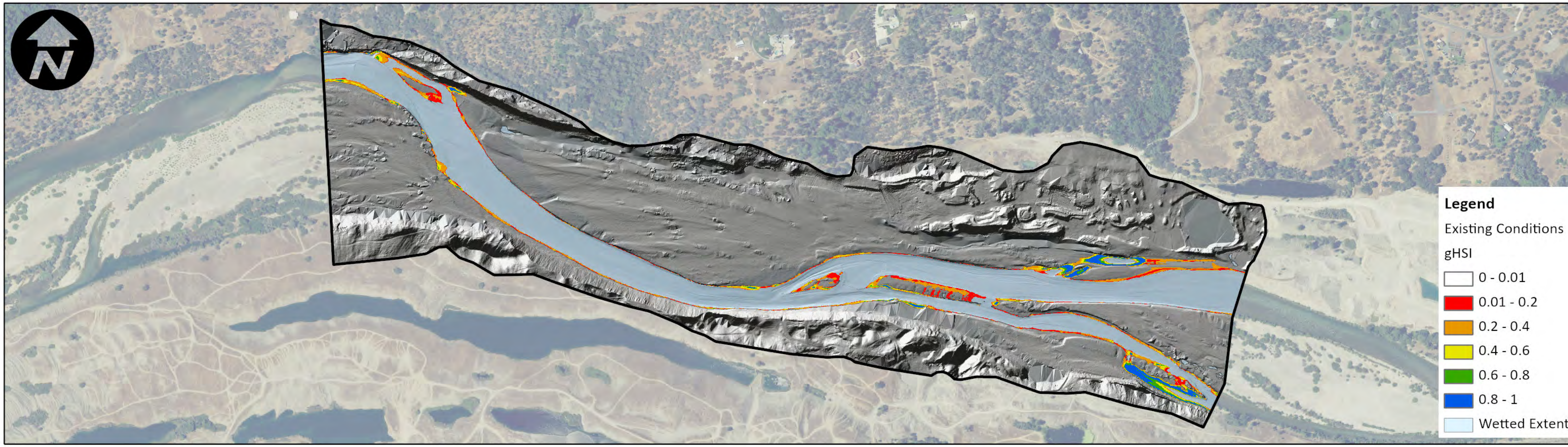
cbec eco engineering

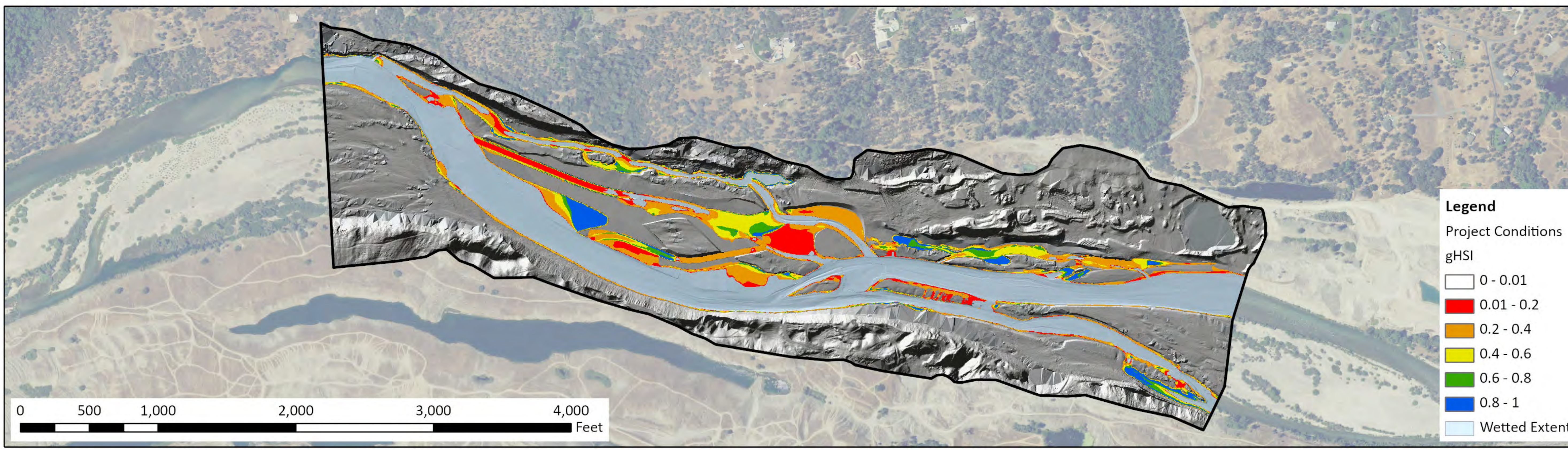
Long Bar Enhancement Project

Steelhead Fry Hydraulic Habitat Suitability – 3500 cfs

Project No. 17−1012	Created By: LL	**Figure 27**

Attachment 1





Notes:

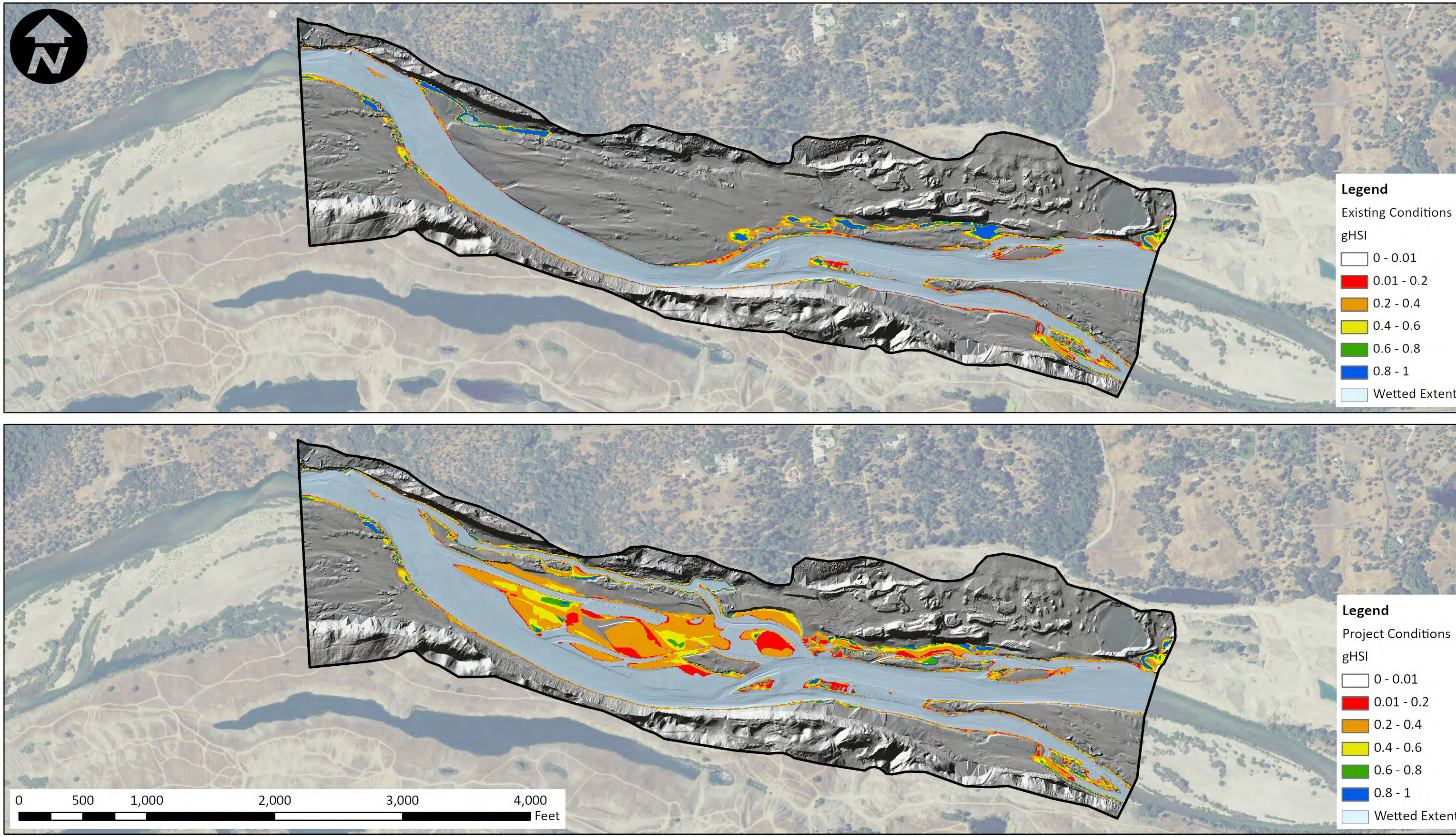
cbec eco engineering

Long Bar Enhancement Project

Steelhead Fry Hydraulic Habitat Suitability – 5000 cfs

Project No. 17−1012	Created By: LL	**Figure 28**

Attachment 1



Notes:

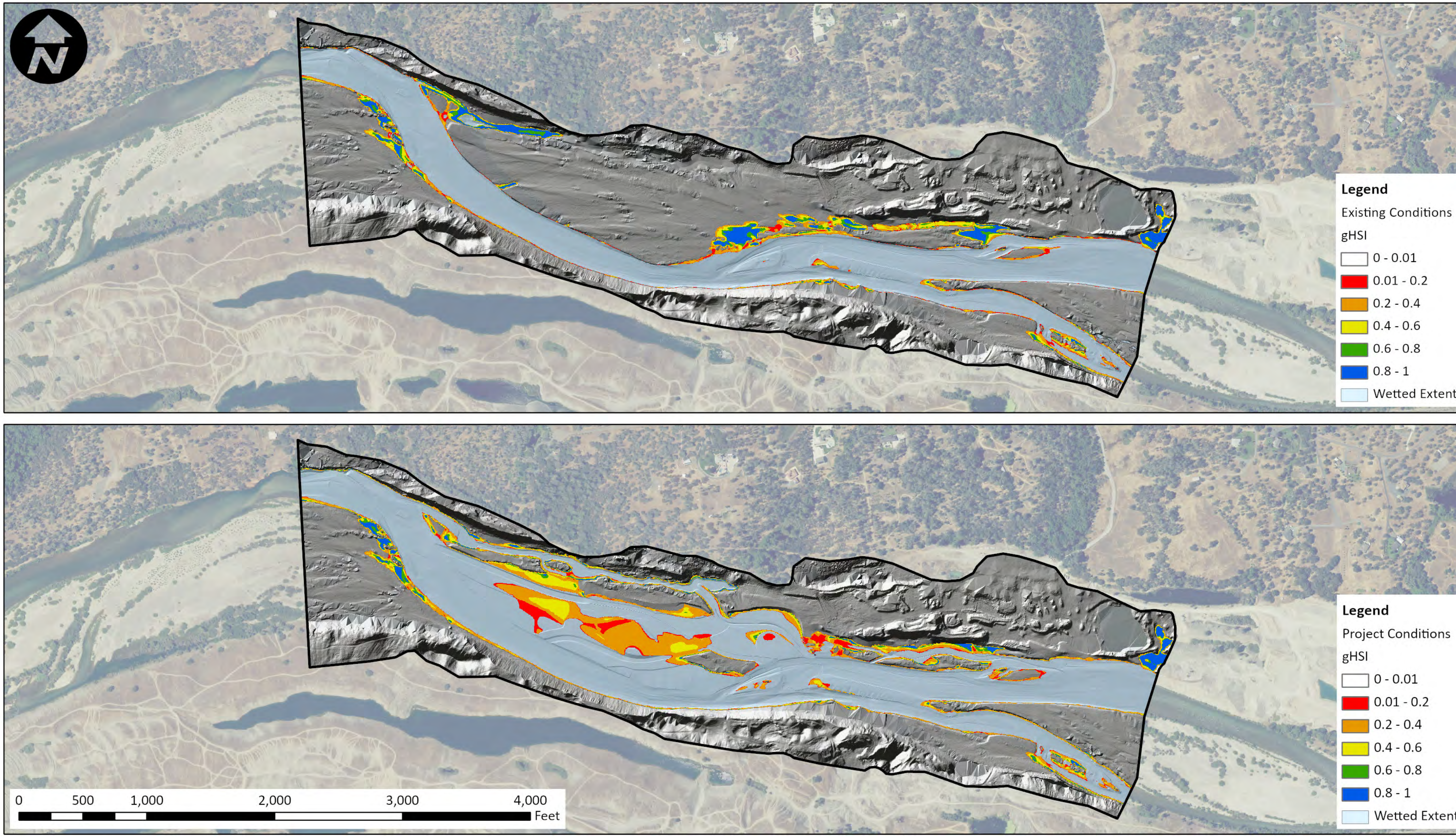
cbec eco engineering

Long Bar Enhancement Project

Steelhead Fry Hydraulic Habitat Suitability – 7500 cfs

Project No. 17−1012	Created By: LL	**Figure 29**

Attachment 1



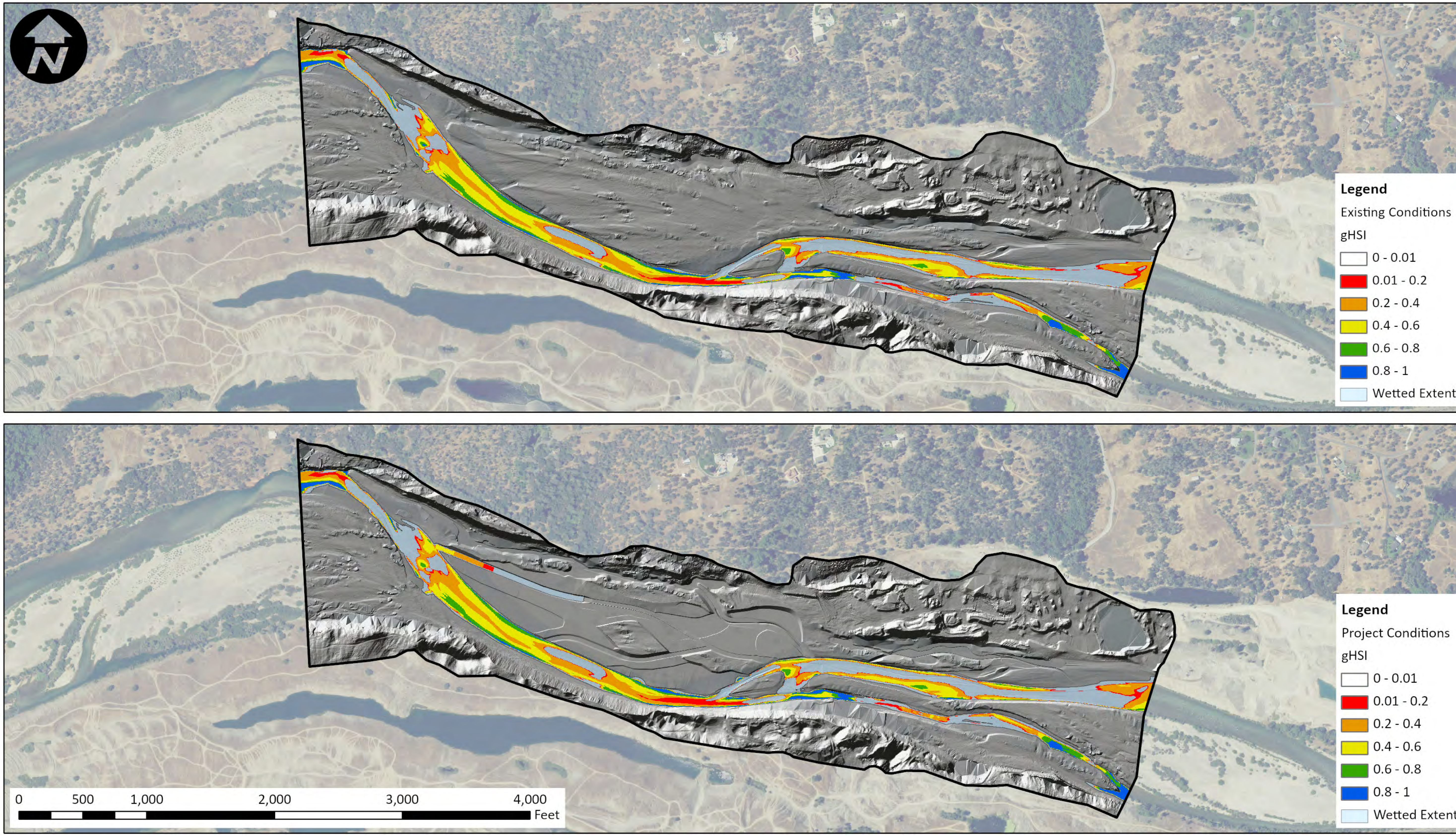
Notes:

cbec eco engineering

Long Bar Enhancement Project
Steelhead Fry Hydraulic Habitat Suitability – 10000 cfs

Project No. 17−1012	Created By: LL	**Figure 30**

Attachment 1



Notes:

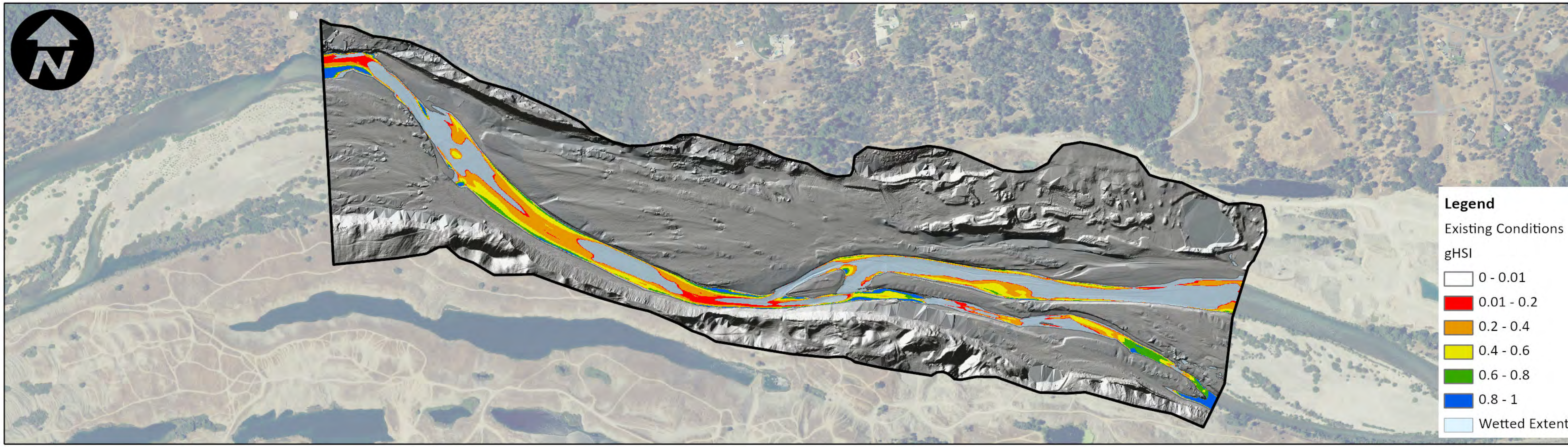
cbec eco engineering

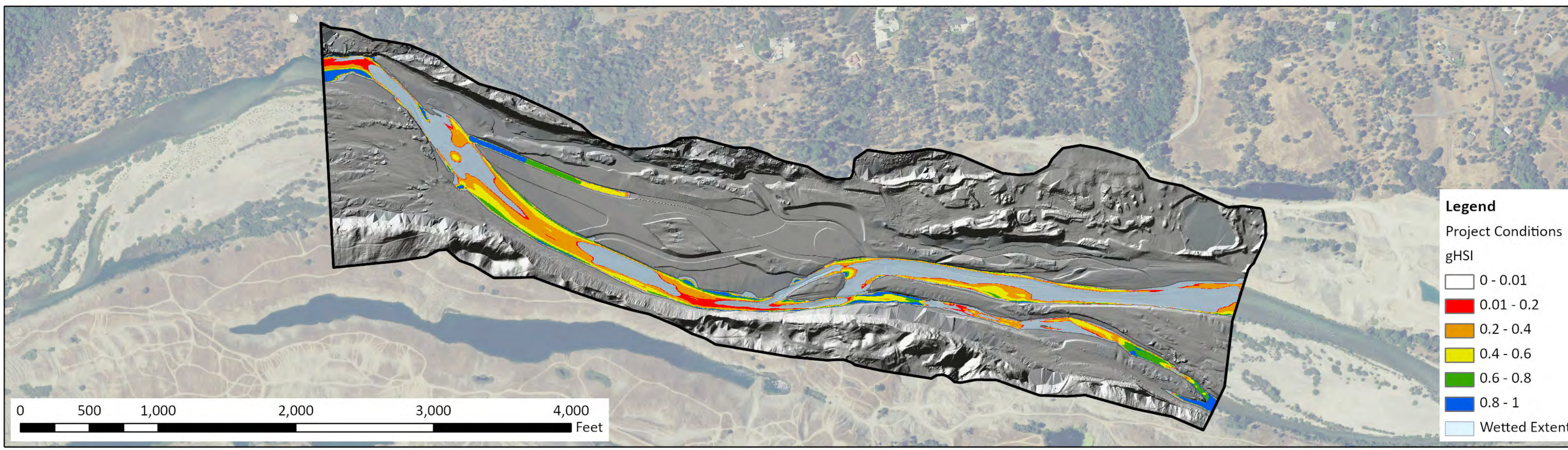
Long Bar Enhancement Project

Steelhead Juvenile Hydraulic Habitat Suitability – 700 cfs

Project No. 17−1012 | Created By: LL | **Figure 31**

Attachment 1



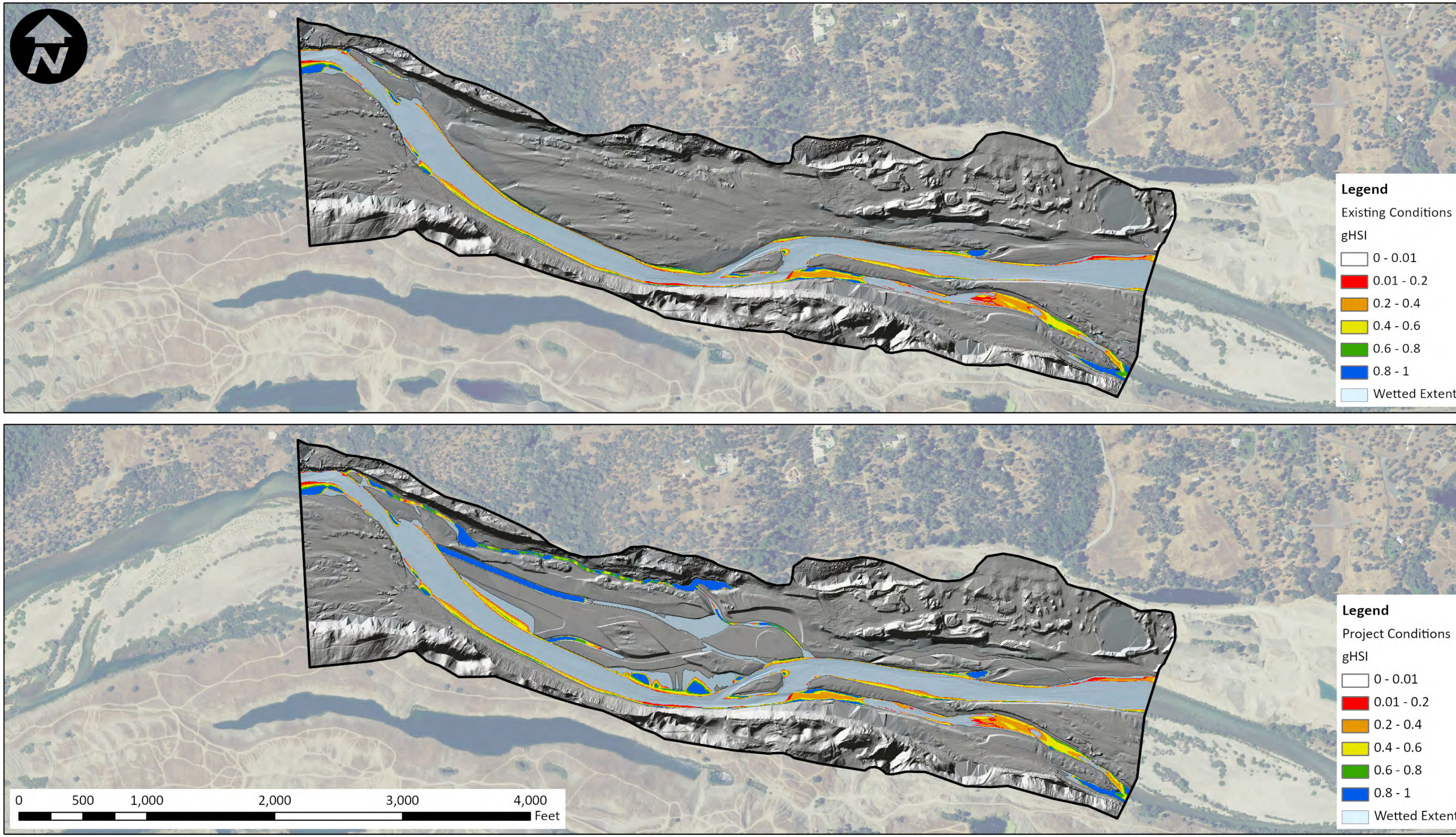


Notes:

cbec eco engineering

Long Bar Enhancement Project
Steelhead Juvenile Hydraulic Habitat Suitability – 1000 cfs

Project No. 17−1012	Created By: LL	**Figure 32**



Notes:

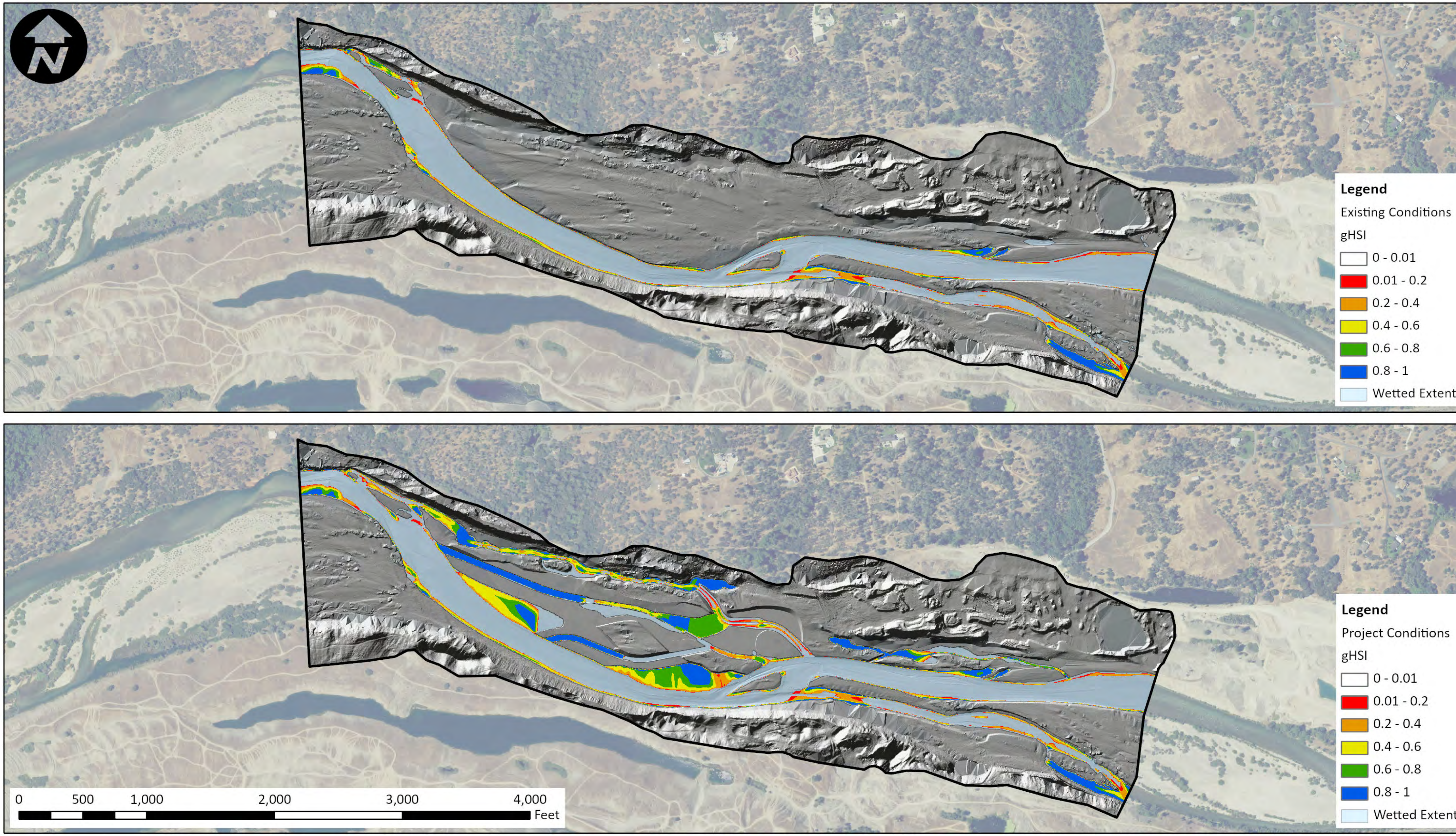
cbec eco engineering

Long Bar Enhancement Project

Steelhead Juvenile Hydraulic Habitat Suitability – 2000 cfs

Project No. 17−1012	Created By: LL	**Figure 33**

Attachment 1



Notes:

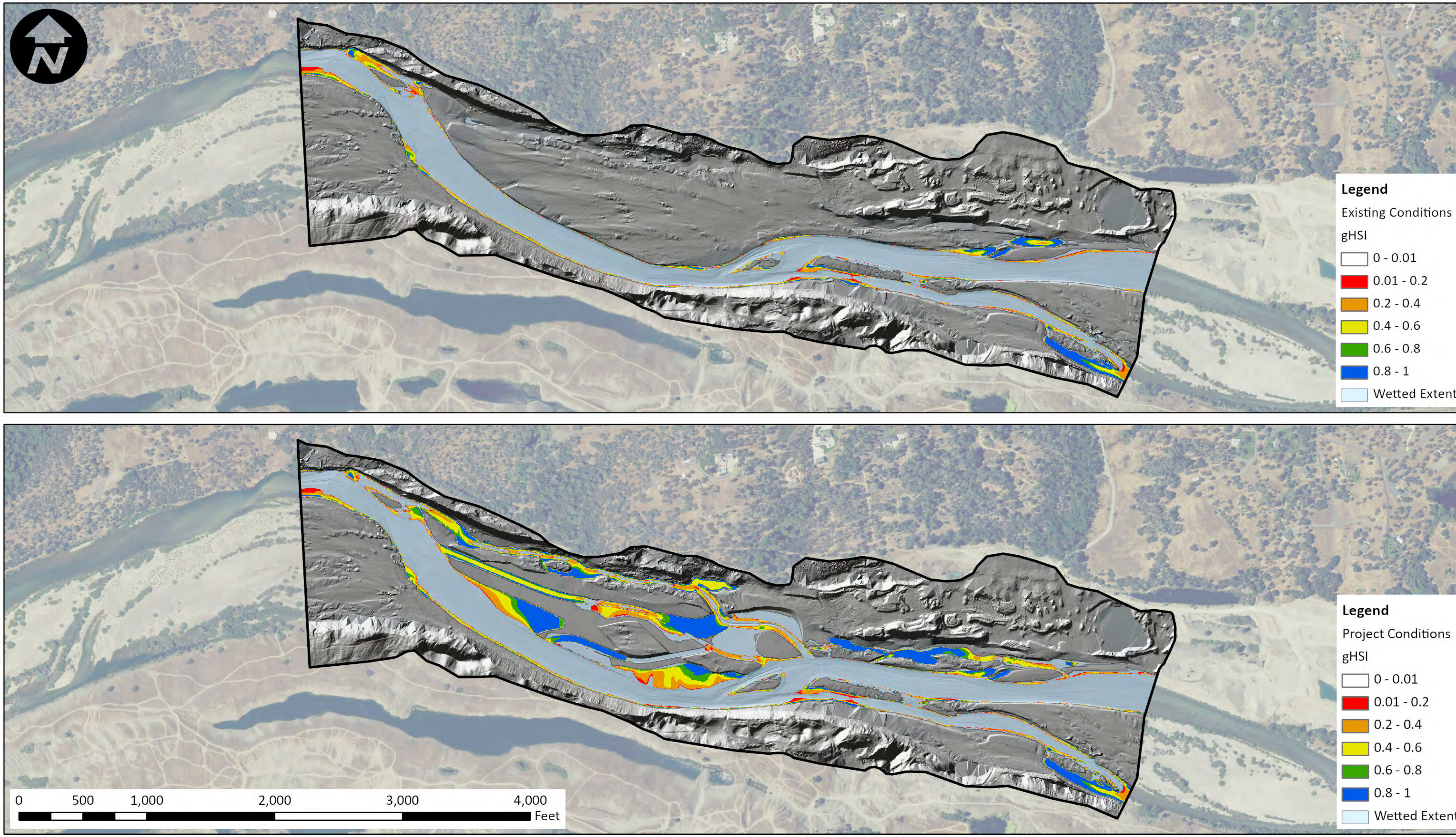
cbec eco engineering

Long Bar Enhancement Project

Steelhead Juvenile Hydraulic Habitat Suitability – 3500 cfs

Project No. 17−1012	Created By: LL	**Figure 34**

Attachment 1



Notes:

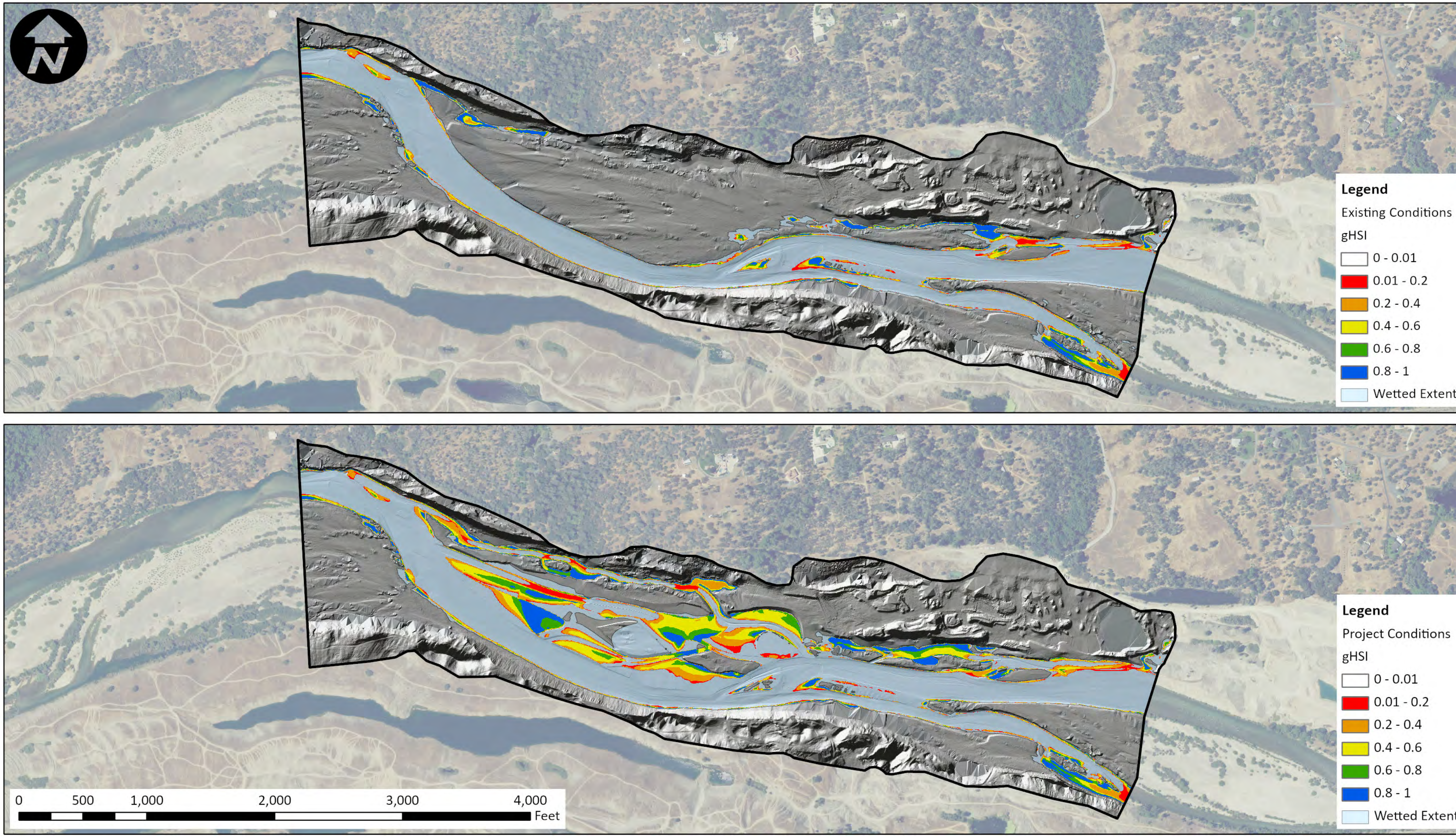
cbec eco engineering

Long Bar Enhancement Project

Steelhead Juvenile Hydraulic Habitat Suitability – 5000 cfs

Project No. 17−1012	Created By: LL	**Figure 35**

Attachment 1



Notes:

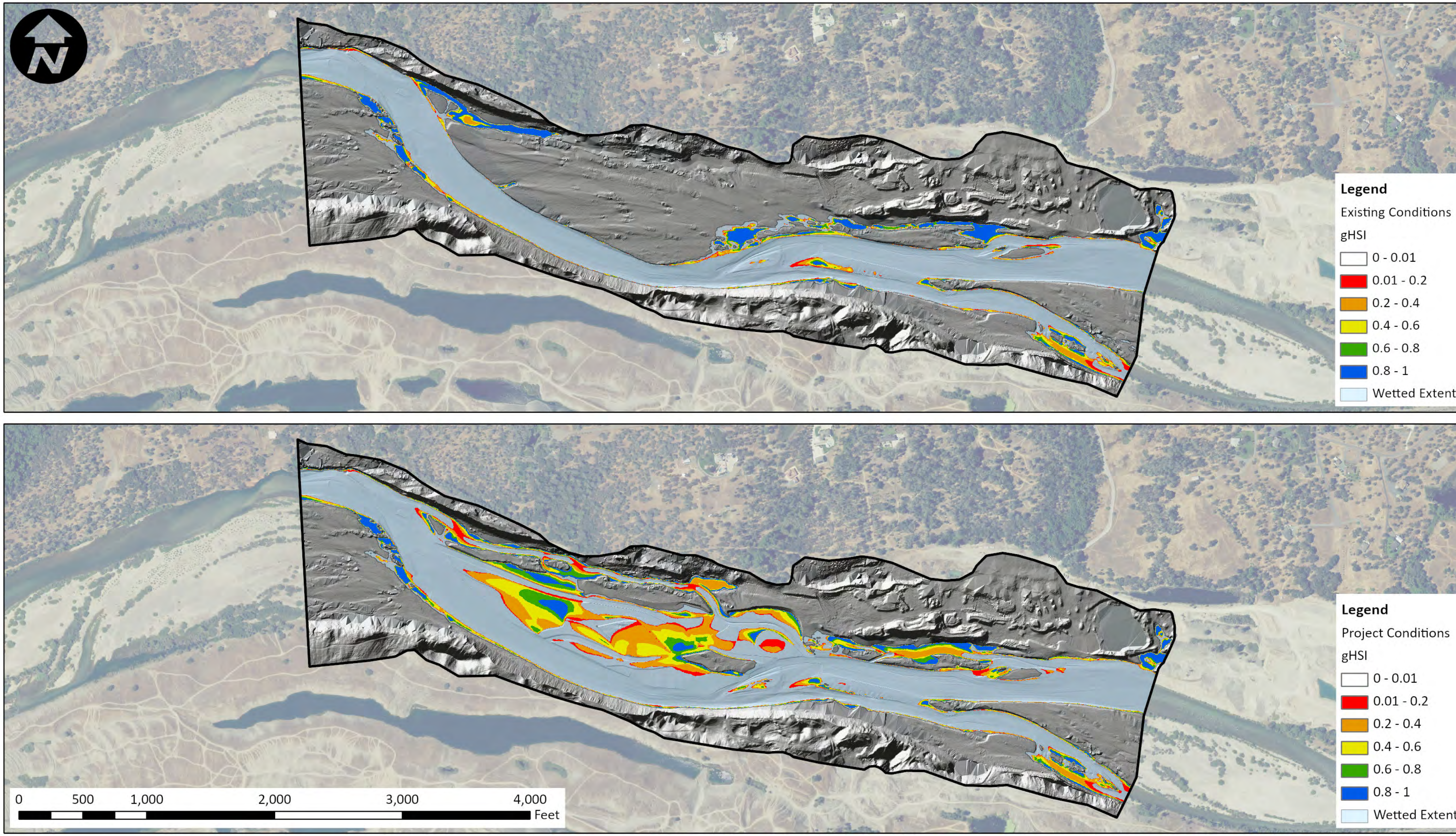
cbec eco engineering

Long Bar Enhancement Project

Steelhead Juvenile Hydraulic Habitat Suitability – 7500 cfs

Project No. 17−1012	Created By: LL	**Figure 36**

Attachment 1



Notes:

Long Bar Enhancement Project

Steelhead Juvenile Hydraulic Habitat Suitability – 10000 cfs

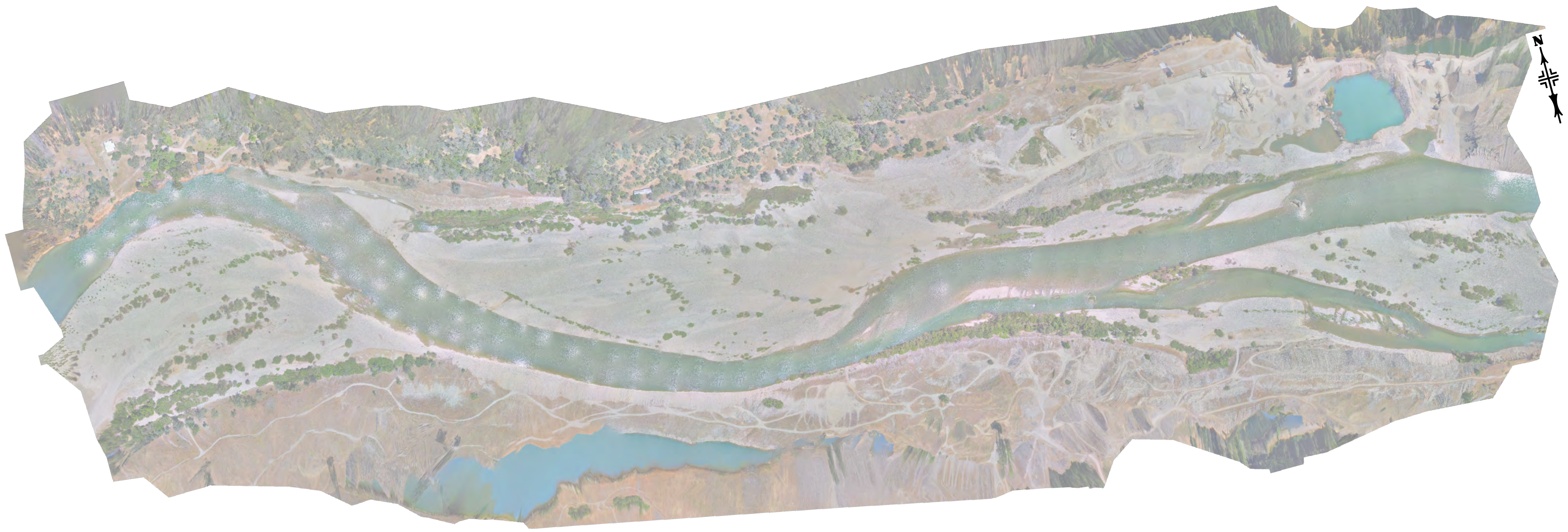
Project No. 17−1012	Created By: LL	**Figure 37**

APPENDIX B. 65% DESIGN PLANS

A B C D E

1 2 3 4

LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER



0 400 800 1200 FT

1" = 400'

LOCATION MAP

PROJECT SPONSOR:

U.S. Fish and Wildlife Service
through the Anadromous Fish
Restoration Program (AFRP)

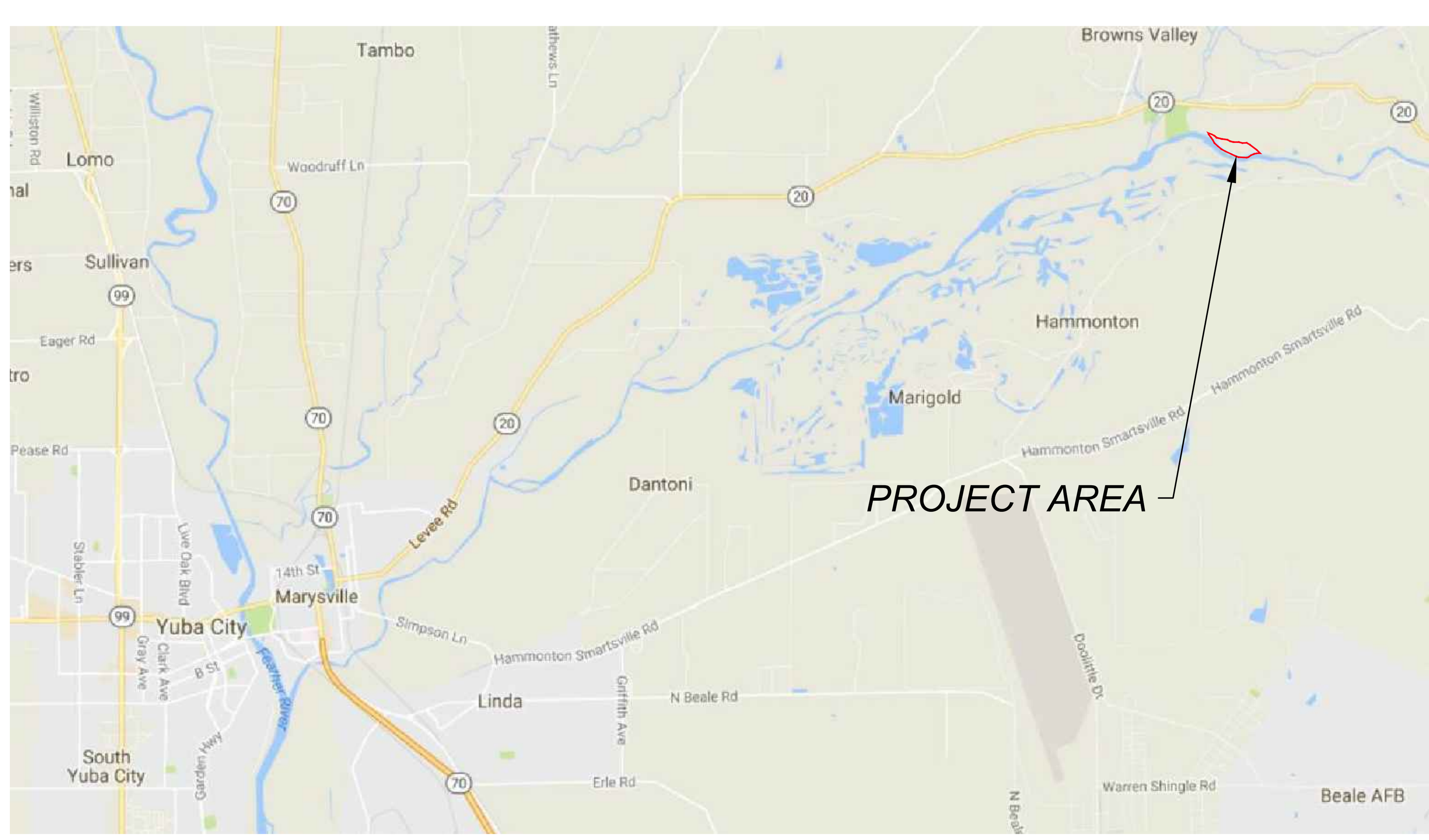
PROJECT TEAM:
South Yuba River Citizens League
CBEC ECO Engineering
Cramer Fish Sciences

PARTICIPATING LANDOWNERS:

Long Bar Mine, LCC
Western Aggregates

PARTICIPATING ENTITY:

Silica Resources, INC.



VICINITY MAP (NOT TO SCALE)

Sheet Number	Sheet Title
G1	COVER SHEET
G2	EXISTING CONDITIONS
G3	SHEET LAYOUT PLAN
G4	EROSION AND SEDIMENT CONTROL PLAN
G5	EROSION AND SEDIMENT CONTROL NOTES
C1	GRADING PLAN 1
C2	GRADING PLAN 2
C3	GRADING PLAN 3
C4	GRADING PLAN 4
C5	SECONDARY CHANNEL PROFILE
C6	BACKWATER CHANNEL PROFILE
C7	UPSTREAM SIDE CHANNEL PROFILE
C8	ALIGNMENT GEOMETRY POINTS
C9	ALIGNMENT GEOMETRY POINTS
C10	TYPICAL CHANNEL SECTIONS AND DETAILS

LEGEND

- 100 — EXISTING GROUND CONTOURS
- 80 — FINISHED GRADE CONTOURS
- GRADING BREAKLINE (TOP OF BANK, TYP)
- HYDRAULIC ROUGHNESS BERM
- ×89.4 EXISTING GROUND SPOT ELEVATION
- × 84.5 FINISHED GRADE SPOT ELEVATION
- ELDERBERRY SHRUB (PROTECT IN PLACE)

NOTE: ELEVATIONS SHOWN ARE IN REFERENCE
TO NORTH AMERICAN VERTICAL DATUM OF 1988.

DOCUMENT RELEASE: 65% DESIGN

REVISION NOTES

DESIGNED: SD | DRAWN: JM | REVIEWED: SD | APPROVED: CH

PREPARED BY: cbec eco engineering

CLIENT: USFWS - PACIFIC SOUTHWEST REGION
ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER
COVER SHEET

JOB NUMBER 17-1012

DATE MAY 2020

SHEET G1

A B C D E

1 2 3 4

0 150 300 750 FT

1" = 250'

LEGEND:

EXISTING ROAD

DOCUMENT RELEASE
65% DESIGN
REVISION NOTES

DESIGNED SD
DRAWN JM
REVIEWED SD
APPROVED CH

PREPARED BY:

cbec eco engineering

CLIENT:

USFWS - PACIFIC SOUTHWEST REGION
ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

EXISTING CONDITIONS

JOB NUMBER
17-1012

DATE
MAY 2020

SHEET
G2
2 OF 15

Attachment 1

0 200 400 600 FT

1" = 200'

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

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REVISION NOTES

DESIGNED: SD
DRAWN: JM
REVIEWED: SD
APPROVED: CH

PREPARED BY: cbec eco engineering

CLIENT: USFWS - PACIFIC SOUTHWEST REGION
ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY, CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER
SHEET LAYOUT PLAN

JOB NUMBER: 17-1012
DATE: MAY 2020
SHEET: G3
3 OF 15

LOCATION: D:\Work\Projects\17-1012_LYR_Long_Bar_Enhancement_Plan_Technical_Support\400_Technical_Data\403_CAD_Data\CAD_DWGS\Production\SHEET_LAYOUT_PLAN.dwg

PLOT:5/14/2020

A B C D E

1 2 3 4

0 250 500 750 FT

1" = 250'

LEGEND

— — — — — GRADING EXTENT

COIR FIBER ROLL SLOPE STABILIZATION

NOTE: SEE SHEET G5 FOR EROSION AND SEDIMENT CONTROL NOTES

USE OF DOCUMENTS
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DOCUMENT RELEASE
65% DESIGN

REVISION NOTES

DESIGNED SD
DRAWN JM
REVIEWED SD
APPROVED CH

PREPARED BY:
cbec eco engineering

CLIENT:
USFWS - PACIFIC SOUTHWEST REGION
ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

EROSION AND SEDIMENT CONTROL PLAN

JOB NUMBER
17-1012

DATE
MAY 2020

SHEET
G4
4 OF 15

LOCATION: D:\Work\Projects\17-1012_LYR_Long_Bar_Enhancement_Plan_Technical_Support\400_Technical_Data\403_CAD_Data\CAD_DWGS\Production\EROSION_AND_SEDIMENT_CONTROL.dwg

PLOT:5/14/2020

EROSION CONTROL NOTES

GENERAL

1. PROJECT IS PLANNED TO BE COMPLETED PRIOR TO SUBSTANTIAL RAIN EVENTS. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES MAY BE REQUIRED IF CONSTRUCTION SCHEDULE IS EXTENDED OR IF UNFORESEEN RAIN EVENTS OCCUR.
2. TYPICAL EROSION CONTROL SEQUENCING WILL BE AS FOLLOWS:
   - 2.a. CONVERT ALL EQUIPMENT THAT WILL BE WORKING IN THE RIVER CORRIDOR TO VEGETABLE-BASED LUBRICANTS PRIOR TO CONSTRUCTION.
   - 2.b. INSTALL EROSION AND SEDIMENT CONTROL BMPS TO ESTABLISH PERIMETER CONTROL. INSTALL TEMPORARY CONSTRUCTION ENTRANCE. INSTALL OTHER PERIMETER CONTROL BMPS PER WORK AREA, AS REQUIRED BY THE SWPPP.
   - 2.c. INSTALL DEWATERING DEVICES TO DEWATER WORK AREAS AS APPLICABLE PRIOR TO BEGINNING CONSTRUCTION. INSTALLATION OF NEW, TEMPORARY EARTH FILL DAMS WILL NOT BE ALLOWED.
   - 2.d. DEWATER WORK AREA TO THE EXTENT PRACTICABLE. INSTALL BMPS PRIOR TO CONSTRUCTION FOR AREAS THAT WILL BE EXCAVATED IN THE WET.
   - 2.e. PERFORM EARTHWORK.
   - 2.f. INSTALL TEMPORARY AND PERMANENT EROSION AND SEDIMENT CONTROL BMPS REQUIRED BY THE SWPPP.
   - 2.g. REVEGETATE WORK AREA (IF SPECIFIED).
   - 2.h. SEED AS SPECIFIED IN SPECIFICATION 02950 AND VACATE COMPLETED WORK AREAS TO MINIMIZE TRAFFIC IN EXCAVATION AREAS.
   - 2.i. SEED ALL INDICATED WORK AREAS AS SPECIFIED IN SPECIFICATION 02950. SWPPP WILL REMAIN IN EFFECT UNTIL 70% VEGETATIVE COVER, OR 70% EROSION CONTROL COVERAGE OF ALL WORK AREAS IS ESTABLISHED.
   - 2.j. REESTABLISH CONTACT WITH OPEN WATER.
3. DOWNSTREAM ENDS OF CHANNELS AREAS WILL REQUIRE ENHANCED SITE PERIMETER CONTROLS THROUGH USE OF SILT CURTAINS.
4. CEASE CONSTRUCTION AND COVER DISTURBED AREA DURING 50% CHANCE RAIN EVENT/COMPLY WITH RAIN EVENT ACTION PLAN (REAP).
5. UPON COMPLETION, PROJECT WILL RESULT IN THE ESTABLISHMENT OF WETLAND (INUNDATED) AREAS WITH ACCESS TO OPEN WATER. FOLLOWING PROJECT COMPLETION, SEDIMENT TRANSPORT IS EXPECTED INTO AND OUT OF THE PROJECT SITE.
6. IN THE EVENT OF PRECIPITATION, DIRECT STORMWATER RUN-ON AROUND THE CONSTRUCTION AREA.
7. MINIMIZE ENVIRONMENTAL IMPACTS BY USING EXISTING ROADS AND OFF-HIGHWAY VEHICLE TRAILS FOR VEHICLE TRAVEL WHERE POSSIBLE.
8. INSPECT AND MAINTAIN ALL EQUIPMENT TO AVOID FLUID LEAKS.
9. NON-STORMWATER DISCHARGES THAT ARE AUTHORIZED FROM THIS PROJECT SITE IS LIMITED TO DUST CONTROL WATER.
10. UNAUTHORIZED NON-STORMWATER DISCHARGES WHICH MAY BE APPLICABLE TO THE SITE INCLUDE:
    - 10.1. VEHICLE AND EQUIPMENT CLEANING, FUELING, AND MAINTENANCE OPERATIONS.
    - 10.2. VEHICLE AND EQUIPMENT WASH WATER.
    - 10.3. SANITARY AND SEPTIC WASTES.
13. ENSURE THAT UNAUTHORIZED NON-STORMWATER DISCHARGES ARE ELIMINATED, CONTROLLED, DISPOSED, OR TREATED ON-SITE. DISCHARGES OF CONSTRUCTION MATERIALS AND WASTES, SUCH AS FUEL OR PAINT, RESULTING FROM DUMPING, SPILLS, OR DIRECT CONTACT WITH RAINWATER OR STORMWATER RUNOFF ARE PROHIBITED.
14. PRESERVE EXISTING VEGETATION TO THE EXTENT PRACTICABLE, AND AS DIRECTED BY THE OWNER'S REPRESENTATIVE. DIMENSIONS SHOWN ON PLANS MAY BE MODIFIED TO AVOID DAMAGE TO EXISTING VEGETATION.
15. CONTROL THE AREA OF SOIL DISTURBING OPERATIONS SO THAT EROSION CONTROL BMPS CAN BE IMPLEMENTED QUICKLY AND EASILY.
16. STABILIZE NON-ACTIVE AREAS WITHIN 14 DAYS OF CESSATION OF CONSTRUCTION ACTIVITIES OR SOONER IF STIPULATED BY LOCAL REQUIREMENTS.
17. CONTROL EROSION IN CONCENTRATED FLOW PATHS BY APPLYING EROSION CONTROL SEEDING OR ALTERNATE METHODS.
18. PRIOR TO COMPLETION OF CONSTRUCTION, APPLY PERMANENT EROSION CONTROL TO REMAINING DISTURBED SOIL AREAS.
19. MAINTAIN SUFFICIENT EROSION CONTROL MATERIALS ON-SITE TO ALLOW IMPLEMENTATION IN CONFORMANCE WITH THE SWPPP.

BMPS

SCHEDULING
1. SEQUENCE TIMING OF CONSTRUCTION SITE ACTIVITIES (EXCAVATION, SCREENING, STOCKPILING, ETC.) TO MINIMIZE THE ACTIVE CONSTRUCTION AREA DURING THE RAINY SEASON.
2. MONITOR THE WEATHER FORECAST FOR RAINFALL, AND ADJUST THE CONSTRUCTION SCHEDULE ACCORDINGLY TO ALLOW FOR SOIL STABILIZATION AND SEDIMENT TREATMENT CONTROLS ON DISTURBED AREAS PRIOR TO THE ONSET OF RAIN.
3. SCHEDULE RECONTOURING/GRADING OF OFF-CHANNEL AREAS TO OCCUR DURING DRIER PERIODS, BUT ALSO TO AVOID IMPACTS TO SENSTIVE TERRESTRIAL SPECIES.
4. THE PROJECT IS LOCATED ON A REGULATED RIVER WITH FLOWS BEING CONTROLLED BY RELEASES FROM UPSTREAM DAMS. SEQUENCE CONSTRUCTION ACTIVITIES IN THE RIVER TO ACCOMMODATE SCHEDULED RELEASES AND FLUCTUATING WATER LEVELS AND TO MINIMIZE IMPACTS TO SENSITIVE AQUATIC SPECIES.
5. APPLY HYDRAULIC MULCH, HYDROSEEDING, AND SOIL BINDERS AFTER VEGETATION HAS BEEN INSTALLED TO AVOID DAMAGE TO BMP APPLICATIONS CAUSED BY EQUIPMENT USED FOR PLANTING.

PRESERVATION OF EXISTING VEGETATION
1. MARK AREAS CONTAINING RIPARIAN AND WETLAND VEGETATION TO BE PRESERVED PRIOR TO ANY SITE CLEARING.
2. INCLUDE SUFFICIENT SETBACK IN MARKED AREAS TO PROTECT ROOTS DURING GRADING OPERATIONS.
3. AVOID DAMAGE TO WOODY VEGETATION.
4. CONSULT WITH THE OWNER'S REPRESENTATIVE BEFORE ANY UNPLANNED VEGETATION REMOVAL OR OFF-ROAD ACCESS IS MADE WITHIN THE PROJECT AREA.

HYDRAULIC MULCH
1. APPLY HYDRAULIC MULCH TO:
   - 1.1. ROUGH GRADED AREAS THAT WILL BE INACTIVE FOR LONGER THAN 14 DAYS.
   - 1.2. SOIL STOCKPILES AT THE END OF THE CONSTRUCTION SEASON.
   - 1.3. APPLY TO GRADED FLOODPLAIN AREAS INDICATED ON PLANS AS DIRECTED BY QSP AND ONLY IF EXCAVATION UNCOVERS EROSIVE FINE MATERIAL.
   - 1.4. DO NOT APPLY IN CHANNELS, INCLUDING SECONDARY CHANNEL, ALCOVE CHANNELS, AND BANKS OF TERTIARY CHANNELS SLOPED 4:1 OR STEEPER.

HYDROSEEDING
1. APPLY HYDROSEED TO:
   - 1.1. ROUGH GRADED AREAS THAT WILL BE INACTIVE FOR LONGER THAN 14 DAYS.
   - 1.2. SOIL STOCKPILES AT THE END OF THE CONSTRUCTION SEASON.
   - 1.3. APPLY TO GRADED FLOODPLAIN AREAS INDICATED ON PLANS AS DIRECTED BY QSP AND ONLY IF EXCAVATION UNCOVERS EROSIVE FINE MATERIAL.
   - 1.4. DO NOT APPLY IN CHANNELS.

SOIL BINDERS
1. APPLY SOIL BINDERS TO:
   - 1.1. ROUGH GRADED AREAS THAT WILL BE INACTIVE FOR LONGER THAN 14 DAYS.
   - 1.2. SOIL STOCKPILES AT THE END OF THE CONSTRUCTION SEASON.
   - 1.3. CONSTRUCTION STAGING, MATERIALS LAYOUT, AND STORAGE AREAS.
   - 1.4. APPLY TO GRADED FLOODPLAIN AREAS INDICATED ON PLANS AS DIRECTED BY QSP AND ONLY IF EXCAVATION UNCOVERS EROSIVE FINE MATERIAL.
   - 1.5. DO NOT APPLY IN CHANNELS.

STREAMBANK STABILIZATION
1. STABILIZE STREAMBANKS AS INDICATED ON PLANS IF CONSTRUCTION ACTVITIES DISTURB OR OCCUR WITHIN STREAM CHANNELS AND THEIR ASSOCIATED RIPARIAN AREAS.

WIND EROSION CONTROL
1. APPLY WATER TO SOIL STOCKPILES, UNPAVED AND DISTURBED AREAS, AND TO OTHER AREAS WHICH MAY GENERATE DUST, SUCH AS EXCAVATION SITES OR SOIL LOADING/UNLOADING AREAS.

FIBER ROLLS
1. PLACE FIBER ROLLS AT THE TOE AND ON THE FACE OF SLOPES.

STABILIZED CONSTRUCTION ENTRANCES
1. STABILIZE ACCESS WITH CRUSHED AGGREGATE (GREATER THAN 3 IN., BUT SMALLER THAN 6 IN) PLACED OVER GEOTEXTILE FABRIC TO 12 IN. DEPTH, MINIMUM.
2. ALL EMPLOYEES, SUBCONTRACTORS, AND SUPPLIERS MUST UTILIZE THE STABILIZED ACCESS POINTS.
3. PROVIDE ACCESS AS CLOSE TO THE WORK AREA AS POSSIBLE.
4. PLAN WORK SITE ACCESS SO AS TO MINIMIZE DISTURBANCE TO THE RIVER AND ADJACENT CHANNEL BEDS, BANKS, AND SURROUNDING VEGETATION.

WATER CONSERVATION PRACTICES
1. WASH VEHICLES OFF-SITE.
2. REPAIR WATER LEAKS PROMPTLY.

ILLICIT CONNECTION-ILLEGAL DISCHARGE CONNECTION
1. INSPECT THE SITE BEFORE CONSTRUCTION AND DURING PROJECT EXECUTION FOR EVIDENCE OF ILLICIT CONNECTIONS, ILLEGAL DUMPING OR DISCHARGES. REPORT ANY SUSPICION TO THE PROPERTY OWNER.

VEHICLE EQUIPMENT AND CLEANING
1. DO NOT WASH ANY VEHICLES OR EQUIPMENT AT THE PROJECT SITE.
2. CLEAN/WASH VEHICLES AND EQUIPMENT ONLY AT APPROVED OFF-SITE AREAS.
3. STEAM-CLEAN ALL EQUIPMENT WORKING WITHIN THE STREAM CHANNEL PRIOR TO PROJECT IMPLEMENTATION AND RE-ENTRY TO PROJECT SITE TO REMOVE CONTAMINANTS THAT MAY ENTER THE RIVER AND ADJACENT LANDS. CONTAMINANTS INCLUDE INVASIVE SPECIES.
4. ENSURE THAT ALL EQUIPMENT WORKING WITHIN OR WITHOUT THE STREAM CHANNEL IS FREE OF FUEL, LUBRICATION, AND COOLANT LEAKS DURING PROJECT IMPLEMENTATION.
5. INSPECT EQUIPMENT WORKING WITHIN THE STREAM CHANNEL FOR LEAK POTENTIALS (I.E. CRACKED HOSES, LOOSE FILLING CAPS, STRIPPED DRAIN PLUGS, ETC.) PRIOR TO PROJECT IMPLEMENTATION AND AT THE END OF EACH WORK SHIFT.

VEHICLE EQUIPMENT FUELING
1. DO NOT PERFORM FUELING IN THE STREAM CHANNEL OR IN AREAS AT THE TOP OF THE CHANNEL BANK THAT MAY FLOW INTO THE STREAM CHANNEL.
2. MAINTAIN SPILL KITS IN CLOSE PROXIMITY (E.G. CREW TRUCKS AND OTHER LOGICAL LOCATIONS) WHEN USING HAZARDOUS MATERIALS.
3. PRIOR TO ENTERING THE WORK SITE, INFORM ALL FIELD PERSONNEL OF THE LOCATION OF SPILL KITS ON CREW TRUCKS AND AT OTHER LOCATIONS AT THE PROJECT SITE, AS WELL AS PROPER FUELING AND CLEANUP PROCEDURES. THE OWNER'S REPRESENTATIVE WILL DOCUMENT THIS TRAINING.

VEHICLE EQUIPMENT MAINTENANCE
1. DO NOT PERFORM EQUIPMENT MAINTENANCE IN THE STREAM CHANNEL OR IN AREAS AT THE TOP OF THE CHANNEL BANK THAT MAY FLOW INTO THE STREAM CHANNEL.
2. MAINTAIN SPILL KITS IN CLOSE PROXIMITY (E.G. CREW TRUCKS AND OTHER LOGICAL LOCATIONS) WHEN USING HAZARDOUS MATERIALS.
3. PRIOR TO ENTERING THE WORK SITE, INFORM ALL FIELD PERSONNEL OF THE LOCATION OF SPILL KITS ON CREW TRUCKS AND AT OTHER LOCATIONS AT THE PROJECT SITE, AS WELL AS PROPER FUELING AND CLEANUP PROCEDURES. THE OWNER'S REPRESENTATIVE WILL DOCUMENT THIS TRAINING.

MATERIAL DELIVERY AND STORAGE
1. STORE ANY ONSITE CHEMICALS IN WATERTIGHT CONTAINERS WITH SECONDARY CONTAINMENT OR IN A STORAGE SHED.
2. COVER ERODIBLE LANDSCAPE MATERIAL WHEN NOT IN USE.
3. DESIGNATE SPECIFIC AREAS FOR MATERIAL DELIVERY AND STORAGE.
4. PRIOR TO ENTERING THE WORK SITE, INFORM ALL FIELD PERSONNEL OF THE LOCATION OF SPILL KITS ON CREW TRUCKS AND AT OTHER LOCATIONS AT THE PROJECT SITE, AS WELL AS PROPER FUELING AND CLEANUP PROCEDURES. THE OWNER'S REPRESENTATIVE WILL DOCUMENT THIS TRAINING.

STOCKPILE MANAGEMENT
1. SECURELY INSTALL STOCKPILED SOIL COVERINGS IF STOCKPILES ARE NOT SCHEDULED TO BE USED FOR 14 DAYS AND AT THE END OF EACH CONSTRUCTION DAY.

SPILL PREVENTION AND CONTROL
1. APPROPRIATELY TRAIN FIELD PERSONNEL IN SPILL PREVENTION, HAZARDOUS MATERIAL CONTROL, AND CLEAN-UP OF ACCIDENTAL SPILLS.
2. DO NOT PERFORM FUELING, REPAIR, CLEANING, MAINTENANCE, OR VEHICLE WASHING IN THE STREAM CHANNEL OR IN AREAS AT THE TOP OF THE CHANNEL BANK THAT MAY FLOW INTO THE STREAM CHANNEL.
3. MAINTAIN SPILL KITS IN CLOSE PROXIMITY (E.G. CREW TRUCKS AND OTHER LOGICAL LOCATIONS) WHEN USING HAZARDOUS MATERIALS.
4. PRIOR TO ENTERING THE WORK SITE, INFORM ALL FIELD PERSONNEL OF THE LOCATION OF SPILL KITS ON CREW TRUCKS AND AT OTHER LOCATIONS AT THE PROJECT SITE, AS WELL AS PROPER FUELING AND CLEANUP PROCEDURES. THE PROJECT LEAD WILL DOCUMENT THIS TRAINING.

SOLID WASTE MANAGEMENT
1. PLACE SOLID WASTE GENERATED FROM TAILING PILE EXCAVATIONS AND WOODY VEGETATION DURING LAND CLEARING/FLOODPLAIN CONTOURING IN SELECT DESIGNATED WASTE COLLECTION AREAS ONSITE.
2. ARRANGE REGULAR WASTE COLLECTION AND DISPOSAL AT AUTHORIZED DISPOSAL AREAS.
3. EDUCATE FIELD PERSONNEL ON SOLID WASTE STORAGE AND DISPOSAL PROCEDURES.

HAZARDOUS WASTE MANAGEMENT
1. IF MERCURY LEVELS ABOVE BACKGROUND MEASUREMENTS ARE OBSERVED DURING THE SAMPLING PROCESS, CEASE SCREENING ACTIVITIES AND MAKE AN ASSESSMENT AS TO WHETHER REMEDIAL ACTIONS ARE NECESSARY. THIS MAY INCLUDE AVOIDANCE OF CONTAMINATED AREAS OR HALTING OF FURTHER ACTIVITIES WITHIN THE FLOODPLAIN ALONG WITH REMEDIAL ACTIONS IDENTIFIED WITH THE APPROPRIATE AGENCIES.

SANITARY SEPTIC WASTE MANAGEMENT
1. EDUCATE EMPLOYEES ON SEPTIC WASTE STORAGE AND DISPOSAL PROCEDURES.

BMP INSPECTION AND MAINTENANCE
1. MAINTENANCE SCHEDULE AND RESPONSE TIME SHALL BE AS STATED IN THE SWPPP.

DOCUMENT RELEASE: 65% DESIGN
REVISION NOTES

DESIGNED: SD
DRAWN: JM
REVIEWED: SD
APPROVED: CH

PREPARED BY: cbec eco engineering

CLIENT: USFWS - PACIFIC SOUTHWEST REGION
ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY, CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

EROSION AND SEDIMENT CONTROL NOTES

JOB NUMBER: 17-1012
DATE: MAY 2020
SHEET: G5
5 OF 15

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2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY CALIFORNIA

LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

GRADING PLAN 1

JOB NUMBER: 17-1012

DATE: MAY 2020

SHEET: C1

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2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY CALIFORNIA

LONG BAR ENHANCEMENT PLAN LOWER YUBA RIVER

GRADING PLAN 2

JOB NUMBER 17-1012

DATE MAY 2020

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2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY, CALIFORNIA

LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER
GRADING PLAN 3

JOB NUMBER: 17-1012

DATE: MAY 2020

SHEET: C3

8 OF 15

LOCATION: D:\Work\Projects\17-1012_LYR_Long_Bar_Enhancement_Plan_Technical_Support\400_Technical_Data\403_CAD_Data\CAD_DWGS\Production\PLAN_SHEETS.dwg

PLOT:5/14/2020

LOCATION: D:\Work\Projects\17-1012_LYR_Long_Bar_Enhancement_Plan_Technical_Support\400_Technical_Data\403_CAD_Data\CAD_DWGS\Production\PLAN_SHEETS.dwg

PLOT:5/14/2020

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ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

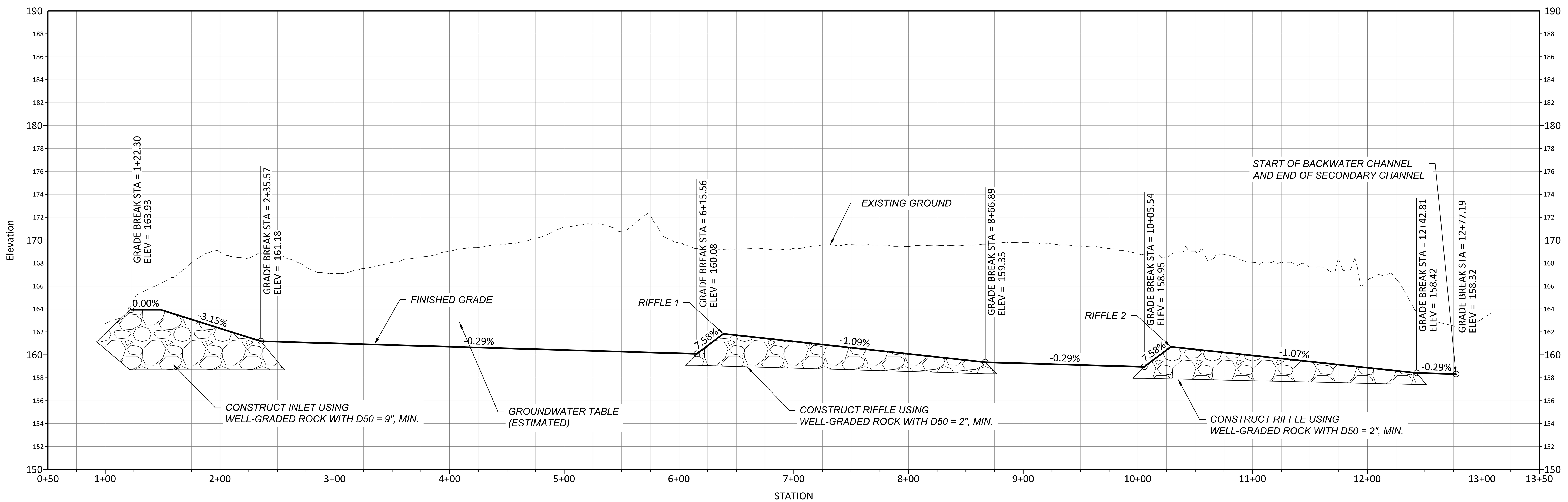
YUBA COUNTY
CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER
GRADING PLAN 4

JOB NUMBER
17-1012
DATE
MAY 2020
SHEET
C4
9 OF 15

A B C D E

1 2 3 4

Secondary Channel PROFILE



HORIZONTAL: 0 50 100 150 FT
1" = 50'

VERTICAL: 0 5 10 15 FT
1" = 5'

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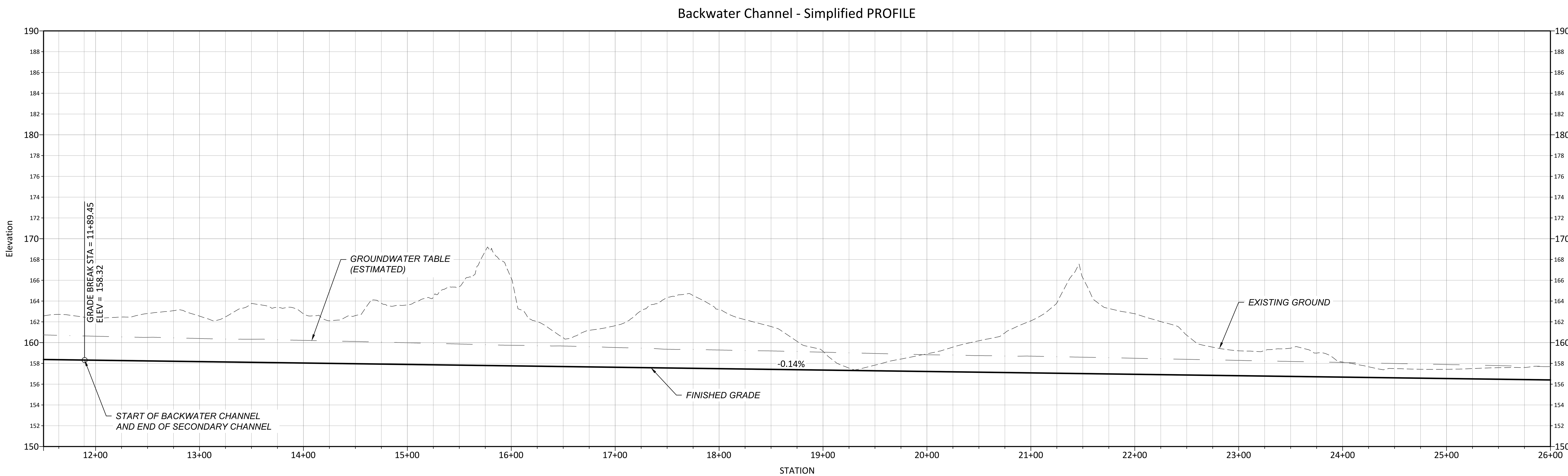
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER
SECONDARY CHANNEL PROFILE

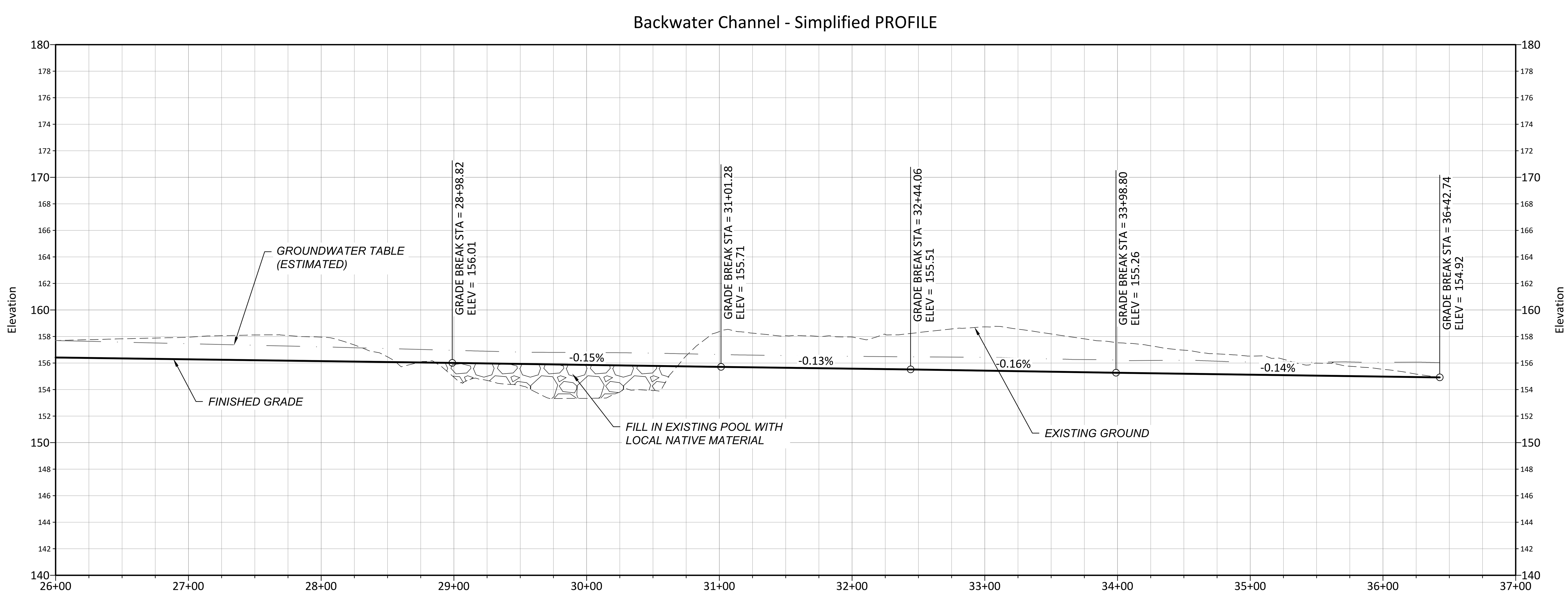
JOB NUMBER 17-1012
DATE MAY 2020
SHEET C5
10 OF 15

A B C D E

Backwater Channel - Simplified PROFILE



Backwater Channel - Simplified PROFILE



HORIZONTAL: 0 50 100 150 FT
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VERTICAL: 0 5 10 15 FT
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SACRAMENTO, CA 95825
(209)-334-2968

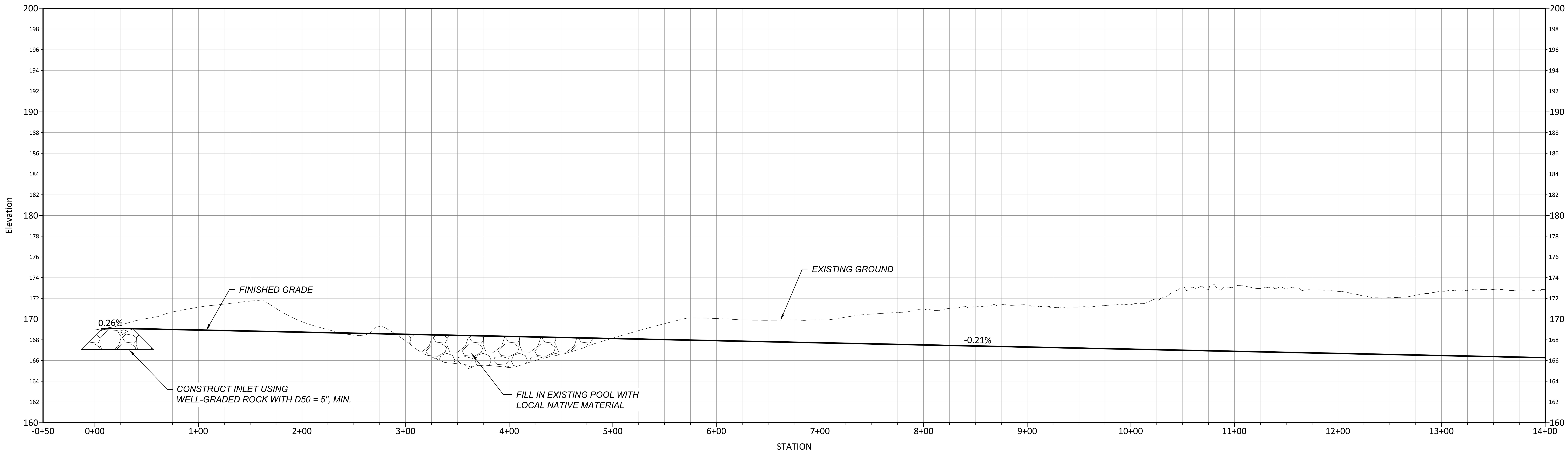
YUBA COUNTY CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER
BACKWATER CHANNEL PROFILE

JOB NUMBER
17-1012
DATE
MAY 2020
SHEET
C6
11 OF 15

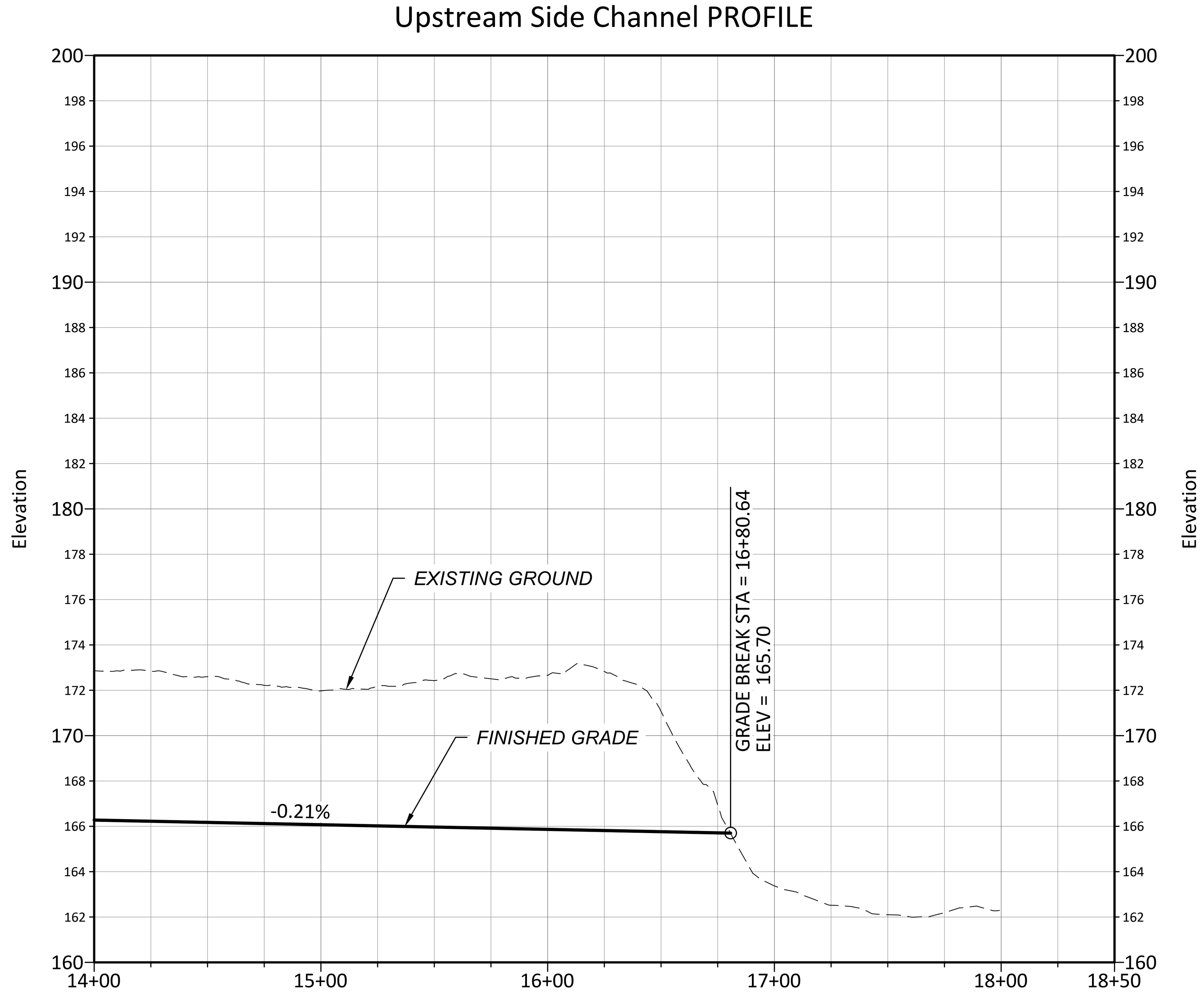
A B C D E

1 2 3 4

Upstream Side Channel PROFILE



Upstream Side Channel PROFILE



HORIZONTAL: 0 50 100 150 FT
1" = 50'

VERTICAL: 0 5 10 15 FT
1" = 5'

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2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

YUBA COUNTY CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

UPSTREAM SIDE CHANNEL PROFILE

JOB NUMBER
17-1012

DATE
MAY 2020

SHEET
C7
12 OF 15

SECONDARY CHANNEL ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L1	196.4		E: 6736405.56 N: 2207199.70	E: 6736279.66 N: 2207350.38
C1	133.4	504	E:6736279.66 N: 2207350.38	E: 6736181.63 N: 2207440.31
C2	147.5	243	E:6736181.63 N: 2207440.31	E: 6736043.19 N: 2207484.12
L2	244.3		E: 6736043.19 N: 2207484.12	E: 6735798.90 N: 2207484.88
C3	154.3	138	E:6735798.90 N: 2207484.88	E: 6735675.17 N: 2207563.03
L3	47.6		E: 6735675.17 N: 2207563.03	E: 6735654.61 N: 2207605.91
C4	223.7	426	E:6735654.61 N: 2207605.91	E: 6735510.52 N: 2207773.66
L4	60.7		E: 6735510.52 N: 2207773.66	E: 6735460.42 N: 2207807.84

BACKWATER CHANNEL ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L5	34.3		E: 6735488.80 N: 2207813.90	E: 6735467.17 N: 2207787.31
C5	35.3	38	E:6735467.17 N: 2207787.31	E: 6735436.19 N: 2207773.13
L6	26.8		E: 6735436.19 N: 2207773.13	E: 6735409.45 N: 2207773.91
C6	38.0	135	E:6735409.45 N: 2207773.91	E: 6735372.08 N: 2207780.32
L7	37.3		E: 6735372.08 N: 2207780.32	E: 6735336.59 N: 2207791.71
C7	10.3	23	E:6735336.59 N: 2207791.71	E: 6735326.37 N: 2207792.60
L8	13.3		E: 6735326.37 N: 2207792.60	E: 6735313.19 N: 2207790.78
C8	28.7	35	E:6735313.19 N: 2207790.78	E: 6735286.33 N: 2207798.24
L9	7.9		E: 6735286.33 N: 2207798.24	E: 6735280.16 N: 2207803.20
C9	25.7	34	E:6735280.16 N: 2207803.20	E: 6735256.20 N: 2207810.51
L10	17.1		E: 6735256.20 N: 2207810.51	E: 6735239.20 N: 2207809.04
C10	25.3	72	E:6735239.20 N: 2207809.04	E: 6735214.10 N: 2207811.29
L11	3.3		E: 6735214.10 N: 2207811.29	E: 6735210.96 N: 2207812.14
C11	60.6	200	E:6735210.96 N: 2207812.14	E: 6735150.98 N: 2207818.98
L12	86.8		E: 6735150.98 N: 2207818.98	E: 6735064.23 N: 2207815.68
C12	18.8	71	E:6735064.23 N: 2207815.68	E: 6735045.60 N: 2207817.45
L13	115.3		E: 6735045.60 N: 2207817.45	E: 6734933.30 N: 2207843.43
C13	16.7	58	E:6734933.30 N: 2207843.43	E: 6734917.84 N: 2207849.45
L14	35.4		E: 6734917.84 N: 2207849.45	E: 6734887.04 N: 2207866.89
C14	14.8	60	E:6734887.04 N: 2207866.89	E: 6734873.41 N: 2207872.53

BACKWATER CHANNEL ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L15	123.9		E: 6734873.41 N: 2207872.53	E: 6734753.97 N: 2207905.61
C15	36.7	200	E:6734753.97 N: 2207905.61	E: 6734717.92 N: 2207912.11
L16	41.8		E: 6734717.92 N: 2207912.11	E: 6734676.31 N: 2207915.73
C16	54.3	108	E:6734676.31 N: 2207915.73	E: 6734625.60 N: 2207933.55
L17	64.3		E: 6734625.60 N: 2207933.55	E: 6734572.15 N: 2207969.26
C17	20.5	77	E:6734572.15 N: 2207969.26	E: 6734553.79 N: 2207978.26
L18	118.7		E: 6734553.79 N: 2207978.26	E: 6734441.21 N: 2208015.85
C18	71.3	111	E:6734441.21 N: 2208015.85	E: 6734371.11 N: 2208016.00
L19	26.4		E: 6734371.11 N: 2208016.00	E: 6734346.06 N: 2208007.76
C19	43.8	47	E:6734346.06 N: 2208007.76	E: 6734304.26 N: 2208013.91
L20	12.2		E: 6734304.26 N: 2208013.91	E: 6734294.30 N: 2208020.88
C20	79.8	154	E:6734294.30 N: 2208020.88	E: 6734220.21 N: 2208048.08
L21	268.0		E: 6734220.21 N: 2208048.08	E: 6733953.40 N: 2208073.08
C21	51.9	200	E:6733953.40 N: 2208073.08	E: 6733902.93 N: 2208084.53
L22	76.2		E: 6733902.93 N: 2208084.53	E: 6733831.40 N: 2208110.88
C22	14.2	47	E:6733831.40 N: 2208110.88	E: 6733817.52 N: 2208113.73
L23	8.0		E: 6733817.52 N: 2208113.73	E: 6733809.51 N: 2208114.14
C23	43.8	200	E:6733809.51 N: 2208114.14	E: 6733766.36 N: 2208121.17
L24	19.3		E: 6733766.36 N: 2208121.17	E: 6733747.73 N: 2208126.34
C24	83.0	72	E:6733747.73 N: 2208126.34	E: 6733695.87 N: 2208185.19

BACKWATER CHANNEL ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L25	18.2		E: 6733695.87 N: 2208185.19	E: 6733693.24 N: 2208203.22
C25	27.6	50	E:6733693.24 N: 2208203.22	E: 6733682.15 N: 2208228.07
L26	18.0		E: 6733682.15 N: 2208228.07	E: 6733670.64 N: 2208241.91
C26	74.4	200	E:6733670.64 N: 2208241.91	E: 6733613.59 N: 2208289.04
L27	275.1		E: 6733613.59 N: 2208289.04	E: 6733372.72 N: 2208422.02
C27	49.8	200	E:6733372.72 N: 2208422.02	E: 6733326.59 N: 2208440.44
L28	102.1		E: 6733326.59 N: 2208440.44	E: 6733227.81 N: 2208466.24

DOCUMENT RELEASE: 65% DESIGN

REVISION NOTES

DESIGNED SD | DRAWN JM | REVIEWED SD | APPROVED CH

PREPARED BY: cbec eco engineering

CLIENT: USFWS - PACIFIC SOUTHWEST REGION
ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
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YUBA COUNTY, CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

ALIGNMENT GEOMETRY POINTS

JOB NUMBER 17-1012

DATE MAY 2020

SHEET C8

UPSTREAM SIDE CHANNEL ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L29	112.0		E: 6738462.46 N: 2207007.30	E: 6738381.87 N: 2207085.09
C28	98.4	153	E:6738381.87 N: 2207085.09	E: 6738294.64 N: 2207126.78
L30	58.4		E: 6738294.64 N: 2207126.78	E: 6738236.72 N: 2207133.99
C29	134.5	662	E:6738236.72 N: 2207133.99	E: 6738105.86 N: 2207164.01
L31	79.5		E: 6738105.86 N: 2207164.01	E: 6738030.58 N: 2207189.55
C30	163.2	378	E:6738030.58 N: 2207189.55	E: 6737869.69 N: 2207207.51
L32	103.7		E: 6737869.69 N: 2207207.51	E: 6737766.54 N: 2207196.67
C31	148.2	373	E:6737766.54 N: 2207196.67	E: 6737620.00 N: 2207210.46
L33	72.9		E: 6737620.00 N: 2207210.46	E: 6737550.22 N: 2207231.46
C32	207.5	399	E:6737550.22 N: 2207231.46	E: 6737345.15 N: 2207238.06
L34	105.9		E: 6737345.15 N: 2207238.06	E: 6737242.03 N: 2207214.13
C33	86.0	180	E:6737242.03 N: 2207214.13	E: 6737156.86 N: 2207215.08
L35	49.9		E: 6737156.86 N: 2207215.08	E: 6737108.53 N: 2207227.44
C34	137.8	217	E:6737108.53 N: 2207227.44	E: 6736973.35 N: 2207218.37
L36	241.6		E: 6736973.35 N: 2207218.37	E: 6736749.40 N: 2207127.78

NORTH FLOOD RUNNER AND ALCOVE ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L37	113.8		E: 6736115.05 N: 2207168.00	E: 6736007.92 N: 2207206.50
L38	123.5		E: 6736007.92 N: 2207206.50	E: 6735884.67 N: 2207214.23
C35	280.5	590	E:6735884.67 N: 2207214.23	E: 6735619.23 N: 2207296.42
L39	418.8		E: 6735619.23 N: 2207296.42	E: 6735259.60 N: 2207510.93
C36	306.6	819	E:6735259.60 N: 2207510.93	E: 6734973.36 N: 2207615.66
L40	384.4		E: 6734973.36 N: 2207615.66	E: 6734594.04 N: 2207678.29
C37	366.6	1611	E:6734594.04 N: 2207678.29	E: 6734242.18 N: 2207778.48
L41	894.7		E: 6734242.18 N: 2207778.48	E: 6733415.04 N: 2208119.63

SOUTH FLOOD RUNNER AND ALCOVE ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L42	487.7		E: 6735627.95 N: 2207291.79	E: 6735149.05 N: 2207199.54
C38	244.8	421	E:6735149.05 N: 2207199.54	E: 6734908.93 N: 2207223.76
L43	320.6		E: 6734908.93 N: 2207223.76	E: 6734612.55 N: 2207346.06
C39	226.5	340	E:6734612.55 N: 2207346.06	E: 6734390.61 N: 2207359.04
L44	87.1		E: 6734390.61 N: 2207359.04	E: 6734306.81 N: 2207335.44

CONNECTOR CHANNEL ALIGNMENT GEOMETRY				
NUMBER	LENGTH	RADIUS	START POINT	END POINT
L45	127.0		E: 6735813.23 N: 2207509.63	E: 6735688.21 N: 2207487.41
C40	103.8	584	E:6735688.21 N: 2207487.41	E: 6735588.17 N: 2207460.30
L46	3.5		E: 6735588.17 N: 2207460.30	E: 6735584.90 N: 2207459.09
C41	135.3	259	E:6735584.90 N: 2207459.09	E: 6735451.75 N: 2207446.74
L47	360.4		E: 6735451.75 N: 2207446.74	E: 6735096.49 N: 2207507.20

DOCUMENT RELEASE
65% DESIGN
REVISION NOTES

DESIGNED SD
DRAWN JM
REVIEWED SD
APPROVED CH

PREPARED BY:
cbec eco engineering

CLIENT:
USFWS - PACIFIC SOUTHWEST REGION
ANADROMOUS FISH RESTORATION PROGRAM
2800 COTTAGE WAY, SUITE W-2606
SACRAMENTO, CA 95825
(209)-334-2968

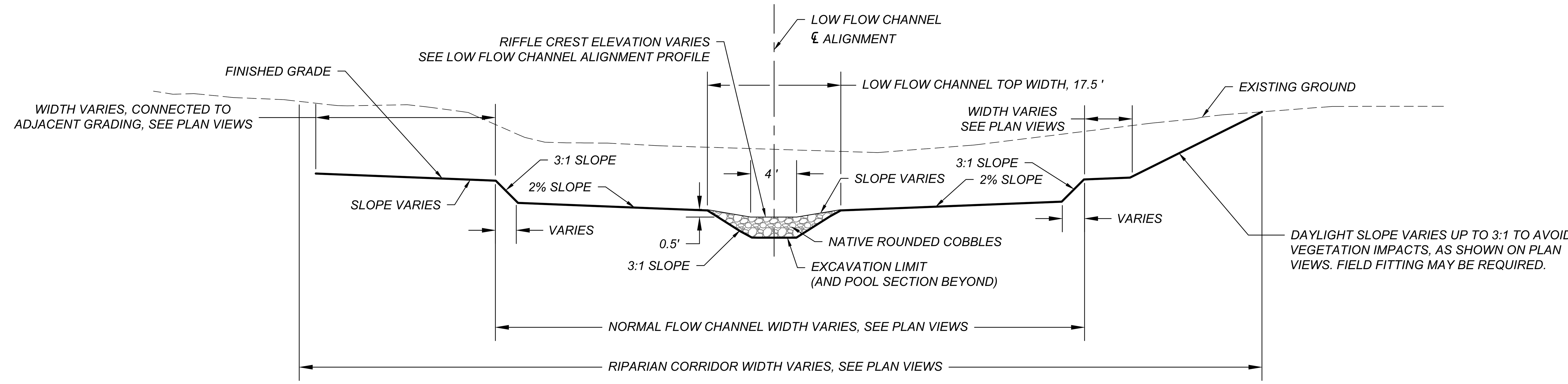
YUBA COUNTY
CALIFORNIA
LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

ALIGNMENT GEOMETRY POINTS

JOB NUMBER
17-1012

DATE
MAY 2020

SHEET
C9
14 OF 15



SECONDARY CHANNEL RIFFLE CREST TYPICAL SECTION A

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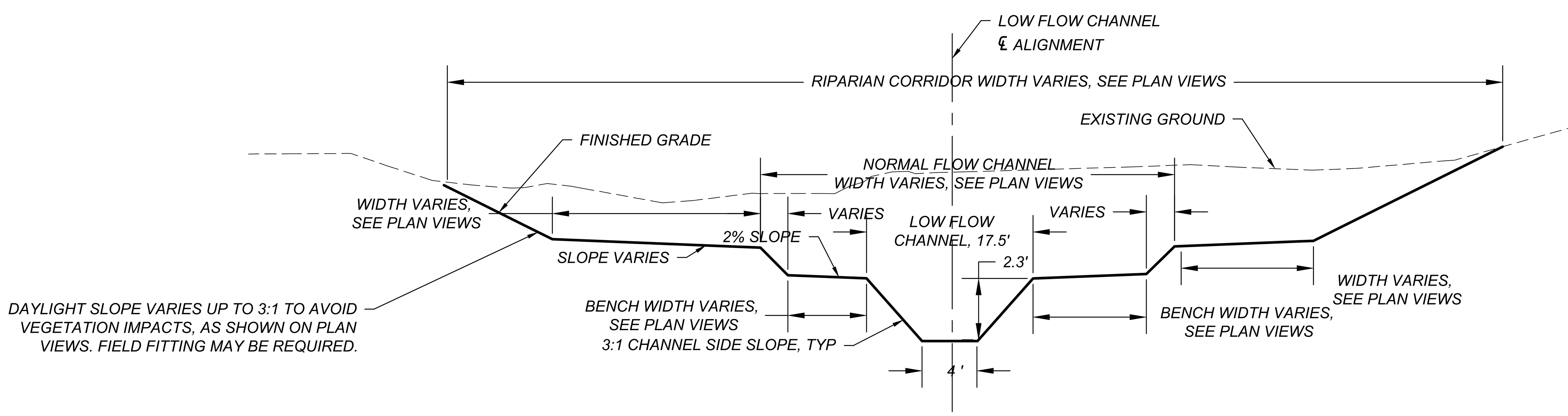

SECONDARY CHANNEL POOL TYPICAL SECTION B

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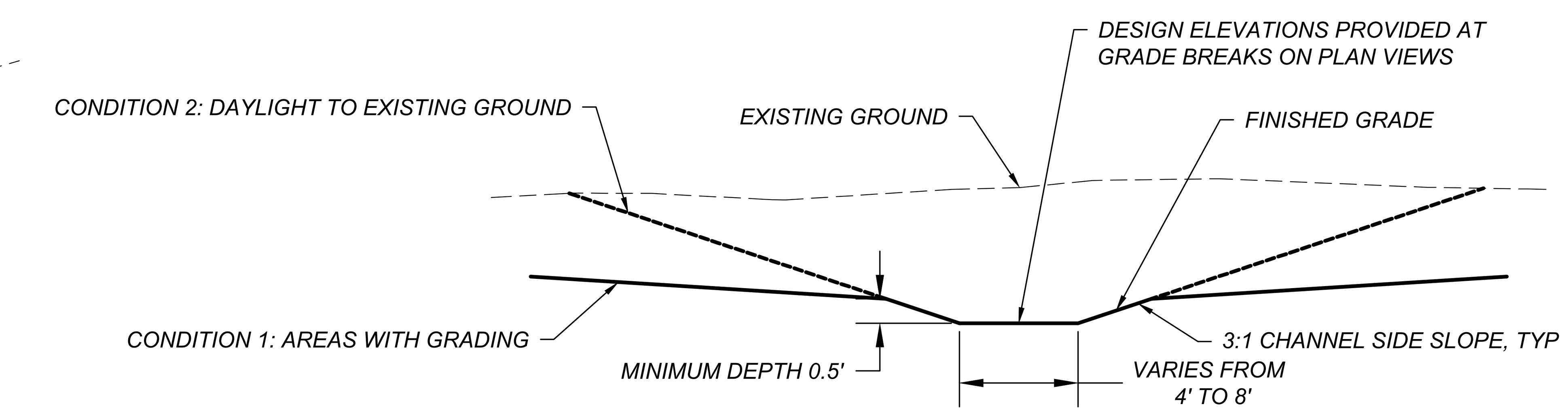

UPSTREAM SIDE CHANNEL TYPICAL SECTION D

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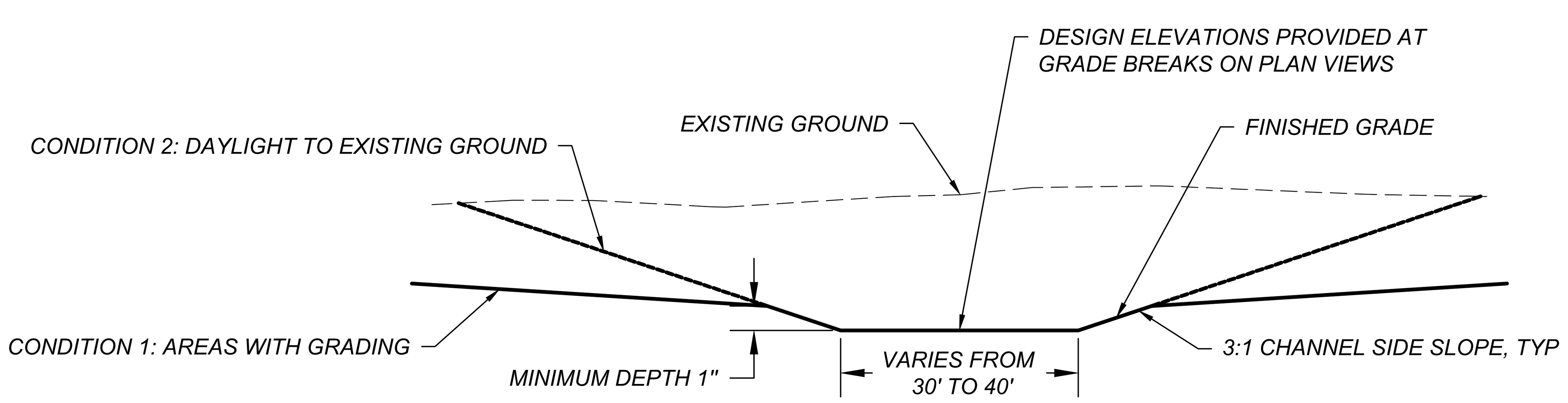

FLOOD RUNNERS TYPICAL SECTION C

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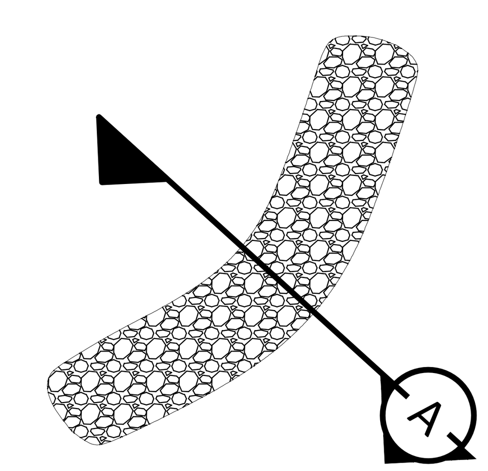

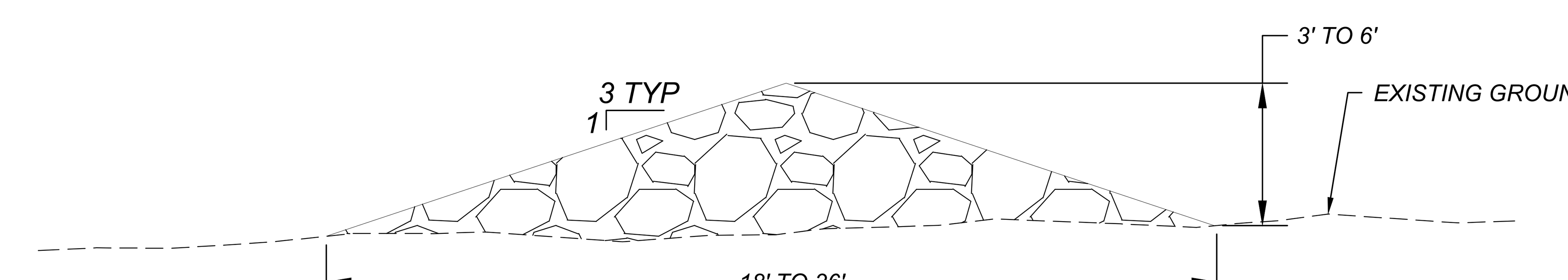

SECTION A

NTS

1. ROUGHNESS FEATURES SHALL CONSIST OF ROUNDED, WELL-GRADED LOCAL MATERIAL.
2. SIZE OF ROCKS TO BE USED FOR ROUGHNESS FEATURES ARE INDICATED ON PLANS ACCORDING TO GRADATION D50 VALUES.

HYDRAULIC ROUGHNESS BERM TYPICAL DETAILS

NTS

DOCUMENT RELEASE: 65% DESIGN

REVISION NOTES

DESIGNED SD
DRAWN JM
REVIEWED SD
APPROVED CH

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YUBA COUNTY CALIFORNIA

LONG BAR ENHANCEMENT PLAN
LOWER YUBA RIVER

TYPICAL CHANNEL SECTIONS AND DETAILS

JOB NUMBER 17-1012

DATE MAY 2020

SHEET C10

APPENDIX C. MITIGATION MONITORING AND REPORTING PROGRAM

**MITIGATION MONITORING AND REPORT PROGRAM:
LONG BAR SALMONID HABITAT RESTORATION PROJECT ON THE LOWER YUBA RIVER MITIGATED NEGATIVE DECLARATION**

This Mitigation Monitoring and Reporting Program (MMRP) was prepared in accordance with Section 15097 of the California Environmental Quality Act (CEQA) Guidelines. Section 15097 requires that a lead agency establish a program to report on or monitor measures adopted as part of the environmental review process to mitigate or avoid significant effects on the environment. The MMRP for the Long Bar Salmonid Habitat Restoration Project is presented here as Table 1. As the Lead Agency, the U.S. Fish and Wildlife Service is responsible for enforcement of the adopted mitigation measures. This MMRP is designed to ensure that the mitigation measures necessary to reduce significant impacts identified in the Long Bar Salmonid Habitat Restoration Initial Study and Proposed Mitigated Negative Declaration (IS/MND) are implemented. The components of the MMRP Table 1 are listed below:

Mitigation Measures: The mitigation measures are taken verbatim from the Long Bar Salmonid Habitat Restoration Project IS/MND.

Timing/Milestone: Identifies a schedule for conducting each mitigation action.

Responsible Entity: Identifies the entity responsible for implementing specific mitigation measures.

Mitigation Action: Identifies the specific action or actions that must be completed to implement the mitigation measure.

Monitoring and Enforcement Responsibility: Identifies the department/agency, consultant, or other entity responsible for overseeing that mitigation occurs.

Check off Date/Initials: To be filled out when individual mitigation is complete.

MITIGATION MONITORING AND REPORTING PROGRAM: LONG BAR SALMONID HABITAT RESTORATION PROJECT					
Mitigation Measure(s)	Timing/ Milestone	Responsible Entity	Mitigation Action	Monitoring and Enforcement Responsibility	Check off Date/Initials
Reduce Dust Impacts The following dust reduction measures will be implemented during movement of materials from the construction area to the processing plant to reduce construction-related emissions: • wet materials to limit visible dust emissions using water; • provide at least 6 in (15.2 cm) of freeboard space from the top of the container; or, • cover the container. Implement the following dust reduction measure during cobble placement to reduce construction-related emissions: • limit or promptly remove any of mud or dirt on construction equipment and vehicles at the end of each workday, or once every 24 hours. Water trucks would be used to wet down construction access roads, staging areas, and restoration activity zones to minimize dust production.	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Protect Elderberry Plants and Special Status	Prior to initiation of	Project Applicant/	Implement specified	Project Applicant/	

Plants with Buffer Each year, before beginning construction activities, a pre-project special status plant survey will be conducted of the Proposed Project site. If elderberry shrubs (or other special status plants) are identified in subsequent surveys they will be avoided. Complete avoidance of elderberry plants may be assumed when there is at least a 100-ft (30.5 m) buffer around the plant. However, 20 ft buffers will be established and maintained for all elderberry plants with stems measuring 1 in or greater in diameter at ground level which will be retained in situ (83 plants). All buffer zones will be flagged and Proposed Project activities will be adjusted to ensure no activities occur in the buffer area, thereby minimizing any negative effects on valley elderberry longhorn beetle. No insecticides, herbicides, fertilizers, or other chemicals that might harm valley elderberry longhorn beetle or its host plant will be used for the Proposed Project (USFWS 1999).	restoration activities	Contractor	mitigation measures	Contractor	
Transplant Unavoidable Elderberry Plants to Suitable Locations Elderberries that were transplanted pre-project, following consultation with U.S. Fish and Wildlife Service, will be monitored in years 1, 2, and 3 and 10 with a target minimum survival rate of at least 60%. If necessary, replacement plants will be added to the restoration area to maintain survival above 60%.	Prior to initiation of restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Protect and Compensate for Native Trees Native trees, such as Fremont cottonwood (*Populus*	Prior to initiation of restoration	Project Applicant/	Implement specified mitigation	Project Applicant/ Contractor	

fremontii), willows (*Salix* spp.), and Alder (*Alnus rhombifolia*) with a diameter-at-breast-height (DBH) of 6 in (15.2 cm) or greater will be protected with 30-ft (9.1-m), 10-ft (3-m), and 10-ft (3-m) buffers, respectively. Native trees will be marked with flagging if close to the work area to prevent disturbance. To compensate for the removal of riparian shrubs and trees during Proposed Project implementation, the plans will identify tree and shrub species that will be planted, how, where, and when they will be planted, and measures to be taken to ensure a minimum performance criteria of 60% survival of planted trees for a period of three consecutive years. Irrigation will not be used, but the return of inundation to the floodplain is expected to promote growth of native riparian species. The tree plantings will be based on native tree species compensated for in the following manner: • Oaks having a DBH of 3 – 5 in (7.6 – 12.7 cm) will be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a DBH of greater than 5 in will be replaced in-kind at a ratio of 5:1. • Riparian trees (i.e., willow, cottonwood, poplar, alder, ash, etc.) and shrubs will be replaced in-kind and on site, at a ratio of 3:1, and planted in the nearest suitable location to the area where they were removed.	activities	Contractor	measures		

Construction Approach to Minimize Impacts to Fish The construction approach will allow fish to move progressively downstream and away from the impact area as construction moves from upstream to downstream through the backwater channel. The majority of the in-water work will involve the filling in and creation of a side channel through the ponds and backwater. Before in-water work starts in a section of the channel a qualified fisheries biologist will survey the area and determine whether there is a suitable egress route for fish to move downstream and away from the construction area. If a suitable downstream egress route is not present, most likely because an area is deemed too shallow, then the problem area will be altered such that it becomes suitable. An excavator would likely be used to deepen the problem area and would work from downstream to upstream to discourage fish from migrating downstream until the egress route is completed. Once suitable downstream egress has been established, in-stream construction will begin at the most upstream section of the channel and work progressively downstream and across the channel. The listed fish species most likely to be present are juvenile CCV Steelhead from 7 to 30 cm (3 – 12 in) fork length and possibly juvenile CV spring-run Chinook Salmon that are demonstrating the yearling life history strategy from 7 to 12 cm (3 – 5 in) fork length. Juvenile CCV steelhead and Chinook Salmon are highly mobile and would be expected to easily move downstream and away from the impact	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

area with a suitable egress route. Juvenile CCV steelhead and Chinook Salmon are not likely to be present in the ponds or the majority of the backwater, since they are not juvenile salmonid habitat. During pre-project surveys juvenile Chinook Salmon were only observed in the observed in the backwater in winter and spring when flows were sufficient to allow access (CFS unpublished data). Juvenile *O. mykiss* were never observed in the backwater (CFS unpublished data). Once work proceeds past an area, fish will be able to return to use the newly created habitat through upstream migration. If a qualified fisheries biologist, with input from the contractor, determines that in-stream work in an area cannot be performed using the construction approach then fish relocation will be performed to avoid fish injury and mortality and minimize disturbance.					
Fish Relocation to Minimize Impact to Fish from Construction Activities If fish relocation needs to be performed, a qualified fisheries biologist will determine which fish relocation method is most appropriate for the area. Fish relocation will most likely initially be attempted by trying to herd the fish out of the work area as this would minimize impacts to fish as they would not be handled and transported. The following guidelines will apply to fish relocation through herding. • Before fish relocation through herding begins, a qualified fisheries biologist will identify the most appropriate method and approach. Prior to beginning the fisheries	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

biologist will ensure that the location to which fish are herded contains suitable habitat. • The fish relocation through herding will be conducted under the supervision of a qualified fisheries biologist. The method that will most likely be used will be to install an exclusion screen or block-net above the upstream most work area. An appropriately sized seine that covers the width of the channel, operated by qualified personnel, will be pulled in the downstream direction until it is below the bottom of the work area. The net will then be fastened in place, blocking the entire channel until a temporary block net can be installed. The temporary block-net will be installed immediately upstream of the seine net such that fish have been herded downstream and cannot return upstream. A minimum of three seine hauls will be performed. For each haul, when the seine approaches the block-net, the block-net will be removed until the seine has passed downstream of its location and will then be re-installed immediately upstream of the seine. After the final pass, as determined by the fisheries biologist, the block-net will be left in place or replaced with an exclusion screen to prevent fish from moving upstream. • After the area has been adequately seined, based on the judgement of a qualified fish biologist, the area will once again be					

surveyed for fish. The fisheries biologist will determine the most appropriate method to survey the area for remaining fish. • If the survey results in an estimate of greater than 95% of individuals that were present prior to relocation efforts being absent after relocation efforts and no listed species are observed, the fish relocation effort will be considered successful and construction activities can commence. If initial relocation efforts are deemed unsuccessful, the fisheries biologist will determine whether further herding with a seine should be conducted until the success criteria is met or relocation using a capture method will be employed. If fish relocation using herding is not successful or the fisheries biologist decides it is not feasible, then fish capture and relocation will be used. The following guidelines will apply to fish capture and relocation. • Before fish relocation begins, a qualified fisheries biologist will identify the most appropriate release location(s). Release locations will have water temperatures within 2°C of the capture location, offer suitable habitat for released fish, and will be selected to minimize the likelihood that fish will re-enter the work area or become impinged on the exclusion net or screen. • The method used to capture fish will depend					

on the nature of the work site, and will be selected by a qualified fisheries biologist who is experienced with fish capture and handling. Areas of complex habitat may require the use of electrofishing equipment, whereas in other areas fish may be captured through seining or dip netting. Electrofishing will only be performed by properly trained personnel following NMFS guidelines (2000). Electrofishing will only be performed if seining and/or dip netting is not feasible. • Handling of salmonids will be minimized. When it is necessary, personnel will only handle fish with wet hands or nets. • Fish will be held temporarily in cool, shaded water. Overcrowding in buckets will be avoided by using at least two buckets and no more than 25 fish will be kept in a five gallon bucket. Aeration will be provided with a battery powered external bubbler. Fish will be protected from jostling and noise and will not be removed from the bucket until the time of release. The water temperature in each bucket will be monitored and partial water changes or the addition of ice will be conducted as necessary to maintain a stable water temperature (within 2°C of initial water temperature). Fish will not be held for more than 30 minutes. If water temperature reaches or exceeds NMFS limits, fish will be released and relocation operations will					

cease. • If fish are abundant, capture will cease periodically to allow release and minimize the time fish are held in containers. • Fish will not be anesthetized or measured. However, they will be visually identified to species level, and year classes will be estimated and recorded. • When feasible, initial fish relocation efforts will occur several days prior to the scheduled start of construction. The fisheries biologist will perform a final survey on the day before or the day of construction. • Reports on fish relocation activities will be submitted to CDFW and NMFS within 6 months of the relocation effort. • If mortality during relocation exceeds 2%, relocation will cease and CDFW and NMFS will be contacted as soon as possible.					
Exclusion of Fish from Construction Areas to Prevent Impacts Fish exclusion screens or nets may be used in strategic locations at various times to prevent fish from being impacted by construction activities. Exclusion will prevent fish from accessing areas from which they were relocated.	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Work Outside of Critical Periods for Sensitive	Prior to restoration	Project Applicant/	Implement specified	Project Applicant/	

Species Table 14 lists the critical periods when disturbance could result in significant impacts to individuals or populations of special status species. To avoid these impacts, all Proposed Action in-water activities will be conducted during the period 15 July through 30 September, which is outside the listed critical periods for the majority of the species. Surveys will be performed for species which have critical periods overlapping with the in-water work window or dry-ground work window (16 April to 31 October) which may be impacted by the Proposed Action activities. If special status or sensitive species are identified within the area which may be impacted by Proposed Action activities, then buffers will be established and/or CDFW and USFWS will be consulted. Nesting birds and raptors are protected under the MBTA and California Fish and Game Code, and trees and shrubs within the Action Area likely provide nesting habitat for songbirds and raptors. If tree removal is unavoidable, it will occur during the non-breeding season (mid-September). If other construction activities must occur during the potential breeding season (1 February- 31 August) surveys for active nests and/or roosts will be conducted by a qualified biologist no more than 10 days prior to the start of construction. A minimum no disturbance buffer will be delineated around active nests (note, size of buffer depends on species encountered) until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.	activities	Contractor	mitigation measures	Contractor	

Monitor for Bats to Prevent Impacts For bat species, before any ground disturbing activities, a qualified biologist will survey for the presence of associated habitat types for the bat species of concern. If bats are present, suitable avoidance and conservation measures will be implemented, including a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged.	Prior to restoration activities	Project Applicant/ Contractor	Hire qualified biologist to perform surveys; if necessary, implement specified mitigation measures	Project Applicant/ Contractor	
Use Special Transportation Routes and Work Areas Special transportation routes and work areas will be designated to avoid damaging trees and shrubs in riparian habitats, especially those sensitive species described above. Potential impacts to the riparian vegetation could occur during heavy equipment operation. These impacts will be minimized to the greatest extent practicable by selecting travel routes that avoid or minimize damage. Heritage size trees (i.e., greater than 24 in [40.6 cm] in diameter) near the work area will be identified, flagged and fenced prior to construction to prevent unintended damage. If damage cannot be avoided, these trees will be replaced at a ratio prescribed in **Mitigation Measure 5 - Protect and Compensate for Native Trees.**	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Monitor for Wildlife to Prevent Impacts Pre-construction surveys by qualified biologists will be conducted no more than 10 days prior to the start of construction. Pre-construction surveys will be conducted by qualified wildlife biologists, who will determine the	Prior to restoration activities	Project Applicant/ Contractor	Hire qualified biologist to perform surveys; if necessary, implement specified mitigation	Project Applicant/ Contractor	

use of the Action Area by American badgers; surveys will focus on identification of potential badger dens within, and a minimum 250 ft (76.2 m) buffer, around the Action Area. If badger dens are located within the construction or buffer area, prior to initiation of construction CDFW will be consulted for further instructions on methods to avoid direct impacts to this species. Protocol-level surveys will also be implemented for other state and federally-listed species such as Foothill Yellow-legged Frog, Swainson's Hawk, White-tailed Kite, Bald Eagle, Chinook Salmon, CCV steelhead, and Western Pond Turtle, which may be impacted by restoration activities (Swainson's Hawk Technical Advisory Committee 2000). This includes pre-construction surveys conducted no more than 15 days before Proposed Action construction activities by qualified wildlife and fisheries biologists. Surveys for active nests will be performed using qualified biologists no more than 10 days prior to the start of disturbance activities. A minimum no-disturbance buffer of 250 ft around active nests of non-listed bird species; a 500-ft no-disturbance buffer around migratory bird species; and a half mile buffer for nest of listed species and fully protected species (including White-tailed Kite and Bald Eagle) will be established until breeding season is over or young have fledged. If such a buffer cannot be accomplished, CDFW will be consulted. If Foothill Yellow Legged Frog or Western Pond Turtle are present in Action Areas that will be disturbed then CDFW will be consulted for further instructions on methods to avoid direct			measures		

impacts to these species.					
Monitor Water Quality and Prevent Impacts During in-water work, turbidity will be monitored with intermittent grab samples from the river, and construction curtailed if turbidity exceeds criteria established by the Regional Water Quality Control Board in its Clean Water Act §401 Water Quality Certification. Only clean native sediment from within the Action Area will be used to create riffles and perform other topographic modification. As appropriate, silt curtains will be used along the river corridor to capture floating materials or sediments mobilized during construction activities, and prevent water quality impacts. Stream bank impacts will be isolated and minimized to reduce bank sloughing. Banks will be stabilized with revegetation following Proposed Action activities, as appropriate. A Spill Prevention and Response Plan will also be developed as part of the Long Bar Best Management Practices Plan (BMP Plan), as well as a Stormwater Pollution Prevention Plan (SWPPP). All pertinent staff will be trained on and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them will be made available at the site and staff will be trained in its use. Spill prevention kits will be in close proximity to construction areas, and workers will be trained in their proper use.	Ongoing prior to, during and after restoration activities	Project Applicant/ Contractor	Use qualified QSP and implement measures	Project Applicant/ Contractor	
Monitor Mercury Levels and Mitigate for Impacts Sediment and aqueous total mercury levels will be	Ongoing prior to, during and after restoration	Project Applicant/ Contractor	Use qualified QSP and implement measures	Project Applicant/ Contractor	

measured before, during, and after restoration activities in the Action Area. Following methods in the Stillwater Sciences (2004) Mercury Assessment, total mercury from areas of Proposed Action exposed fine sediments (<63 µm) will be evaluated to determine if they are considered elevated by the Central Valley Regional Water Quality Control Board (0.10 mg/kg or greater). Aqueous raw total mercury will also be tested to ensure that it is below the California Toxics Rule for a drinking water source of 50 ng/L. It is unlikely that excavation and regrading activities may uncover mercury hot spots and or mobilize mercury in the aquatic food web; however, if samples are found with mercury levels above established standards, work will be halted in the vicinity of the elevated mercury area to assess contamination potential. If, sediment total mercury levels meet the elevated criteria then the mitigation action(s) defined in the Proposed Action 401 water quality certification will be implemented.	activities				
Use Clean Equipment and Biodegradable Lubricants All equipment will be clean and those performing in-water work will use biodegradable lubricants and hydraulic fluids. All equipment will be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs). Vehicles are to be fueled and lubricated in a designated staging area located outside the stream channel and banks. Front-end loaders will be wheeled (rubber tire) to minimize impacts. Construction specifications will require that any equipment used in or near the river is properly	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

cleaned to prevent any hazardous materials from entering the river, and containment material will be on site in case of an accident. Contracted personnel will regularly monitor contractors to ensure environmental compliance. Spill prevention kits will be located close to construction areas, with workers trained in their use.					
Prevent Spread of Aquatic Invasive Species To minimize the chance that aquatic invasive plants and invertebrates will be transported and spread to other sections of the Yuba River or other water bodies on equipment, construction specifications will require that equipment be steam cleaned immediately after the work is completed and before being used in other water bodies. An Invasive Species Risk Assessment and Planning (ISRAP) protocol will be developed, and all appropriate staff will be trained as to its purpose and implementation before construction begins. The plan will be used to prevent the spread of invasive species during construction. Additional measures may be taken at the recommendation of CDFW.	Prior to restoration activities	Project Applicant/ Contractor	Implement mitigation measures specified in ISRAP	Project Applicant/ Contractor	
Reduce Impacts from Noise To mitigate noise related impacts, the Proposed Action will require all contractors to comply with the following operational parameters: • restrict construction activities to time periods under which the aggregate plant is allowed to operate; • install and maintain sound-reducing equipment and muffled exhaust on all	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

construction equipment.					
Inadvertent Discoveries of Objects of Cultural Significance The following mitigation measure would be implemented as the Proposed Action would not have a Tribal or Archeological Monitor present during ground disturbing activities. Cultural items include darkened soil (midden), shell fragments, faunal bone fragments, fire affected rock and clay, isolated artifacts, bowl mortars, handstones and pestles, flaked stone, and human remains. Recommendations of the treatment of a Tribal Cultural Resource (TCR) will be documented in the project record. For any recommendations made by traditionally and culturally affiliated Native American Tribes that are not implemented, a justification for why the recommendation was not followed will be provided in the project record. If adverse impacts to a TCR, unique archeological, or other cultural resources occurs, then consultation with the United Auburn Indian Community of the Auburn Rancheria (UAIC) and other by traditionally and culturally affiliated Native American Tribes regarding mitigation contained in the Public Resources Code sections 21084.3(a) and (b) and CEQA guidelines section 15370 will occur. • If potentially significant TCRs, cultural or archeological resources are discovered during ground disturbing construction activities, all work will cease within 100 feet of the find. UAIC's Tribal Historic Preservation Department and Mooretown	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

Rancheria Tribal Historic Preservation Officer will be immediately contacted to assess the significance of the find, according to Section 15064.5 of the CEQA Guidelines, and make recommendations for appropriate treatment. • A qualified cultural resources specialist meeting the Secretary of the Interior's Standards and Qualifications for Archeology, may also assess the significance of the find in join consultation with Tribal Representatives from UAIC and Mooretown Rancheria to ensure that Tribal values are considered. Work will remain suspended or slowed within 100 feet of the find until the resource is evaluated, which will occur within one day, but no more than two days, of the find. • The Proposed Action applicant will coordinate with UAIC's Tribal Historic Preservation Department and Mooretown Rancheria Tribal Historic Preservation Officer all necessary investigations and treatment of the discovery under the requirements of CEQA, including AB 52. Preservation in place would be the preferred alternative under CEQA and Tribal protocols, and every effort will be made to preserve the resources in place, including through project redesign. • The contractor will implement any measures deemed by Yuba County to be necessary and					

feasible to preserve in place, avoid, or minimize impacts to the resource, including, but not limited to, the use of a paid Tribal Monitor, and facilitating the appropriate Tribal treatment of the find, as necessary. The final disposition of archaeological, historical, and paleontological resources recovered on State lands under the jurisdiction of the State Lands Commission must be approved by the Commission					
Public Safety During construction, signs will be posted upstream and downstream of the work zone to warn river users of the potential hazards created by heavy equipment and how to safely avoid the work zone. The importance of monitoring for the presence of rafters and boaters will be part of the initial construction crew safety training and this will be reiterated during weekly BMP meetings.	Prior to and ongoing during restoration activities	Project Applicant/ Contractor	Implement mitigation measure specified	Project Applicant/ Contractor	

APPENDIX D. PRE-PROJECT SPECIAL STATUS PLANT SURVEY

Long Bar Restoration Project
Lower Yuba River

Project Area Special Status Plant Survey Report

August 4, 2020

Cody Wasuta

Introduction
The goal of the Long Bar Restoration Project is to improve and restore juvenile rearing habitat quality and ecosystem function by enhancing a disconnected side channel and adjacent floodplain areas to increase connectivity with the main channel along the Yuba River above Daguerre Point Dam. The project scope includes construction activities that will significantly impact the existing physical attributes of the site. Pre-project surveys are required to identify and mitigate for any special status species present within the project footprint.

Methods
A list of federal protected plant species with potential to occur within the project area was compiled from three sources. The California Natural Diversity Database was utilized to search for special status species in the nine quadrangles adjacent to the Browns Valley quad, where the project is located. The California Native Plant Society database was searched for all the special status plant species that are present in Yuba County. Additionally, the Browns Valley Quad was submitted to obtain an official species list from the U.S. Fish and Wildlife Service. Table 1 shows the resulting 21 species, their status listing, habitats and flowering time.

Surveys were conducted by walking transects across the project area. Extra care was taken in conditions most likely to support any of the species listed in Table 1. Three separate surveys were conducted to capture various conditions and potential flowering times: April 23-24, May 20th-21st, June 15-16th; 2020.

Results
None of the species listed in Table 1 were observed during the three surveys.

Attachment 1

Table 1 - Special Status Species likely to occur at Project Site

Family	Scientific_Name	Common_Name	Listing	Habitat	Flowering
Fabaceae	*Astragalus pauperculus*	depauperate milk-vetch	CNPS 4.3	open, vernally moist volcanic clay	March-May
Fabaceae	*Astragalus tener var. ferrisiae*	Ferris' milk-vetch	CNPS 1B.1	Alkaline flats, vernally moist meadows	March-June
Azollaceae	*Azolla microphylla*	Mexican mosquito fern	CNPS4.2	ponds, ditches	
Themidaceae	*Brodiaea rosea ssp. vallicola*	valley brodiaea	CNPS 4.2	Vernal pools, swales	April-May(June)
Themidaceae	*Brodiaea sierrae*	Sierra foothills brodiaea	CNPS 4.3	Ultramafic, foothill, dry meadow	June-July
Onagraceae	*Clarkia biloba ssp. brandegeeae*	Brandegee's clarkia	CNPS 4.2	foothill woodland	June-July
Boraginaceae	*Cryptantha rostellata*	red-stemmed cryptantha	CNPS 4.2	valley and foothill grasslands	April-June
Ranunculaceae	*Delphinium recurvatum*	recurved larkspur	CNPS 1B.2	poorly drained, fine, alkaline soils	March-June
Campanulaceae	*Downingia pusilla*	dwarf downingia	CNPS 2B.2	vernal pools, seasonal wetlands	March-May
Phrymaceae	*Erythranthe glaucescens*	shield-bracted monkeyflower	CNPS 4.3	Serpentine seeps	February-August
Liliaceae	*Fritillaria agrestis*	stinkbells	CNPS 4.2	grasslands	March-June
Asteraceae	*Hesperevax caulescens*	hogwallow starfish	CNPS 4.2	mesic clay, shallow vernal pools	March-June
Juncaceae	*Juncus leiospermus var. ahartii*	Ahart's dwarf rush	CNPS 1B.2	vernal pool margins	March-May
Campanulaceae	*Legenere limosa*	legenere	CNPS 1B.1	vernal pools, seasonal wetlands	May-June
Polemoniaceae	*Leptosiphon acicularis*	bristly leptosiphon	CNPS 4.2	chaparral, valley and foothill grassland	April-July
Lamiaceae	*Monardella venosa*	veiny monardella	CNPS 1B.1	wet meadows	March-June
Caryophyllaceae	*Paronychia ahartii*	Ahart's paronychia	CNPS 1B.1	drying vernal pools	March-June
Boraginaceae	*Plagiobothrys glyptocarpus var. modestus*	Cedar Crest popcornflower	CNPS 3	seeps	April-May
Asteraceae	*Pseudobahia bahiifolia*	Hartweg's golden sunburst	FE, CE, CNPS 1B.1	grassland, open woodland, clay soil	March-May
Alismataceae	*Sagittaria sanfordii*	Sanford's arrowhead	CNPS 1B.2	ponds, ditches	May-October
Lemnaceae	*Wolffia brasiliensis*	Brazilian watermeal	CNPS 2B.3	ponds, ditches	April-December

APPENDIX E. USFWS BIOLOGICAL OPINION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

In reply refer to:
08FBDT00-2021-F-0008

Memorandum

To: Field Supervisor, Lodi Fish and Wildlife Office, Lodi, California

From: Acting Field Supervisor, San Francisco Bay Delta Fish and Wildlife Office, Sacramento, California

Subject: Formal Consultation for the Long Bar Salmonid Habitat Restoration Project on the Lower Yuba River, Yuba County, California

This memorandum is in response to your September 29, 2020 request for intra-U.S. Fish and Wildlife Service (Service) section 7 formal consultation on the proposed Long Bar Salmonid Habitat Restoration Project on the lower Yuba River (Project) in Yuba County, California. Your request was received by the Service's San Francisco Bay-Delta Fish and Wildlife Office (BDFWO) on September 29, 2020 and included the Biological Assessment (BA) for the Project prepared by Cramer Fish Sciences (CFS), cbec eco engineering (cbec), and South Yuba River Citizen's League (SYRCL). Addressed herein are the Project's potential effects on the federally threatened valley elderberry longhorn beetle *(Desmocerus californicus dimorphus)* (beetle) and California red-legged frog *(Rana draytonii)* (frog). This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.) (Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

The federal action on which we are consulting is the Service's Anadromous Fish Restoration Program (AFRP) funding of the creation and enhancement of juvenile salmonid rearing habitat through the creation of seasonally or perennially inundated side channels, alcove channels, flood runner channels, and backwater channel and lowering of floodplain elevations. Pursuant to 50 CFR 402.12(j), you submitted a BA for our review and requested concurrence with the findings presented therein. These findings conclude that the Project may affect, and is likely to benefit the beetle, although temporary adverse effects likely will occur during site-restoration construction activities. In addition, the findings also conclude that the Project may affect, but is not likely to adversely affect the frog. The Project is not within designated or proposed critical habitat for either federally-listed species.

In considering your request, we based our evaluation on the following: (1) your September 29, 2020 letter initiating formal consultation and the attached *Lower Yuba River Long Bar Salmonid Habitat Restoration Project* Biological Assessment; (2) supplemental information provided from September 3, 2019, through December 1, 2020; (3) site visits on September 16, 2019 and November 18, 2020; and (4) other information available to the Service.

The Service concurs with your findings that the Project may affect, but is not likely to adversely affect, the frog. The Action Area contains bullfrogs (*Lithobates catesbeianus*) and several species of predatory fish in the pond/isolated pools, lacks fine sediment substrate used for predator avoidance, and the nearest known occupied breeding habitat is greater than 15 miles away.

The remainder of this document provides our biological opinion on the effects of the Project on the beetle.

Consultation History

September 3, 2019	BDFWO was contacted by Paul Cadrett, Lodi Fish and Wildlife Office (Lodi FWO), via email concerning the proposed Project and the presence of elderberry shrubs at the site and technical assistance began.
September 16, 2019	BDFWO and CFS conducted a site visit to observe the proposed Project location and the elderberry shrubs.
September 3 through October 2, 2019	BDFWO provided technical assistance through emails and phone calls.
September 29, 2020	BDFWO received the September 29, 2020 letter requesting consultation, which included the September 2020 BA.
October 26 through December 1, 2020	Consultation coordination was conducted through email and phone calls.
November 18, 2020	BDFWO, Lodi FWO, CFS, SYRCL, and cbec conducted a site visit to observe the proposed Project location and the elderberry shrubs.

BIOLOGICAL OPINION

Description of the Proposed Action

The proposed Project is designed to restore and enhance ecosystem processes with a primary focus on enhancing productive juvenile salmonid rearing habitat to increase natural production of fall-run and spring-run Chinook salmon *(Oncorhynchus tshawytscha)* and California Central Valley steelhead (*O. mykiss)* in the lower Yuba River. The proposed Project is designed to create and enhance riparian vegetation within the site, which is expected to benefit anadromous fish as well as other terrestrial species including the beetle.

The proposed Project involves the rehabilitation and enhancement of 62.4 acres of gravel bar and riparian habitat that will be topographically modified to create/enhance juvenile salmonid rearing habitat through creation of seasonally or perennially inundated side channels (5.9 acres), alcove channels (2.4 acres), flood runner channels (1.9 acres), and backwater channel (5.4 acres) and lowering of floodplain elevations (27.2 acres). Restoration activities for the Project will consist of the following:

Topographic Modification -- The Project will re-grade and rehabilitate the gravel bar using heavy equipment to reestablish main channel and off-channel connectivity and complexity which is expected to restore ecological processes. Modifications include: (1) lowering floodplain elevations for more frequent and longer duration inundations; (2) enhancing or expanding a network of perennially and seasonally inundated side channels; and (3) using material from the gravel bar to build riffle habitat that will provide aquatic habitat variability while increasing floodplain connectivity.

Riparian Plantings -- Planting of native riparian trees and shrubs would occur on areas adjacent to the restoration features which have shallow depth to groundwater. The planting mix for areas alongside channels will be 20% Fremont cottonwood (*Populus fremontii*), 15% arroyo willow (*Salix lasiolepis*), 15% shining willow (*Salix lasiandra*), 15% Goodding's willow (*Salix gooddingii*), 15% western sycamore (*Platanus racemosa*), 10% sandbar willow (*Salix exigua*), and 10% white alder (*Alnus rhombifolia*). The planting mix for vegetated floodplain areas will be 40% Fremont cottonwood, 20% western sycamore, 20% Goodding's willow, 10% arroyo willow, 5% sandbar willow, and 5% elderberry (*Sambucas* spp.). Exotic species present in the riparian area, including Himalayan blackberry (*Rubus armeniacus*), yellow starthistle (*Centaurea solstitialis*), and milk thistle (*Silybum marianum*), will be removed where possible.

Large Woody Material Placement-- Any trees greater than five-inch diameter at breast height removed during restoration activities will be used within the created floodplains and side channels as large woody material habitat elements. The trees will be strategically placed in the floodplains and side channels to provide cover and habitat complexity for rearing juvenile salmonids.

<u>Timing</u>

The restoration activities are currently scheduled to occur over a two-year period. Dry floodplain grading activities may start as early as April 16 and continue as late as October 31. In-water work would only occur between July 15 and September 30 to minimize adverse effects to Chinook salmon, *O. mykiss*, and other aquatic species. Riparian planting will occur in October and November, which is the likely beginning of the rainy season, to maximize survival rates.

Valley Elderberry Longhorn Beetle Habitat

Within the action area, there are four elderberry shrubs, the sole host plant for the beetle, with at least one stem greater than one inch at ground level, and one has a potential exit hole. Of the four elderberry shrubs, one will be fenced off from construction activities with a 20 foot buffer from all ground disturbance. The remaining three elderberry shrubs will be directly affected by construction activities. Lodi FWO has proposed transplanting the three shrubs that cannot be avoided during construction. However, during a site visit on November 18, 2020, participants noted that it might be difficult to successfully transplant two of the elderberry shrubs due to a large volume of woody debris interwoven at the base of one shrub and another elderberry shrub growing near the base of a large willow. Although transplanting the three shrubs is preferred, it may be impossible to transplant up to two of the shrubs.

Conservation Measures

In addition to implementing best management practices which include erosion and sediment control, water quality measures for in-channel work, general vegetation protection measures, and general wildlife protection measures, the following measures to minimize effects to the beetle and its habitat are proposed. The measures proposed below are considered part of the proposed action evaluated by the Service in this biological opinion.

Buffers

- Elderberry shrubs with stem diameter at ground level greater than 1 inch were identified during surveys. Except for elderberry shrubs that may be removed, twenty-foot buffers will be established and maintained for all elderberry plants with stems measuring 1 inch (2.5 centimeter) or greater in diameter at the ground level. No Project activities will occur in the identified buffer areas, thereby minimizing adverse effects on the beetle.
- The elderberry shrub that will remain in place will be avoided with a 20-foot buffer and will be marked using construction stanchions, flagging, and/or orange plastic fencing to facilitate avoidance during construction activities.
- During dry floodplain grading, starting as early as April 16, the elderberry shrubs that will be transplanted will be avoided prior to transplanting with 20-foot buffers to minimize effects from noise and vibration and other construction disturbance. The elderberries will be marked using construction stanchions and/or flagging to facilitate avoidance during construction activities.
- All elderberry bushes that have been identified for transplanting will be clearly marked in a manner to distinguish them from bushes remaining in place.
- A biological monitor will be onsite for the duration of the restoration activities to ensure that no activities occur in the buffer zones.
- No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used for the Project.
- Contractors and work crews will be educated about the status of the beetle and the need to protect and avoid damaging its host plant. They will also be informed of the possible penalties for not complying with the avoidance requirements.

Project implementation includes provisions to control erosion and sedimentation, as well as a Spill Prevention and Response Plan. All equipment working within the stream corridor will be inspected daily for fuel, lubrication, and coolant leaks; and for leak potentials (e.g., cracked hoses, loose filling caps, stripped drain plugs); and, all equipment will be free of fuel, lubrication, and coolant leaks. Vehicles or equipment will be washed or cleaned only at approved off-site areas. All equipment will be steam-cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands. All equipment will be fueled and lubricated in a designated staging area located outside the stream channel and banks. Lodi FWO proposes to limit airborne dust particles by wetting gravel roads on-site as needed; however, Lodi FWO staff does not anticipate high densities of airborne particles, as the local gravels and cobble have very little to no silt.

Transplanting

During the pre-Project survey, three elderberry shrubs with ground-level stem diameter greater than 1 inch were identified within the Action Area that cannot be avoided by the proposed Project through use of 20 foot buffers. These unavoidable elderberry shrubs will be transplanted when dormant to a suitable on-site location following the most current version of the ANSI A300 guidelines for transplanting. In order to avoid and minimize adverse effects to the beetle when trimming elderberry shrubs, trimming will occur when the shrub is dormant and will avoid the removal of any branches that are greater than or equal to 1 inch in diameter. Lodi FWO anticipates that elderberry shrubs could be transplanted in January or February 2021, prior to commencing dry floodplain grading activities. However, the heavy equipment used for transplanting may not be available or able to access the site during this time period due to potential high flows in the Yuba River. If this occurs, the elderberry plants will be transplanted later in the year, once they have lost their green leaves and enter dormancy, which can be as early as September (CFS unpublished data).

Elderberry plants will be transplanted into appropriately sized pre-dug holes in the on-site restoration area using heavy equipment, such as an excavator or front loader. All transplanted elderberry bushes will be transplanted to suitable on-site areas that are buffered by at least 20 feet from the grading footprint, at floodplain elevations between the 2- and 10-year inundation recurrence interval, suitable depth to groundwater, and in proximity to existing riparian vegetation. Monitoring and reporting of the condition of the transplanted elderberry shrubs and their use by the beetle will occur in years 1, 2, 3, and 10, and use survey methods consistent with Service 2017. A minimum of 60% of the transplanted elderberry shrubs must be maintained throughout the first three years. Within one year of discovery that transplant survival has dropped below 60%, Lodi FWO must replace failed transplants with nursery seedling plantings to bring survival above this level. The BDFWO will make any determination as to the applicant's replacement responsibilities arising from circumstances beyond its control, such as plants damaged or killed as a result of severe flooding or vandalism. The BDFWO may also take into account any natural recruitment of elderberry that has occurred to the applicant’s replacement responsibilities.

Nursery Plantings

As part of the proposed Project, Lodi FWO has proposed to compensate for the transplantation and/or removal of up to three elderberry shrubs within the Action Area. To compensate for elderberry shrubs that will be transplanted, 3 elderberry seedlings will be planted for each elderberry shrub that is transplanted. To compensate for elderberry shrubs that may be removed, 9 elderberry seedlings will be planted for each shrub that is removed. Lodi FWO will obtain the elderberry seedlings from an appropriate native plant nursery. Monitoring and reporting of the condition of the elderberry seedlings and their use by the beetle will occur in years 1, 2, 3, and 10, and use survey methods consistent with Service 2017. A minimum survival rate of at least 60% of the elderberry plants must be maintained throughout the first three years. Within one year of discovery that survival has dropped below 60%, the applicant must replace failed plantings to bring survival above this level. Lodi FWO may plant additional elderberry seedlings during project implementation, above and beyond mitigation requirements, to achieve performance targets. The Service will make any determination as to the applicant's replacement responsibilities arising from circumstances beyond its control, such as plants damaged or killed as a result of severe flooding or vandalism. The Service may also take into account any natural recruitment of elderberry that has occurred to the applicant’s replacement responsibilities.

Action Area

The Action Area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The proposed Project footprint is located on the north bank of the Yuba River, approximately four miles upstream of the Daguerre Point Dam and is accessible via Digger Pine Rd off Highway 20, near the unincorporated community of Browns Valley. A map is included in Figure 1 of the BA. The northern boundary of the Project is the Silica Resources Incorporated (SRI) Stringer Pit aggregate operation. The current alignment of the Yuba River delineates the southern boundary of the Project. For the proposed project, the 62.4-acre action area encompasses the construction footprint, any areas used for access and staging, as well as the area within 165 feet of those components to account for impacts to the beetle.

Analytical Framework for the Jeopardy Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. “Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed Federal action, and any cumulative effects, on the rangewide survival and recovery of the listed species. It relies on four components: (1) the *Status of the Species*, which describes the current rangewide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which analyzes the current condition of the species in the

Action Area without the consequences to the listed species caused by the proposed action, the factors responsible for that condition, and the relationship of the Action Area to the survival and recovery of the species; (3) the *Effects of the Action*, which includes all effects that are caused by the proposed Federal action; and (4) the *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the Action Area on the species. The *Effects of the Action* and *Cumulative Effects* are added to the *Environmental Baseline* and in light of the status of the species, the Service formulates its opinion as to whether the proposed action is likely to jeopardize the continued existence of listed species.

Status of the Species

The-Service designated the beetle as threatened and proposed critical habitat on August 8, 1980 (45 FR 52803) and approved a final Recovery Plan on June 28, 1984 (Service 1984). For the most recent comprehensive assessment of the species' range-wide status, please refer to the beetle's 5-year review completed on September 26, 2006 (Service 2006), which determined that the beetle had recovered and therefore recommended delisting. A proposed rule to delist the beetle was published on October 12, 2012 (77 FR 60237). After public comment and peer review, that proposal was withdrawn on September 17, 2014 (79 FR 55879).

This wood boring beetle is a subspecies of the California elderberry longhorn beetle, which persists in small isolated populations in the California Central Valley in riparian areas which have a component of elderberry savannah. The listed subspecies is typified by sexual dimorphism, in which the male shows a predominantly red elytra. Elderberry shrubs *(Sambcus* spp.) are the obligate larval host plants for the beetle (Collinge *et al.* 2001, Holyoak 2010). The beetle larvae live one to two years exclusively within the elderberry plant. Adult emergence occurs in the spring and summer, typically coinciding with the elderberry flowering period (Burke 1921, Halstead and Oldharn 1990). Adults may live a few days to a few weeks (Arnold 1984, Barr 1991, Halstead and Oldharn 1990). The only exterior evidence of elderberry use by beetle is the exit hole created by the larvae.

The primary threat to the species is habitat loss, particularly along major river systems that are known to have supported the species, often as a result of urban or agricultural development and flood control actions (including construction and operation and maintenance).

Environmental Baseline

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the *Environmental Baseline*.

The Action Area has very little riparian vegetation or elderberry shrubs, and existing conditions are not conducive to natural regeneration, which reduces the likelihood of beetle occupancy throughout the majority of the area.

The terrestrial portion of the Action Area is cobble-field, largely devoid of perennial vegetation. The north side of Long Bar supports a narrow, longitudinal strip of riparian vegetation as well as a few patches of vegetation on the alluvial gravel bar. The native riparian tree and shrub species in the Action Area include elderberry, willows (*Salix* spp.), white alder, Fremont cottonwood, Western sycamore, buttonbush (*Cephalanthus occidentalis var. californicus*), gray pine (*Pinus sabiniana*), and blue oak (*Quercus douglasii*). Widespread processing of the sediments remaining from historic gold mining operations continues through surface and dredge mining for the production of aggregate and other construction materials. This processing has the potential to produce airborne dust, which can lower plant photosynthesis production and alter community structure (Farmer 1993). Water found along the riparian strip is likely seasonally connected with the lower Yuba River at the head of the gravel bar. Hydraulic changes from upstream dams, coupled with river channelization and impacts from historic hydraulic mining, have resulted in the lack of conditions to support permanent riparian vegetation or a functioning riparian forest. Future hydropower license conditions, upstream of the Action Area, may include riparian recession flows that would provide for increased natural riparian regeneration within the Action Area.

The action area is within the current range of the beetle. One of the elderberry shrubs within the Action Area was observed to have a potential exit hole. Seven occurrences of the beetle are recorded approximately five miles downstream of the Project area in the CNDDB, adjacent to the Hallwood area near Daguerre Point Dam. All seven occurrences are dated as July 1998 and as occurring in elderberry shrubs along a transmission line and are described as exit holes found in dead and live parts of the elderberry shrubs. Subsequently, the Hallwood restoration project has also identified elderberry shrubs with exit holes. The CNDDB has not yet been updated to reflect these occurrences.

Due to the fact that the life cycle of the beetle takes one to two years to complete, during which it spends most of its life in the larval stage living within the stems of the elderberry shrubs, it is not possible to know if all the elderberry shrubs in the action area are currently inhabited by the beetle. However, since the proposed project is within the range of the beetle, one of the elderberry shrubs has a suspected exit hole, and the beetle is known to occur nearby, it is likely that the beetle may be present in one or more elderberry shrubs in the action area.

Effects of the Proposed Action

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

The Project is designed to re-engage the Yuba River with a functioning riparian floodplain to support a future riparian forest and salmonid habitat during floodplain inundation. Although the Project is specifically designed to increase the juvenile salmonid rearing habitat, it is expected to result in an ecosystem that will resemble the historical conditions that promote beetle abundance. The Project is ultimately expected to enhance beetle habitat by increasing the total area of suitable riparian habitat available for elderberry plant recruitment and by establishment of a riparian overstory that will enhance beetle dispersal; however, adverse effects may occur during elderberry shrub transplanting and/or removal.

Construction activities will result in effects to beetles inhabiting the three elderberry shrubs that will be removed and/or transplanted in the action area. Removal and/or transplanting of elderberry shrubs will result in the harm or death of an unknown number of individual beetle larvae inhabiting the stems. Occasionally, elderberry shrub stems are trimmed during transplanting activities in order to facilitate transport and enhance the survival of the transplanted shrub. Trimming may kill or interrupt the beetle’s life cycle, whether the beetle is an egg, larva, pupa, or an adult, by equipment damaging the stem and killing a beetle within the stem. Transplantation of these elderberry shrubs that are reasonably likely to be occupied by beetle larvae is expected to adversely affect the beetle because the elderberry shrub may experience stress due to changes in soil, hydrology, microclimate, or associated vegetation. The elderberry shrubs may die as a result of transplantation; and branches containing larvae may be cut, broken, or crushed as a result of the transplantation process. Transplanting of elderberry shrubs will occur during their dormant phase, which will reduce effects by increasing the likelihood that the elderberry shrubs will survive the transplanting process and continue to provide habitat to the beetle. If up to two elderberry shrubs are removed and not transplanted, all of the beetles inhabiting the removed elderberry shrubs will be killed.

One elderberry shrub is not scheduled to be removed or transplanted. This shrub will be clearly marked and a 20 foot buffer will be maintained during construction activities. Therefore, the adverse effects from the proposed project to this elderberry shrub are expected to be insignificant.

As noted previously in the *Description of the Proposed Action* section, the project proponent has also proposed a set of conservation measures that will minimize the effect of elderberry shrub mortality on the beetle over time. The conservation measures include the transplantation of up to three elderberry shrubs to a nearby suitable location. The survival rate of transplanted elderberry shrubs is estimated to be 72.8% in the first year following shrub relocation (Holyoak et al. 2010). Therefore, it is anticipated that 1 of the transplanted elderberry shrubs may not survive in the first year following relocation, and that the remaining transplanted elderberry shrubs may experience damage to stems either accidentally or from targeted trimming during transplanting activities. The conservation measures also include the commitment to provide for the planting of elderberry seedlings for the establishment of an estimated 9 - 21 elderberry shrubs on-site, depending on how many shrubs are able to be transplanted, as a condition of the action. This is intended to minimize the effect on the species of the proposed project’s anticipated incidental take and is expected to result in a potential increase of beetle habitat over time. The restoration area will provide suitable habitat for beetle breeding, feeding, and/or sheltering of a higher quality than existing habitat as a result of the proposed Project. Providing this habitat may contribute to other recovery efforts for the species. Additionally, if the transplanted elderberry shrubs are occupied by both male and female larvae that successfully emerge, beetles can reproduce and colonize unoccupied neighboring elderberry shrubs that may occur outside of the action area.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. During this consultation, the Service did not identify any future non-federal actions that are reasonably certain to occur in the Action Area of the proposed project.

Conclusion

After reviewing the current *Status of Species* for the beetle, the *Environmental Baseline* for the Action Area, the *Effects of the Proposed Action*, and the *Cumulative Effects*, it is the Service's biological opinion that the Long Bar Salmonid Habitat Restoration Project, as proposed, is not likely to jeopardize the continued existence of the beetle. The Service reached this conclusion because the project-related effects to the species, when added to the *Environmental Baseline* and analyzed in consideration of all potential *Cumulative Effects*, will not rise to the level of precluding recovery or reducing the likelihood of survival of the species based on the following: (1) the effects to the beetle are small, relative to the range of the species; (2) adverse effects to the beetle will be reduced by implementation of the described conservation measures; and (3) the restoration of this area will contribute to the long-term management of the beetle by creating habitat of greater quality for the beetle than currently occurs in the Project area.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by Service regulations at 50 CFR 17.3 as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the same regulations as an act which actually kills or injures wildlife. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Lodi FWO so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Lodi FWO has a continuing duty to regulate the activity covered by this incidental take statement. If the Lodi FWO (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Lodi FWO must report the progress of the action and its impact on the species to the BDFWO as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take

The Service anticipates that incidental take of the beetle will be difficult to detect and quantify due to the fact that it is not possible to know how many larvae inhabit any one elderberry shrub providing habitat for the beetle. The beetle spends most of its time in the larval stage living within the stems of the elderberry shrub, and the life cycle of the beetle takes one or two years to complete. Beetle larval use of an elderberry shrub is not readily apparent, and in early stages of development beetle larvae can be present in stems that have no evidence of exit holes. The transplanting of the elderberry shrubs could result in harm and mortality to an unknown number of larvae inhabiting the stems. Removal of elderberry shrubs would result in mortality to all larvae inhabiting the stems.

For the 1 – 3 elderberry shrubs that are scheduled for transplant, the Service anticipates that transplanted elderberry shrubs may experience damage to stems either accidentally or from targeted trimming during transplanting activities, and that one of the shrubs may not survive following transplanting. For the 1 – 2 elderberry shrubs that could be removed if transplantation is not possible, the Service anticipates that all the beetles in these shrubs would die as a result of project-related activities. Therefore, the Service is authorizing incidental take to the proposed action as the harm or death of any beetle larvae within stems that may be trimmed or damaged during shrub transplantation as well as the death of all beetle larvae within the one elderberry shrub that is anticipated to not survive transplanting. The Service is also authorizing incidental take to the proposed action as the death of all beetle larvae within the up to two elderberry shrubs that might be removed and not transplanted.

Ideally, all three elderberry shrubs will be transplanted to a nearby suitable location. In which case, the authorized incidental take includes the harm or death of larvae in stems of the shrubs that are trimmed or damaged during transplanting as well as all beetle larvae within the one elderberry shrub that may not survive transplanting. However, there is uncertainty regarding the feasibility of transplanting up to two elderberry shrubs. If two shrubs are able to be transplanted and one shrub removed, the authorized incidental take includes the death of all beetle larvae within the one elderberry shrub that will be removed and not transplanted, the harm or death of larvae in stems of the 2 elderberry shrubs that are trimmed or damaged during transplanting, as well as all beetle larvae within one elderberry shrub that may not survive after transplanting. If only one shrub is able to be transplanted and two shrubs are removed, the authorized incidental take includes the death of all beetle larvae within the two elderberry shrubs that are removed and not transplanted, the harm or death of larvae in stems of the one elderberry shrub that are trimmed or damaged during transplanting, as well as all beetle larvae within the same one elderberry shrub that may not survive after transplanting.

Upon implementation of the following *Reasonable and Prudent Measures*, incidental take of the beetle associated with the Long Bar Restoration Project will become exempt from the prohibitions described in section 9 of the Act. No other forms of take are exempted under this opinion.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. There is no critical habitat in the Action Area, so there will not be any destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

All necessary and appropriate measures to avoid or minimize effects on the beetle resulting from implementation of this project have been incorporated into the project's proposed conservation measures. Therefore, the Service believes the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of the beetle:

1. All conservation measures, as described in the biological assessment and restated here in the Project Description section of this biological opinion, shall be fully implemented and adhered to. Further, these reasonable and prudent measures shall be supplemented by the terms and conditions below.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Lodi FWO must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. Lodi FWO will include full implementation and adherence to the conservation measures as a condition of any permit or contract issued for the project.
2. Use best management practices to reduce dust in the Project area during the flight period of adult beetles in the spring and summer.
3. Include notification of the BDFWO in the Spill Prevention and Response Plan.
4. Have a Biological Monitor on-site during all elderberry transplanting activities.
5. Train all on-site workers in the identification and avoidance of elderberry shrubs and the importance of ensuring that the avoidance buffers are adhered to.
6. In order to monitor whether the amount or extent of incidental take anticipated from implementation of the proposed project is approached or exceeded, Lodi FWO will adhere to the following reporting requirements. Should this anticipated amount or extent of incidental take be exceeded, Lodi FWO must immediately reinitiate formal consultation, as per 50 CFR §402.16.

a. During transplanting, survey all transplanted elderberry shrubs for exit holes and provide a survey report to the BDFWO following each transplanting period for the Project.
b. Provide the BDFWO with a pre-project map of all elderberry shrubs to be transplanted, and a post-planting map of all transplant and seedling plantings of elderberry shrubs.
c. Monitor transplant and seedling planting success of elderberry shrubs and cuttings in years 1, 2, 3, and 10 and provide a report of survey and elderberry mortality results to BDFWO in the following January after each survey.
d. If elderberry planting and transplanting mortality is greater than 40% in Years 1, 2, or 3 of the Project, replant seedlings during the subsequent year of the Project.
e. In year 10 of the Project, survey all transplanted elderberry shrubs and seedling plantings for exit holes and report survey results and any changes in potential beetle occupancy to the BDFWO.

REINITIATION—CLOSING STATEMENT

This concludes formal consultation on the Long Bar Salmonid Habitat Restoration Project. As provided in 50 CFR §402.16,

(a) Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

(1) If the amount or extent of taking specified in the incidental take statement is exceeded;

(2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

(3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or

(4) If a new species is listed or critical habitat designated that may be affected by the identified action.

(b) An agency shall not be required to reinitiate consultation after the approval of a land management plan prepared pursuant to 43 U.S.C. 1712 or 16 U.S.C. 1604 upon listing of a new species or designation of new critical habitat if the land management plan has been adopted by the agency as of the date of listing or designation, provided that any authorized actions that may affect the newly listed species or designated critical habitat will be addressed through a separate action-specific consultation. This exception to reinitiation of consultation shall not apply to those land management plans prepared pursuant to 16 U.S.C. 1604 if:

(1) Fifteen years have passed since the date the agency adopted the land management plan prepared pursuant to 16 U.S.C. 1604; and

(2) Five years have passed since the enactment of Public Law 115-141 [March 23, 2018] or the date of the listing of a species or the designation of critical habitat, whichever is later.

If you have any questions regarding this biological opinion, please contact Stephanie Millsap, Fish and Wildlife Biologist, at stephanie_millsap@fws.gov.

cc:
Chris Hammersmark, cbec, West Sacramento
Aaron Zettler-Mann, SYRCL, Nevada City
Philip Colombano, Cramer Fish Sciences, West Sacramento

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APPENDIX F. NMFS BIOLOGICAL AND ESSENTIAL FISH HABITAT ASSESSMENT

Biological and Essential Fish Habitat Assessment

Lower Yuba River Long Bar Salmonid Habitat Restoration Project

Prepared for:
U.S. Fish and Wildlife Service
Anadromous Fish Restoration Program
850 S. Guild Avenue, Suite 105
Lodi, CA 95240-3188

On behalf of:
South Yuba River Citizen's League
313 Railroad Ave. #101
Nevada City, CA 95959

Prepared by:
Cramer Fish Sciences
3300 Industrial Blvd Suite 100
West Sacramento, CA 95961

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List of Acronyms and Abbreviations

AFRP	Anadromous Fish Restoration Program
BA	Biological Assessment
BACI	Before-After-Control-Impact
BEFHA	Biological and Essential Fish Habitat Assessment
BMI	benthic macroinvertebrate
CA	California
CCV	California Central Valley
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
CFS	Cramer Fish Sciences
cfs	cubic feet per second
cm	centimeter
Corps	U.S. Army Corps of Engineers
CV	Central Valley
CVPIA	Central Valley Project Improvement Act
dbh	diameter at breast height
DO	dissolved oxygen
DPD	Daguerre Point Dam
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
FMP	Pacific Coast Salmon Fishery Management Plan
FL	fork length
FR	Federal Register
ft	feet
GIS	geographic positioning system
ha	hectare
HSC	habitat suitability criteria
HSI	habitat suitability index
kg	kilogram
km	kilometer
lbs	pounds
LYR	Lower Yuba River
m	meter
mg/L	milligrams per liter

mi	mile
mm	millimeter
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NTUs	nephelometric turbidity units
PIT	passive integrated transponder
PBFs	physical or biological features
QSP	Qualified Stormwater Pollution Prevention Plan Practitioner
rm	river mile
RMT	River Management Team
RST	Rotary Screw Trap
SD	standard deviation
SE	standard error
SRI	Silica Resources Incorporated
SWPPP	Storm Water Pollution Prevention Plan
SYRCL	South Yuba River Citizens League
USC	U.S. Government Code
USFWS	U.S. Fish and Wildlife Service
WSE	Water Surface Elevation
WUA	weighted usable area
yd^3	cubic yards

Introduction

Purpose and Objectives

This Biological and Essential Fish Habitat Assessment (BA) was prepared for the United States Fish and Wildlife Service Anadromous Fish Restoration Program (USFWS AFRP) to support consultation between the lead federal agency, USFWS AFRP, and the National Marine Fisheries Service (NMFS) for the Long Bar Salmonid Habitat Restoration Project (Proposed Action). It documents effects the Proposed Action may have on species listed as threatened or endangered and their critical habitat regulated by NMFS under the Endangered Species Act (ESA) as well as Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) in the Action Area. This BA has been prepared in compliance with legal requirements set forth under Section 7 of the ESA of 1973 (U.S. Government Code [USC] Title 16, Section 1536 [16 USC 1536]) and the MSA.

The Proposed Action's design, permitting, monitoring, and implementation is funded by USFWS AFRP grants to the South Yuba River Citizen's League (SYRCL), a non-profit organization. The U.S. Army Corps of Engineers (Corps) has designated USFWS as the lead Federal agency.

The overall vision of the Proposed Action is to enhance habitat for native fish species, emphasizing rearing habitat for Central Valley (CV) spring and fall-run Chinook Salmon (*Oncorhynchus tshawytscha*) and California Central Valley steelhead (*O. mykiss*) in the lower Yuba River (LYR). The Proposed Action aims to protect and improve riverine habitat, including benefits to fish, wildlife, vegetation, and water quality. The Proposed Action includes several components and incorporates multiple strategies to meet goals of the USFWS AFRP. These goals include long-term habitat enhancement for Chinook Salmon and steelhead populations in the LYR, including recovering backwater side channel, and floodplain habitats that support juvenile salmonid growth and survival. Enhancement actions to be implemented pursuant to Section 3406(b) of the Central Valley Project Improvement Act (CVPIA) include a plan to assess the effectiveness of each action. Ensuring that each action includes monitoring is the responsibility of the USFWS AFRP, designated agencies, and partners (USFWS 2001).

The specific goals and objectives of the Proposed Action are to:

- Incorporate the Proposed Action into an ecologically-sound, ecosystem context by designing the Proposed Action to function under current water management constraints (i.e., timing, frequency, magnitude, and duration of elevated flows).
- Reestablish main channel and off-channel connectivity and complexity to restore ecological processes at the Proposed Action site and to increase the availability and maintenance of off-channel juvenile salmonid rearing habitats.
- Create habitat conditions suitable for spring juvenile salmonid rearing (i.e., fry and sub-yearling smolts).
- As possible, create habitat conditions suitable for summer rearing of juvenile spring-run Chinook Salmon and steelhead.
- Create conditions suitable for natural riparian vegetation recruitment and survival (i.e., willows (*Salix* spp.), Fremont cottonwood (*Populus fremontii*), white alder (*Alnus rhombifolia*), etc.).

- Do no harm to existing habitat features (e.g., main channel spawning and incubation habitat).
- The Proposed Action aims to significantly increase suitable rearing habitat acreage through the restoration of natural ecosystem processes associated with a well-connected, frequently inundated floodplain.

The Proposed Action will be implemented on property near the community of Browns Valley, California in the CV (**Figure 1**).

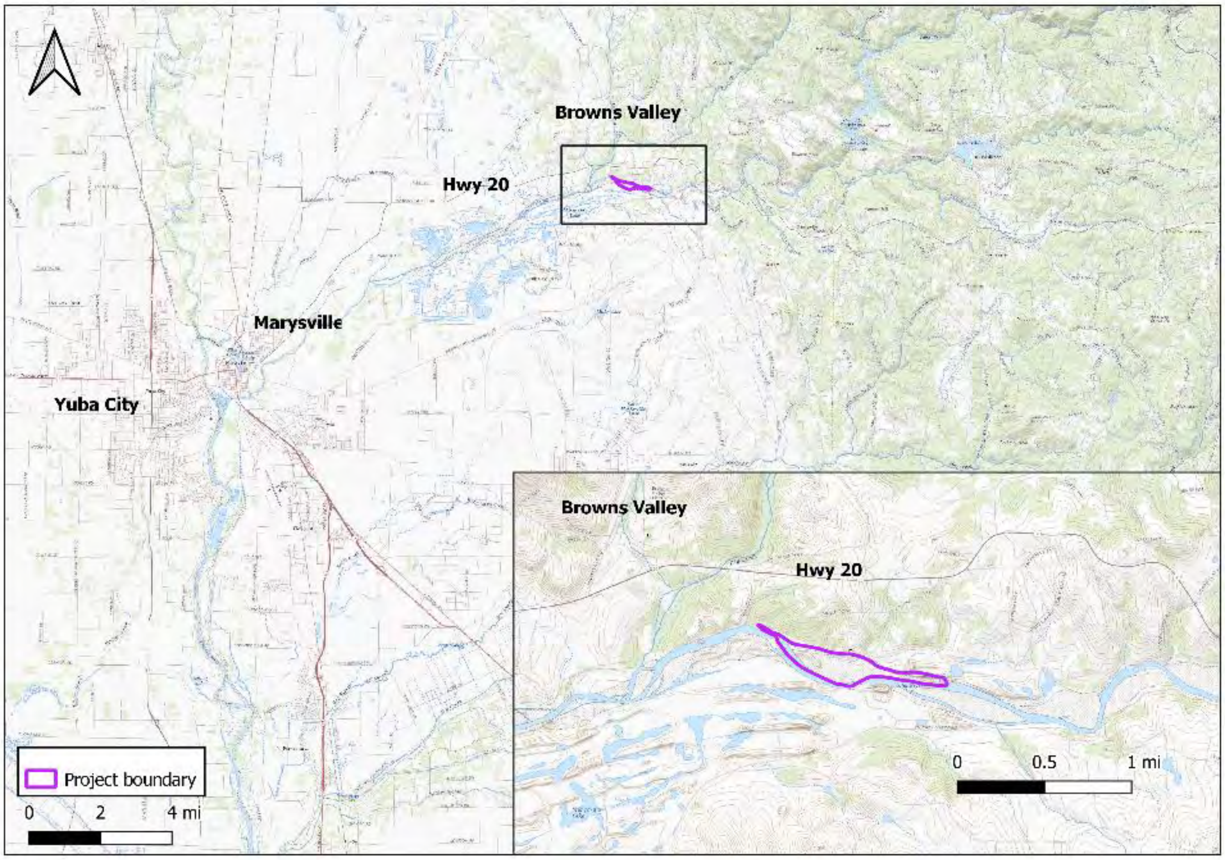

Figure 1. Location of the Long Bar Salmonid Habitat Restoration Project on the lower Yuba River.

In 1998 the USFWS AFRP, under the federal CVPIA, was charged with making all reasonable efforts to double natural production of CV Chinook Salmon on a sustainable basis (USFWS 2001). A major underpinning of recovery efforts for Pacific salmon (*Oncorhynchus* spp.) listed under the ESA is that there is a strong relationship between freshwater habitat quantity and quality and salmon abundance, survival, and productivity in the freshwater environment (Roni *et al.* 2014). This is a key component of ESA recovery plans and biological opinions for salmon and steelhead. Because of this assumption, it is important to 1) document our understanding of the relationship between habitat quantity and quality and salmonid production, and 2) quantify the improvements in salmonid production and survival that can be expected with different habitat enhancement actions (Roni 2005).

The Yuba River is a tributary to the Feather River in the northern portion of the California CV (CCV) and drains an approximately 1,300 square mile (mi^2) (3,367 square kilometer [km^2])

watershed. The Yuba River has three forks (north, middle, and south), which each originate in the Sierra Nevada mountain range. Elevations in the watershed range from 9,148 ft (2,788 meter [m]) on Mt. Lola at the crest of the Sierra Nevada to 60 ft (18 m) at the confluence with the Feather River. The Middle Fork flows into the North Fork downstream of New Bullards Bar reservoir, forming the main Yuba River, which then flows into Englebright Reservoir. The South Fork also flows into Englebright Reservoir. The LYR begins below Englebright Dam and flows for approximately 24 miles before joining the Feather River near Marysville. The LYR has two major tributaries: Deer Creek, which flows in ~ 1 mile below Englebright Dam; and Dry Creek, which flows in downstream of Long Bar near Hammon Grove Park.

As in many CV rivers, historic gold and gravel mining greatly altered geomorphic and hydraulic conditions under which salmonids evolved within the Yuba River prior to European expansion. Gold was discovered on the Yuba River in 1848, and the subsequent influx of thousands of miners forever changed the physical attributes of the Yuba River, adversely impacting species and displacing native tribes that relied upon the river for sustenance. Hundreds of millions of cubic yards (yd^3) of gravel and debris from hydraulic mining were washed into the river and its tributaries between 1849 and 1909 (Gilbert 1917). The sediment from hydraulic mining caused the LYR to aggrade from 16 to 82 ft in the Yuba Goldfields area (Hunerlach *et al.* 2004). The resulting sedimentation and siltation of the Sacramento River channel, San Francisco Estuary, and farmlands led to the construction of Englebright and Daguerre Point dams by the California Debris Commission to capture/control the hydraulic mining debris (Beak Consultants, Inc. 1989).

The 260-ft high Englebright Dam (rm 23.9) was completed in 1941. Two hydroelectric power plants (Narrows 1 and 2) operated by Yuba Water Agency below Englebright Dam release regulated flows into the LYR. Englebright Dam was built without fish passage and therefore blocks anadromous fish migration upstream, eliminating up to 60% of traditional salmon spawning habitat on the Yuba River (Beak Consultants, Inc. 1989). Unregulated flood flows spill over Englebright Dam into the LYR. Daguerre Point Dam (DPD [rm 11.5]) was built for grade control and mining debris storage; construction was completed in 1906 and the river was diverted over it in 1910 (Corps 2014). It was re-built in 1965 following flood damage in 1963 and 1964 (Corps 2014). DPD has fish ladders on either side of it. The fish ladders are passable for Chinook Salmon and steelhead but other fish species including Green Sturgeon (*Acipenser medirostris*), Striped Bass (*Morone saxatilis*), and American Shad (*Alosa sapidissima*) are not able to ascend them. The fish ladders have cameras to enumerate Chinook Salmon escapement past DPD. Additionally, DPD provides head pressure for agricultural diversions on both the north and south banks upstream from the dam. Currently, Englebright and Daguerre Point dams are operated and maintained by the Corps.

LYR dredge mining occurred after hydraulic mining ceased. A 9,000 acre area, known as the Yuba Goldfields, has been dredged numerous times. Training walls were constructed using coarse mine tailings to protect the Yuba Goldfields from flood flows. These training walls redirected the LYR to the north of its historic channel and confined it to a 1,000-1,500 ft-wide channel in the Dry Creek and DPD reaches (Wyrick and Pasternack 2012; cbec 2013a). Historically, the LYR had a meandering to braided channel with ample floodplain area, riparian vegetation, large woody debris, and prey production (cbec 2013b). Juvenile salmon migrate into side channel and floodplain habitats to exploit food resources, seek optimal temperatures, and escape unfavorable environmental conditions in the main channel, such as predators and high turbidities (Sommer *et al.* 2001; Bellmore *et al.* 2013). As a result, high complexity riverine habitats, including off-channel habitats such as floodplains (Sommer *et al.* 2001), side channels (Bellmore *et al.* 2013), and backwaters (Beechie *et al.* 2005), are known to be of high importance for rearing juvenile salmonids (Moyle 2002). Shallow off-channel rearing habitat has been found to be more productive than main channel rearing and supports higher growth rates and more favorable temperatures (Sommer *et al.* 2001; Jeffres *et al.* 2008; Limm and Marchetti 2009) and habitat complexity influences salmon productivity at a watershed scale (Hall *et al.* 2018).

Anthropogenic channel modifications to the LYR described above have reduced juvenile salmonid rearing habitat quality and quantity. The LYR has two major juvenile salmonid habitat deficiencies: functional floodplain for salmonid rearing and quality and quantity of riparian vegetation and large woody debris (cbec 2013a). Currently, the LYR has one main channel with few secondary channels that have experienced incision into hydraulic mining sediment deposits resulting from multiple dams in the watershed, which regulate flow and reduce sediment supply. Many areas within the LYR's historic riparian corridor and floodplain are now hydrologically disconnected from the main channel during more frequent flood flows (1.5 to 5 year recurrence interval) due to channel incision, the construction of training walls, and reduction in flood flows due to flow regulation (cbec *et al.* 2010). Without inundation, floodplains and riparian vegetation cannot provide terrestrial food for juvenile salmonids, organic matter that increases productivity in the river, or physical habitat for fish.

Where present, existing remnant side channels and riparian vegetation on the LYR provide flood refugia, protection from invasive predators, and abundant food resources, which promote extended rearing and the "expression of the stream-type rearing characteristic of spring-run Chinook Salmon" (DWR and PG&E 2010; NMFS 2014). However, habitat complexity and juvenile rearing habitat in the Yuba Goldfields reach of the LYR are currently limited (NMFS 2014) therefore, enhancing off-channel rearing habitat is a key step in increasing salmonid populations in the LYR and the entire Sacramento River system (DWR and PG&E 2010). The LYR Accord River Management Team Interim Monitoring and Evaluation Report (Yuba RMT 2013) recommended the "investigation of potential actions to enhance or restore habitat or improve population status" of LYR anadromous salmonids. In addition, reestablishing large riparian gallery trees, such as Fremont cottonwoods, along the LYR would help to increase large woody material recruitment.

The Proposed Action has been specifically designed to improve the quality and quantity of juvenile salmonid rearing habitat within the site which has been degraded by the factors discussed in the previous paragraphs.

This BA has been prepared with the following objectives:

- Provide information to NMFS about results of biological resource field surveys conducted for the Proposed Action.

- Determine whether federally protected fish species managed by NMFS and that may exist within the Action Area are likely to be adversely affected by the Proposed Action.

- Determine if designated or proposed critical habitat and EFH would be adversely affected or modified by the Proposed Action.
- Describe conservation measures for the Proposed Action that would avoid or minimize adverse effects on these species and their habitats.
- Determine whether formal consultation with NMFS is necessary.

Consultation to Date

This BA was prepared by Cramer Fish Sciences (CFS), cbec eco-engineering, and SYRCL as requested by USFWS AFRP.

- On 4/15/2020 Cramer Fish Sciences emailed Ruth Goodfield (NOAA Restoration Center) concerning potential to use the Central Valley restoration project programmatic biological opinion.
- On 4/23/2020 the Long Bar Project Team had a phone call with Ruth Goodfield to discuss use of the Central Valley restoration project programmatic biological opinion.
- On 9/24/2020 Amanda Cranford was emailed regarding the preferred permitting path for the Proposed Action.

Proposed Action Description

The Proposed Action's design, permitting, and monitoring is funded by the USFWS AFRP. The Corps has designated USFWS AFRP as the lead agency.

Proposed Action Location

The Proposed Action will take place over one to two years in the LYR on property owned by Long Bar Mine LLC and Western Aggregates. The Proposed Action Area encompasses a 6,929-ft (2,112 m) segment of the LYR approximately rm 15 upstream from the confluence with the Feather River between 39°13'29.45"N, 121°23'53.55"W (downstream limit) and 39°13'16.09"N, 121°22'32.76"W (upstream limit; **Figure 2**). The Proposed Action on the LYR lies within United States Geological Survey (USGS) hydrologic unit 18020107. The Proposed Action is located at 6130 Highway 20, Browns Valley, CA 95918 and reached via an access road off Hwy 20.

The Proposed Action will re-grade and rehabilitate a large gravel bar on the north side of the river adjacent to the Silica Resources Incorporated (SRI) Stringer Pit aggregate operation (**Figure 2**). The area of the LYR encompassing the Proposed Action is downstream and across the river from the feature commonly referred to as Long Bar. An estimated 62.4 acres of gravel bar and riparian habitat are available for rehabilitation and enhancement. A total of 42.8 acres of the gravel bar (**Figure 2**) will be topographically modified to create/enhance juvenile salmonid rearing habitat through creation of seasonally or perennially inundated side channels (upstream side channel and secondary channel; 5.9 acres), backwaters (2.4 acres), flood runner channels (1.9 acres), and backwater channel including a perennial side channel (5.4 acres), main channel terrace (6.4 acres), and lowering floodplain elevations to construct riparian terrace and enhance floodplain function (20.8 acres) (Table 1). Additionally, riparian trees and shrubs will be planted adjacent to select re-graded areas and any large woody material removed during Proposed Action implementation will be incorporated into Proposed Action features.

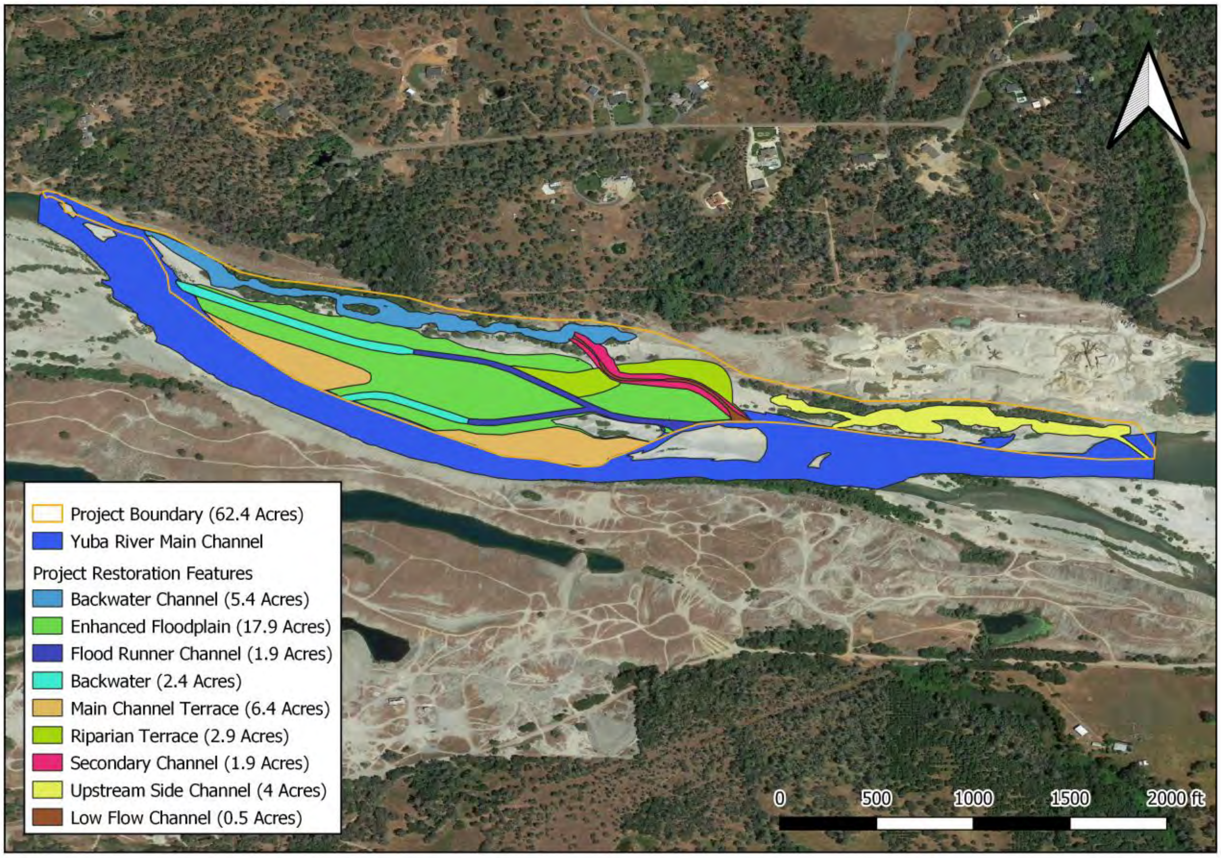

Figure 2. Proposed Action conceptual design with grading for side, secondary, flood-runner, and backwater channels, backwaters, and floodplain areas (enhanced floodplain, main channel terrace, and riparian terrace) indicated.

Table 1. Estimated area and channel length of restoration habitat elements and excavation and fill volumes associated with the Proposed Action on the lower Yuba River.

Habitat Element	Excavation Volume (yds^3)	Fill Volume (yds^3)	Area (acres)	Channel Length (ft)
Upstream Side Channel	14,000	2,600	4.0	1,674
Secondary Channel (includes Low Flow Channel)	19,000	0	1.9	1,135
Riparian Terrace	31,000	0	2.9	
Main Channel Terraces	52,000	0	6.4	
Flood Runner Channel	16,000	0	1.9	2,168
Enhanced Floodplain	141,000	200	17.9	
Backwater Channel	24,000	400	5.4	2,841
Perennial Backwaters	34,000	0	2.4	
TOTAL	331,000	3,200	42.8	4,430

Construction Description

Access to the property for restoration activities will occur via the county-maintained access road at 6130 Highway 20. The paved access road is gated at the bottom where the county maintenance ends. The access road to the Long Bar Mine LLC property containing the SRI plant continues past the gate. Access for restoration activities will solely be through an existing access road through the SRI aggregate operation which leads to the gravel bar to be topographically modified to enhance juvenile salmonid rearing (Figure 3). Heavy equipment used for restoration construction will be able to drive on the gravel bar throughout the site, as it is sparsely vegetated. The staging area to be used already exists and is part of the SRI operations (Figure 3). Dry floodplain grading activities may start as early as 16 April and continue as late as 31 October. In-water work would only occur between 15 July and 30 September to minimize adverse effects to CV spring-run Chinook Salmon, CCV steelhead, and other aquatic species.

Figure 3. The existing access road and staging area to be used for construction of the Proposed Action.

An estimated 331,000 yd^3 (251,360 m^3) of material will be excavated by heavy equipment during restoration activities and transported to the SRI aggregate operation for processing (Table 1). Heavy equipment likely to be used include one or more of the following: front-end loader, scraper, grader, bulldozer, excavator, and haul truck. Native river rock excavated as part of topographic modification and/or specific sizes sorted at the SRI processing plant will be transported back to the restoration area to create specific features, including side channel/floodplain entrances and side channel riffles.

Design Hydrology

The flow values provided in Table 2 and Table 3 were used to develop habitat that is inundated for the preferred duration and frequency over the target ecological period (i.e., juvenile salmon rearing). The optimal floodplain inundation duration to benefit rearing salmonid growth is still under study and appears to be highly location-specific. Available literature from the California CV suggests that continuous inundation duration in the range of 14-24 days, with a target of 21 days, will promote food production, providing the opportunity for invertebrates (key salmonid prey items) to colonize off-channel areas (Merz and Chan 2005; Ahearn *et al.* 2006). Studies on the lower American River, a CV river system similar to the LYR, have shown that floodplain invertebrate densities approach main channel densities after two to four weeks of inundation (Sellheim *et al. in prep*).

We also note that a shorter flow pulse (e.g., 3-day) may be beneficial to the LYR by providing an influx of terrestrial invertebrates from the floodplain to the main channel, as hypothesized by Ahearn *et al.* (2006). Although at present there is limited evidence to support the benefits of a short pulse, we provide the 3-day pulse flow values (Table 2) for context in the LYR setting. Inundation frequency determines the likelihood that any anadromous salmonid year-class will have the opportunity to utilize floodplain habitats. CV Chinook Salmon adults generally return to spawn at age three (Fisher 1994) with variations in each brood year. As such, the population may be continually supported by a benefit to juveniles that occurs as seldom as one in three years. Three frequencies were used for the Proposed Action design: 1) 33% exceedance probability, or the specified inundation duration during the specified rearing period occurring in one of every three years; 2) 50% exceedance probability, occurring every other year; and 3) 67% exceedance probability, occurring two out of three years, on average (Table 2).

Table 2. Summary of ecologically significant flows guiding Proposed Action design

Dataset	January to June			January to June			July to October
	21-day Duration Flow (cfs)			3-day Duration Flow (cfs)			Baseflow (cfs)
	33%	50%	67%	33%	50%	67%	
Yuba River Development Project (YRDP) Model[1]	5,000	4,100	2,000	10,400	6,900	3,800	700

[1]YRDP Operations Model (FERC No. 2246) accessed from http://www.ycwa-relicensing.com

Based on the ecological flow evaluation above, design flows were developed to govern the development of habitat enhancements. Table 3 lists the various design flows along with their ecological importance and their significance related to physical processes.

Table 3. Design flows based on EFM results from the YRDP model

Flow (cfs)	Ecological Significance	Physical Process Significance
700	Minimum required flow 1 September-15 April	Baseflow
880	Typical Chinook Salmon spawning flow	Main channel spawner bed modification (Hassan *et al.* 2008; DeVries 2012)
1,000	Upper end of Chinook Salmon spawning flow	Surface water flow disconnection to all floodplain features (cbec design)
2,000	21-day duration occurring almost every year (January to June); lower end of rearing range	Channel defining flow for Secondary Channel geometry (cbec design)
3,500	21-day duration approximately every other year; activates riparian corridor	Potential for vegetation and sediment recruitment feedbacks (cbec design)
5,000	21-day duration every third year; upper end of steelhead spawning	LYR bankfull (Kammel and Pasternack 2014)
7,500	Occurs for ~3 days every other year; provides access to floodplain	Potential for vegetation and sediment recruitment feedbacks (cbec design)
10,000	Upper end of rearing range	~1.5-year recurrence interval flood; Secondary Channel riffle-pool maintenance
40,000	Linked to implications for the floodway	~5-year recurrence interval flood; material critical grain size threshold (cbec design) for riffle crests, inlets, and roughness features
70,000	Linked to implications for the floodway (scour and vegetation regeneration); vegetation recruitment assumptions	~10-year recurrence interval flood

Sub-surface flow is important to characterize because it sustains riparian plants on bars and floodplain areas. Riparian plants that have access to soil moisture at their roots during the driest portion of the year are most likely to become established and thrive (Mahoney and Rood 1998; Stella *et al.* 2003). Additionally, to maintain appropriate water temperature to support over-summer salmonid rearing, the low flow portion of the Secondary Channel and the Backwater Channel are designed to convey groundwater input in late summer and fall when the channels are disconnected from surface flow. To determine appropriate elevations for floodplain and bar grading and to quantify potential groundwater inputs to the Secondary and Backwater channels, an approximation was made of the water table during the driest portion of the year.

A groundwater surface was developed by incorporating data from a topographic survey conducted by cbec in September 2017. Water Surface Elevation (WSE) data were collected along the bank of Long Bar and in the Backwater Channel where standing water was visible. A groundwater elevation surface was developed by interpolating between data points collected on the north and south sides of Long Bar at a flow of approximately 880 cfs, slightly above baseflow (700 cfs) for the main channel. The surface developed from these data was then projected laterally to the margins of the river corridor to provide coverage below Proposed Action design elements. This yielded a comprehensive map of the water table in the vicinity of the Proposed Action during low flow conditions (Figure 4). To determine depth to groundwater at all graded areas in the design, elevation values of this groundwater surface were subtracted from the existing and finished grade surface elevations in GIS to create a map of elevation differences (Figure 5).

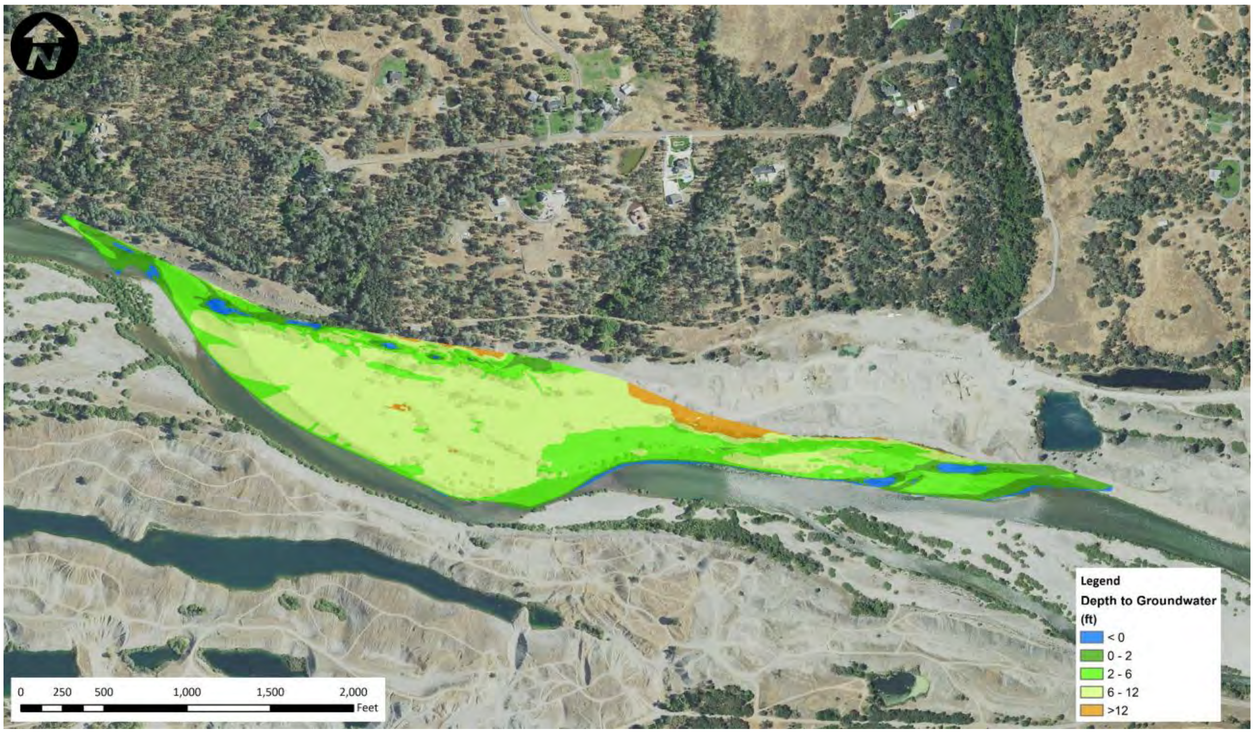

Figure 4. Existing conditions depth to groundwater within the Proposed Action site at a flow of 880 cfs.

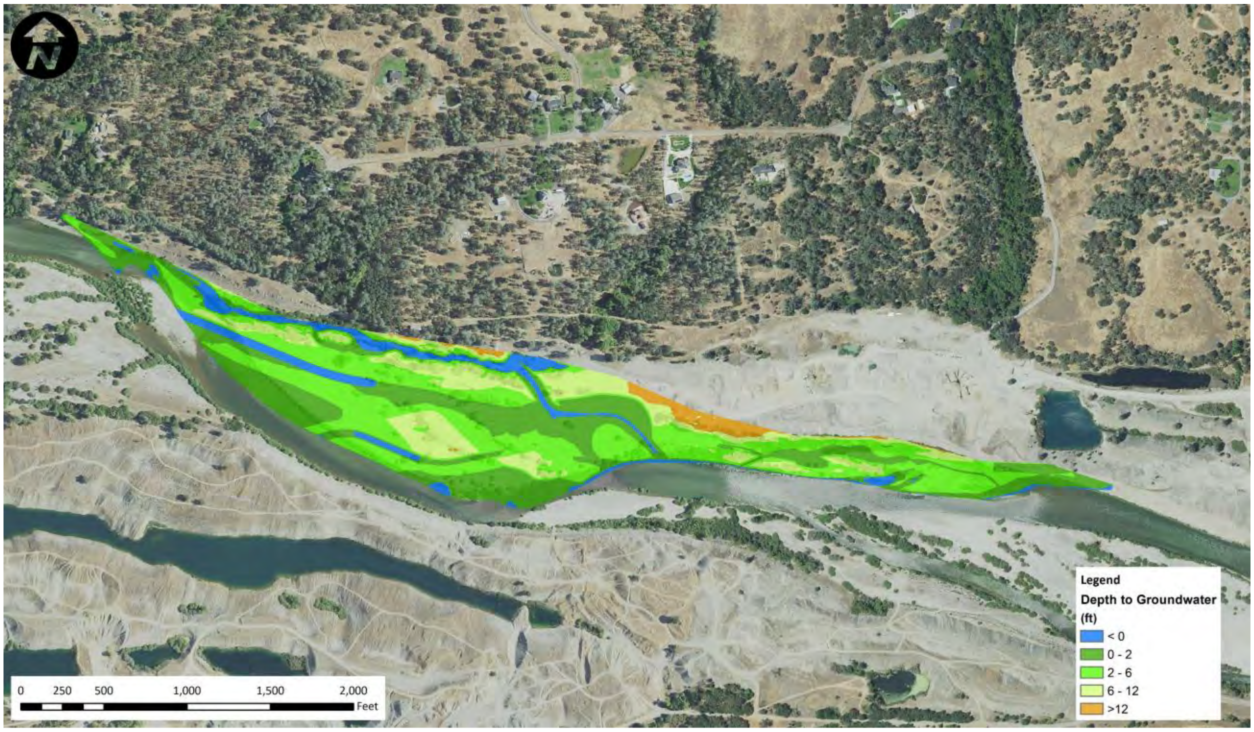

Figure 5. Proposed Action conditions depth to groundwater at a flow of 880 cfs.

Design of Habitat Elements

Channel and floodplain grading designs were based on site hydrology and geomorphic considerations (i.e., evolution and persistence). Hydrology was evaluated to determine ecologically significant flows that occur during the juvenile salmonid rearing period. The goal of floodplain and channel grading was to provide inundation throughout the range of ecological flows, so water surface elevations associated with those flows were used as grading design criteria. Table 4 lists the various channel and floodplain types included in the design and the ranges of ecological flows under which they were designed to function. The functional range column reflects the target range for which habitat is optimized in each feature, but this is not to imply that habitat stops functioning outside of that range.

Habitat features were designed to “initiate” or begin to inundate at the approximate flows listed in Table 4 to develop inundation depths that would satisfy the needs of juvenile salmonids over the rearing period according to selected habitat suitability indices. The grading designs for the features identified in Table 4 were refined through an iterative process of evaluation and redesign to target juvenile salmonid habitat suitability index (HSI) and to maximize weighted useable area (WUA).

In the target performance ranges for evaluated flows identified in Table 4, it should be noted that the Backwater Channel and Secondary Channel bed elevations were designed to maintain a minimum of 1 ft depth throughout the driest months in about half of all years to provide over-summer habitat for rearing juvenile salmonids.

Table 4. Summary of design habitat elements and flow criteria

Habitat Element	Flow (cfs)		Inundation Regime			
	Initiation	Functional Range	Analysis Flow (cfs)	Timing	Duration (days)	% Exceedance
Secondary Channel	2,000	2,000-5,000	2,000	Jan - June	21	67%
Backwater Channel	700	700-5,000	2,000	Jan - June	21	67%
Upstream Side Channel	2,000	2,000-10,000	2,000	Jan - June	21	67%
Flood Runner Channels (frequent flows)	3,000	3,500-10,000	3,500	Jan - June	21	50%
Riparian Terraces[1] (seasonally inundated, off-channel habitat)	2,000	5,000-10,000	3,500 / 5,000	Jan - June	21	33-50%
Backwaters	700	700-5,000	2,000	Jan - June	21	67%
Enhanced Floodplain	5,000	5,000-26,000	10,000	Jan - June	3	33%
Main Channel Terraces	1,000	2,000-10,000	2,000	Oct - June	21	67%

[1]Includes terracing north of the Secondary Channel and the Connector Channel.

Secondary Channel Features

During baseflow conditions, when total LYR flow upstream of DPD is around 700 to 1,000 cfs, the Secondary Channel will not exhibit a direct surface connection to the main channel at the upstream connection. Baseflows occur in most years from mid-August to October, corresponding to the latter portion of the adult immigration period, peak spring-run Chinook Salmon spawning, and the beginning of fall-run Chinook Salmon spawning. During this period, there is a focus on providing deeper, colder, main channel habitat. It is not desirable to distribute the limited surface water flows onto the floodplain or Secondary Channel because if redds are built in these areas, they are at risk of becoming stranded if flows are reduced.

The sectional design geometry of the Secondary Channel is planned as a combination of four different functional elements: 1) Inlet, 2) Riffles, 3) Low Flow Channel, 4) Floodplain Terraces. A description of the geometric considerations for these elements follows. Specific attention is placed on the hydrologic flow criteria used to inform and refine restoration concept geometry.

Inlets

Secondary Channel and Upstream Side Channel inlet elevations were set to approximate the 2,000-cfs WSE to correspond with the habitat goals for the channels. Because the inlets were designed to divert flows from the main channel when total river flows exceed 2,000 cfs, spawning habitat in the main channel should not be affected, as spawning typically occurs when main channel flows are below 1,000 cfs. Inlet mouth sections are narrow by design to maintain their form by inducing sediment-clearing flow velocities. To the extent possible, inlets will be located outside of geomorphically active areas to avoid sediment deposition or scour. However, inlet locations were balanced with goals for maximizing channel length to enhance habitat and aligning the inlets with the channel form to conduct flow more effectively.

Riffles

Riffles were included in the design in the pattern and form identified by Newbury and Gadboury (1993) (also known as Newbury riffles) to provide habitat variability, increase floodplain connectivity, and provide grade control in the Low Flow Channel (**Figure 2**). Three distinct habitat units are created by the inclusion of Newbury riffles in the Proposed Action: an upstream glide/pool section, a riffle section, and a downstream transition section. Riffle spacing was designed so that the downstream riffle backwaters the majority of the riffle upstream, creating a series of pools 1 to 2.5 ft in depth to target rearing juvenile salmonid HSI and to provide dry season groundwater-fed habitat. The backwater created by the pools will reduce the hydraulic slope and flow velocity in the Secondary Channel to help maintain velocity within target HSI values. As flows approach the riffle crest, the channel conveyance is reduced, encouraging flows to disperse laterally onto the adjacent floodplain.

Newbury riffles are intended to resist erosion and headcutting, thereby providing grade control. The riffles will be composed of well-graded (i.e., not uniform in size) sediment that will adjust to fill voids caused by such erosion. Riffle rocks will be placed in a mound with a relatively steep upstream face and a milder slope on the downstream side. Riffle crests will be keyed into the banks of the Low Flow Channel to resist lateral flanking. Rock gradations for the riffles will be selected to resist transport during a 5-year event.

The Low Flow Channel riffles are anticipated to be a self-sustaining feature that will maintain channel form by facilitating the flushing out of finer pool sediments during relatively high recurrence flow events. In low flows, velocity in the pools is slower than over the riffles due to the relatively larger cross-sectional area. In higher flows, the cross-sectional area of the riffles can exceed that of the pools, as flows spread out over the riffle (Lane and Borland 1954). This leads to a “flow reversal” (Keller and Florsheim 1993; MacWilliams *et al.* 2006) in which the pool velocities are higher than those over the riffle. This may assist in maintaining pool depth and riffle form by removing sediment from the pools and distributing it to the floodplain adjacent to the riffles, or to the riffles downstream (Lane and Borland 1954). The Floodplain Terraces allow flows to spread onto a wider floodplain and slow down, reducing the shear stress, or erosive power. The Secondary Channel flows required to activate this process are associated with ~1.75-year recurrence interval flow.

Low Flow Channel

The channel that serves as a connection between the upstream end of the Backwater Channel and the main channel is a two-stage design, with a Low Flow Channel and shallow Floodplain Terraces. The Low Flow Channel profile elevation varies to allow for perennial, groundwater-fed, trickle flows through a series of shallow riffle habitats separated by deeper pool and glide habitats. The Low Flow Channel was designed as a patterned sequence of deeper and narrower areas (pools) followed by wider and shallower areas (riffles) imitative of natural, gravel bedded river forms. It is important to note that these are not uniformly trapezoidal channels with unchanging widths and fixed slopes.

The Low Flow Channel was designed to maintain full depth during dry year baseflow conditions, when it is disconnected from surface flow, to provide habitat for over-summering juvenile spring-run Chinook Salmon and CCV steelhead. The Low Flow Channel geometry design is based on the estimated depth to groundwater at an 880-cfs main channel flow (the 98% exceedance baseflow in June-August, and the 55% exceedance baseflow in September-October) to provide a continuous, wetted channel in the dry months in approximately half of all years. The Secondary Channel riffle crest elevations were set six inches below the estimated groundwater elevation to provide egress for juvenile salmonids from the pools they form, and pool depths were set to 2.5 ft to discourage occurrence of deep-bodied predatory species such as black bass (*Micropterus* spp.), which have a higher probability of occupancy at depths exceeding this value (CFS 2018).

The Low Flow Channel is designed to provide habitat to support extended juvenile salmonid rearing without providing favorable habitat for predatory and invasive species that are known to use and benefit from deeper, slow-moving water (Gelwick *et al.* 1997; CFS 2018). Optimal depth and velocity for juvenile salmonids are approximately 0.9 to 2.5 ft deep and 0 to 1 ft/s, according to the HSIs used for the Proposed Action. The varying slope and elevation in the riffle pattern are intended to provide a range of appropriate depths, and velocities are anticipated to be appropriately low when the Secondary Channel is disconnected from the main channel and fed by groundwater inputs.

Floodplain Terraces

The Low Flow Channel is set into broad and shallow Floodplain Terraces, comprising the Secondary Channel (**Figure 2**). The alignment of the Low Flow Channel moves with respect to the Floodplain Terraces, swinging left and right to move to the outside of bends. As the Low Flow Channel position moves to the outside of the bend, the Floodplain Terrace area increases on the inside of the bend. This design mimics natural channel morphology, promoting helical flow patterns and floodplain activation.

The Floodplain Terraces of the Secondary Channel are designed to disperse flows out of the Low Flow Channel, creating a broader refuge area with reduced velocity. The Floodplain Terraces connect to Riparian Terrace features on the north and south sides of the Secondary Channel.

Riparian Terraces

The Connector Channel is a Riparian Terrace feature on the south side of the Secondary Channel that contributes to the performance of the Backwater Channel. The Connector Channel is intended to divert water away from the Backwater Channel as main channel flows increase, thereby reducing depth and velocity in the Backwater Channel and extending its function as a refuge for rearing fish. The Connector Channel is a wide, shallow channel that extends from the top of bank on the south side of the Secondary Channel to the Flood Runner Channel. While it serves to divert water away from the Backwater Channel, it also provides expanded floodplain habitat over the upper range of ecological flows associated with salmonid rearing (5,000 to 10,000 cfs).

A Riparian Terrace was included on the north side of the Secondary Channel to disperse flows and reduce velocity. This Riparian Terrace slopes up from the top of bank of the Secondary Channel Floodplain Terrace, activating around 5,000 cfs. This feature is intended to disperse flows on the higher end of the ecological flows range to maintain the effectiveness of the

Secondary Channel and Backwater Channel to provide habitat value to rearing juvenile salmonids at these flows.

Backwater Channel

The Backwater Channel is an existing feature on the north side of Long Bar that this Proposed Action seeks to enhance through opportunistic grading to develop perennial access to high quality edge habitat. Perennial access will be provided by maintaining a minimum depth in the channel and lowering local high spots to provide continuous egress to the outlet at the downstream end. The bed of the Backwater Channel grading was designed to provide 1 ft of depth during the low water period, based on the estimated groundwater elevation surface. Existing vegetation will be preserved to the extent practicable to maintain existing habitat value and grading will be designed to increase edge length and to bring the channel edges closer to overhanging vegetation. Because the area is spatially small and narrow, it is anticipated that it will function best as rearing habitat over the lower end of the range of ecological flows associated with salmonid rearing (2,000 to 5,000 cfs), which occur over a 21-day duration as frequently as two out of three years, but not less than one out of three years. The enhanced perennial access will also provide increased habitat for over-summering juvenile CV spring-run Chinook Salmon and CCV steelhead.

Enhanced edge habitat will be provided by widening the channel, opportunistically, to bring the edges of the feature into contact with existing vegetation. Grading extents were based on vegetation observed in cbec’s 2017 aerial orthophoto. A varied bank line was established to increase edge length and to incorporate flow diversity in the design to provide habitat variability. Design grading elevations along the edges of the Backwater Channel were set to provide topographic heterogeneity such that the feature functions over the lower end of the range of ecological flows.

By enhancing pool connectivity and communication of groundwater inflows throughout the Backwater Channel, the design is intended to reduce water temperatures in summer. This, in turn, should reduce bullfrog habitat suitability in the Backwater Channel.

Upstream Side Channel

Like the Backwater Channel, the Upstream Side Channel is an existing feature that will be enhanced to provide increased access to and egress from the floodplain. Flow connection will be enhanced by extending a small channel upstream to connect to the main channel and to activate at 2,000 cfs. A narrow, shallow central channel was included in the design to convey flows from the upstream inlet to the downstream outlet, providing constant slope and drainage to minimize fish stranding potential. The central channel was designed with a minimum depth of six inches to encourage spreading of flows onto the broad floodplains adjacent to it. Floodplain grading around the central channel was designed to activate just above 2,000 cfs. Main channel flow and floodplain elevations were varied to provide suitable depth and velocity over the range of ecological flows associated with salmonid rearing (2,000 cfs to 10,000 cfs). A varied bank line will be established to increase proximity to vegetation and edge length, and to create flow diversity. Grading extents were based on vegetation observed in cbec’s 2017 aerial orthophoto.

Isolated pools exist in the area where the Upstream Side Channel will be constructed. Similar to the Backwater Channel, Upstream Side Channel grading will connect these pools with the intention of enhancing circulation of groundwater in the summer and lowering water temperatures, which will reduce bullfrog habitat suitability.

Flood Runner Channels

The Flood Runner channels are intended to mimic natural features that form on bars due to scour during elevated flows. The Flood Runner channels will provide off-channel rearing habitat through regular and sustained shallow inundation of these channel features in most years. Main channel flows are expected to exceed 2,000 cfs for a duration of 21 days in two out of three years (i.e., 66% exceedance) and to exceed 4,100 cfs for a duration of 21 days in one out of two years (i.e., 50% exceedance) (Table 2). The Flood Runner channels were designed to activate at 3,000 cfs, meaning it should be inundated for a 21-day period at least every other year.

The Flood Runners were designed to provide shallow-water habitat within their banks and access to the larger, open floodplain areas that surround them as flows increase. The channels have a 30 ft bottom width, are nine inches deep, and are anticipated to be full at main channel flows of 3,500 cfs. As main channel flows increase to 5,000 cfs, the banks of the Flood Runners are anticipated to be covered by six inches of water, and flows should spread out onto the larger Enhanced Floodplain.

Perennial Backwaters

Backwaters, defined as partially enclosed, low-velocity areas separated from the main channel, were designed to create shallow, slackwater areas that salmonids have shown preference for over higher velocity in-channel habitats (Beechie, et al. 2005). The Backwaters will provide habitat diversity and increase edge habitat during the rearing period as well as the low-flow period to benefit over-summering juvenile CV spring-run Chinook Salmon and CCV steelhead. Backwaters were designed to perform during main channel flows ranging from base flow to 5,000 cfs. Backwater bed elevations were set for shallow inundation (less than 1 ft) during main channel flows of 1,000 cfs and less than 3 ft depth at 5,000 cfs. The Backwater channels were sloped toward the downstream ends to allow egress from the upstream end of the Backwaters and adjacent floodplain areas. Inundation depths and seasonality were reviewed with respect to predator habitat preferences to confirm the Backwaters do not provide favorable conditions (CFS 2018).

Enhanced Floodplain

In addition to the riparian terraces surrounding the Secondary Channel, and the fringes of the Backwater Channel and Upstream Side Channel, the design also includes several larger areas of restored floodplain habitats. These are located on the larger degraded portion of Long Bar, adjacent to the Flood Runners. Enhanced Floodplain elevations were set to provide inundation of the entire graded floodplain area for a period of 21 days in one out of three years (i.e., 33% exceedance), which corresponds to a main channel flow of approximately 5,000 cfs. These floodplain areas are intended to provide additional inundated acreage at the upper end of the targeted range of ecological flows (5,000 cfs to 10,000 cfs), and to provide a depth to groundwater that will promote native riparian vegetation establishment and recruitment.

Main Channel Terraces

Large areas of more frequently inundated floodplain were added to the design adjacent to the main channel. The elevations of these large terraces were designed to maintain in-channel flows during the spawning season, and to potentially activate during all other times of the year to provide a significant addition to available shallow edge habitat in the Proposed Action Area. The terraces slope gently toward the main channel at variable slopes. The edges adjacent to the main channel are anticipated to inundate around 1,000 cfs and the highest portion of the terraces are anticipated to become wet at 2,000 cfs main channel flow. The variation in elevation in the terraces was intended to promote utilization over the range of ecological flows associated with salmonid rearing (2,000 cfs to 10,000 cfs).

Roughness Features

Inorganic roughness features were added to areas of broadly graded floodplain (Enhanced Floodplain, Main Channel Terraces) to add hydraulic variability, provide refuge areas, and to promote fine sediment accretion. These features will be oriented to form ridges perpendicular to flow to encourage sediment deposition on the downstream side. They will be constructed of locally available, well-graded, rounded rock stacked approximately 3 to 6 ft high, with 3:1 slopes.

Riparian Habitat

Riparian vegetation can benefit rearing salmonids both directly and indirectly. Direct benefits include refuge from predation and high velocities, while indirect benefits include shading impacts on water temperature, allochthonous nutrient and prey (invertebrate) contributions, and woody material inputs that enhance cover and habitat complexity (Bisson *et al.* 1982; Eberle and Standford 2010; Sellheim *et al.* 2016a). However, these mechanisms have not been well tested in large Mediterranean climate streams similar to the LYR. Floodplain grading was designed according to the hydrology that will support both rearing juvenile salmonids and vegetation recruitment and establishment. Riparian plants are constrained by the availability of soil moisture at their roots and are limited by exposure to high velocity flows (Mahoney and Rood 1998; Stella *et al.* 2003; Bywater-Reyes *et al.* 2015). Soil moisture availability is influenced by substrate texture, plant distance from a flowing channel, and/or relative elevation above groundwater (e.g., Vaghti *et al.* 2009), while high velocity exposure relates primarily to extant plant root strength and position with respect to scouring velocities (Bywater-Reyes *et al.* 2015).

As summarized in Table 2, there is a 50% likelihood in any year that flows of approximately 4,100 cfs would persist for at least 21 consecutive days during January-June. Thus, some riparian areas that were graded to begin inundating between 2,000 and 3,000 cfs are anticipated to be partially inundated when flows reach or exceed 4,100 cfs. Proposed floodplain grading will remove material from higher elevation areas such that these features are anticipated to inundate above 2,000 cfs (Upstream Side Channel, Secondary Channel and Backwater Channel) or above 3,000 cfs (Flood Runners). Floodplains adjacent to the Upstream Side Channel, Secondary Channel and Backwater Channel features are anticipated to inundate incrementally above 2,000 cfs. Enhanced Floodplain areas adjacent to the Flood Runners that will cover a majority of Long Bar are anticipated to inundate above 5,000 cfs. The resulting range of elevations, inundation frequencies, groundwater depths and flood energy are intended to generate a diverse mosaic of habitat types for juvenile salmonid rearing and riparian vegetation.

Vegetation Recruitment

Given the mining and dredging legacy in the LYR, several factors influence the success, or hypothesized lack thereof (e.g., cbec *et al.* 2010), of riparian vegetation recruitment. Dredging activities altered the character and distribution of the sediment in the river corridor. Prior to the influx of hydraulic mining sediment, historical accounts describe cultivated “bottom lands” along the Yuba with dark fertile soils, presumably representing floodplains in frequent connection with the river (Gilbert 1905 as described in James *et al.* 2009). Because of dredging, the modern channel alluvium is a mix of hydraulic-mining sediment and Quaternary alluvium (James *et al.* 2009, Hunerlach *et al.* 2004). In the process of dredging, the mined sediment was separated into fine and coarse fractions, with a mixture of clay, silt, and sand typically tens of feet thick and the coarse fraction (gravel and larger) stacked 40-100+ ft high. Such dredger tailings hinder vegetation recruitment due to detachment from groundwater, relatively high porosity due to large sediment sizes, and lack of soil horizon (e.g., cbec *et al.* 2010).

When tailings are re-contoured to inundate more frequently and sediment size classes are reduced, native recruitment of riparian vegetation can be rapid (Sellheim *et al.* 2016b). While we expect flood disturbance to keep vegetation in earlier succession for many areas of the Proposed Action site, young willows, cottonwoods, alders etc. provide important rearing habitat (Sellheim *et al.* 2016a). Mature vegetation will require a longer time to establish but will potentially provide future allochthonous inputs such as terrestrial invertebrates and woody material. Funding availability limits Proposed Action revegetation efforts. Therefore, the floodplain area grading was designed with consideration for promoting natural vegetation recruitment. Vegetation success is related to availability of soil matrix, groundwater, and exposure to high flows. Reducing floodplain elevation increases potential for available groundwater by reducing the distance to the water table, but it also increases the frequency of inundation that could expose plants to higher velocities/scour, so a balance was established between these opposing constraints.

Floodplains were primarily designed as rearing habitat, and as such, were designed for initial inundation at 2,000 to 5,000 cfs total river flow to provide habitat at the upper range of ecological flows. At elevations corresponding with 2,000 to 5,000 cfs total river flow, floodplains are typically within 2-12 ft of estimated groundwater to support a variety of vegetation (Figure 5). Flows exceeding 5,000 cfs typically occur between December and March, during which the floodplains receive water, fine sediment deposits, and seeds. After June, flows typically diminish and vegetation becomes established in the floodplain into late October, supported by available groundwater. Figure 5 shows the ranges of Proposed Action condition depth to groundwater beneath graded floodplain areas. Shallow groundwater depths from 0-2 feet are expected to support herbaceous vegetation and shrubs (e.g., willows and California buttonbush [*Cephalanthus occidentalis* var. *californicus*]). Moderate groundwater depths from 2-6 feet would support similar shrubs to shallow groundwater depths and trees such as white alder. Moderate groundwater depths may support establishment of elderberry (*Sambucus* spp.) and Fremont cottonwood. High groundwater depths from 6-12 feet are expected to support successful establishment of elderberry, Fremont cottonwood, and western sycamore (*Platanus racemosa*).

Recruited floodplain vegetation is expected to create hydraulic roughness, reduce flow velocity, and encourage sediment deposition that will promote the natural recruitment process (Bendix and

Hupp 2000; Manners *et al.* 2013; Yager and Schmeeckle 2013). Established floodplain vegetation roots are expected to stabilize the soil and help sustain the form of the floodplains and channels designed to convey water through them.

A secondary goal of floodplain grading is to increase edge contact with vegetation. Where possible, floodplain grading was extended to meet existing vegetation, as interpreted from a 2017 aerial orthophoto. Provision will be made for adaptive grading during construction to preserve existing vegetation and to maximize shaded edge habitat. Floodplain grading will require removal of existing vegetation in some instances; the resulting woody debris will be utilized within the Proposed Action as appropriate to provide additional cover for juvenile salmonids.

Restoration Grading Conservation Measures

To minimize any potential negative effects on salmonids, in-water activities will occur during summer/early-fall (15vJuly 15 to 30 September) when flows are low (approximately 1,000 to 2,000 cfs) and active salmonid spawning is not occurring. In-water activities would be limited to creating side channel/floodplain entrances and exits, grading in sections of the Backwater Channel and Upstream Side Channel containing isolated pools/depressions, and minor fill in deep pools in the Backwater Channel. Construction will occur over one to two seasons.

Native trees, such as Fremont cottonwood, oak (*Quercus* spp.), and willow with a diameter at breast height (dbh) of at least 12 in (15.2 cm) will be protected, as possible, with buffers that extend to the canopy edge to avoid ground disturbance within the tree's drip line. To compensate for the removal of riparian shrubs and trees during implementation, the plans will identify tree and shrub species that will be planted, how, where, and when they will be planted, and measures that will be taken to ensure a performance criterion of 60% survival of planted trees for a period of three consecutive years. Mitigation tree plantings will occur for any native tree species that are removed during site construction in the following manner:

- Oaks with a dbh of three to five inches will be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a dbh greater than five inches will be replaced in-kind at a ratio of 5:1.
- Native riparian trees with a dbh greater than six inches will be replaced in-kind at a ratio of 5:1 and planted in the nearest suitable location to the area where they were removed. Any heritage size (24 inch or greater dbh) native trees removed will be replaced in-kind at a ratio of 10:1.

Any trees with a dbh greater than five inches that are removed during restoration activities will be used within the created floodplains and side channels as large woody material habitat elements. The trees will be strategically placed in the floodplains and side channels to provide cover and habitat complexity for rearing juvenile salmonids. Juvenile salmonids use large woody material for cover (Shirvell 1990; Beechie *et al.* 2005; Nagayama *et al.* 2009) and juvenile salmonid abundance has been observed to be greater in reaches which contain large woody material than reaches without (Inoue and Nakano 1998; Miyakoshi *et al.* 2002; Roni and Quinn 2001; Nagayama *et al.* 2009).

After floodplain grading and gravel augmentation activities have been completed, the disturbed areas will be revegetated with native riparian plants. In addition to mitigation planting, restoration planting of native riparian trees and shrubs may occur on areas adjacent to the restoration features which have shallow depth to groundwater, if funding is available. Native riparian trees and shrubs to be planted would include Fremont cottonwood, willows, buttonbush, western sycamore, and elderberry. Planting will occur in October and November, which is the likely beginning of the rainy season, to maximize survival rates. The planting mix for areas alongside channels will be 20% Fremont cottonwood, 15% arroyo willow (*Salix lasiolepis*), 15% shining willow (*Salix lasiandra*), 15% Goodding's willow (*Salix gooddingii*), 15% western sycamore, 10% sandbar willow (*Salix exigua*), and 10% white alder. The planting mix for vegetated floodplain areas will be 40% Fremont cottonwood, 20% western sycamore, 20% Goodding's willow, 10% arroyo willow, 5% sandbar willow, and 5% elderberry. Exotic species present in the riparian area, including Himalayan blackberry (*Rubus armeniacus*), yellow starthistle (*Centaurea solstitialis*), and milk thistle (*Silybum marianum*), will be eradicated where possible. A detailed monitoring program will document the pre-project conditions, rehabilitation and revegetation, and the effectiveness of the planting in terms of vigor and survival (CFS 2020).

Habitat Suitability Modeling

The Proposed Action seeks to increase juvenile salmonid rearing habitat without impacting current CV Chinook Salmon and CCV steelhead spawning habitat. To evaluate change in physical habitat from existing to design conditions, habitat suitability modeling was performed for the target species and life stages for defined ecologically meaningful flows. The focus of this analysis was CV Chinook Salmon and CCV steelhead juvenile rearing habitat and adult spawning habitat within the Action Area. Habitat suitability index (HSI) values for fry (<50 mm fork length) and juvenile (>50 mm fork length) Chinook Salmon and steelhead were developed for YWA (Moniz and Pasternack 2019a Moniz *et al*. 2019) based on data collected on the LYR in 2012, 2014 and 2015. The HSI curves were bioverified using a 2D hydraulic model based on 2014 river topo-bathymetry and comparing predicted preferential habitat areas to observations of fry and juvenile salmonid presence (Moniz and Pasternack 2019b,).. Spawning HSI curves were also used to confirm that the Proposed Action did not cause a reduction in spawning habitat. Spawning HSI curves for the LYR developed using field-measured hydraulics at CV Chinook Salmon redds were used for this assessment (Beak Consultants Inc. 1989). CCV steelhead spawning curves were also assessed for existing and Proposed Action conditions (Kammel *et al.* 2016). Table 5 shows the full range of flows assessed for spawning and rearing habitat.

Table 5. Flows analyzed for salmonid spawning and rearing habitat

Discharge (cfs)	Chinook spawning	steelhead spawning	Chinook/steelhead fry and juvenile rearing
700	X	X	X
880	X		
1,000	X	X	X
2,000		X	X
3,500		X	X
5,000		X	X
7,500			X
10,000			X

To compare existing and design condition of the Proposed Action for juvenile and adult salmonids, the combined (or global) habitat suitability index (gHSI) and the total WUA within the Proposed Action Area were calculated using the following equations:

$$gHSI_{cell} = VHSI \times DHSI \quad (1)$$

$$WUA = \sum(gHSI_{cell} \times Area_{cell}) \quad (2)$$

Where VHSI, and DHSI are velocity and depth habitat suitability indices, respectively, taken from curves for juvenile and adult CV Chinook Salmon and CCV steelhead. The gHSI is a product of VHSI and DHSI (Equation 1) and represents hydraulic habitat suitability. gHSI was then binned into habitat suitability ranges for the results. Cover was not included in the analysis because it is too difficult and subjective to predict vegetation recruitment under the design condition within a limited area. To calculate WUA, the value of each cell in the gHSI raster was multiplied by the cell area and summed across all the cells in the model domain to calculate the total WUA (equation 2) to estimate the total usable habitat for a given flow, where the percent change in usable habitat after implementation is assumed to be due to restoration actions.
The Proposed Action increases the wetted area by 5% at the baseflow of 700 cfs, 29% at 2,000 cfs, and a maximum of 51% at 5,000 cfs (Table 6).

Table 6. Inundated acreage for Existing and Proposed Action conditions

Flow (cfs)	Existing (Acres)	Proposed Action (Acres)	Difference	
			Acres	(%)
700	32.6	34.2	1.6	5%
1,000	34.7	36.5	1.8	5%
2,000	39.9	51.5	11.6	29%
3,500	44.9	64.8	19.9	44%
5,000	50.2	75.8	25.6	51%
7,500	62.3	92.2	29.9	48%
10,000	69.2	99.2	30.0	43%

Table 7 and 8 show the WUA comparison between Existing and Proposed Action fry and juvenile Chinook Salmon rearing habitat conditions, under the range of flows most commonly observed during the spring rearing period. The Proposed Action increases the available fry Chinook Salmon habitat by 22% at the baseflow of 700 cfs, 182% at 2,000 cfs, and a maximum of 320% at 5,000 cfs (Table 7). Similarly, juvenile Chinook Salmon available habitat increases by 10% at the baseflow of 700 cfs, 131% at 2,000 cfs, and a maximum of 264% at 3,500 cfs (Table 8).

Table 7. Fry Chinook Salmon (<50 mm fork length) rearing WUA

Flow (cfs)	Existing (acres)	Proposed Action (acres)	Difference	
			Acres	(%)
700	5.1	6.2	1.1	22%
1,000	3.9	5.5	1.6	40%
2,000	3.2	9.0	5.8	182%
3,500	2.9	12.2	9.3	320%
5,000	3.3	11.8	8.5	254%
7,500	5.6	11.1	5.5	99%
10,000	7.6	9.7	2.1	27%

Table 8. Juvenile Chinook Salmon (>50 mm fork length) rearing WUA

Flow (cfs)	Existing (acres)	Proposed Action (acres)	Difference	
			Acres	(%)
700	8.0	8.8	0.8	10%
1,000	6.4	7.5	1.1	17%
2,000	4.4	10.2	5.8	131%
3,500	3.8	13.8	10.0	264%
5,000	4.2	14.7	10.5	251%
7,500	6.1	14.8	8.7	143%
10,000	7.9	13.4	5.5	70%

Tables 9 and 10 show the WUA comparison between Existing and Project conditions for Steelhead fry and juvenile rearing habitat conditions. The Project increases the steelhead fry available habitat by 26% at the baseflow of 700 cfs, 213% at 2,000 cfs, and a maximum of 338% at 3,500 cfs (Table 12). Similarly, juvenile steelhead available habitat increases by 3% at the baseflow of 700 cfs, 102% at 2,000 cfs, and a maximum of 270% at 5,000 cfs (Table 13).

Table 9. Steelhead fry (<50 mm fork length) rearing WUA

Flow (cfs)	Existing (acres)	Project (acres)	Difference	
			Acres	(%)
700	4.8	6.0	1.2	26%
1,000	3.8	5.5	1.7	46%
2,000	3.1	9.7	6.6	213%
3,500	2.8	12.1	9.4	338%
5,000	3.2	11.3	8.1	257%
7,500	5.6	10.8	5.3	94%
10,000	7.5	9.1	1.6	21%

Table 10. Steelhead juvenile (>50 mm fork length) rearing WUA

Flow (cfs)	Existing (acres)	Project (acres)	Difference	
			Acres	(%)
700	8.5	8.8	0.3	3%
1,000	6.8	7.7	1.0	14%
2,000	4.3	8.7	4.4	102%
3,500	3.7	13.2	9.5	260%
5,000	3.8	14.0	10.2	270%
7,500	5.3	14.3	9.0	171%
10,000	7.4	14.3	6.9	92%

Table 11 shows the WUA comparisons between Existing and Proposed Action Chinook Salmon spawning habitat conditions, under the range of flows most commonly observed during the fall/winter spawning period. The Proposed Action has negligible impact to Chinook Salmon spawning habitat, with increases of 1% (0.1 acres) for all the flows analyzed.

Table 11. Chinook Salmon spawning WUA comparison[1]

Flow (cfs)	Existing (Acres)	Proposed Action (Acres)	Difference	
			Acres	(%)
700	14.1	14.2	0.1	1%
880	13.7	13.8	0.1	1%
1,000	13.3	13.4	0.1	1%

[1]Note that substrate was not considered in this evaluation, hydraulic variables (depth and velocity) only.

Table 12 shows the WUA comparisons between Existing and Proposed Action CCV steelhead spawning habitat conditions, under the range of flows most commonly observed during the winter/spring spawning period. The Proposed Action has negligible impact to CCV steelhead spawning habitat from 700 to 1,000 cfs but increases spawning habitat by 33% at 2,000 cfs and up to 271% at 5,000 cfs.

Table 12. Steelhead spawning WUA comparison[1]

Flow (cfs)	Existing (Acres)	Proposed Action (Acres)	Difference	
			Acres	(%)
700	14.6	14.7	0.1	1%
1,000	12.5	12.7	0.1	1%
2,000	7.0	9.3	0.1	33%
3,500	4.8	12.7	2.3	164%
5,000	4.1	15.1	7.9	271%

[1]Note that substrate was not considered in this evaluation, hydraulic variables (depth and velocity) only.

Overall, the Proposed Action is predicted to increase juvenile CV Chinook Salmon and CCV steelhead rearing habitat substantially in the Proposed Action Site over a range of common flows (Tables 7 - 10).

Proposed Action Monitoring

A detailed Monitoring Plan is being developed for the Proposed Action (CFS 2020), with the primary goal of defining the current state of the system before restoration and determining whether the implemented Proposed Action has had the desired effect on target species and overall system health. The Monitoring Plan follows a Before After Control Impact (BACI) design to account for background variation in success metrics. The Monitoring Plan is intended to be a working document, and will be further refined with input from USFWS AFRP, NMFS, CDFW, and the Corps.

The monitoring program consists of four monitoring stages: 1) pre-project site description, 2) implementation, 3) effectiveness, and 4) validation (Table 13). Pre-project monitoring helps identify the baseline for the Proposed Action, including the identification of deficiencies in ecosystem health, and is necessary to detect change over time (Roni 2005). Implementation monitoring will determine if the Proposed Action was constructed according to the design standards. Hydrology, topography and bathymetry, sediment dynamics, and vegetation will be assessed. Effectiveness monitoring will determine if the Proposed Action was effective in meeting target physical and biological objectives. A range of physical and biological traits will be tracked before and after restoration to assess ecosystem function. Pre-project monitoring is essential for effectiveness monitoring because it establishes an objective baseline of ecosystem function with which to evaluate change caused by Proposed Action implementation. Finally, validation monitoring will be conducted to substantiate the underlying assumptions of the restoration work and determine if restoration projects, like the Proposed Action, recover productive habitat that promotes juvenile CV Chinook Salmon and CCV steelhead growth and riparian vegetation recruitment. Surveys of elderberry plant recruitment success in areas within the site that are expected to be favorable for elderberry recruitment will be performed as part of validation and effectiveness monitoring.

The monitoring efforts described in this plan will improve our understanding of restored ecosystem function and the potential of restoring off-channel rearing habitat to enhance salmonid populations within streams impacted by dam flow regulation and channel modification.

Table 13. Monitoring stages associated with Proposed Action.

Monitoring stage	Question addressed	Time frame
Pre-project	What is the baseline condition of the site? Does the site contain special-status species?	1-3 years before project implementation
Implementation	Was the project installed as planned?	2+ years
Effectiveness	Was the project effective at meeting restoration objectives?	1 year to decades
Validation	Are the basic assumptions behind the project conceptual model valid?	1-10 years

Sampling Sites

Sampling sites will be stratified and randomized in the BACI context, and replicate samples within these sites will be collected. Sampling sites will be upstream, within, and downstream of restored reaches. Within the project area, three off-channel (side channel, backwater, floodplain) and three main channel (glide, run, riffle) habitat types will be sampled. Figure 6 depicts the general Project area, with example locations of sampling sites.

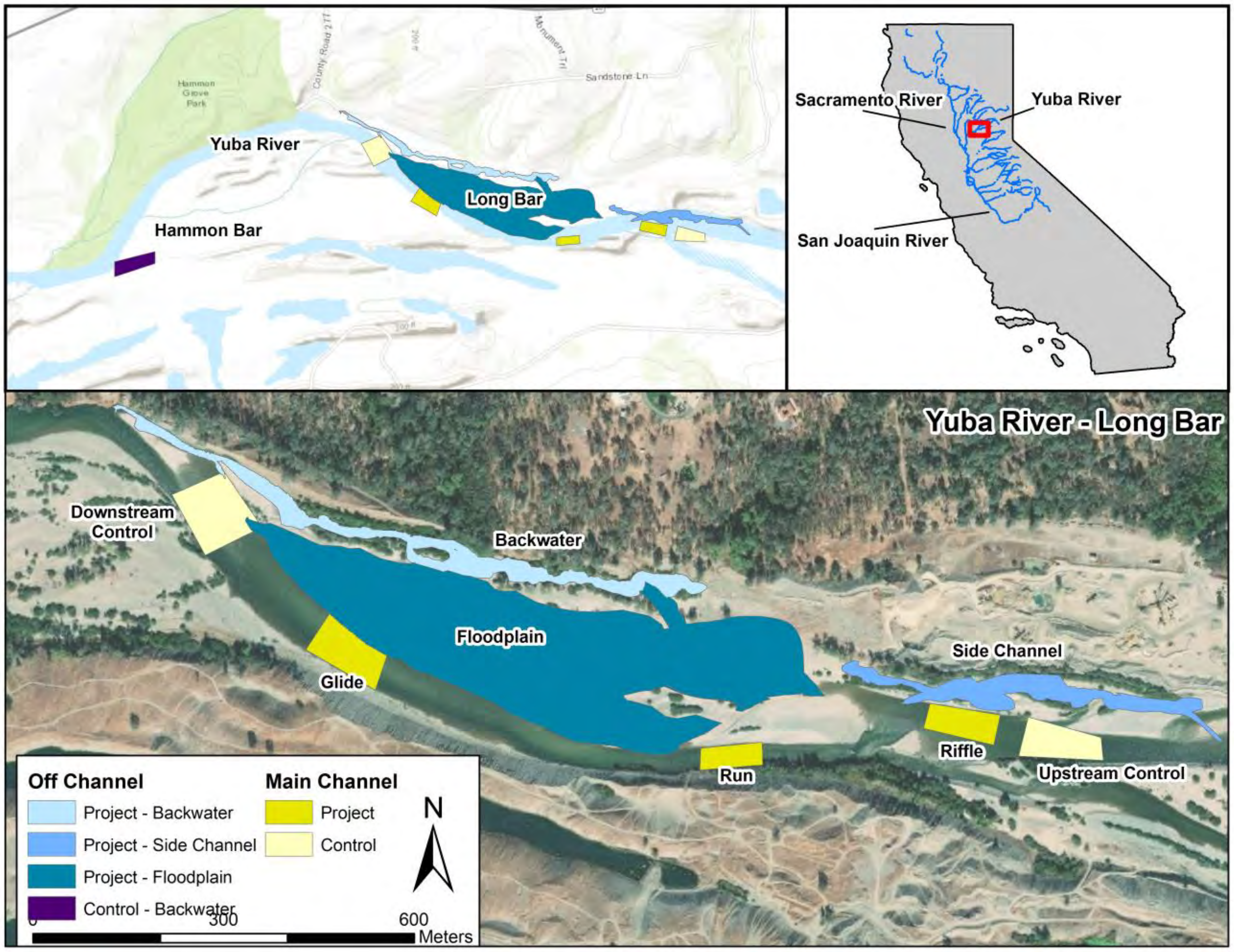

Figure 6. Location of Long Bar Juvenile Salmonid Habitat Restoration Project (Proposed Action). Monitoring will be performed in main channel and off-channel habitats within Proposed Action grading footprint and at control sites within the Yuba River.

Fish Monitoring Surveys

Fish Community

Snorkel surveys will be conducted to test hypotheses related to juvenile use of the restored treatment and unrestored control sites (Table 14). Surveys will be conducted in the spring through summer, coinciding with rearing for juvenile CV fall-run Chinook Salmon (spring), CV spring-run Chinook Salmon (spring and summer), and CCV steelhead (spring and summer; Table 15). Stream flow conditions must also be considered prior to conducting a survey for safety precautions. Snorkeling methods will be consistent with other studies (Edmundson *et al.* 1968; Dolloff *et al.* 1996; Cavallo *et al.* 2004). All surveys will be led by a biologist or senior technician with training and experience conducting snorkel surveys. Sample units will be snorkeled by two or three divers moving upstream adjacent to each other for margin habitats and downstream for mid-channel habitats. Fish will be observed, identified, and counted by size group. Counts will later be converted to densities (fish/m^2) using the transect length and a standard width of 2 m/snorkeler to calculate total area sampled. Fish will be categorized by species and size classes (0-50 mm, 51-80 mm, 81-100 mm, 101-120 mm, 121-150 mm, 151-200 mm, 201-300 mm, and >301 mm).

Depth and velocity will be measured for each fish observation. Habitat characterizations, including qualitative assessments of river margins, cover habitat, and predominant substrate types, will also be assessed. River margins will be classified according to position in the channel (i.e., left, middle, or right). Cover habitat will be broken down into three qualitative classes (i.e., type, size, and quality). Cover types include large woody material, undercut bank, overhanging vegetation, flooded terrestrial plants, aquatic vegetation, and boulders. Aerial extent of the cover (m^2) will also be estimated. Dominant and sub-dominant substrate types will be defined by organic matter/silt, sand, gravel, cobble, boulder, bedrock, and rip-rap.

Table 14. Effectiveness monitoring juvenile salmonid questions and parameters measured.

Question	Parameter
1. Will restored habitat support greater densities of juvenile salmonids compared to unrestored habitats?	Snorkel surveys
2. When off-channel habitat is fully restored, will more complex side channel and backwater habitats support greater densities of juvenile salmonids than floodplain habitat?	Snorkel surveys
3. Which off-channel habitats (side channels, backwater, floodplain) support greater densities of juvenile salmonids over the duration of the rearing season?	Snorkel surveys
4. Will cover features (e.g., large wood, boulders) increase the probability of juvenile salmonid habitat occupancy?	Physical structure mapping (woody material, aquatic and riparian vegetation) Snorkel surveys
5. Will restored habitats support greater drift and/or benthic macroinvertebrate density relative to unrestored habitats and pre-restoration conditions? Will densities differ between off-channel habitats?	Macroinvertebrates (density, biomass)

Table 15: The critical periods for CV fall-run and spring-run Chinook Salmon and CCV steelhead within the Action Area. The dark gray squares represent the primary period of occurrence for that life stage and light gray the secondary period. White indicates absence of the life stage.

Species/ Life Stage	Yuba River Distribution	Month Present											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Central Valley Fall-Run Chinook Salmon													
Adult holding and spawning	Feather River confluence to Englebright Dam												
Egg incubation	Feather River confluence to Englebright Dam												
Juvenile emergence and rearing	Feather River confluence to Englebright Dam												
Juvenile/smolt out-migration	Feather River confluence to Englebright Dam												
Central Valley Spring-Run Chinook Salmon													
Adult migration and holding	DPD pool and locations upstream.												
Adult spawning	Primarily upstream of DPD.												
Egg incubation	Primarily upstream of DPD.												
Juvenile emergence and rearing	Primarily upstream of DPD.												
Juvenile/smolt out-migration	Feather River confluence to Englebright Dam												
California Central Valley steelhead[c]													
Adult migration	Feather River confluence to Englebright Dam												
Adult spawning	Primarily upstream of DPD.												
Egg incubation	Primarily upstream of DPD.												
Juvenile emergence and rearing	Primarily upstream of DPD.												
Juvenile/smolt out-migration	Feather River confluence to Englebright Dam												

Juvenile Chinook Salmon Rearing Experiment

Previous studies have suggested that fish rearing in off-channel habitats exhibit enhanced growth and survival as compared to those in the main channel (Sommer *et al.* 2001; Jeffres *et al.* 2008). However, these studies were conducted in low-elevation, expansive, managed floodplain systems that are geomorphologically and hydrologically quite different from the off-channel habitat present in the LYR and that which will be created/enhanced by the Proposed Action. The extent to which the enhanced growth observed in these studies is applicable to off-channel habitat in the upper reaches of the Sacramento River system is unknown. Backwater/alcove habitat is relatively common in the LYR but it is unknown if this habitat would provide similar growth/survival benefits as demonstrated by previous off-channel habitat studies. To examine this, we will passive integrated transponder (PIT) tag juvenile Chinook Salmon captured by beach seine (see beach seining method description below) and allow them to rear in the backwater habitat at the restoration sites and in an unrestored backwater habitat before and after restoration to test the hypothesis that juvenile salmon rearing in restored off-channel habitats will exhibit greater growth rate and health condition than those that rear in unrestored backwater habitats (Table 16).

Table 16. Juvenile Chinook Salmon rearing experiment questions and parameters measured.

Question	Parameters Measured
Will juveniles that rear in restored off-channel habitats exhibit greater growth rates than those that rear in non-restored habitats?	Juvenile rearing experiment (growth from recaptures and otoliths)
Will juvenile salmonid diet composition and fullness differ before and after restoration, and as compared with an unrestored control site?	Juvenile rearing experiment (stomach contents)
Will the abundance of invasive predatory fish decrease following restoration?	Snorkel surveys

We will release up to approximately 500 fish at each location (additional hatchery fish from the Feather River Hatchery will likely also be used). All natural-origin juvenile Chinook Salmon captured by seining that are PIT-tagged will also have a genetic tissue sample/swab collected from them to determine run (spring-run vs. fall-run) using genetic analysis. The ratio of spring-run to fall-run Chinook Salmon among PIT-tagged fish can be expanded to other juvenile Chinook Salmon captured by beach seine or in the fyke-net which are not genetically analyzed for run. This will allow for an estimate of juvenile spring-run and fall-run Chinook Salmon capture over the course of the experiment. We will recapture the PIT-tagged fish at the downstream end of the backwater using a fyke trap and compare growth, health condition, diet, and development of fish that reared in each habitat.

Prior to fish being released into the restoration site and the unrestored backwater, a fyke-trap with nylon mesh wings which spans the channel will be set up at the exit (downstream) end of each site to recapture fish as they swim towards the main channel. Depending on the final design for the restoration, an additional net may need to be set up at the upstream end following restoration to prevent PIT-tagged fish from migrating upstream out of the system. Traps will be checked daily, and each captured salmon will be scanned with at PIT tag reader, its size (fork length [FL] and weight) recorded, and a photo taken. Incidental catch (including all native and non-native fish species) will also be recorded and measured to provide additional data on fish assemblages. A sub-sample (100; 50 from Project and 50 from Control) of natural origin PIT tagged fish recaptured in the fyke-net will be euthanized and placed into a small vial containing 100% ethanol, and all other fish will be released downstream of the trap. To determine health condition, we will measure lipid content of the fish. Stomach contents will also be analyzed following recapture to assess prey biomass and composition. In addition, we will determine smoltification level to test for differences in development trajectories between fish in restored and unrestored habitat, hypothesizing that fish rearing in restored habitat will develop more quickly and be physiologically more prepared to out-migrate successfully than fish at unrestored sites. This will be accomplished quantitatively using either a handheld chromameter or by taking standardized photos and testing for differences in light reflectance across treatments.

Otoliths will also be collected from a sub-set of the sacrificed juvenile Chinook Salmon. Otoliths have been successfully used to track juvenile Chinook Salmon growth, life history and habitat use (Kennedy *et al.* 2002, Limm and Marchetti 2009). We will follow the methods of Secor *et al.* (1992) for otolith preparation. Right side otoliths will be mounted on microscope slides in Crystalbond™ (Aremco, Valley Cottage, NY) with the sulcus acoustics facing down. The otolith will then be polished using 600 wet grit sandpaper followed by alumina micropolish (0.05 μm grit, Buehler ltd.). Polishing will continue until central primordia and daily increments are clearly visible using light microscopy. The left otolith will be used if the right otolith is in the vaterite form rather than the more common aragonite form.

We will photograph otoliths at 400X using a digital camera mounted to a compound microscope. Daily increment widths will be measured using ImageJ imaging analysis software and a daily growth will be calculated. Two independent researchers will count the number of increments to avoid reader bias in the otolith analysis. We will then measure the ten most recently accreted daily increment widths to characterize growth for each fish at each site. All measurements will be made at a 45° angle to the longitudinal axis at the posterior end, ventral side. We will compare otolith increment width for fish rearing in the restoration site before and after restoration and those rearing in the unrestored backwater. One of the primary hypotheses behind salmonid habitat restoration projects is that juvenile salmonids that rear in restoration areas are expected to have enhanced growth, which would result in higher downstream migration and marine survival (Zabel and Achord 2004, Welch *et al.* 2011, Osterback *et al.* 2014), ultimately resulting in higher adult returns. Otolith microstructure analysis provides a very fine scale for growth analysis, as daily rings are laid down on the otolith with the increment width of each ring corresponding to growth (Neilson and Green 1982). Otolith microstructure analysis has previously been used to compare daily growth between restored and control sites (Miller and Simenstad 1997), including in the Central Valley (Utz *et al.* 2012). Similarly, otolith microstructure analysis has been used to compare daily growth between main channel and off-channel habitat in the Central Valley (Limm and Marchetti 2009). Otolith microstructure analysis will be used to test the hypothesis that juvenile Chinook Salmon rearing in restored habitat will have higher daily growth than those rearing in un-restored habitat.

Macroinvertebrate Sampling

Aquatic macroinvertebrates play a pivotal role in river food webs and provide essential ecosystem services in rivers and streams (Wallace and Webster 1996; Woodward and Hildrew

2002). They function in nutrient cycling, processing both autochthonous and allocthonous carbon inputs, and controlling algal growth (Vannote *et al*. 1980; Power 1992). Juvenile salmonid biomass and production are strongly correlated with invertebrate drift densities (Elliott 1973; Wilzbach *et al.*1986) and drift densities are positively correlated with benthic primary and secondary productivity (Benke *et al.* 1991; Sagar and Glova 1992). Food availability, abundance, and quality determine when and in what condition anadromous juvenile salmonids exit the freshwater riverine system (Sommer *et al.* 2001; Jeffres *et al.* 2008). Despite this, little attention has been paid to the importance of the composition and abundance of invertebrate drift in stream restoration projects (Wipfli and Baxter 2010).

Benthic macroinvertebrates (BMI) generally dominate the diet of juvenile salmonids in CV rivers (Merz and Vanicek 1996; Merz 2001; Utz *et al.* 2012). Previous studies have demonstrated that BMI biomass in newly-inundated off-channel habitats can achieve levels similar to the main channel in a period of four to eight weeks (Merz and Chan 2005). However, floodplains may receive drift BMI from the main channel immediately following inundation that may be more readily available as prey for juvenile salmonids compared to in the main channel due to lower velocity conditions in the floodplain. Over time, BMI production in the inundated floodplain may represent a significant prey source for rearing juvenile salmonids that utilize this habitat.

Terrestrial invertebrates can comprise a significant proportion of drift and are an important food subsidy for juvenile salmonids in some systems (Elliott 1973; Rondorf *et al.* 1990). Terrestrial imports are particularly important in unproductive (e.g., Ellis and Gowing 1957) or impaired rivers, such as the Stanislaus River in the California CV (CFS 2013). Aquatic and terrestrial invertebrate peak densities in the drift may not overlap over the course of the season (Stoneburner and Smock 1979; Sagar and Glova 1992) and juvenile salmonid diets may shift accordingly.

Many studies have demonstrated the importance of biological productivity on salmonid growth rates (Naman *et al.* 2019; Lusardi *et al.* 2018 and 2020), and food availability can be a primary factor in determining fish growth and residency (Wilzbach 1985; Boss and Richardson 2002). Therefore, restoration projects may have limited success if they do not explicitly include juvenile salmonid food requirements and resource availability. Floodplains are nutrient-rich environments that can enhance prey productivity and, subsequently, salmonid growth and survival; however, their productivity is strongly related to inundation duration (Jeffres *et al.* 2008; Bellmore *et al.* 2013). Further, most floodplain research in the CV has focused on reaches far downstream in the system near the San Francisco-San Joaquin Delta, and floodplain productivity and function in river reaches further upstream are not well understood. The hypotheses listed in Table 14 will be tested to determine how physical habitat features influence floodplain productivity and juvenile growth.

Restoration actions including creation/enhancement of side channels and floodplains are predicted to increase the density and biomass of macroinvertebrates in the drift (Table 14, Hypothesis 5). To address this hypothesis, drift sampling will be used to sample both terrestrial and aquatic invertebrates that are present in the drift and readily available for drift-feeding juvenile salmonids during the time period that they are present (January through October). Drift samples would be collected pre- and post-project at both control and treatment sites. Drift macroinvertebrate communities will be monitored through the spring and summer to determine the composition and abundance of various species available to juvenile salmon as prey items. Replicate macroinvertebrate samples will be collected using drift nets from habitats with sufficient flow. Drift insects will also be collected using a drift sampler with 106 µm mesh pulled for 32.8 ft (10 m) across the water's surface. In addition, replicate samples will be collected from all habitats using Schindler traps, which involve taking a standardized water sample from the water column do not require flowing water. Collected samples are rinsed into 500 mL labeled bottles with 70-95% ethanol. Samples will be transported to the laboratory and sorted under a light dissecting scope (e.g., 60X).

Additionally, it is hypothesized that the increase in drift availability will result in a subsequent increase in consumption by juvenile Chinook Salmon (Table 16). To test this hypothesis, a sub-sample of juvenile Chinook Salmon captured by seine or fyke-net in control and restored locations pre- and post-project would be euthanized and preserved for later stomach content analysis. The sampled fish will also be used for otolith microstructure analysis as a secondary means of comparing growth across treatments. Following the methods of Limm and Marchetti (2009), juvenile Chinook Salmon to be euthanized for stomach content and otolith microstructure analysis would be captured between 08:00 and 11:00 am to minimize differential digestion of prey items.

For both stomach content and drift samples, taxa will be identified to the lowest possible taxonomic level, enumerated, and further classified according to size class (<2, 2-7 mm, 8-13 mm, 14-20 mm, > 20 mm) and life stage (larva/nymph, pupa, adult).

Methods

Beach Seine Sampling

In general, a 50 ft wide seine net with 1/8 inch mesh will be used for beach seine sampling. However, a smaller width and/or mesh size may be used depending on seining location and timing. At each seining location three non-overlapping seine hauls will be performed. Seine hauls are typically performed parallel with shore. The seine is stretched out moving in the upstream direction until it is the full width and parallel to shore and then it is pulled by the team into the shore. The team will work together to keep the lead line down while bringing it into shore, making sure that the floats stay at the water surface. If any rocks, sticks, or other objects are caught in the seine, they will be removed to avoid crushing fish and damaging the seine. Water volume sampled is calculated from the length, width and depth of haul area and is used as a metric of effort. After most of the debris has been removed, fish will be concentrated into a small pocket in the seine and removed either by hand or with a net. Fish captured from each seine haul will be stored in separate five gallon buckets containing fresh water and an aerator or live-cars secured in the body of water being seined. No more than 25 fish should be placed into any one bucket, and a live car should be used if water or air temperatures are high. Buckets or live cars should be placed in the shade, and a canopy set up if no natural shade is available. Water quality (temperature and dissolved oxygen [DO]) of recovery buckets will be monitored frequently and water changed if needed, particularly if air temperatures are high. Captured fish will be processed separately for each site using standard procedures, described below. All captured fish will be released in the area of capture after recovering from processing except for juvenile Chinook Salmon selected to be used in the juvenile rearing experiment.

Fyke-net Sampling

Fyke-net sampling will be used as part of the juvenile Chinook Salmon rearing experiment. A four-ft-tall by five-ft-wide fyke made of 1/4 inch nylon mesh or a three-ft-tall by four-ft-wide fyke made of 1/8 inch nylon mesh, both with 25-ft wings, will be used for trapping. The cod end of the fyke net will be connected to a live box that is 4 ft long, 2.5 ft wide, and 2.5 ft high. A velocity break will be inserted into the live box to ensure that captured fish are not impinged on the back of the box. The fyke net will be placed in the downstream end of the backwater/channel and the wings will be extended as necessary by adding additional 1/4 or 1/8 inch nylon mesh to cover the width of the channel. The fyke net is planned to be "fished" continuously during the experiment but may be temporarily removed in advance of a high flow event that would be likely to damage or destroy the equipment. Depending on the number of fish captured and debris loads, the live boxes will be checked once or twice a day, typically in the morning and afternoon, to process fish and to clean debris from the traps and live boxes. During each trap check, the fyke trap will be cleaned of debris and all fish in the live box will be netted out using aquarium nets and placed in five-gallon buckets of fresh river water. Larger, piscivorous fish will be placed in separate buckets from juvenile salmonids and other smaller fish to prevent predation. Water in the buckets will be monitored to ensure that temperature remains within 2°C of the river water and DO is above 5 milligrams per liter (mg/L). Water will be replaced and aerators used, as necessary to maintain water quality. All non-target fish will be identified to species, enumerated, and released. All salmonids with a FL greater than 50 mm will be anesthetized, measured and weighed, and scanned for a PIT tag, while salmonids with a FL less than or equal to 50 mm will only be anesthetized and measured. After processing, the fish will be immediately placed in a recovery bucket with a battery powered aerator. Once all fish in the recovery bucket are behaving normally, they will be released immediately downstream of the live box (except for the sub-sample of 100 recaptures that will be sacrificed for otolith and stomach content analysis).

Anesthetize

Fish will be placed in a five-gallon bucket containing an anesthetic solution created by adding Alka Seltzer Gold brand sodium bicarbonate ($NaHCO_3$) or MS-222 to fresh river water. The lowest concentration of sodium bicarbonate or MS-222 to allow safe fish handling will be used and will vary depending on fish size and water temperature. When using Alka Seltzer Gold, typically one to two tablespoons will be used per gallon of water. MS-222 is typically used at a concentration of 50 mg/L. Smaller fish (fry, small parr) will be placed in the anesthetic solution in groups of ten or fewer while larger fish (large parr, smolts) will be added in groups of two. After groups of fish are placed in the anesthetic solution they will be closely monitored and will be processed immediately after they have lost equilibrium but still have operculum movement. After processing, fish will be placed in aerated five gallon buckets containing fresh river water and allowed to recover until they exhibit normal behavior. Water in the buckets will be monitored to ensure that temperature remains within 2°C of the river water and DO is above 5 mg/L. Water will be replaced and aerators used, as necessary to maintain water quality.

Measure and Weigh

After all juvenile Chinook Salmon and *O. mykiss* greater than 50 mm FL are anesthetized, FL will be measured to the nearest mm and they will be weighed to the nearest 0.01 g. Juvenile Chinook Salmon and *O. mykiss* that are less than or equal to 50 mm FL will only be anesthetized and FL measured to the nearest mm. After anesthetized fish have lost equilibrium, they will be placed on a wetted measuring board and FL measured to the nearest mm. After measuring they will be placed in a tared weigh boat containing river water on the scale and weighed to the nearest 0.01 g. After processing, all fish will either be PIT tagged (see below) or be immediately placed in a recovery bucket containing fresh river water, a battery powered aerator, and Stress Coat (API Inc.) at a concentration of 1 mL per 1 gallon of water.

Passive Integrated Transponder Tag

Only juvenile Chinook Salmon between 55 and 65 mm FL will be PIT tagged with 8 mm tags; fish larger than 65 mm FL will be PIT tagged using a 12 mm tag. While still anesthetized and after measuring and weighing, the juvenile salmonid will be PIT tagged using a PIT tag injector. The needle of the PIT tag injector will be inserted posterior of the tips of the pelvic fins and to the left of the mid ventral line and then the tag injected in the posterior direction. Alternatively, a micro-scalpel may be used to tag the fish in the same location. PIT tags will be sterilized in Nolvasan (chlorhexidine diacetate) disinfectant, rinsed in reverse osmosis or distilled water, and scanned with a handheld PIT tag reader and the unique number recorded on the datasheet before being inserted. The PIT tagging instrument will be dipped in Nolvasan and then reverse osmosis or distilled water between each PIT tagged fish. Immediately after being PIT tagged, the fish will be placed in a recovery bucket containing a battery powered aerator. The PIT tagged fish will only be released once they have recovered (are swimming normally and will avoid/swim away from a disturbance). PIT tagged fish will be re-captured in the fyke-net(s) or during periodic beach seine sampling. After the first batch of PIT-tagged fish have been released, all juvenile Chinook Salmon captured during beach seining or in fyke-nets will be scanned with a handheld PIT tag reader.

Genetic Tissue Sample

A subset of recaptured PIT-tagged juvenile Chinook Salmon (55 mm or greater FL) will have a genetic tissue sample taken via either fin-clip or swab while the fish is anesthetized during processing. A fin-clip will consist of cutting a small piece of tissue from the upper caudal lobe using clean surgical scissors. Tissue size will be approximately 1 mm^2 for fish less than 65 mm and 4 mm^2 for fish greater than 65 mm FL. All scissors will be sterilized in a 20% bleach solution, rinsed in reverse osmosis or distilled water, and then rinsed in 70% ethanol between each use. Each fin-clip will be placed in an individually labeled cryotube filled with 95% ethanol or on a piece of rite in the rain paper and placed in an individually labeled scale envelope. The cryotubes or scale envelopes will be labeled with the sample ID, collection location, date, fish species, and FL.

Genetic tissue samples from juvenile Chinook Salmon will be analyzed by Genidaqs to determine the run of each fish (fall-run or spring-run). This will allow a more accurate estimate of the relative proportion of fall- and spring-run fish that are impacted by the study, and provide resource agencies with important information to better understand the temporal distribution of the two runs.

Humanely Sacrifice

Juvenile Chinook Salmon selected to be sacrificed for otolith and stomach content analysis will be processed for length and weight and then euthanized using an overdose of MS-222. They would then be placed in individually labeled whirl-pacs and placed on ice prior to freezing in the lab.

Proposed Action Conservation Measures

Conservation measures are measures and practices adopted by a project proponent to reduce or avoid adverse effects that could result from project construction, maintenance, or operation. The following sections describe the conservation measures adopted for the proposed restoration activities and follow-up monitoring. These measures will be incorporated in construction documents (plans and specifications) prepared for the Proposed Action and will be contractually required of all construction contractors.

General Measures to Protect Water Quality

Subject to requirements of Section 402 of the federal Clean Water Act and the National Pollutant Discharge Elimination System permitting process, all construction projects that disturb more than one acre of land are required to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP). A SWPPP will be prepared by CFS. The restoration construction contractor(s) will be required to post a copy of the SWPPP at the Project site, file a notice of intent to discharge stormwater with the Regional Water Quality Control Board, and implement all measures required by the SWPPP. A Qualified SWPPP Practitioner (QSP) will be responsible for monitoring to ensure that the provisions of the SWPPP are effectively enforced. In the event of noncompliance, the QSP will have the authority to shut down the construction site or fine the responsible party or parties.

The SWPPP will include the following information and stipulations:

- A description of site characteristics, including runoff and drainage characteristics and soil erosion hazard.

- A description of proposed construction procedures and construction-site housekeeping practices, including prohibitions on discharging or washing potentially harmful materials into streets, shoulder areas, inlets, catch basins, gutters, or agricultural fields, associated drainage, or irrigation features.

- A description of measures that will be implemented for erosion and sediment control, including requirements to:

    - Conduct major restoration activities involving excavation and spoils haulage during the dry season, to the extent possible.

    - Conduct all restoration work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to storm drains and surface waters.

    - Grade and stabilize spoils sites to minimize erosion and sediment input to surface waters and generation of airborne particulate matter.

    - Implement erosion control measures 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.

- A Spill Prevention and Response Plan that identifies any hazardous materials to be used during restoration work; describes measures to prevent, control, and minimize the spillage of hazardous substances; describes transport, storage and disposal procedures for these substances; and outlines procedures to be followed in case of a spill of a hazardous material. The Spill Prevention and Response Plan will require that hazardous and potentially hazardous substances stored onsite be kept in securely closed containers located away from drainage courses, agricultural areas, storm drains, and areas where stormwater is allowed to infiltrate. It will also stipulate procedures, such as the use of spill containment pans, to minimize hazard during onsite fueling and servicing of construction equipment. Finally, the Spill Prevention and Response Plan will require that the County be notified immediately of any substantial spill or release.

- A stipulation that restoration work will be monitored by a QSP to ensure that contractors are adhering to all provisions relevant to state and federal stormwater discharge requirements, and that the QSP will shut down the construction site in the event of noncompliance.

Water Quality Measures for In-Water Restoration Work

In-water work, including all wetted channel and bank modifications, will be restricted to the minimum necessary to support Proposed Action success. In-water work will be limited to the dry season (July 15 –September 30).

- The Proposed Action will comply with Section 401 of the Clean Water Act and obtain certification for construction-related activities to control sediment from entering the main river channel during restoration activities. To minimize risk from additional fine sediments, all trucks and equipment will be cleaned prior to arrival on site. Turbidity and aqueous and sediment total mercury levels will be monitored in accordance with Section 401 permit requirements.

- Stream bank impacts will be isolated and minimized to reduce bank sloughing. The banks will be stabilized following construction activities.

- All equipment working within the stream corridor will be inspected daily for fuel, lubrication, and coolant leaks; and for leak potentials (e.g., cracked hoses, loose filling caps, stripped drain plugs); and all equipment must be free of fuel, lubrication, and coolant leaks. Vehicles or equipment will be washed/cleaned only at off-site areas. All equipment will be steam cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands. All equipment will be fueled and lubricated in a designated staging area located outside the stream channel and banks.

- Only heavy equipment with vegetable-based hydraulic fluid will work in the wetted channel to reduce the potential for water quality impacts to the Yuba River.

- All equipment entering the river will be steam cleaned before it is used elsewhere to minimize the chance of introducing New Zealand mud snails (*Potamopyrgus antipodarum*) to other water bodies.

- Fish and other aquatic organisms will be protected as described under Measures to Protect Biological Resources below.

Measures to Protect Biological Resources
The following measures will apply to all construction and maintenance activities:

Vegetation Protection Measures
In order to avoid and minimize adverse effects on riparian vegetation, the following guidelines will be observed.

- Before restoration work begins, the engineer and a qualified biologist will identify locations for equipment and personnel access and materials staging that will minimize riparian disturbance.

- Existing access points and roads will be used whenever possible in order to avoid disturbance to sensitive locations. Least sensitive areas will be used for parking, stockpiling, and staging areas and these areas will be clearly marked and restored following completion.

- During restoration activities, as much understory brush and as many trees as possible will be retained. The emphasis will be on retaining shade-producing and bank-stabilizing vegetation.

- Impacts on heritage size trees (i.e., greater than 24 inches [61 cm] dbh) will be avoided as possible through use of 30 foot no disturbance buffers. If a heritage sized tree needs to be removed it will be replaced at a 10:1 ratio.

- When chainsaws are used to remove riparian vegetation, saws compatible with vegetable-based bar oil will be used if possible.

- When heavy equipment is required, unintentional soil compaction will be minimized by using equipment with a greater reach or using low-pressure equipment. Disturbed soils will be decompacted when work is completed.

- Any disturbed and decompacted areas outside the restoration area will be revegetated with locally native stock in an appropriate palette.

- Sensitive vegetation (e.g., elderberry shrubs) in the near vicinity of restoration areas will be flagged or fenced.

- All contractors and equipment operators will be given instructions to avoid impacts and be made aware of the ecological value of the site.

Salmonid Protection Measures
To reduce the likelihood of adverse impacts on salmonids that use the LYR corridor, in-water construction, including both stream bank and channel bed construction, will be limited to the dry season (July 15-September 30) and outside of the critical period for salmonids in the LYR.

Procedures to Protect Salmonids during In-Water Work

The majority of work will occur outside of the LYR main channel. In-water work in the LYR main channel will involve the grading and excavation of material to create connections to the main channel for seasonal and perennial side channels and alcove channels. Grading will be performed on floodplain terraces adjacent to the main channel in order to lower their elevation, thereby allowing them to inundate at lower flows. In-water work will also occur in the perennially-inundated backwater and isolated ponds at the downstream end of the Action Area. In these areas, substrate will be added to fill in the ponds and backwater to create the Backwater Channel. In addition, the configuration of the channel areas that currently connect the ponds and backwater may be changed. The backwater and isolated pond complex is groundwater-fed and only connects to the LYR main channel at the downstream end when flows are approximately 2,000 cfs. Surface water enters the upstream end of the backwater complex when flows are approximately 10,000 cfs. The length of the groundwater-fed complex where in-water work will occur is approximately 360 m (1,181 ft) long at its maximum extent when it has a downstream surface connection to the main channel. However, during the summer it typically becomes isolated and is only 230 m (755 ft) long.

The listed fish species that may be present during the in-water construction (15 July-30 September) are juvenile CCV steelhead and CV spring-run Chinook Salmon, with juvenile steelhead more likely to be present as they are present year round in the Yuba River (Yuba RMT 2013) and have been observed in the main channel in the Action Area during all months surveyed (January to October; Table 17). Juvenile CV spring-run Chinook Salmon may be present in very low densities as the majority of them have out-migrated from the Yuba River by the end of June, but it is possible that some juveniles demonstrating the yearling life history strategy may be present (Yuba RMT 2013). However, juvenile Chinook Salmon have not been observed at any of the pre-project survey locations from June-October (Table 17). Backwater pools are not considered suitable habitat for adult salmonids that may be present in the river during the construction period; however, if adults are observed, work will cease until the fish have left the Action Area.

Table 17. Pre-project snorkel survey juvenile Chinook Salmon and *O. mykiss* presence/absence data compiled from surveys conducted in 2017 (May), 2018 (Feb, April, May), and 2020 (January – March, May - October). The Control Backwater was only surveyed in 2020. * O. mykiss were observed during April 2018 outside of the official survey transects.

Habitat	Pre-project Snorkel Observations									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Juvenile Chinook Salmon										
Main Channel										
Project Backwater										
Control Backwater										
Juvenile/sub-adult *O. mykiss*										
Main Channel				*						
Project Backwater										
Control Backwater										

CFS conducted monthly pre-project snorkel surveys February, April, and May in 2018 and January-October (except for April) in 2020 to characterize baseline fish communities prior to restoration and determine the presence or absence of listed fish species. Juvenile salmonids have been observed in the isolated ponds upstream of the backwater, but the ponds primarily contain Sacramento Pikeminnow (*Ptychocheilus grandis*), Sacramento Sucker (*Catostomus occidentalis*), sunfish (family: *Centrarchidae*), and American Bullfrogs (*Lithobates catesbeianus*) (CFS, unpublished data). Juvenile Chinook Salmon were observed in the backwater during the spring when flows were sufficient to create a surface connection with the main channel. However, juvenile Chinook Salmon have not been observed in the backwater during the Proposed Action in-water work months (July-September; Table 17). *O. mykiss* have not been observed in the backwater (Table 17).

A three-tiered approach will be used to minimize the adverse effects on fish during in-stream construction work. The three approaches are the following: 1) construction approach, 2) fish relocation through herding, and 3) fish capture and relocation. Ideally, only the first technique will be used as it will be the easiest to implement and is expected to have the lowest impact to fish, as they will not be subjected to the stress of capture, handling, or transport. However, it is possible that a combination of the methods may be necessary during the in-water work (Figure 7) to complete the restoration and avoid adverse effects. The three methods are discussed in detail below.

Figure 7: The area within the backwater complex where fish relocation may be necessary during construction of the Proposed Action.

Construction Approach

The construction approach will consist of construction beginning at the upstream-most part of the Project and working its way downstream, allowing fish to move volitionally downstream and away from the impact area. The majority of in-water work will involve creating a side channel through the existing ponds and backwater. To accomplish this, prior to any filling or excavation, an excavator would create connector channels between the isolated ponds and the backwater and between the backwater and the main channel, to allow for fish egress. Once suitable downstream egress has been established, in-stream construction will begin at the most upstream section of the channel and work progressively downstream and across the channel. This is expected to allow fish to move progressively downstream and away from the construction impacts and eventually into the LYR main channel. The listed fish species that may be present are juvenile CV spring-run Chinook Salmon that are demonstrating the yearling life history strategy from 7-2 cm (3-5 inches) FL and juvenile CCV steelhead from 5-30 cm (2-12 inches) FL. Juvenile Chinook Salmon and steelhead are highly mobile and would be expected to easily move downstream and away from the impact area with a suitable egress route. Juvenile Chinook Salmon and steelhead are not likely to be present in the ponds or the backwater during the summer because, as mentioned above, they were not observed over the summer in these locations during pre-project snorkel surveys. Once work proceeds past an area, fish will be able to migrate upstream to use the newly created habitat.

If it is not feasible to use heavy equipment to create a downstream egress route prior to starting in-water work, fish relocation will be performed to prevent fish injury and mortality and minimize disturbance.

Fish Capture and Relocation

If the construction approach is not feasible, fish capture and relocation will be implemented. The following guidelines will apply to fish capture and relocation.

- Before fish relocation begins, a qualified fisheries biologist will identify the most appropriate release location(s). Release locations will have water temperatures within 2°C of the capture location, offer suitable habitat for released fish, and will be selected to minimize the likelihood that fish will re-enter the work area.

- The method used to capture fish will depend on the nature of the work site and will be selected by a qualified fisheries biologist who is experienced with fish capture and handling. Areas of complex habitat may require the use of electrofishing equipment, whereas in other areas fish may be captured through seining or dip netting. Electrofishing will only be performed by properly trained personnel following NMFS guidelines (2000). Electrofishing will only be performed if seining and/or dip netting is not feasible.

- Handling of salmonids will be minimized. When it is necessary, personnel will only handle fish with wet hands or nets.

- Fish will be held temporarily in cool, shaded water in a five-gallon bucket with a lid or in a mesh live-car placed in an appropriate location in the river. Overcrowding will be avoided by ensuring that no more than 25 fish are be kept in each five-gallon bucket and limiting each live-car to 50 fish. Aeration will be provided with a battery powered external bubbler. Fish will be protected from jostling and noise and will not be removed from the bucket until the time of release. The water temperature in each bucket will be monitored and partial water changes or the addition of ice and stress coat will be conducted as necessary to maintain a stable water temperature (within 2°C of initial water temperature). Fish will not be held for more than a half hour. If water temperature reaches or exceeds NMFS limits, fish will be released and relocation operations will cease.

- If fish are abundant, capture will pause periodically to allow release and minimize the time fish are held in containers.

- Fish will not be anesthetized or measured. However, they will be visually identified to species level and year classes will be estimated and recorded to support annual take reporting.

- When feasible, initial fish relocation efforts will occur several days prior to the scheduled start of construction and the fisheries biologist will perform a survey on the same day before construction.

- Reports on fish relocation activities will be submitted to Californian Department of Fish and Wildlife (CDFW) and NMFS in a timely fashion.
- If mortality during relocation exceeds 2%, relocation will cease and CDFW and NMFS will be contacted as soon as feasible.

Endangered and Threatened Species

Endangered Species and Critical Habitat within the Action Area

For the purposes of this BA, an endangered species refers to those species that meet one or more of the following criteria:

- Species that are listed or proposed for listing as threatened or endangered under the ESA (50 CFR 17.12 for listed plants, 50 CFR 17.11 for listed animals, and various notices in the Federal Register for proposed species).

Background information on endangered species with potential to occur in the Action Area was compiled through a review of the following resources:

A. USFWS official list of threatened and endangered species that may occur in the Proposed Action location (USFWS 2019)

B. NMFS Endangered and Threatened Species List (NMFS 2004)

C. Inland Fishes of California; revised and expanded (Moyle 2002)

A review of the USFWS species list for the Action Area (USFWS 2019) and the NMFS endangered and threatened species list identified two fish species, CV spring-run Chinook Salmon and CCV steelhead, listed under the ESA as threatened that may occur within the Action Area. Southern Distinct Population Segment of North American Green Sturgeon are not considered in this BA as the Action Area is upstream of DPD which is impassable to Green Sturgeon. Endangered, Threatened, or Proposed Threatened or Endangered Species considered in this BA:

- Central Valley spring-run Chinook Salmon evolutionarily significant unit (ESU) (79 FR 20802). Critical Habitat for CV spring-run Chinook Salmon was designated in 2005 (70 FR 52488).
- California Central Valley steelhead (*O. mykiss*) Distinct Population Segment (DPS) (79 FR 20802). Critical Habitat for CCV steelhead was designated in 2005 (70 FR 52488).

Critical Habitat and Essential Fish Habitat

Critical Habitat is defined as specific locations within the geographical area occupied by the species in which are found those physical and biological features essential to the conservation of the species and which may require special management considerations or protections (ESA section 3(5)(A)(I)). The physical or biological features (PBFs) of Critical Habitat include freshwater spawning habitat, juvenile rearing habitat, and migration corridors. The Action Area serves as a migratory corridor and may provide freshwater spawning habitat for adult CCV steelhead and CV spring-run Chinook Salmon and provides migration and rearing habitat for juveniles of both species.

Pacific salmon, which includes Chinook Salmon, are subject to the MSA and regulated by the Pacific Coast Salmon Fishery Management Plan (FMP). The FMP includes designation of EFH and requires consultation with NMFS if a project or action would potentially affect EFH. EFH applies to Pacific salmon and other commercial fish species and is defined as the aquatic habitat necessary for spawning, breeding, feeding, or growth to maturity. Important components of EFH are substrate; water quality; water quantity, depth, and velocity; channel gradient and stability; food; cover and habitat complexity; space; access and passage; and habitat connectivity. The Action Area is within the designated EFH for Chinook Salmon (includes spring-run and fall-run). Fall-run Chinook Salmon are not federally listed but are covered under the MSA. Critical Habitat and EFH within the Action Area are described in greater detail in the Environmental Baseline.

California Central Valley steelhead (Oncorhynchus mykiss) Distinct Population Segment (DPS)

Listing Status and Critical Habitat

The CCV steelhead DPS is listed as threatened by federal ESA (71 FR 834, 79 FR 20802) and the LYR below Englebright Dam is included in the designated Critical Habitat (70 FR 52488). Critical Habitat is defined by ESA as specific areas within a geographic region where the habitat values are essential for conserving the species. This designation includes river and adjacent riparian areas (NMFS 2005) and restoring rearing areas may be important for conservation (NMFS 2014).

Distribution

NMFS (2009) reported that prior to dam construction, water development and watershed development, CCV steelhead were distributed throughout the Sacramento and San Joaquin rivers (Busby *et al.* 1996, McEwan 2001). Steelhead occurred from the upper Sacramento and Pit rivers, which are now inaccessible due to Shasta and Keswick dams, south to the Kings River, and possibly the Kern River, and in both east- and west-side Sacramento River tributaries (Yoshiyama *et al.* 1996, 2001). Lindley *et al.* (2006) speculates that prior to European settlement, at least 81 independent steelhead populations were distributed primarily throughout the eastern tributaries of the Sacramento and San Joaquin rivers. Presently, impassable dams block access to 80 percent of historically available habitat, and block access to all historical spawning habitat for about 38 percent of historical populations (Lindley *et al.* 2006). Existing wild CCV steelhead stocks are mostly confined to the Sacramento River and its tributaries, including Antelope, Deer, and Mill creeks, and the Yuba River. Populations may exist in Big Chico and Butte creeks, and a few wild steelhead are produced in the American and Feather rivers (McEwan 2001). NMFS reports that CCV steelhead also currently occur in the Stanislaus, Calaveras, and Tuolumne rivers (NMFS 2014).

Habitat Requirements and Life Ecology

Steelhead have the greatest diversity of life history patterns of any Pacific salmonid species, including varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations (Sogard *et al.* 2012). Adult migration from the ocean to CV spawning grounds occurs during much of the year, with peak migration occurring in the fall or early winter (Table 12). Migration through the Sacramento River main stem begins in July, peaks at the end of September, and continues through February or March (Bailey 1954 and Hallock *et al.* 1961, both as cited in McEwan and Jackson 1996 [Table 12]). CCV steelhead typically return from the ocean at ages two or three, weighing 2-12 lbs (0.9-5.4 kg) (Reynolds *et al.* 1993). CCV steelhead are mostly 'winter steelhead'; that is, they mature in the ocean and arrive on the spawning grounds nearly ready to spawn. In contrast, 'summer steelhead', or stream-maturing steelhead, enter freshwater with immature gonads and typically spend several months in freshwater maturing before spawning. Winter steelhead prefer cold water between 13°C-21°C that is saturated with DO.

In the LYR, two forms of *O. mykiss* exist: rainbow trout, the resident form that remains in the river its entire life, and steelhead, the anadromous form that migrates to the ocean as a juvenile and returns to the river to spawn one or more times (Mitchell 2010). The relationship between resident and anadromous forms is not well understood, but some evidence suggests the two forms interbreed and produce juveniles of the alternate form (Shapovalov and Taft 1954, Zimmerman *et al.* 2009). No genetic differentiation has been found between forms, supporting this hypothesis (Busby *et al.* 1993, Nielsen 1994, Van Doornik and Berejikian 2015). The Feather River Fish Hatchery propagates CCV steelhead as mitigation for production lost after construction of Oroville Dam. Adipose fin-clipped hatchery steelhead have been observed to stray into the LYR by the Vaki Riverwatcher system at DPD (Yuba RMT 2013). From 2010-2012, 43%-63% of upstream migrating steelhead were adipose fin-clipped, indicating that they were of hatchery origin (Yuba RMT 2013).

Historically, CCV steelhead spawned primarily in upper stream reaches and smaller tributaries. As a result of CV water development projects, most spawning is now confined to lower stream reaches below dams. In a few streams, such as Antelope, Mill, and Deer creeks, CCV steelhead still have access to historic spawning areas. CCV steelhead spawning in the upper Sacramento River generally occurs between November and late April, with a peak between early January and late March (NMFS 2014). Adult CCV steelhead immigration and holding in the Lower Feather River occurs from August through March, with spawning occurring from January through March (Hartwigesen and Reid 2009; Reid and Kastner 2011 [Table 3]). Adult CCV steelhead immigration and holding in the LYR occurs from August through March with spawning occurring from January through April (Yuba RMT 2013; Kammel and Pasternack 2014).

CCV steelhead are generally iteroparous; they may return to the ocean after spawning and repeat the spawning cycle (Narum *et al.* 2008). The percentage of Feather River steelhead adults repeat spawning has been documented between approximately one and five percent (Mercer and Kurth 2012). Recent acoustic tagging studies of Coleman Hatchery kelts (spawned steelhead) indicate that reconditioned kelts released in late spring may out-migrate to the Pacific Ocean within weeks to months of release and return to freshwater the following fall (Null *et al.* 2013). Others may remain in freshwater for an undetermined time (Null *et al.* 2013).

CCV steelhead in the LYR use riffle transitions, riffles, fast glides, slow glides, and point bars for spawning depending on the discharge (Kammel and Pasternack 2014). Spawning steelhead in the LYR prefer areas with mean water column velocity of 1.2 to 2.3 feet per second, water depths of 1.3 to 2.8 feet, and the medium gravel/small cobble (32-90 mm) substrate size class (Kammel and Pasternack 2014). CCV steelhead in the Lower Feather River primarily use riffle habitats with substrates composed of small and large gravel (Hartwigsen and Reid 2009; Reid and Kastner 2012). The survival of embryos is reduced when fine substrates with a diameter smaller than 0.5 inches (1.3 cm) comprises more than 20-25 percent of the total substrate by volume. Studies have shown higher embryo survival when intragravel velocities exceed eight in/hr (0.2 m/hr) (Coble 1961, Phillips and Campbell 1961).

The number of days required for steelhead eggs to hatch is inversely proportional to water temperature and varies from about 19 days at 15.6°C (60.1°F) to about 80 days at 5.6°C (42.1°F). Embryo incubation in the LYR occurs from January through May (Yuba RMT 2013). Fry typically emerge from the gravel two to three weeks after hatching (Barnhart 1986). Upon emerging from the gravel, fry rear in stream margin habitats and move gradually into pools and riffles, as they grow larger (Merz *et al.* 2015). Older fry establish territories, which they defend. Cover is an important habitat component for juvenile steelhead both as velocity refuge and as a means of avoiding predation (Shirvell 1990; Meehan and Bjornn 1991). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Suitable habitat in the Lower Feather River can be found in the main channel, but the bulk of rearing occurs in Hatchery Side Channel and other smaller side channels where there is abundant instream and overhead cover (Mercer 2012). Young steelhead feed on a wide variety of aquatic and terrestrial insects, and gradually become more piscivorous as they grow; emerging fry are sometimes preyed upon by older juveniles (Merz and Vanicek 1996; Merz 2002). In winter, they become inactive and hide in any available cover, including gravel or woody debris.

Rearing juvenile CCV steelhead may reside in freshwater all year (Merz 2002; Sogard *et al.* 2012; Merz *et al.* 2015 [Table 12]). Water temperature and food availability influence the growth rate, population density, swimming ability, ability to capture and metabolize food, and ability to withstand disease (Barnhart 1986; Bjornn and Reiser 1991; Sogard *et al.* 2012). Optimal temperatures for Feather river steelhead growth range between 62.6-68.0°F (17-20°C), and juvenile steelhead have an upper lethal limit of 85.8°F (29.9°C) (Myrick and Cech 2000). Adequate flow and water temperature conditions are important factors for juvenile survival and growth (CDFG 1998). During rearing, suspended and deposited fine sediments can directly affect salmonids by abrading and clogging gills, and indirectly cause reduced feeding, avoidance reactions, destruction of food supplies, reduced egg and alevin survival, and relocation to another rearing habitat (Suttle et al. 2004; Reiser and Bjornn 1979). Bell (1986) found that silt loads of less than 25 mg/L permit good rearing conditions for juvenile salmonids. Increasing concentrations of deposited fine sediment in gravel bedded streams has been observed to decrease growth and survival of juvenile salmonids (Suttle *et al.* 2004, Harvey *et al.* 2009).

Generally, CCV steelhead that are successful in surviving to adulthood spend at least two years in freshwater before out-migrating downstream (Sogard *et al.* 2012). However, CV populations below non-passable barriers contain some component of the population that does not demonstrate anadromy (Sogard *et al.* 2012). Out-migration appears to be more closely associated with size than age, but environmental conditions appear to influence the proportion of the population demonstrating anadromy (Sogard *et al.* 2012). While juvenile CCV steelhead rearing and downstream migration occur year-round, the peak out-migration period for naturally-spawned CCV steelhead juveniles migrating past Knights Landing on the lower Sacramento River ranges from late December through May (McEwan 2001). Feather River rotary screw traps (RSTs) operated at multiple locations collected CCV steelhead from February through June, with peaks in March and April (Bilski and Kindopp 2009). In streams south of the American River, CCV steelhead out-migration has been observed from November through July (Bilski and Rible 2011, CFS 2015).

Current Population and Critical Habitat Status

There is very little monitoring focused on CCV steelhead; as a result, population trends and status are largely unknown. However, analyses of CCV steelhead abundance across the DPS indicate that naturally reproducing stocks are suffering severe and long-term declines range-wide. In the Sacramento River and its tributaries below impassable barriers there are small, remnant populations of CCV steelhead present (NMFS 2014). Recent counts of CCV steelhead in several of these streams indicate that they generally have CCV steelhead returns less than 1,000 adults (NMFS 2016). In the San Joaquin River tributaries the CCV steelhead populations are very small, with most fish apparently demonstrating the resident phenotype (Zimmerman *et al.* 2009; Sogard *et al.* 2012). Trawl data at Chipps Island suggest that natural production of CCV steelhead is very low (NMFS 2016). These apparent population declines have been attributed to longstanding human-induced factors that exacerbate the adverse effects of natural environmental variability (NMFS 1996). Important factors in this decline include habitat destruction and degradation of freshwater spawning and rearing habitat, river flow regulation, hatchery trout planting, over-fishing, and the introduction of non-native piscivorous fish species (62 FR 43937). In particular, impassable dams block access to 80 percent of historically available habitat and block access to all historical spawning habitat for about 38 percent of historical populations (Lindley *et al.* 2006). The presence of C rim dams has created a tendency for *O. mykiss* to remain in cold tailwater-influenced areas with less biological motivation for exiting into marine waters.

The condition of CCV steelhead Critical Habitat throughout their range, and specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. The depressed population conditions are in part due to anthropogenic activities that have affected Critical Habitat, including: agricultural and mining activities, dams, stream channel modification, wetland loss, and water withdrawals, including unscreened irrigation diversions. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and LWD, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion entry to streams from upland areas, loss of shade, and loss of nutrient inputs. Depletion and storage of natural river flows have drastically altered natural hydrologic cycles in most rivers in the DPS. Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage; fish stranding from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions; and water temperature alteration that adversely affects the species.

Central Valley Spring-Run Chinook Salmon (Oncorhynchus tshawytscha)

Listing Status

The CV spring-run Chinook Salmon ESU is listed as threatened under the ESA (64 FR 50394, 79 FR 20802) and California Endangered Species Act and Critical Habitat was designated in 2005 (70 FR 52488), which includes the LYR below Englebright Dam.

Distribution

Historically, spring-run Chinook Salmon occurred in the headwaters of all major river systems in the CV that lacked barriers to migration (Yoshiyama *et al.* 2001). In the Feather River watershed, both spring- and fall-run Chinook Salmon were known to exist, with spring-run Chinook Salmon found up to elevations of ~5,000 ft (Yoshiyama *et al.* 2001). Fry 1961 (as cited in Yoshiyama *et al.* 2001) reported runs of 1,000-4,000 spring-run Chinook in the Feather River, mostly spawning in the Middle Fork with smaller numbers spawning in the North Fork, South Fork, and the West Branch. Since the construction of Englebright Dam (1910) the majority of spawning habitat is inaccessible, however spawning still occurs below the dam.

Habitat Requirements and Life Ecology

In general, spring-run Chinook enter the Lower Feather River in March to June as immature adults. Adult spring-run Chinook Salmon migrate into the LYR in April through June. Some spring-run Chinook Salmon run hold during the summer upstream of the Highway 20 bridge; the rest of the run holds below DPD and then, before the end of September, migrates upstream of the Highway 20 bridge to spawn. Spring-run Chinook Salmon spawning generally occurs from the beginning of September through the middle of October (Yuba RMT 2013). Chinook Salmon spawn in moderately-sized cobble in riffles, riffle transitions, run, and fast glide habitat (Pasternack *et al.* 2014; Merz *et al.* 2004). Spawning distribution and incubation success are important factors controlled by substrate size and intragravel flow (McNeil 1964). Female Chinook Salmon excavate a redd that is typically 111-189 ft^2 (10.3-17.6 m^2) in size (Healey 1991). The female defends the redd until death, and fertilized eggs incubate for about 13 weeks, depending on water temperature (Bjornn and Reiser 1991). In the American River, Chinook Salmon egg survival varied with temperature, the highest survival occurring when temperatures ranged between 53-54 ˚F (~12˚C) and in the Sacramento River eggs became more likely to die or suffered reduced viability above 57 ˚F (14˚C) and 100% mortality occurred when temperatures rose above 65 ˚F (18˚C) (Seymour 1956 and Hinze *et al.* 1959, both as cited in Boles 1988). Larvae hatch with yolk sacs and remain in substrate until the sac is absorbed, about two to three weeks. Spring-run Chinook Salmon fry begin to emerge from the gravel starting in November and continuing through February (Yuba RMT 2013). After emerging, fry disperse downstream or to lateral margins of the river. Large numbers of fry have been captured at the mouth of the river in wet years. Spring-run Chinook Salmon fry rearing occurs in the LYR from mid-November to mid-February and young of the year out-migration occurs from mid-November through June. Some spring-run Chinook Salmon in the LYR rear for a year before out-migrating as smolts between October and March. However, the majority of Chinook Salmon out-migrate as fry (30-49 mm), with peak out-migration generally occurring in late January and 95% of out-migration occurring prior to April 30 (Yuba RMT 2013). A similar pattern is observed in the Feather River with most juveniles appearing to out-migrate from the upper river quickly and a smaller proportion holding and rearing through spring (Bilski and Kindopp 2009; Mercer 2012). Rearing habitat and conditions require cover, space, and food, and in the lower reaches fry have been observed using channel irregularities, instream and overhead cover, and low velocity channels to provide refuge (Cavallo *et al.* 2004; Mercer 2012) as well as an increasing reliance on turbidity as cover (Gregory and Levings 1998).

Current Population and Critical Habitat Status

Historically, spring-run Chinook Salmon were likely the most abundant salmonid in the CV, but have suffered the most severe declines of any of the four CV Chinook Salmon runs (NMFS 2014; Yoshiyama *et al.* 1996). CV spring-run Chinook Salmon runs may have been as large as 1,000,000, but recent returns have averaged around 10,000 (NMFS 2014; Yoshiyama *et al.* 1996). Analyses of spring-run Chinook Salmon abundance across the ESU indicate that naturally reproducing stocks are suffering severe and long-term declines, range-wide, including within the Action Area (NMFS 2014). Currently, there are only three CV streams (Mill, Deer, and Butte creeks) that support self-sustaining and non-hybridized populations, and each of these populations are small and isolated. The only hatchery that produces spring-run Chinook Salmon, Feather River Fish Hatchery, has experienced considerable hybridization between spring-run and fall-run Chinook Salmon, imperiling the genetic integrity of the run (NMFS 2014). A reintroduction program is occurring for spring-run Chinook Salmon in the San Joaquin River downstream of Friant Dam. CV spring-run Chinook Salmon Critical Habitat has been degraded by a host of anthropogenic impacts, and reaches with conditions known to support viable salmonid populations are severely limited. This hinders the ability of currently designated Critical Habitat to provide for the conservation of spring-run Chinook Salmon. Factors that have adversely affected Critical Habitat include agricultural and mining activities, dams, stream channel modification, wetland loss, and water withdrawals, including unscreened irrigation diversions. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and LWD, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion entry to streams from upland areas, loss of shade, and loss of nutrient inputs. Impassable dams prevent CV spring-run Chinook Salmon from accessing virtually all historic spawning habitat in the CV (Lindley *et al.* 2007). Depletion and storage of natural river flows have drastically altered natural hydrologic cycles in most rivers designated as Critical Habitat. Alteration of flows can result in migration delays, loss of suitable habitat due to dewatering and blockage, stranding of fish due to rapid flow fluctuations, entrainment of juveniles into poorly screened or unscreened diversions, and stressful water quality conditions.

Central Valley Fall-run Chinook Salmon (Oncorhynchus tshawytscha)

Listing Status

CV fall- and late fall-run Chinook Salmon are considered by NMFS to be in the same Evolutionary Significant Unit (ESU) (64 FR 50394). NMFS determined in 1999 that listing this ESU as a threatened species was not warranted (64 FR 50394), but subsequently classified this ESU as a Federal Species of Concern because of specific risk factors, including population size and hatchery influence in 2004 (69 FR 19975). In the CV, fall-run Chinook Salmon are the most numerous of the four salmon runs, and continue to support commercial and recreational fisheries of significant economic importance. Because of its commercial importance, fall-run Chinook Salmon and its designated EFH are managed under the MSA. In the Yuba River, EFH is designated downstream of Crocker-Huffman Diversion Dam.

Distribution

Historically, CV fall-run Chinook Salmon spawned in all major CV rivers from the Kings River in the south to the Upper Sacramento in the north (Yoshiyama *et al.* 2001). Currently, they are restricted in their distribution by impassible dams with spawning occurring downstream of dams on all major rivers from the Sacramento River below Keswick Reservoir in the north to the Merced River below Crocker Huffman Diversion Dam in the south (Yoshiyama *et al.* 2001). In the Yuba River, CV fall-run Chinook Salmon occur from below Englebright Dam downstream to the confluence with the Feather River.

Habitat Requirements and Life Ecology

CV fall-run Chinook Salmon spend most of their lifecycle in the North American Pacific Ocean coastal waters but must return to freshwater to reproduce (Merz *et al.* 2013). During immigration, adults stop feeding and live on body fat reserves. Although cues triggering adult return to natal spawning grounds are not well understood, it is thought that the ability to navigate is mainly related to long-term olfaction memory (Dittman and Quinn 1996). Homing ability may also be aided by vision (Healey 1991), and celestial and magnetic compass orientation (Quinn 1980), and may be stimulated by changes in streamflow, turbidity, temperature, and oxygen content (Allen and Hassler 1986). Migratory routes must be free of barriers that impede movement upstream and downstream. Numerous factors, such as predation, harvest, water diversion structures, physical barriers, channel modification, and water quality affect an adult's ability to reach spawning areas and complete successful spawning (Hillemeier 1999; Beamesderfer 2000; Goniea *et al.* 2006).

In general, Chinook Salmon spawn in stream gravels with a median diameter up to about 10% of their body length (Zeug *et al.* 2014; Kondolf and Wolman 1993). Proximity to cover and flow shear zones provide important refuge from predation and resting zones for energy conservation (Merz 2001; Wheaton *et al.* 2004). During spawning, females force gravel and fine sediment into the water column, which coarsens the spawning substrate and creates an oval depression with a mound of bed material located immediately downstream (Crisp and Carling 1989). Often several males will court a female and her eggs may be fertilized by more than one male. Chinook Salmon spawn once and then die (semelparity) although individuals may survive for days to weeks after spawning completion.

Fecundity and egg size differ among salmon stocks inhabiting different geographic areas (Fleming and Gross 1990; Myers *et al.* 1998). For example, the average number of eggs per female CV fall-run Chinook Salmon from the Mokelumne River is 5,423 (range: 2,132-9,492) while the average for the Sacramento River is 7,423 eggs (range: 4795-11,012) (Healey and Heard 1984; Kaufman *et al.* 2009). Density-dependent (e.g., disease, redd superimposition) and density-independent variables (e.g., temperature, flow) can affect spawning success and health of gametes released to the stream (Patterson 2004; Tierney *et al.* 2009). Since available spawning areas are limited, late spawners may superimpose redds on previously constructed sites. Superimposition can be a major mortality factor for incubating embryos, causing a density-dependent relationship in which fry production is inversely related to adult spawner numbers (McNeil 1964; Heard 1978; Buklis and Barton 1984; Parenskiy 1990; Chebanov 1991).
Female salmon bury fertilized eggs in redds, where they develop in gravel interstices. Incubation generally lasts from 40-90 days at water temperatures of 40-54°F (Bams 1970; Heming 1982; Bjornn and Reiser 1991; Geist *et al.* 2006). Alevins may remain in the gravel for four to six weeks after hatching, receiving nutrients and energy from their yolk sacs before emerging to the water column (Moyle 2002). Incubation is highly dependent on water temperature, DO, and substrate permeability (Merz *et al.* 2004). For successful incubation, gravel must be sufficiently free of fine sediment to adequately bring DO to embryos, carry off metabolic wastes, and not hinder emergence (Tappel and Bjornn 1983; and see discussions in Chevalier *et al.* 1984 and Groot and Margolis 1991). Other water quality-related parameters (e.g., disease, contaminants) can further affect development and survival (Merz *et al.* 2006).

Newly emerged young are often found in shallow, slow-moving water and transition to deeper, faster water as they increase in size (see Cramer and Ackerman 2009). Habitat complexity (e.g., woody debris, overhanging vegetation, seasonally inundated areas) provides juvenile hiding, resting, and feeding habitat, increasing ability to grow, mature, and survive out-migration. Juvenile diets often vary by habitat type, but terrestrial and aquatic invertebrates, and larval fish and eggs are important prey for juvenile salmon upstream of the Delta (Sasaki 1966; Merz and Vanicek 1996; Sommer *et al.* 2001). Prey size and ingestion rates are affected by juvenile size and water temperature (Merz 2002). Floodplains may provide better juvenile rearing opportunities because they often have more optimal temperatures, are rich in prey items, and provide refuge from salmon predators and high flows (Sommer *et al.* 2001; Jeffres *et al.* 2008). Habitat availability, water quality, and predation are examples of environmental parameters that can affect successful rearing (Lindley and Mohr 2003).

When and how out-migrants leave a natal stream depends on individual genetics, social cues, and environmental factors individuals are exposed to as they emerge, rear, and migrate downstream. Within the CV, fall-run Chinook Salmon out-migration size varies extensively. For example, juvenile CV fall-run out-migrate as fry (<55 mm [2.2 in] FL), parr (>55 mm [2.2 in] FL and <75 mm [3 in] FL), or smolts (>75 mm [3 in] FL) (Brandes and McLain 2001; Williams 2001; Sturrock *et al.* 2015). In some systems, the proportion of salmon leaving as fry, parr, or smolts may shift from year to year. While several researchers have questioned if fry out-migrants make a significant contribution to adult populations (Brandes and McLain 2001; Williams 2001), Miller *et al.* (2010) and Sturrock *et al.* (2015) demonstrated that fry-sized CV Chinook Salmon out-migrants are a viable life history strategy. Flow, temperature, water quality, diversion, and predation are thought to be key parameters affecting successful out-migration (Sabal *et al.* 2016; Cavallo *et al.* 2013).

Juvenile fall-run Chinook Salmon in the Yuba River primarily out-migrate as fry shortly after emergence, although some individuals rear in the river for up to several months before out-migrating (Yuba RMT 2010). According to RST data, fall-run Chinook Salmon emergence and rearing period generally extends from mid-December through June, and out-migration may occur throughout this period (Yuba RMT 2010).

Action Area

The NMFS defines the Action Area as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations [CFR] §402.02.). The Action Area for proposed actions that involve instream construction work must include the Proposed Action footprint and the area downstream, where instream construction activities can temporarily decrease water quality. The effects of increased turbidity will attenuate downstream as suspended sediment settles out of the water column. Instream projects with a larger footprint than the Proposed Action have created turbidity plumes of 25-75 nephelometric turbidity units (NTUs) extending up to 1,000 ft (304.8 m) downstream as a result of instream construction activities (NMFS 2006). Therefore, a conservative definition of the Action Area for restoration projects with instream activities includes the project boundary and the segment of river extending from the edge of the Proposed Action boundary to 1,000 ft (304.8 m) downstream. The Action Area for this Proposed Action also includes adjacent biological monitoring control sites that are located both upstream and downstream of the Proposed Action footprint. These sites will be affected by the Proposed Action during pre-and post-project monitoring activities to determine restoration effectiveness (CFS 2020). Therefore, the Action Area for the Proposed Action includes the reach of the LYR mainstem from the upstream control site to the downstream boundary and extending downstream for 1,000 ft and the backwater control site (downstream of the Proposed Action grading footprint on river left; Figure 8). This is the area in which the Proposed Action could result in direct or indirect effects on federally listed species. Figure 8 shows the Action Area boundary and the restoration grading extent.

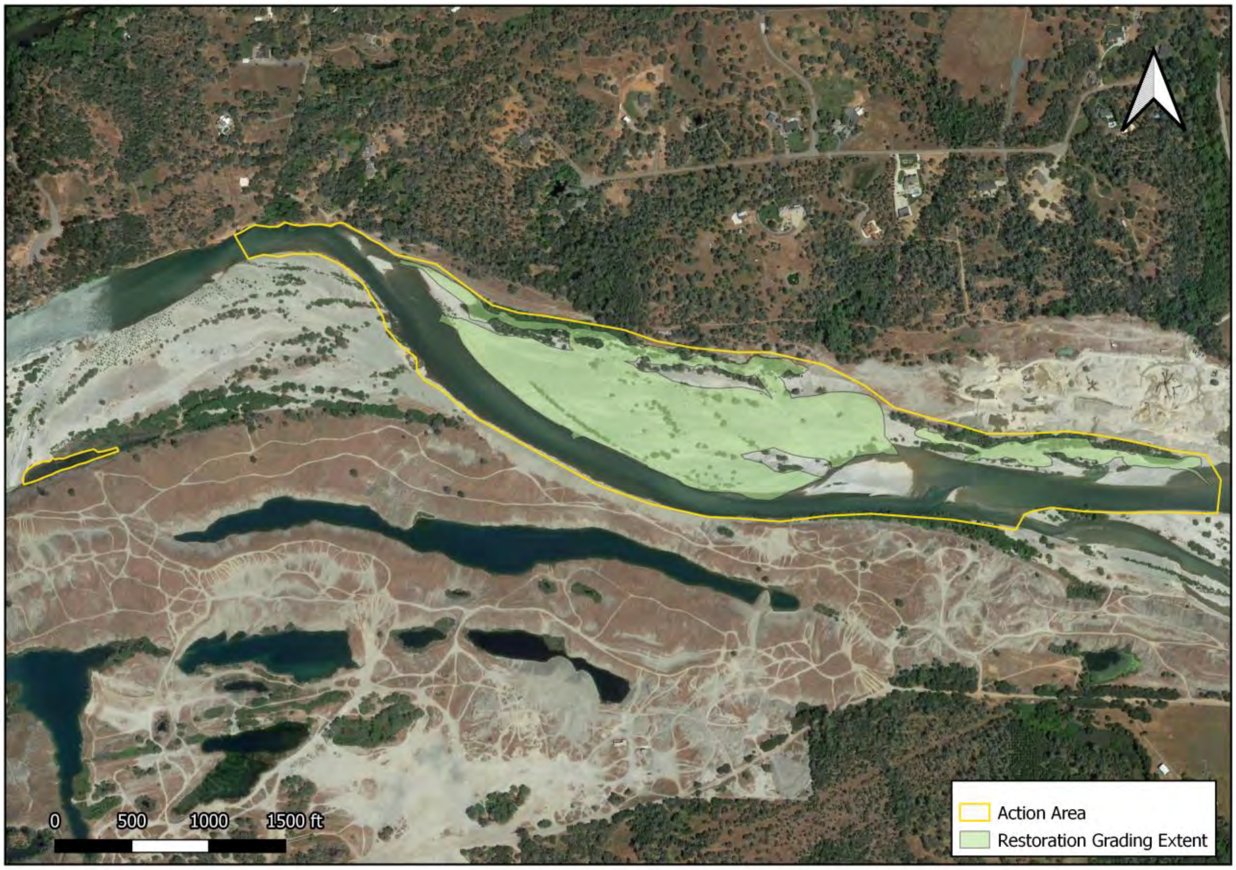

Figure 8. The Action Area for the Proposed Action.

Environmental Baseline

The LYR downstream of Highway 20, including within the Action Area, is confined by massive cobble and gravel deposits derived from hydraulic and dredge mining activities ("training walls") resulting in a relatively simple river corridor dominated by a single main channel and large cobble-dominated bars, with little riparian and floodplain habitat (as summarized in cbec *et al.* 2010). Many areas within the LYR's historic corridor, including within the Action Area, are now hydrologically disconnected from the main channel during more frequent flood flows (1.5-5 year recurrence interval) due to anthropogenic impacts including, but not limited to, the construction of training walls and deposition of mining tailings in the channel that reduce floodplain availability, and reduction in flood flows due to flow regulation (cbec *et al.* 2010). The LYR within the Action Area is comprised largely of a large gravel bar on the north side of the river and the main channel of the LYR which has relatively little complexity. At the upstream end of the site, a long side channel enters the main channel on river left. At the downstream end of the site, on river right, there is a perennial backwater/pond (Figure 4). These two features comprise the existing off-channel habitat within the Action Area adjacent to or within the Proposed Action grading footprint. Within the Action Area, the main channel is constrained on river left by a large training wall that was built in the early 1900's to realign the river to the north and confine it to facilitate gold dredge mining to the south in the goldfields. On river right, at the upstream end of the Proposed Action grading footprint, there is a smaller training wall maintained by SRI to minimize flooding of their aggregate operation. Currently, the large gravel bar within the Proposed Action grading footprint on river right does not start inundating until flows exceed 10,000 cfs. Despite the historic impacts to fish habitat, the Action Area still supports rearing juvenile Chinook Salmon, CCV steelhead, and other native fish species (CFS, unpublished data; see Baseline Fish Monitoring Data Summary, below). Chinook Salmon redds have also been observed in the LYR main channel within the Action Area (CFS, unpublished data).

Baseline Fish Monitoring Data Summary

Pre-project snorkel surveys were performed in May 2017; February, April, and May 2018; and monthly from January to March and May to September 2020 (Figure 9). Total number of juvenile Chinook Salmon observed each year was 0 in 2017, 1,151 in 2018, and 16,869 in 2020 (Figure 9). Only one survey was performed in 2017 due to sustained extreme high flows through the spring rearing period, which increased turbidity and created unsafe conditions for snorkeling. In 2020, the most juvenile Chinook Salmon were observed in February (8,994) while in 2018 the most were observed in May (659; Figure 9). Mean juvenile Chinook Salmon density was lower in 2018 compared to 2020 (Figure 10). The highest mean juvenile Chinook Salmon density in 2018 was observed in the Project Backwater in May (0.82 fish/m² ± 0.24 standard error [SE]; Figure 10). The highest mean juvenile Chinook Salmon density in 2020 was observed in the Project Main Channel (5.34 fish/m² ± 0.42 SE; Figure 10). Low flows in 2020 did not allow juvenile Chinook Salmon to access either the Project or Control Backwater sites (Figure 10). Snorkel surveys of the Control Backwater site did not occur until 2020. It is visually impossible to distinguish between juvenile spring-run and fall-run Chinook Salmon and length-at-date criteria is known to be an unreliable way to designate CV Chinook Salmon runs (Harvey et al. 2014), but juveniles observed in January were more likely to be spring-run as they emerge earlier than fall-run due to earlier spawn timing (Yuba RMT 2013).

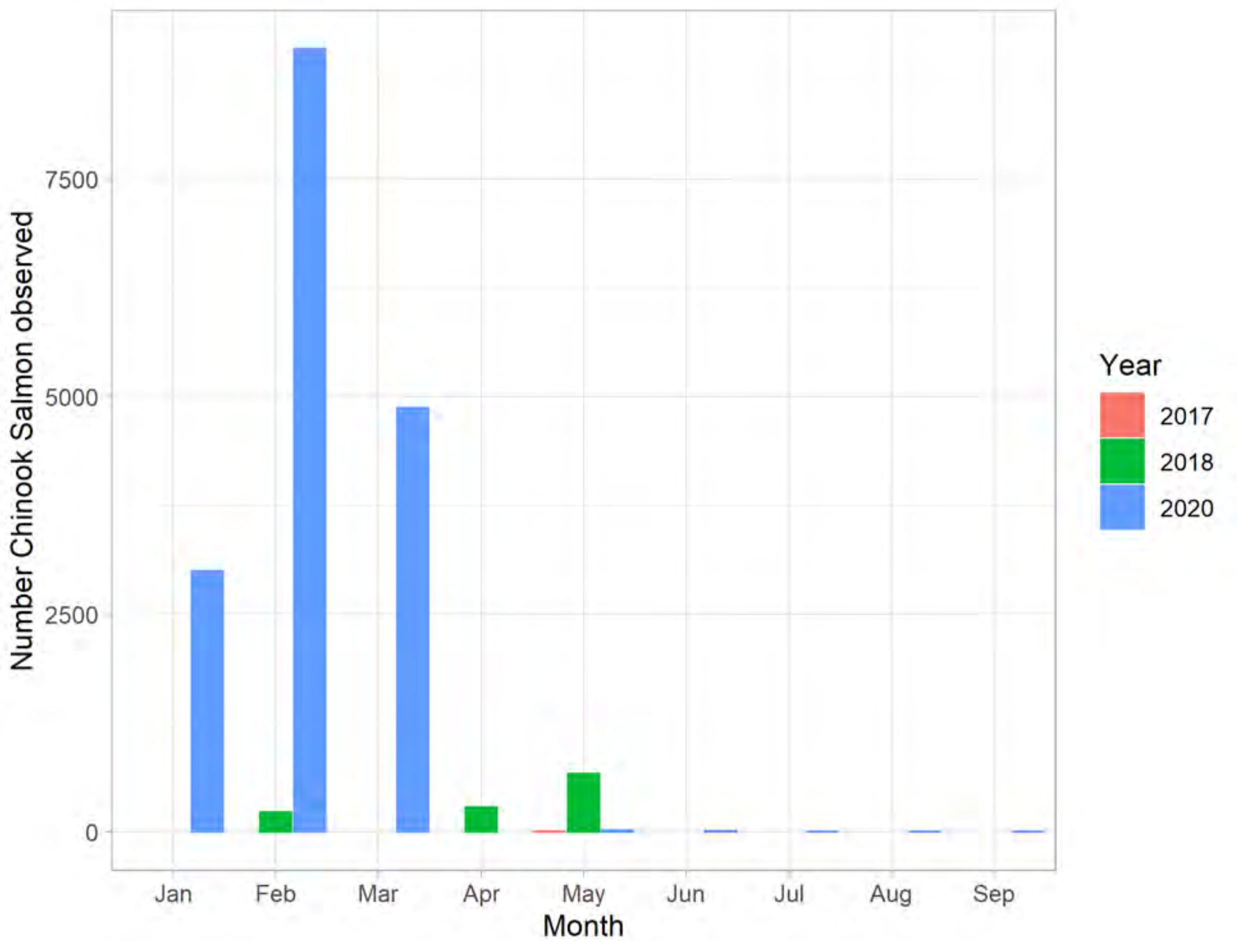

Figure 9. Total number of juvenile Chinook Salmon observed by month during pre-project snorkel surveys for the Proposed Action in 2017, 2018, and 2020. Thin lines near the "0" on the Y axis indicate that surveys occurred but no Chinook Salmon were observed.

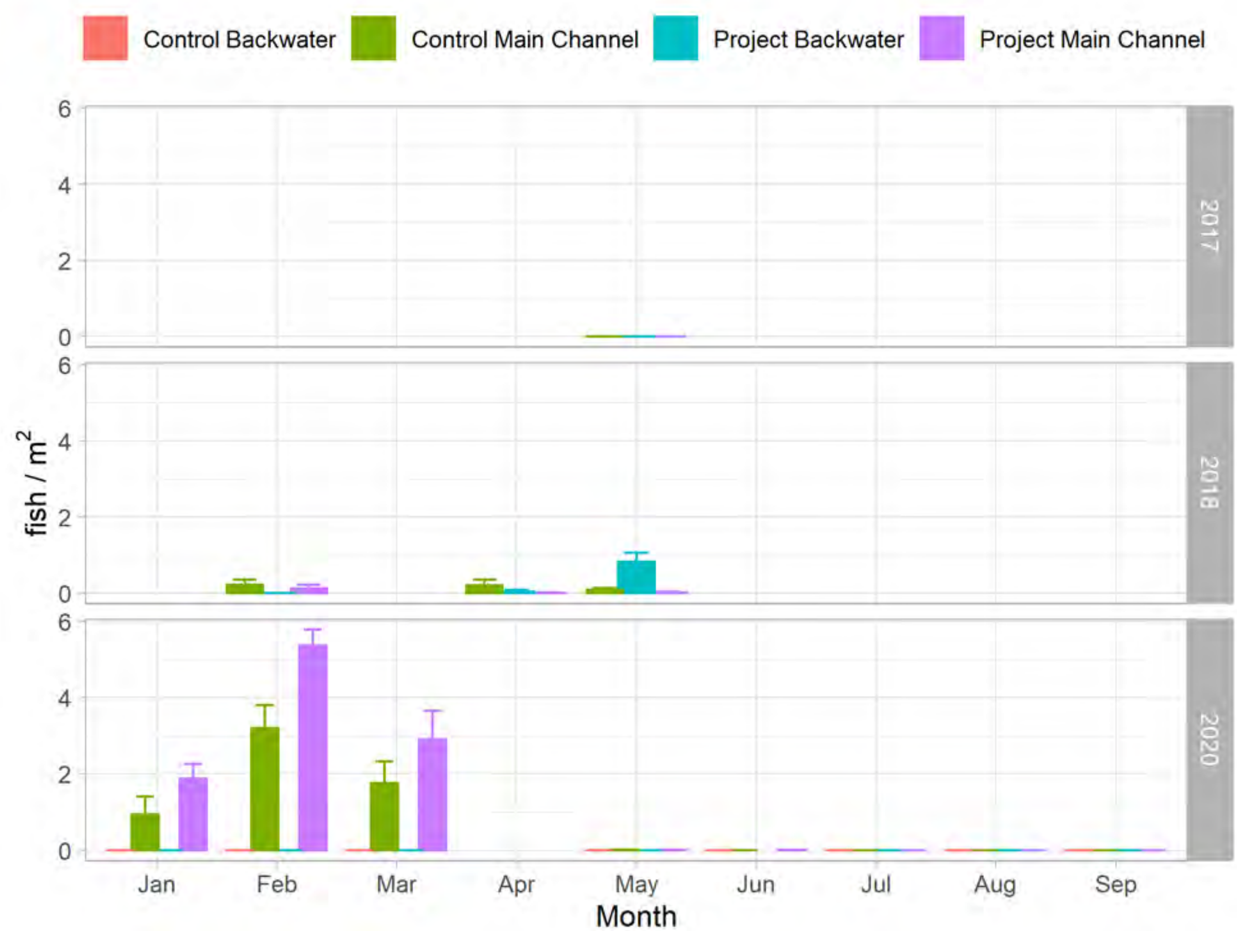

Figure 10. Mean juvenile Chinook Salmon density (fish/m²) in specific locations (Backwater, Backwater Control, Main Channel Control, and Main Channel Project) by month observed during pre-project snorkel surveys for the Proposed Action in 2017, 2018, and 2020. Thin lines near the "0" on the Y axis indicate that surveys occurred but no Chinook Salmon were observed.

Total number of *O. mykiss* observed was 4 in 2017, 1 in 2018, and 130 in 2020 (Figure 9). The most *O. mykiss* in 2018 and 2020 were observed in May (Figure 11). The highest mean *O. mykiss* densities in 2017 (0.0018 fish/m² ± 0.0013 SE) and 2020 (0.011 fish/m² ± 0.005 SE) were in the Control Main Channel (Figure 12). *O. mykiss* were never observed in the Project Backwater in any pre-project year but were observed in the Control Backwater in multiple months during 2020 surveys (Figure 12). During winter (January to March), typically only *O. mykiss* with FLs greater than 200 mm were observed (CFS, unpublished data). Young of the year *O. mykiss* were observed starting in April and were observed thereafter through the summer and into the fall, in addition to continued observations of *O. mykiss* greater than 200 mm FL (CFS, unpublished data).

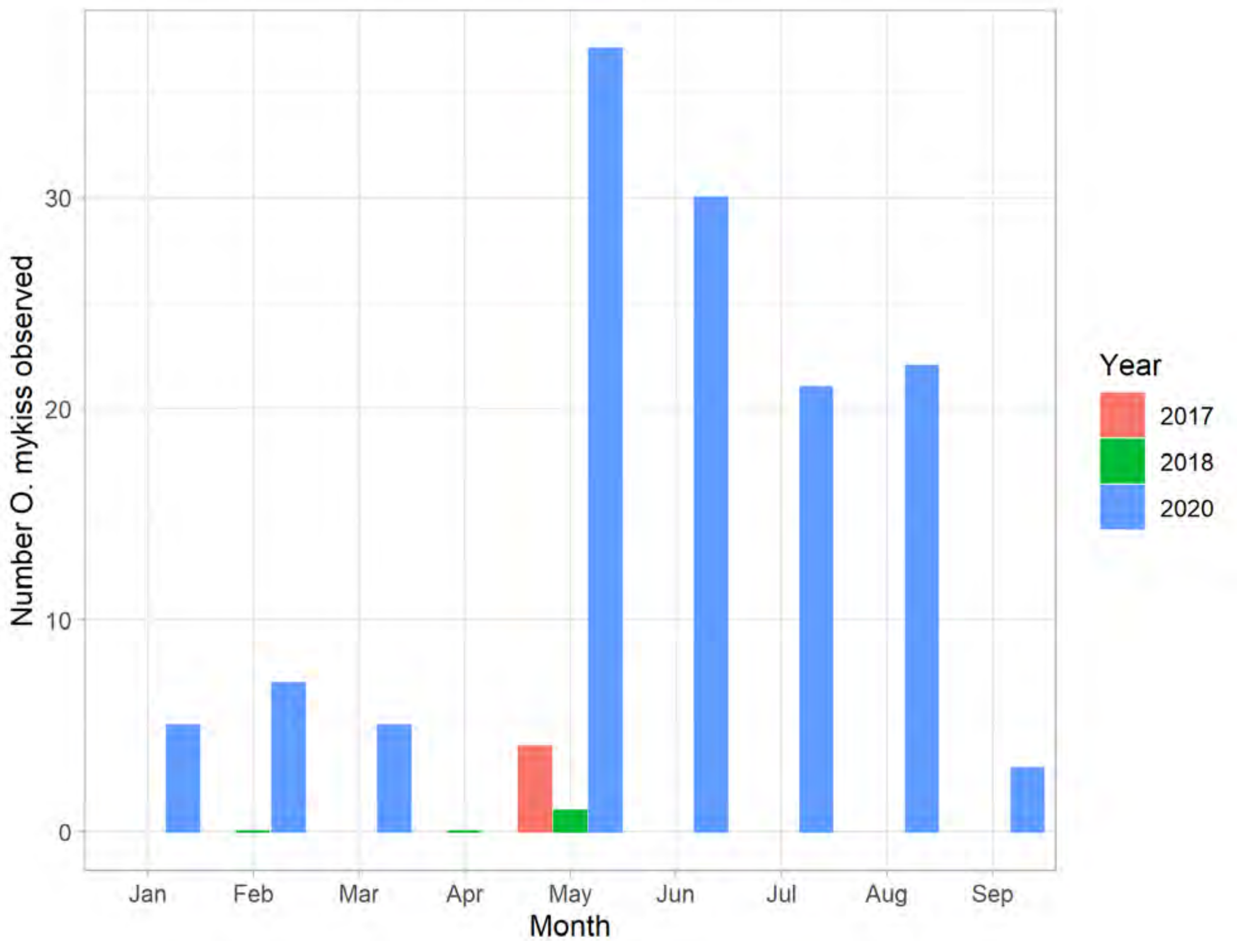

Figure 11. Total number of *O. mykiss* observed by month during pre-project snorkel surveys for the Proposed Action in 2017, 2018, and 2020.

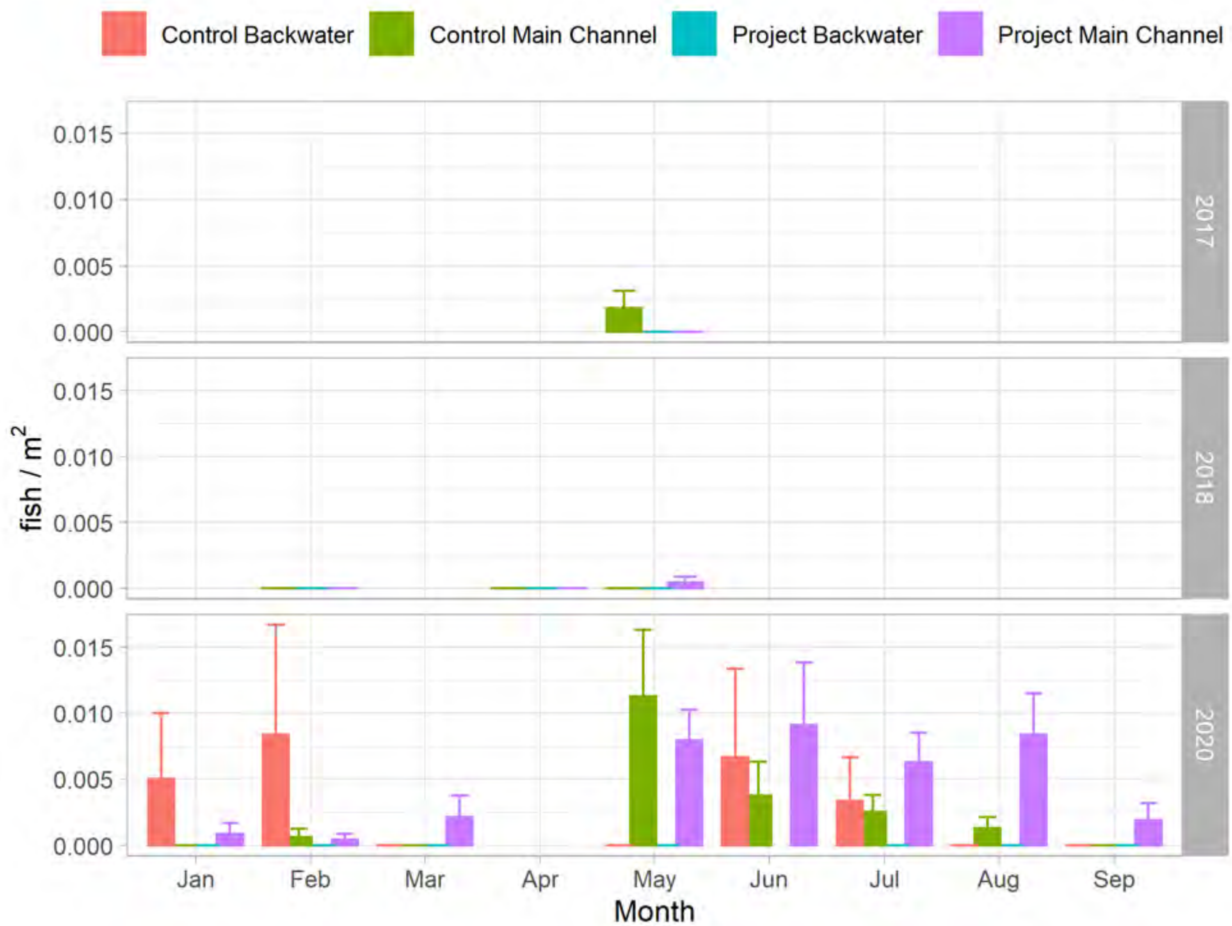

Figure 12. Mean density of *O. mykiss* (fish/m²) in specific locations (Backwater Project, Backwater Control, Main Channel Control, and Main Channel Project) by month observed during pre-project snorkel surveys for the Proposed Action in 2017, 2018, and 2020.

Salmonid Critical Habitat within the Action Area

The PBFs of critical habitat for CV spring-run Chinook Salmon and CCV steelhead present in the Action Area are freshwater rearing habitat, freshwater migration corridors, and spawning habitat. Instream habitats within the LYR have been modified or converted for uses such as agriculture, gravel and gold mining, water impoundments, increased water diversions, decreased instream flows, and training walls (levees). These major actions and other events have led to the deterioration of riparian and aquatic habitat conditions. As described above, the LYR, including within the Action Area, has been converted from a complex multi-channel system to a single, incised and constricted channel with a relatively narrow floodplain. However, compared to many other CV rivers, the LYR is less constricted and still contains alluvial river attributes including large gravel bars (Wyrick and Pasternack 2012). Features such as functional floodplains and other off-channel salmonid rearing habitat are rare; the LYR within the Action Area is dominated by floodplain and side channels that only inundate at extreme high flows, with a few perennially inundated backwater pools at the downstream end of remnant side channels sustained via subsurface flow. The backwater pool within the Proposed Action grading footprint is perennially disconnected at its downstream end with the main channel; juvenile Chinook Salmon are only able to access it when flows are sufficient to create a surface flow connection with the main channel during the rearing period. Infrequent and short-duration inundation onto historic floodplains due to incision provides little opportunity for juvenile salmonids to access seasonally inundated terrestrial vegetation and off-channel areas in the Action Area, and rearing habitat is generally considered a limiting factor in the LYR (Yoshiyama *et al.* 1996; Lindley *et al.* 2007). Instream cover is also sparse within the Action Area, except along the narrow riparian corridor at the river margins, where there is some instream woody material and overhead cover provided by low-growing riparian vegetation.

The LYR within the Action Area is used as a migration corridor for adult and juvenile CV spring-run Chinook Salmon and CCV steelhead. Spring-run Chinook Salmon have been documented to hold for an extended period of time in the pool below DPD before migrating upstream in September to spawn.

Riffles and glides used by salmonids for spawning occur throughout the LYR main channel within the Action Area. Chinook Salmon and steelhead have been documented spawning in the LYR within the Action Area (Yuba RMT 2013). The majority of the early spawning Chinook Salmon (September to mid-October) spawn in reaches above DPD and are believed to be spring-run, which is supported by acoustic tracking data (Yuba RMT 2013). The majority of this early Chinook Salmon spawning occurs upstream of the Highway 20 bridge (Yuba RMT 2013). However, some redds have been observed in September within the Action Area and are likely to be from spring-run Chinook Salmon (Yuba RMT 2013). Steelhead redds have also been observed within or adjacent to the Action Area between January and April (Yuba RMT 2013). The Action Area overlaps with the downstream end of the Parks Bar reach which is one of the two LYR reaches where the majority of steelhead spawning occurs (Yuba RMT 2013). In spring 2020, a steelhead redd was observed in the riffle immediately downstream of the beaver dam that demarcates the downstream end of the Control Backwater site that will be surveyed during effectiveness monitoring (CFS, unpublished data).

Pacific Coast Salmon Essential Fish Habitat in the Action Area

All four major components of Chinook Salmon EFH (PFMC 2014) are found in the Action Area: 1) spawning and incubation, 2) juvenile rearing, 3) juvenile migration corridors, and 4) adult migration corridors and holding habitat. Chinook Salmon have been observed spawning within the Action Area, primarily in the main channel pool tails and riffles within the site (Yuba RMT 2013; CFS, unpublished data). Juvenile Chinook Salmon have been observed during pre-project snorkel surveys in the main channel and the Project Backwater within the Action Area (CFS, unpublished data). The LYR within the Action Area also serves as a migration corridor for juvenile and adult salmon as well as providing adult holding habitat.

There are three EFH Habitat Areas of Particular Concern present in the Action Area, 1) complex channels and floodplain habitats, 2) thermal refugia, and 3) spawning habitat. During high flows (10,000 cfs or greater) the main channel connects with the point bar on the north bank and provides a large area of floodplain habitat as well as connecting with the more complex backwater/side channel complex. However, the main channel is largely disconnected from historic floodplains and flows which inundate the floodplain are generally short events generally lasting only a few days, providing little opportunity for seasonally inundated terrestrial vegetation and off-channel areas that are important for juvenile salmonids.

As mentioned above, the LYR main channel within the Action Area provides a limited amount of complex habitat for juvenile salmonids. At lower flows (less than 4,000 cfs) there are limited areas within the Action Area where riparian vegetation is inundated. Additionally, there are a few locations where large woody material is present along the bank providing complex habitat and cover. There are also a few aggregations of willow twigs (created by beavers) in shallow eddies along the bank that have been observed to be used as cover by juvenile Chinook Salmon (CFS, unpublished data). However, inundation of riparian vegetation and presence of large woody material in the main channel varies from year to year based on flows and flood events. At higher flows (as mentioned above) the side channel/backwater complex becomes inundated and provides more complex habitat due to the presence of riparian vegetation along both edges of the channel and occasionally extending across the channel width. Large schools of juvenile Chinook Salmon (hundreds of individuals) have been observed in the backwater pool in years when flows are sufficient to allow access for juvenile Chinook Salmon to this habitat (CFS, unpublished data).

Water temperature in the LYR main channel within the Action Area rarely exceeds 18°C, which is when water temperatures become stressful for juvenile salmonids (Myrick and Cech 2002). This remains true even during extreme drought years (Yuba RMT 2013; CFS, unpublished data). Since the LYR within the Action Area is a “cold” river, there is little need for thermal refugia from warm water temperatures for juvenile and adult salmonids. But if needed, thermal refugia are likely present in the LYR within the Action Area. The extensive, porous gravel bars facilitate transport of subsurface water, so the downstream end of the large gravel bars may have cooler subsurface water returning as surface flow due to lack of exposure to solar radiation during subsurface transit. In fact, warmer rearing temperatures for juvenile Chinook Salmon during winter and early spring may be beneficial in the LYR, as they would support higher metabolic rates and growth, assuming adequate prey production. When inundated, the floodplain and side channel/backwater complex built under the Proposed Action may be slightly warmer than the main channel due to increased solar radiation on surface water and slower flow depth and velocity.

As mentioned above, there is suitable spawning habitat for Chinook Salmon in several locations within the Action Area. Spawning Chinook Salmon and redds have been observed within the Action Area, primarily in main channel pool tails and riffle heads (Yuba RMT 2013; CFS, unpublished data).

Effects of the Action

The Proposed Action will improve habitat, including enhancing habitat functions for key species and life stages over a variety of flow conditions. Benefits to environmental conditions will include:

- Increase available juvenile salmonid habitat: The Proposed Action will increase the amount and diversity of juvenile salmonid habitat, identified as a factor limiting population recovery within the CV.
- Reestablish floodplain and main channel connectivity: Recontouring perched floodplains under present and future hydrograph scenarios will improve activation and functionality of critical juvenile salmonid habitat, especially under moderate flow conditions.
- Increase native riparian vegetation: Dredger mining along CV rivers resulted in little soil for riparian plants to recolonize (Stella *et al.* 2003). This issue is compounded by floodplains that infrequently connect during moderate and low flow conditions. Recent studies on CV rivers have demonstrated that reestablishing floodplain soils and connectivity allows rapid colonization of native woody vegetation that improve habitat quality (Sellheim *et al.* 2016a). Woody plant colonization will sequester carbon, ameliorating future climate impacts.

Assessment Approach

The assessment of effects on listed species was conducted using the following analytical steps:

- Identify the physical, chemical, or biological stressors resulting from the action(s).
- Describe the observed or predicted responses of fish to these stressors.
- Estimate the number or relative abundance of individuals potentially affected by the action(s) (based on the spatial and temporal overlap between the stressor and listed species/life stage).
- Estimate the probable short- and long-term response of the individuals or population to the action(s).

The effects of the Proposed Action include direct and indirect effects. Direct effects are those that occur as a direct result of the Proposed Action. Indirect effects are defined as "those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur" (50 CFR §402.02). Short-term direct effects, which are caused primarily by restoration construction activities, include potential disturbance or harassment of fish from gravel augmentation, noise, and degradation of water quality from increased suspended sediment and turbidity, and potential mortality or physiological stress from spills of toxic substances. Long-term direct and indirect effects resulting from restoration operations include effects related to habitat modification.

Table 18 lists all potential effects on CV spring-run Chinook Salmon, CCV steelhead, and their designated critical habitat, and Chinook Salmon EFH related to construction and effectiveness monitoring activities. All direct and indirect effects are discussed below in detail.

Table 18. Potential effects of activities associated with the Proposed Action on CCV steelhead, CCV steelhead Critical Habitat, and Chinook Salmon Essential Fish Habitat.

Activity	CV spring-run Chinook Salmon	CV-spring run Chinook Salmon critical habitat	CCV steelhead	CCV steelhead critical habitat	Chinook Salmon EFH
Construction activity effects					
Sediment and turbidity	SMA	SMA	SMA	SMA	SMA
Contaminants	SMA	SMA	SMA	SMA	SMA
Noise	SMA	SMA	SMA	SMA	SMA
Modification of physical habitat					
Bank, bar, and channel modification	SMA, LTB	SMA, LTB	SMA, LTB	SMA, LTB	SMA, LTB
Fish Relocation	SA	SMA	SA	SMA	SMA
Restoration effectiveness monitoring	SA, LTB	LTB	SA, LTB	LTB	LTB

SMA = short-term, minimal adverse effect
SA = short-term, adverse effect
LTB = long-term beneficial effect

Construction activity effects

Sediment and Turbidity

Construction activities related to restoration construction actions will temporarily disturb soil and riverbed sediments as well as riparian vegetation, resulting in the potential for temporary increases in turbidity and suspended sediments in the LYR within the Action Area. Restoration-related increases in sedimentation and siltation above the background level could potentially affect fish species and their habitat by reducing embryo and juvenile survival, interfering with feeding activities, causing breakdown of social organization, and reducing primary and secondary productivity. The magnitude of potential effects on fish will depend on the timing and extent of sediment loading and flow in the river before, during, and immediately following construction.

Impacts to CV spring-run Chinook Salmon and CCV steelhead will be minimized by conducting all in-water restoration activities during the dry season between July 15 and September 30. The number of juvenile salmonids potentially residing in the Action Area during in-water restoration is expected to be very low because of the time of year and low quality of existing habitat (CFS, unpublished data). Individual fish that encounter increased turbidity or sediment concentrations would be expected to move laterally, downstream, or upstream of the affected areas. For juveniles, this may increase their exposure to predators if they are forced to leave protective habitat. Turbidity plumes would be expected to affect only a portion of the channel width and extend up to 1,000 ft downstream of the Proposed Action grading footprint. Turbidity will be monitored in accordance with the Section 401 Water Quality Certification for the Proposed Action and if turbidity exceeds the thresholds identified in the certification, work will cease until turbidity returns to background levels.

Conclusion

The Proposed Action may potentially have temporary direct effects on salmonids by reducing water quality during construction. These effects will be addressed by avoiding construction activities during times when salmonids are most likely to be present and by implementing the Project Site minimization measures, incorporated in the Proposed Action's SWPPP and Section 401 Water Quality Certification. As described in the Restoration Grading Conservation Measures above, measures include provisions to control erosion and sedimentation, as well as a Spill Prevention and Response Plan to avoid, and if necessary clean up, accidental releases of hazardous materials. As the Proposed Action proponent, USFWS AFRP through its representatives, SYRCL, CFS, cbec and the construction contractor (SRI), would be responsible for ensuring compliance with all conditions of these measures.

With the minimization measures described above, there would be short-term, minimal adverse direct effects of sediment and turbidity on CV spring-run Chinook Salmon and its designated critical habitat, CCV steelhead and its designated critical habitat, and Chinook Salmon EFH.

Mercury

Restoration activities have the potential to expose clay and silt sized particles with elevated mercury levels that could then be transported into the wetted channel of the LYR during high flow events. A fraction of the mercury may then methylate and become toxic to fishes and other biota. The inundation of floodplains is a potential risk factor for methylation, mobilization, and transport of mercury. Methylmercury has a range of toxic effects to fish including behavioral, neurochemical, hormonal, and reproductive changes. Berntssen *et al.* (2003) found that methylmercury caused altered behavior and pathological damage in Atlantic Salmon (*Salmo salar*). Fall-run Chinook Salmon that spent time rearing in the Yolo Bypass accumulated more methylmercury than salmon that remained in the Sacramento River (Henery *et al.* 2010). However, juvenile salmon rearing in the Yolo Bypass grew faster (0.7% more per day) than fish that remained in the Sacramento River (Henery *et al.* 2010), presenting a potential trade-off between the two habitats.

The Hallwood Side Channel and Floodplain Habitat Restoration Project, located 4 mi (6.4 km) downstream from the Action Area, conducted mercury sampling in fine sediment recently exposed following restoration activities similar to the Proposed Action. Slightly elevated mercury levels were observed within the construction footprint, with a maximum value of 0.42 mg/kg (USFWS, unpublished data). However, this is well below levels considered hazardous by the California Regional Water Quality Control Board (20 mg/kg; Marshack 1986).

Conclusion

Potential direct and indirect water quality impacts related to the release of methylmercury will be addressed by mercury sampling and mitigation measures that will be included in the 401 water quality permit. With implementation of these measures, potential impacts are expected to be minimized such that impacts would be insignificant to salmonids and their habitat, and unlikely to reach a level that causes injury or death.

Contaminants

During restoration activities, the potential exists for spills or leakage of toxic substances that could enter the LYR. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (e.g., fuels, lubricants, sealants, and oil).
High concentrations of contaminants can cause direct (sub-lethal to lethal) and indirect effects on fish. Direct effects include mortality from exposure or increased susceptibility to disease that reduces the overall health and survival of the exposed fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. A potential indirect effect of contamination is reduced prey availability; invertebrate prey survival could be reduced following exposure, decreasing food availability for fish. Fish consuming infected prey may also absorb toxins directly. For salmonids, potential direct and indirect effects of reduced water quality during construction will be addressed by avoiding construction during times when salmonids are most likely to be present, utilization of vegetable-based lubricants and hydraulic fluids in equipment operated in the wet channel, and by implementing the housekeeping measures incorporated in the SWPPP. These measures include provisions to control erosion and sedimentation, as well as a Spill Prevention and Response Plan to avoid, and if necessary, clean up accidental releases of hazardous materials (see Restoration Grading Conservation Measures above). As the Proposed Action proponent, USFWS AFRP through its representatives, SYRCL, CFS, cbec and the construction contractor (SRI), would be responsible for ensuring compliance with all conditions of these measures.

Conclusion

Potential temporary direct and indirect impacts to salmonids related to contaminants will be addressed by the measures described in Restoration Grading Conservation Measures. With implementation of these measures, there would be short-term, minimal adverse effects on CV spring-run Chinook Salmon and its designated critical habitat, CCV steelhead and its designated critical habitat, and Chinook Salmon EFH.

Noise

Noise generated by heavy equipment and personnel during restoration activities could adversely affect fish and other aquatic organisms. The potential direct effects of underwater noise on fish and other organisms depend on a number of biological characteristics (e.g., fish size, hearing sensitivity, behavior) and the physical characteristics of the sound (e.g., frequency, intensity, duration). Potential direct effects include behavioral effects, physiological stress, physical injury (including hearing loss), and mortality. The loudest noise generated within the Action Area is expected from heavy equipment diesel engines. No diesel engines or their exhaust systems will come into direct contact with the flowing channel. No indirect effects are anticipated as a result of construction noise.

Exposure of adult and juvenile salmonids to noise and disturbance will be minimized by conducting all instream activities between July 15 and September 30 when minimal numbers of adult and juvenile CV spring-run Chinook Salmon and CCV steelhead are likely to be present in the Action Area.

Noise and disturbance will be limited to the immediate Action Area and, at any given time, the area immediately surrounding the restoration activity. Once construction is underway, individual fish approaching the Action Area from upstream or downstream are likely to detect the sounds/vibrations and avoid the Action Area.

Conclusion

Potential temporary direct and indirect impacts of noise to salmonids will be addressed by avoiding construction during times when salmonids are most likely to be present. There will be short-term, minimal adverse impacts to CV spring-run Chinook Salmon and its designated critical habitat, CCV steelhead and its designated critical habitat, and Chinook Salmon EFH due to noise.

Modification of Physical Habitat

Bank, Bar, and Channel Modification

Restoration activities will result in the disturbance of an estimated 42.8 acres (1.5 ha) of gravel bar on the North side of the LYR (Figure 2). Approximately 331,000 yd^3 (253,068 m^3) of material will be excavated and 3,200 yd^3 (2,447 m^3) of sediment fill used as part of floodplain recontouring and side, alcove, and flood runner channel creation. Topographic modification of the gravel bar to create side, alcove, flood runner, and backwater channels and floodplain lowering will modify bank habitat; however, islands of native plants and trees will be preserved within the Proposed Action grading footprint (**Figure 2**). Bank and channel modification will occur during creation of side and alcove channel connections with the main channel and floodplain terraces. Off-channel habitat excavation will change the hydrodynamics of the channel to provide more complex habitat in the Action Area. The amount of shallow water edge habitat and frequency of off-channel habitat inundation will both increase, improving conditions for rearing salmonids. Creation of side and alcove channel connections with the LYR main channel, floodplain terraces, and topographic modification of the backwater complex have the potential to impact juvenile salmonids through disturbance and displacement. These in-water restoration activities will occur during a period (July 15 to September 30) when juvenile and adult salmonid densities are relatively low within the Action Area (CFS, unpublished data). In-stream construction activities will only affect pre-smolt juvenile CCV steelhead because the work will be performed during the summer low flow period, after out-migrating smolts have left and before adults have immigrated to or through the Action Area. Instream construction activities are likely to only affect juvenile CV spring-run Chinook Salmon that demonstrate the yearling life history strategy because the instream work areas are not holding or migration habitat for CV spring-run Chinook Salmon adults and the work will be performed after the majority of the juvenile spring-run CV Chinook Salmon have out-migrated from the LYR. The yearling life history strategy is uncommon for LYR CV spring-run Chinook Salmon (Yuba RMT 2013). Further, juvenile salmonids are highly mobile and will rapidly move away from an area subject to disturbance. Therefore, any juvenile CV spring-run Chinook Salmon and CCV steelhead that may be present in locations where in-water work is occurring without fish relocation (the construction approach) would be able to avoid construction impacts by temporarily or permanently migrating downstream, away from the Action Area. Fish that are spooked by heavy equipment during Proposed Action construction activities are likely to endure short-term stress and/or elevated predation risk while moving away from their current holding/rearing area to temporarily or permanently locate a new holding/rearing location. Displaced fish will likely locate areas downstream in the main channel that have suitable habitat and low competition. Relatively few juvenile salmonids are expected to be impacted by instream restoration activities because juvenile salmonid density has been observed to be relatively low in the LYR within the Action Area during the summer, particularly in the backwater complex (Figures 10 and 12). The temporary displacement of fish is not expected to significantly affect the survival of individual fish or the population as a whole. Fish that are displaced will be able to access the newly created habitat via upstream migration after construction has progressed past the area. CFS (unpublished data) has observed juvenile salmonids feeding immediately downstream of gravel placement activity and returning to placement sites immediately after equipment activity has ceased.

Instream restoration activities are expected to cause benthic aquatic macroinvertebrates to be killed, displaced, or to have their abundance temporarily reduced when they are disturbed by in-water grading activities or covered with coarse sediment added to the backwater complex during topographic modification. However, effects to aquatic macroinvertebrates from displacement and sediment smothering will be temporary because restoration activities will be of relatively short duration, and rapid recolonization (one to two months) of the new sediment is expected (Merz and Chan 2005). The benthic macroinvertebrate production within the Action Area is expected to increase once construction is complete, as there will be an increase in area of perennial riffle habitat. The amount of food available for juvenile salmonids and other native fishes is ultimately expected to increase as a result of the Proposed Action.

Limited wetland areas on site will be temporarily impacted or their wetland type changed by restoration activities. Implementation of the Proposed Action would ultimately result in an increase in wetland habitat within the restoration area. To the maximum extent practicable, existing riparian habitat will be retained and disturbance of riparian vegetation minimized. All gallery trees present in the Proposed Action grading footprint will be retained as possible. If gallery trees are removed, they will be replaced at a 10:1 ratio.

Invasive species may be introduced to the Action Area during Proposed Action construction by heavy equipment or from the clothing or shoes of personnel monitoring the project. To prevent the spread of non-native species, a Hazard Analysis and Critical Control Points document which includes an Invasive Species Risk Assessment Program will be developed for this Proposed Action, containing Best Management Practices that will be followed by all personnel involved in the Proposed Action. Following restoration activities, all disturbed or exposed soils will be stabilized and planted with native woody and herbaceous vegetation to control erosion and offset any unavoidable losses of vegetation. Non-native plant species will be replaced with native riparian plants. Some short-term losses of mature riparian vegetation may occur during restoration, which may result in a short-term reduction in natural cover for salmonids. However, native tree plantings and natural riparian vegetation recruitment is expected to establish and mature following Proposed Action completion, resulting in an increase in the amount and extent of native riparian vegetation within the Action Area (Sellheim *et al.* 2016a).

Conclusion

With the conservation measures incorporated for the Proposed Action, there will be short-term, minimal adverse impacts from bank, bar, and channel modification to CV spring-run Chinook Salmon and its designated critical habitat, CCV steelhead and its designated critical habitat, and Chinook Salmon EFH. Bank, bar, and channel modification will result in long-term benefits to salmonids by increasing the quality and quantity of juvenile salmonid rearing habitat at a wide range of flows. Riparian habitat is also expected to improve as a result of the Proposed Action, which will provide terrestrial prey inputs and cover for juvenile salmonids when inundated.

Fish Relocation

To avoid direct and indirect mortality of fishes from construction activities, fish will be relocated, if necessary, away from areas where instream work occurs. Active relocation will only occur if it is not possible to maintain a path of egress for fish during Proposed Action construction. Fish will be relocated either through herding and excluding them out of the work area, or through capture and relocation. Data to precisely quantify the number of CCV steelhead and CV spring-run Chinook Salmon that will be relocated prior to construction are not available. However, relocation only has the potential to affect pre-smolt juvenile steelhead because the work will be performed during the summer low flow period after out-migrating smolts have left and before adults have immigrated to or through the Action Area. Relocation is not likely to affect adult spring-run Chinook Salmon, as the instream work areas are not holding or migration habitat for adult spring-run Chinook Salmon. Fish relocation may affect juvenile spring-run Chinook Salmon, but the work will be performed after the majority of juvenile spring-run Chinook Salmon have out-migrated from the LYR. It is possible that juvenile spring-run Chinook Salmon that are demonstrating the yearling rearing strategy could be present and would therefore be affected by relocation. However, the yearling life history strategy is uncommon in LYR CV spring-run Chinook Salmon (Yuba RMT 2013).

Fish relocation activities pose a risk of injury or mortality to rearing juvenile CCV steelhead and CV spring-run Chinook Salmon. The amount of unintentional injury and mortality attributable to fish relocation varies widely depending on the method used, ambient conditions, and the experience of the field crew. However, fish relocation activities will be conducted by qualified fisheries biologists following both the CDFW and NMFS guidelines. Therefore, direct effects to and mortality of juvenile CCV steelhead and CV spring-run Chinook Salmon during relocation activities are not likely. Whenever feasible, fish relocation will be attempted using herding, as this method is expected to have a lower impact on the species relative to active relocation methods (e.g., seining or electro-fishing), because fish will not be handled and will not be subject to holding and transport stress.

Fish collection or herding is unlikely to be 100 percent effective at removing all individuals, but experienced biologists are expected to remove at least 95 percent of the fish present. Juvenile CCV steelhead and CV spring-run Chinook Salmon that evade capture and remain in the construction area may be injured or killed from construction activities. But as described above, it is anticipated that juvenile Chinook Salmon and steelhead will be present in very low densities or absent during the summer construction period in the backwater complex.

The anticipated take of CCV steelhead and CV spring-run Chinook Salmon due to relocation activities is minimal, as no CCV steelhead or CV spring-run Chinook Salmon were observed in the Proposed Action construction footprint during pre-project surveys that took place during the months when construction would occur. However, we request take of up to 100 of each species to address the possibility that these species could be present and require relocation (see Table 19 below).

Table 19: Expected take of juvenile CCV steelhead and CV spring-run Chinook Salmon due to fish relocation activities during Proposed Project construction.

Species	Method	Take Action	Life Stage	Expected Take	Indirect Mortality
CCV steelhead	Fish Relocation	Capture/Handle/Release Fish	Juvenile	~ 100	3
CV spring-run Chinook Salmon	Fish Relocation	Capture/Handle/Release Fish	Juvenile	~ 100	3

Sites selected for relocating fish will have similar water temperatures to the capture site and will have suitable habitat area. However, relocated fish may endure short term stress from crowding at the relocation site. Relocated fish may also have to compete with resident fish for available resources such as food and habitat. Some of the fish released at the relocation site will likely move upstream or downstream to areas that have more habitat and a lower density of fish. As each fish disperses, competition diminishes and remains localized in a small area. The number of fish affected by competition cannot be accurately estimated but it is unlikely that this impact will affect the survival of individuals or the population given the small number of individuals likely to be relocated (Table 19).

Conclusion

While relocation of CCV steelhead and CV spring-run Chinook Salmon is unlikely, if it occurs, it is likely to adversely affect fish; and if the capture and relocation method is used, it may reach a level where fish injury or mortality occurs.

Restoration effectiveness monitoring effects

The long-term monitoring efforts accompanying the Proposed Action aim to measure changes in hydrology, geomorphology, and river ecosystem related to CCV steelhead and CV spring- and fall-run Chinook Salmon habitat use (CFS 2020). Pre-project monitoring began under an existing 4(d) permit held by CFS and was performed in 2017, 2018, and 2020. Post-project monitoring will be performed for up to three years following construction. The specific monitoring methods and anticipated effects are described below.

Macroinvertebrate Sampling

As detailed in the Proposed Action Monitoring section, changes to macroinvertebrates (juvenile salmonid prey-base) will be assessed before and after implementation using drift and Schindler sampling. Sampling efforts will require minor disturbance of benthic substrate through wading to perform the sampling. Care will be taken to avoid areas being used by adult salmonids (e.g., active redds). If juvenile or adult salmonids are observed during macroinvertebrate sampling, effort will be made to avoid disturbing them by not sampling or wading in their vicinity. Juvenile and adult salmonids can easily avoid staff and equipment associated with these sampling activities, and individuals that are spooked away from their holding/rearing area during invertebrate sampling will return to the area when the disturbance from sampling has ceased.

Biological impacts from macroinvertebrate sampling are considered temporary and are not likely to adversely impact salmonids.

Snorkel Surveys

Snorkel surveys will require survey staff to observe and enumerate rearing juvenile salmonids within the Action Area and record the GPS coordinates and depth and velocity in the locations in which juvenile salmonids are observed. Snorkel surveys will typically be performed monthly from January through October to capture the breadth of juvenile rearing, including over-summer habitat use. Adult CCV steelhead may be observed during juvenile salmonid snorkel surveys during January through April, as these months overlap with the migration, holding, and spawning of steelhead in the LYR (**Error! Reference source not found.**). Adult CV spring-run Chinook Salmon may be observed from April to October as these months overlap with the migration, holding, and spawning of spring-run Chinook Salmon in the LYR (Table 4). Effort will be made to avoid actively spawning adult salmonids during snorkel surveys by not wading or surveying in their vicinity.

The presence of individuals conducting the snorkel surveys will have short-term impacts on fish behavior and habitat use. Performing snorkel surveys is likely to result in “take” of CV spring-run Chinook Salmon and CCV steelhead through observation and harassment. During pre-project snorkel surveys of selected transects, which were covered under a 4(d) permit, 1-131 juvenile *O. mykiss* and 0-16,869 juvenile Chinook Salmon were observed per year (Figure 9). Post-project monitoring snorkel surveys will be conducted from January to October, which is a similar timeframe to snorkel surveys conducted in 2020. Assuming the restoration project improves juvenile salmonid habitat and resulting occupancy as intended, we estimated predicted post-project monitoring take by increasing 2020 counts by a factor of six. Based on this conservative assumption, juvenile *O. mykiss* snorkel observations post-project may be as high as approximately 800 annually. Assuming approximately one third of juvenile Chinook Salmon observed during snorkel surveys in 2020 were spring-run (resulting in a total of 5,623 CV spring-run Chinook Salmon), post-project observations are predicted to be approximately 34,000 annually. Following post-project sampling, the actual number of juvenile spring-run Chinook Salmon observed during snorkel surveys will be estimated for reporting purposes by applying the ratio of spring-run to fall-run juveniles observed in the genetic analysis of PIT tagged fish (see below).

Juvenile Salmonid Seine and Fyke-Net Sampling

Beach seine sampling will be performed to capture juvenile Chinook Salmon for use in the rearing study in the spring (April/May) and to monitor juvenile salmonid habitat use within the main channel, side-channel, and floodplain in the Action Area. Up to four locations will be seined within each habitat type (main channel, side channel, and floodplain) with up to three seine hauls per location. Seine sampling will occur monthly from February through June. The seine size used will be based on the configuration of the seine location with a larger seine used in the main channel and a smaller seine used in the side channel. Seining will require wading by individuals operating the seine net and the net will agitate stream bottom substrate where it is deployed.

Fyke-net sampling will be used to test the hypothesis that juvenile salmon rearing in restored off-channel habitats will exhibit greater growth rate and health condition than those that rear in unrestored backwater habitats. The fyke net(s) will be installed in the downstream end of Project Backwater and Control Backwater sites. The fyke net will be "fished" continuously for the duration of the experiment, approximately four weeks in the spring (April/May). However, the fyke-nets would be temporarily removed if a flow event is predicted that may damage or destroy the nets. The fyke-nets will be checked up to twice a day to process fish in the live boxes and to clean debris from the traps and live boxes.

Chinook Salmon captured by beach seine for the pre- and post-project juvenile rearing experiment will be weighed and measured, PIT tagged, and genetic fin-clip/swab collected, and placed in a recovery bucket. For all other captured fish, up to 20 of each species measured and the rest enumerated and placed in an aerated recovery bucket. Once fish in the recovery buckets are behaving normally, the fish will be returned to a proper release location within the area from which they were captured, except for the PIT-tagged fish which will be transported to the selected experimental release location.

All juvenile Chinook Salmon captured by the fyke-net will be anesthetized, scanned for a PIT-tag, weighed and measured, and then placed in a recovery bucket. For all other fish, up to 20 of each species measured and the rest enumerated and placed in an aerated recovery bucket. All fish will be released downstream of the fyke-net except for a sub-sample of 100 recaptured PIT-tagged fall-run Chinook Salmon, which will be sacrificed for otolith and diet analysis. Run of PIT-tagged juvenile Chinook Salmon will be determined through genetic analysis within a week of PIT-tagging. This will allow sacrifice of juvenile CV spring-run Chinook Salmon to be avoided. No adult CV spring-run Chinook Salmon or CCV steelhead are expected to be capture by beach seine or fyke-net due to the sampling locations. Beach seining will be performed in shallow, edge habitat along the bank where adult salmonids are not expected to occur. The area to be seined will be visually surveyed for redds prior to commencing. If redds are observed then the seine location will be moved to avoid them. Fyke-nets will not be operated in salmonid spawning habitat. Potential effects of seine and fyke sampling on juvenile salmonids include minor abrasions from the seine or fyke net and short-term effects from the anesthetic and handling.

Juvenile Chinook Salmon PIT-tagging and genetic fin-clip sampling will result in additional handling stress and injury. However, only experienced personnel will perform PIT-tagging and fin-clipping to minimize injury/mortality from these actions. PIT-tagging mortality of an experienced tagger is expected to be around 3%. Assuming one third of the beach seine captured juvenile Chinook Salmon PIT tagged for the juvenile rearing experiment are spring-run, this would result in take of approximately 333 CV spring-run Chinook Salmon. A more accurate estimate of the actual number of PIT-tagged juvenile spring-run Chinook Salmon for reporting will be determined through genetic analysis.

Conclusion

The Proposed Action restoration effectiveness monitoring activities may result in adverse effects due the "take" of individual CV spring-run Chinook Salmon and CCV steelhead through capture and handling as well as through observation and harassment. The expected take as a result of monitoring activities is presented in Table 20. The monitoring efforts will have no effect on salmonid critical habitat or EFH and may result in long-term benefits, because the information collected will allow for adaptive management and improve design criteria for future restoration efforts.

Table 20. Annual take table for monitoring activities associated with the Proposed Action.

Species	Method	Take Action	Life Stage	Expected Annual Take	Indirect Mortality
CV spring-run Chinook Salmon	Beach Seine	Capture/ Handle/PIT-tag/Genetic Sample/ Release Fish	Juvenile	500	5
CV spring-run Chinook Salmon	Beach Seine	Capture/ Handle/ Release Fish	Juvenile	500	5
CV spring-run Chinook Salmon	Fyke-net	Capture/ Handle/ Release Fish	Juvenile	2,000	4
CV spring-run Chinook Salmon	Snorkel Surveys	Observe/Harass	Juvenile	34,000	0
CV spring-run Chinook Salmon	Snorkel Surveys	Observe/Harass	Adult	10	0
CCV steelhead	Beach Seine	Capture/ Handle/ Release Fish	Juvenile	300	1
CCV steelhead	Fyke-net	Capture/ Handle/ Release Fish	Juvenile	200	1
CCV steelhead	Snorkel Surveys	Observe/Harass	Juvenile	1,000	0
CCV steelhead	Snorkel Surveys	Observe/Harass	Adult	20	0

Summary of Proposed Action Effects on CCV steelhead, CCV steelhead Critical Habitat, and CV Chinook Salmon Essential Fish Habitat

The Proposed Action is expected to have direct short- and long-term effects on CV spring-run Chinook Salmon and CCV steelhead and their designated critical habitat and Chinook Salmon

EFH. Potential short-term, minimal adverse effects include temporary water quality degradation from localized increases in turbidity and suspended sediment, temporary disturbance to rearing habitat during topographic modification through sediment addition, temporary channel disturbance during connection of side and alcove channels and terraces to the main channel, short-term reduction of natural cover resulting from channel and riparian disturbance, and potential discharges of contaminants into the LYR during restoration activities. Long-term direct effects on designated CV spring-run Chinook Salmon and CCV steelhead critical habitat and CV Chinook Salmon EFH are all beneficial, including increased channel complexity, increased quantity and inundation of side channel and floodplain habitat, and improved riparian vegetation quality. These modifications will result in a beneficial change to juvenile rearing habitat and migration corridors, critical habitat PBFs currently present in the Action Area. Specifically, enhancement activities will improve existing and provide additional off-channel and main channel rearing habitat for CV spring-run and fall-run Chinook Salmon and CCV steelhead. The Action Area will continue to function as a freshwater migration corridor by providing adequate passage for adult and juvenile salmonids.

The net direct effect of the Proposed Action on CV spring-run Chinook Salmon and CCV steelhead and their critical habitat PBF's will be positive, including improved quantity and quality of juvenile rearing habitat and migration corridors. Likewise, the net direct effect on CV Chinook Salmon EFH will be beneficial.

Effects from Interrelated and Interdependent Actions

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are actions that have no independent utility apart from the action under consideration. There are no interrelated or interdependent effects to CV spring-run Chinook Salmon or CCV steelhead, their Critical Habitat, or Chinook Salmon EFH resulting from the Proposed Action.

Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, which are reasonably certain to occur within the Action Area of the Federal action subject to consultation". Few future non-Federal actions that may affect the Action Area are expected to occur. Potential actions taken in the Action Area include State angling regulation changes and discharge of stormwater and agricultural runoff. Most of these actions would require Federal permits and would undergo individual or programmatic Section 7 consultation. No known specific and reasonably certain future State or private activities are expected to occur within the Action Area, other than ongoing activities already occurring within the existing conditions.

Conclusion and Determination

Proposed Action construction and monitoring activities may affect and are likely to adversely affect CV spring-run Chinook Salmon and CCV steelhead. It is expected that “take” of CV spring-run Chinook Salmon and CCV steelhead would occur in the form of capture and handling as well as through observation and harassment during fish relocation and monitoring activities. All other potential adverse effects from the Proposed Action to CV spring-run Chinook Salmon and CCV steelhead have been determined to be insignificant and not likely to reach a level where “take” will occur. The potential impacts from the Proposed Action to critical habitat for CV spring-run Chinook Salmon and CCV steelhead have been determined to be insignificant and not likely to reduce critical habitat conservation value. It has been determined that the Proposed Action restoration activities would have short-term, minimal adverse effects on CV spring-run Chinook Salmon and CCV steelhead and their Critical Habitat and EFH for CV Chinook Salmon, but will result in long-term benefits to salmonids by increasing the quantity and quality of rearing habitat. In addition, information collected during effectiveness and validation monitoring for the Proposed Action could be used to refine the design of future salmonid habitat restoration efforts in the LYR and other CV rivers to protect and enhance salmonid populations.

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List of Preparers/Reviewers

The Lower Yuba River Long Bar Salmonid Habitat Restoration Project BA was drafted by biologists from CFS. The Project design, flow analysis, and HSC sections were drafted by cbec eco-engineering and adapted for the BA by CFS. Under the guidance and direction of SYRCL, the CFS staff prepared a project description and background information, collected data for the impact analysis, assessed potential effects of the alternatives, and prepared other chapters with additional comment and critique from USFWS, SYRCL, and cbec. The following list identifies the individuals involved in the preparation and review of this BA.

Preparers

Kirsten Sellheim (Senior Scientist), Cramer Fish Sciences, River Science and Restoration Lab, 3300 Industrial Boulevard Suite 100, West Sacramento, CA 95691. Telephone (916) 250-2203; email kirsten.sellheim@fishsciences.net

Philip Colombano (Biologist), Cramer Fish Sciences, River Science and Restoration Lab, 3300 Industrial Boulevard Suite 100, West Sacramento, CA 95691. Telephone (916) 250-1922; email philip.colombano@fishsciences.net

Reviewers

Paul Cadrett (Habitat Restoration Coordinator / Fish Biologist), U.S. Fish and Wildlife Service, Anadromous Fish Restoration Program, Lodi Fish and Wildlife Office, 850 S. Guild Ave. Suite 105, Lodi, CA 95240. Email paul_cadrett@fws.gov

Aaron Zettler-Mann (Watershed Science Director), South Yuba River Citizens League, 313 Railroad Ave. #101, Nevada City, CA 95959. Email aaron@yubariver.org

Tyler Goodearly (Fish Biologist), South Yuba River Citizens League, 313 Railroad Ave. #101, Nevada City, CA 95959. Email tyler@yubariver.org

Sam Diaz (Senior Ecoengineer), cbec eco-engineering, 2544 Industrial Boulevard, West Sacramento, CA 95691. Email s.diaz@cbecoeng.com

APPENDIX G. WETLAND DELINATION REPORT

Attachment 1

Long Bar Salmonid Habitat Restoration Project on the Lower Yuba River

Aquatic Resources Delineation Report

Prepared by:
Cramer Fish Sciences
West Sacramento, CA

Prepared for:
U.S. Fish and Wildlife Service
Anadromous Fish Restoration Program
Lodi, CA

January 2021

Suggested citation: Cramer Fish Sciences. 2021. Long Bar Salmonid Habitat Restoration Project Aquatic Resources Delineation Report. Prepared for the USFWS Anadromous Fish Restoration Program. 20 pp. + appendices.

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1.0 INTRODUCTION

Cramer Fish Sciences (CFS) conducted a wetland delineation of the approximately 121.7-acre survey area for the Long Bar Salmonid Habitat Restoration Project (Proposed Project) in Yuba County, California. This wetland delineation report describes the potentially jurisdictional Waters of the United States (U.S.) (including wetlands) identified within the survey area that may be subject to regulation by the U.S. Army Corps of Engineers (Corps) pursuant to Section 404 of the Clean Water Act (CWA). The Waters of the U.S. boundaries depicted in this report represent a calculated estimate of the potentially jurisdictional features within the survey area and are subject to modification following the Corps verification process. Results are considered preliminary until the Corps verifies the findings.

1.1 PROJECT APPLICANT AND PROPERTY OWNER

Applicant:	Property Owner 1:	Property Owner 2:
Cramer Fish Sciences	Long Bar Mine LLC	Western Aggregates
3300 Industrial Blvd., Suite 100	Philip Sutherling, Manager	4711 Hammonton Rd
Sacramento, CA 95691	18624 Majestic View Court	Marysville, CA 95901
(888) 224-1221	Penn Valley, CA 95946	(530) 749-8670

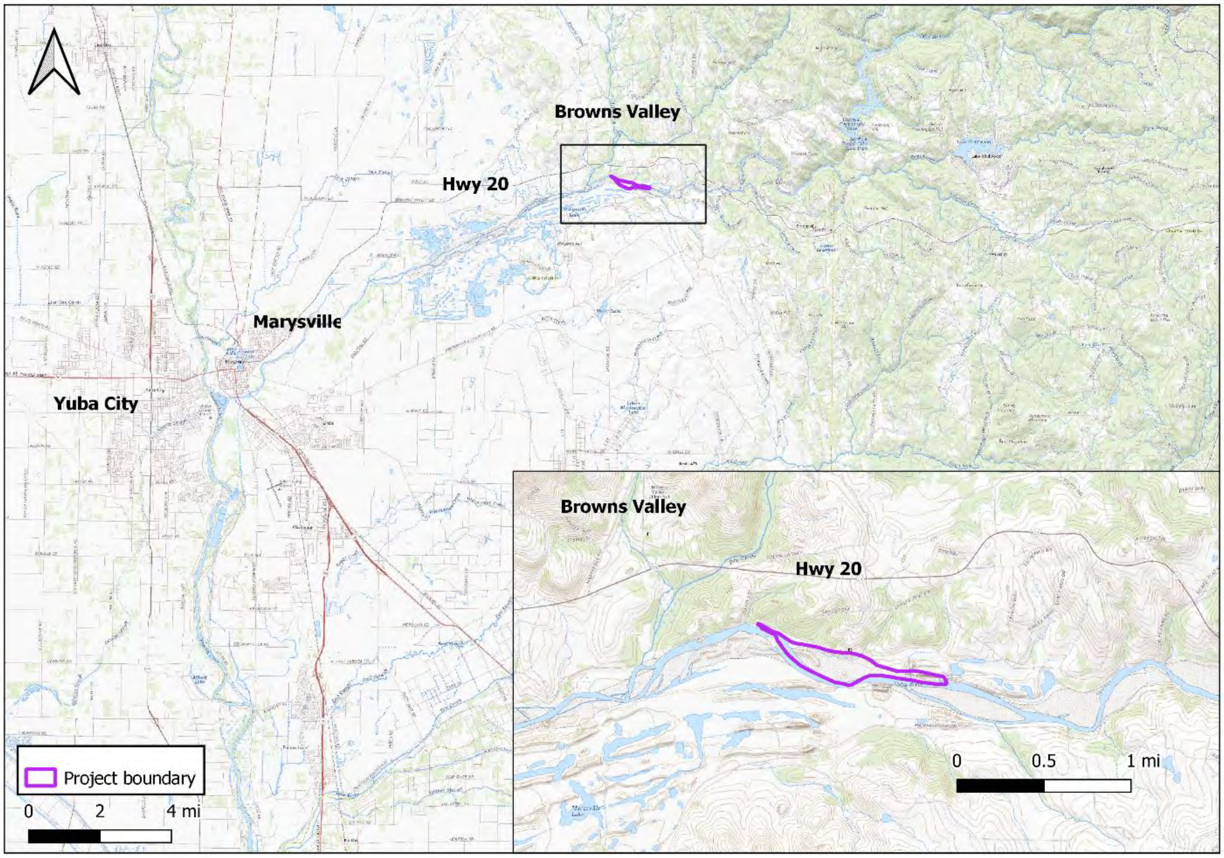

Figure 1. Proposed Project boundary on the lower Yuba River.

1.2 PROJECT LOCATION

The Proposed Project with a boundary of 62.4 acres is located on private property owned by Long Bar Mine LLC and Western Aggregates along the lower Yuba River near the community of Browns Valley in Yuba County, California (**Figure 1**). The Proposed Project survey area encompasses approximately 121.7 acres, of which only 40.1 acres are included in the Proposed Project restoration footprint (**Figure 2**). The survey area is located on the gravel bar on the north side of the lower Yuba River between 39°13'29.45"N, 121°23'53.55"W (downstream limit) and 39°13'16.09"N, 121°22'32.76"W (upstream limit; **Figure 2**). The survey area occurs within Sections 22, 23, 26, and 27, Township 16 North, and Range 5 East, Mount Diablo Baseline and Meridian in the "Browns Valley, CA" U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle(quad) (**Figure 2**). The survey area is at river mile (RM) 15, approximately 8.9 river miles downstream of Englebright Dam (RM 23.9).

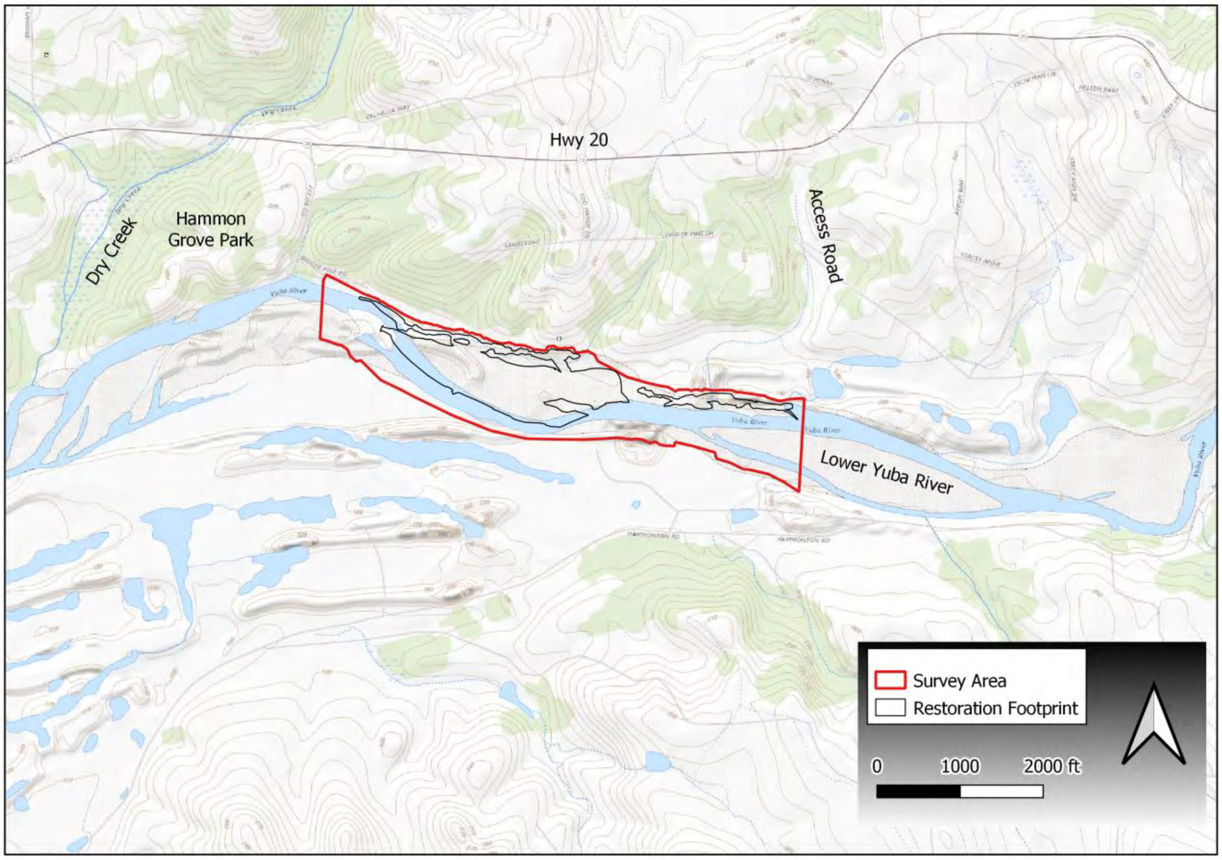

Figure 2. Topographic map depicting project survey area and proposed restoration footprint.

1.3 PROJECT DESCRIPTION

The U.S. Fish and Wildlife Service (USFWS) Anadromous Fish Restoration Program (AFRP), through the Central Valley Project Improvement Act (CVPIA), was mandated to make all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley streams on a long-term sustainable basis (USFWS 2001). The Yuba River still provides valuable spawning and rearing habitat for Central Valley (CV) fall-run and spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) and California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*). CV spring-run Chinook Salmon and CCV steelhead are both listed as threatened under the federal Endangered Species Act (ESA) and fall-run Chinook Salmon are considered a species of concern under the California Endangered Species Act (CESA). The Yuba River is accessible to anadromous fishes for the first 23.9 river miles with access terminating at Englebright Dam. The Rehabilitation Concepts for the Parks Bar to Hammon Bar Reach of the lower Yuba River (cbec, SYRCL, and McBain and Trush 2010) identifies public and private lands in this reach (including the survey area) as high priority for floodplain and side channel enhancement. Habitat rehabilitation in this area will support rearing by spring-run and fall-run Chinook Salmon and CCV steelhead.

The objectives of the Long Bar Salmonid Habitat Restoration Project (Proposed Project) are to rehabilitate side channel, floodplain, and riparian ecosystem processes to benefit Chinook Salmon, CCV steelhead and other native fishes within the study area. The Proposed Project includes the following restoration activities: (1) floodplain grading; (2) side channel excavation and reconnection; and (3) native vegetation planting (Figure 3). The Proposed Project is a collaborative effort by AFRP, South Yuba River Citizen's League (SYRCL), Cramer Fish Sciences (CFS), and cbec eco-engineering (cbec) and private landowners. Project activities will be conducted on private land owned by project partners. The proposed floodplain rehabilitation activities will increase available and usable rearing areas for salmonids by providing increased side channel and floodplain area and frequency of inundation, which will also increase the food base for juvenile salmonids (Merz and Chan, 2005).

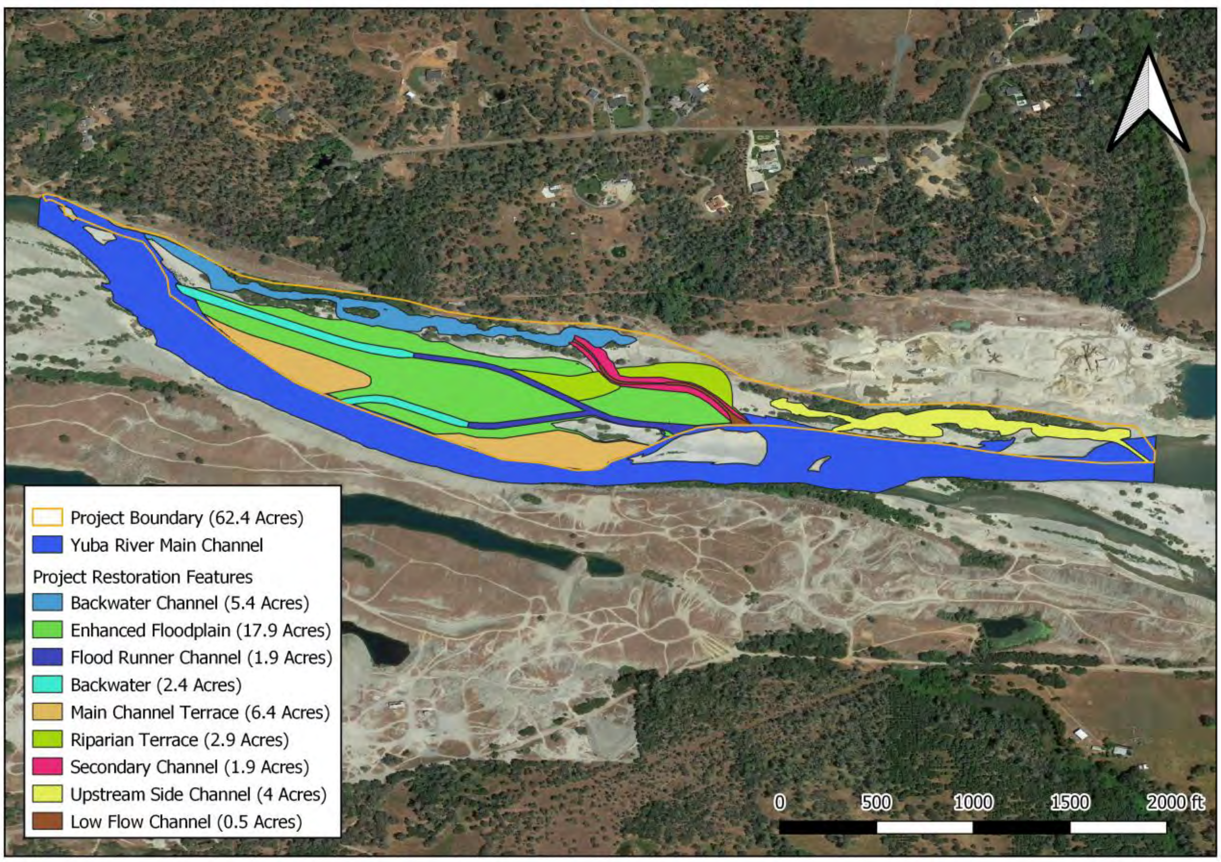

Figure 3. Conceptual restoration design for the Long Bar Salmonid Habitat Restoration Project.

1.4 DRIVING DIRECTIONS

From Sacramento, CA, take Highway 5 north towards Redding, after 5.8 miles keep right to continue on CA-99 north towards Yuba City. Take CA-99 north for 12.5 miles and then keep right to take CA-70 north towards Marysville. Continue on CA-70 north for 22 miles and then turn right on CA-20 east towards Grass Valley. Continue on CA-20 east for 13.9 miles and then turn right on paved access road at 6130 State Highway 20. Take paved access road for 0.5 miles into the entrance for the SRI Stringer Pit.

2.0 REGULATORY SETTING

The Corps has primary federal responsibility for administering regulations that concern Waters of the U.S., including wetlands, under Section 404 of the CWA. Section 404 regulates the discharge of dredged and fill material into Waters of the U.S. The Corps requires that a permit be obtained if a project proposes placing structures within, over, or under navigable waters and/or discharging dredged or fill material into waters below the ordinary high-water mark (OHWM). The Corps has established a series of nationwide permits (NWPs) that authorize certain activities in waters. Wetlands and other water features that lack a hydrologic connection to navigable Waters of the U.S. and that lack a nexus to interstate and foreign commerce are not regulated by the CWA and do not fall under the jurisdiction of the Corps. These features are called “isolated wetlands.”

In addition, a Section 401 Water Quality Certification Permit was established to comply with CWA Sections 301, 302, 303, 306, and 307, and is typically regulated by the California Regional Water Quality Control Board (RWQCB). Anyone proposing to conduct a project that may result in discharge to U.S. surface waters and/or “waters of the state,” including wetlands (all types), year-round and seasonal streams, lakes, and all other surface waters, must obtain a federal permit or water quality certification. At a minimum, any beneficial uses lost must be replaced by a mitigation project of at least equal function, value, and area.

Waters of the U.S. are defined as “all waters used in interstate or foreign commerce; all interstate waters including interstate wetlands; all other waters such as intrastate lakes, rivers, streams (including intermittent and ephemeral streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, where the use, degradation, or destruction of which could affect interstate commerce; impoundments of these waters; tributaries of these waters; or wetlands adjacent to these waters” (Section 404 of the CWA; 33 Code of Federal Regulations (CFR) Part 328). The limit of Corps jurisdiction for non-tidal waters (including non-tidal perennial and intermittent watercourses and tributaries to such watercourses) in the absence of adjacent wetlands is defined by the OHWM. The OHWM is defined as “the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas” (Section 404 of the CWA; 33 CFR Part 328).

Wetlands are defined as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Section 404 of the CWA; 33 CFR Part 328).

The Corps and Environmental Protection Agency (EPA) issued the U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook on 30 May 2007 to provide guidance based on the Supreme Court's decision regarding Rapanos v. United States and Carabell v. United States (Rapanos decision) (Rapanos vs. U.S., No. 04-1034 [June 19, 2006] and Carabell vs. U.S., No. 04-1384 [September 27, 2004]) (CORPS and EPA, 2007). The decision provides standards that distinguish between traditional navigable waters (TNWs), relatively permanent waters (RPWs) with perennial or seasonal flows, and non-relatively permanent waters (non-RPWs). Wetlands and non-TNWs adjacent to TNWs are subject to CWA jurisdiction if: the water body is relatively permanent, or if a water body abuts or is tributary to a RPW, or if a water body, in combination with all wetlands adjacent to that water body, has a significant nexus with TNWs. The significant nexus standard will be based on evidence applicable to ecology, hydrology, and the influence of the water on the "chemical, physical, and biological integrity of downstream traditional navigable waters" (CORPS and EPA 2007). Isolated wetlands are not subject to CWA jurisdiction based on the Supreme Court's decision regarding the Solid Waste Agency of Northern Cook County (SWANCC decision) (Solid Waste Agency of Northern Cook County vs. U.S. Army Corps of Engineers, No. 99-1178, January 9, 2001) (USDOE, 2003).

In addition, ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water are generally not defined as Waters of the U.S. because they are not tributaries or they do not have a significant nexus to downstream TNWs (45, 48, and 51 CFR subsections 62732, 62747, 21466, 21474, 41206, and 41217).

3.0 METHODOLOGY

The information presented in this report was prepared in accordance with the Minimum Standards for Acceptance of Preliminary Wetland Delineations (Corps 2001). This report was also prepared in accordance with the Corps of Engineers Wetland Delineation Manual (WTI, 1995), the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Arid West Region Supplement) (Corps 2008), and the U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook (Rapanos Guidance) (Corps and EPA 2007). The boundaries of potential Waters of the U.S. were delineated through aerial photograph interpretation and standard field methodologies (i.e., paired data set analyses), and all wetland data were recorded on Wetland Determination Data Forms - Arid West Region. A color aerial photograph (ArcMap ESRI online server 2019) was used in the field to assist with the delineation. Munsell Soil Color Charts (Munsell Color 2009) were used in the field to identify hydric soils. Plant identification and nomenclature followed The Jepson Manual: Higher Plants of California (Baldwin et al. 2012).

3.1 DELINEATION

Cramer Fish Sciences biologist Kirsten Sellheim, M.S. conducted the delineation on 8 October 2019. Meandering transects were walked throughout the study area to determine locations of potential wetlands and/or Waters of the U.S. During the delineation, three paired data point sets were sampled to determine if the three-parameter criteria (vegetation, soil, and hydrology) supported a wetland or upland determination. At the paired data point locations, one point was within the limits of a potential wetland area and the other point was located outside the potential wetland area. Data point global positioning system (GPS) locations were recorded for each sample using a Trimble 6000 Series GeoXT.

3.2 ROUTINE DETERMINATIONS

As mentioned previously, wetlands and/or other Waters of the U.S. within the study area were determined based on the following three-parameter criteria:

- the majority of dominant plant species are wetland associated species;
- hydric soils are present; and
- hydrologic conditions exist that result in periods of flooding, ponding, or saturation during the growing season.

3.3 VEGETATION

Hydrophytic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Environmental Laboratory 1987). Prevalent vegetation is characterized by the dominant plant species comprising the plant community (WTI 1995). The dominance test is the basic hydrophytic vegetation indicator and was used at each data point location. The “50/20 rule” was used to select the dominant plant species from each stratum of the vegetation community. This rule states that for each stratum in the community, dominant plant species are the most abundant species (when ranked in descending order of coverage and cumulatively totaled) that immediately exceed 50 percent of the total coverage for the stratum, plus any additional plant species that individually comprise 20 percent or more of the total in the stratum (Corps and EPA 2007).

Dominant plant species observed at each data point were classified by their indicator status (i.e., probability of occurring in a wetland) (**Table 1**) according to the USFWS National List of Vascular Plant Species That Occur in Wetlands: California (Region 0; Reed 1988). If the majority (greater than 50 percent) of dominant vegetation on-site are classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC), the site was considered to be dominated by hydrophytic vegetation. Pursuant to the Arid West Supplement, plus (+) and minus (-) modifiers were not used (i.e., FAC- and FAC+ plant species are all considered FAC) and plant species not listed in Reed (1988) were assumed to be upland (UPL) species (Corps and EPA 2007).

In instances where indicators of hydric soil and wetland hydrology were present but the plant community failed the dominance test, the vegetation was re-evaluated using the prevalence index. The prevalence index is a weighted-average wetland indicator status of all plant species in the sample area, where each indicator status is assigned a numeric code (OBL=1, FACW=2, FAC=3, FACU=4, and UPL=5) and weighted by percent cover (Corps 2010).

Table 1. Classification of Wetland-Associated Plant Species (adopted from Reed 1988).

Plant species classification	Abbreviation	Probability of occurring in a wetland
Obligate	OBL	> 99%
Facultative wetland	FACW	66-99%
Facultative	FAC	33-66%
Facultative upland	FACU	1-33%
Upland	UPL	1%

3.4 SOILS

Hydric soils are defined as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile (Environmental Laboratory 1987). Frequently observed indicators of hydric soils include (but are not limited to) histosols, histic epipedon, hydrogen sulfide, stratified layers, depleted below dark surface, depleted matrix, redox dark surface, depleted dark surface, redox depressions, vernal pools, etc. Soil pits were excavated to the depth necessary to observe and document hydric soils indicators, to confirm the absence of indicators, or until an impermeable layer was encountered. The soils at each data point were examined for the presence or absence of these indicators. The colors of the examined soils were determined while the soils were moist using the Munsell Soil Color Charts (Munsell Color 2009).

3.5 HYDROLOGY

Wetlands are seasonally or perennially inundated or saturated at or near (within 12 inches) the soil surface. Primary indicators of wetland hydrology include (but are not limited to) visual observation of surface water, high water table, saturation, water marks (nonriverine), sediment deposits (nonriverine), drift deposits (nonriverine), surface soil cracks, inundation visible on aerial imagery, water stained leaves, salt crust, biotic crust, aquatic invertebrates, hydrogen sulfide odor, oxidized rhizospheres along living roots, etc. Secondary indicators of wetland hydrology include water marks (riverine), sediment deposits (riverine), drainage patterns, dry-season water table, crayfish burrows, etc. Observation of at least one primary indicator or two secondary indicators is required to confirm the presence of wetland hydrology.

4.0 ENVIRONMENTAL SETTING

In general, Yuba County has a Mediterranean climate regime characterized by hot, dry, sunny summers and cool, rainy winters. The mean annual maximum and minimum temperature for Marysville, California, located roughly 12 miles west from the study area, are approximately 75°F and 49°F, respectively (WRCC 2019a). The average maximum temperature for Marysville peaks in July at 96.3°F (WRCC 2019a). The average annual precipitation for Marysville is approximately 21.0 inches, with a maximum of approximately 11.5 inches on average that occurs from December through February based on climate data collected during 1897-2007 (WRCC 2019b).

The study area is located in Yuba County adjacent to the lower Yuba River. The Yuba River is a tributary to the Feather River in the northern portion of the California's CV. The river, which drains an approximately 1,300 square mile (mi^2) [3,367 square kilometer (km^2)] watershed, has three forks; north, middle, and, south, which each originate in the Sierra Nevada mountain range. Elevations in the watershed range from 9,148 ft [2,788 meter (m)] on Mt. Lola at the crest of the Sierra Nevada to 60 ft (18 m) at the confluence with the Feather River in Marysville. The Middle Fork flows into the North Fork downstream of New Bullards Bar reservoir, forming the main Yuba River which then flows into Englebright Reservoir. The South Fork of the Yuba River flows into Englebright Reservoir. The lower Yuba River begins below Englebright Dam and flows for ~24 miles before joining the Feather River near Marysville. The lower Yuba River has two major tributaries: Deer Creek, which flows in ~ 1 mile below Englebright Dam, and Dry Creek, which flows in near Hammon Grove Park. Long-term average annual unimpaired run-off of the lower Yuba River at Smartsville is 2,370,000 acre-feet (YCWA 2009) but this value is reduced by 534,000 acre-feet when out of basin transfers are considered (YCWA 2009). Similar to many rivers in California, the natural hydrologic processes within the Yuba River have been disrupted by the presence of dams (cbec 2013). Englebright Dam, located on the Yuba River at RM 23.9 (measuring from the confluence with the Feather River), lies upstream of the study area and serves as the upstream migration barrier to anadromous fish.

The study area is situated in a rural residential/agricultural and aggregate mining setting near the community of Browns Valley. The study area is an undeveloped gravel bar on the north side of the lower Yuba River adjacent to the SRI Stringer Pit aggregate mining operation. In the immediate vicinity of the study area, land uses include aggregate mining and rural residences on the north side of the river and the Yuba Goldfields historic mining area and ranches on the south side of the river. Rural residential, ranching/irrigated pasture, aggregate mining, and the Yuba Goldfields comprise the outer perimeter of the Yuba River and represent the dominant land uses in the surrounding area.

The Yuba River flows from east to west below the southern boundary of the study area. The study area is dominated by a large gravel bar with scattered stands of riparian vegetation. Along the northern edge of the gravel bar there is a strip of thick riparian vegetation that contains a few isolated pools which are fed by emerging groundwater. The terrain of the study area ranges in elevation from approximately 150 feet to 180 feet (45.7 to 54.9 meters) above mean sea level.

The study area is located within the northern Sierra Nevada Foothills (n SNF) geographic province, which is characterized by blue-oak/foothill-pine woodlands and chaparral (Baldwin et al. 2012).

4.1 HABITAT TYPES

The study area is dominated by an unvegetated gravel bar. Three terrestrial vegetation habitat types were observed within the study area: Fremont cottonwood woodland and forest (great valley mixed riparian forest), sandbar willow thickets (great valley willow scrub), and cattail marshes (coast and valley freshwater marsh). Despite the study area being in the northern Sierra Nevada Foothills floristic province, it is close to the border of the Sacramento Valley (ScV) floristic province and riparian communities found in the Sacramento Valley extend into foothill riparian areas, particularly along major rivers. These terrestrial habitat types are further discussed below, as adapted from *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986) and Manual of California Vegetation (CNPS 2000). Just outside of the northern boundary of the study area the Fremont cottonwood woodland transitions into blue oak woodland. There are 11.08 acres of riparian vegetation (7.68 acres of Fremont cottonwood forest and 3.40 acres of sandbar willow thickets) and 0.10 acres of emergent vegetation within the survey area. The aquatic habitat types observed within the study area include the main channel and a side channel of the Yuba River and perennial isolated pools at the northern edge of the study area, which are described in detail in **Section 5.0**. A map that illustrates the aquatic habitat types within the property is presented as **Figure 5**.

FREMONT COTTONWOOD WOODLAND

Fremont cottonwood is the most common vegetation community within the study area. This habitat type is characterized by a tall, dense, winter-deciduous, broadleaf tree stratum. Dominant vegetation observed within the overstory include Fremont cottonwood (*Populus fremontii*) and Gooding's willow (*Salix gooddingii*). The understory includes willows (*Salix* spp.) and buttonbush (*Cephalanthus occidentalis* var. *californicus*). Other characteristic species include blackberry (*Rubus* spp.). A strip of Fremont cottonwood woodland is found running from east to west at the northern end of the study area.

SANDBAR WILLOW THICKETS

Sandbar willow thickets is the next most common vegetation community within the survey area. It occurs in scattered patches on the gravel bar, primarily in the middle and southern portions. This habitat is dominated by sandbar willow (*Salix exigua*) less than 10 m tall in open to dense thickets. In scour prone areas there is little ground cover but in higher elevation areas an herbaceous understory of introduced grasses occurs.

CATTAIL and BULRUSH MARSH

Freshwater marsh communities are dominated by perennial, emergent monocots one to two meters tall. Within the study area the marsh community is dominated by either cattails (*Typha* spp.) or California bulrush (*Schoenoplectus californicus*). These communities are occasionally found along the coast and in valleys associated with rivers and other freshwater habitats. These communities are much reduced in area compared to historical extent. Within the study area these communities are found in a couple of areas fringing small isolated ponds and seasonal channels.

4.2 SOIL TYPES

According to the U.S. Department of Agriculture (USDA) National Resources Conservation Service (NRCS) online Soil Survey of Yuba County, California, the dominant soil types mapped within the study area are riverwash and dumps/mine tailings (**Appendix 3**, USDA 2019). A map that illustrates the extent of the soil types within the study area is provided in **Appendix 3**. Riverwash soil type consists of recent depositions of gravel, sand, and silt alluvium along major rivers and streams. Gravel bars comprise the majority of these areas. Mine tailings consist of riverwash that has been dredge mined and typically formed into regular windrows. The process of dredge mining typically results in the larger substrates (cobble and gravel) being left on the surface while the smaller substrates (small gravel and sand) are buried below the larger material. At present, riverwash and mine tailings are not identified in the NRCS National Hydric Soil List for Yuba County (USDA 2019).

4.3 NATIONAL WETLANDS INVENTORY

The USFWS National Wetlands Inventory (NWI) online mapping tool was used to detect any previously mapped aquatic features within the study area (NWI, 2019). The NWI map of the study area is shown in **Figure 4**. The NWI map depicts Freshwater Forested/Shrub as the dominant wetland types occurring within the study area. A detailed description of the wetland features identified within the study area during the delineation is included in Section 5.0 and shown in **Figure 5.**

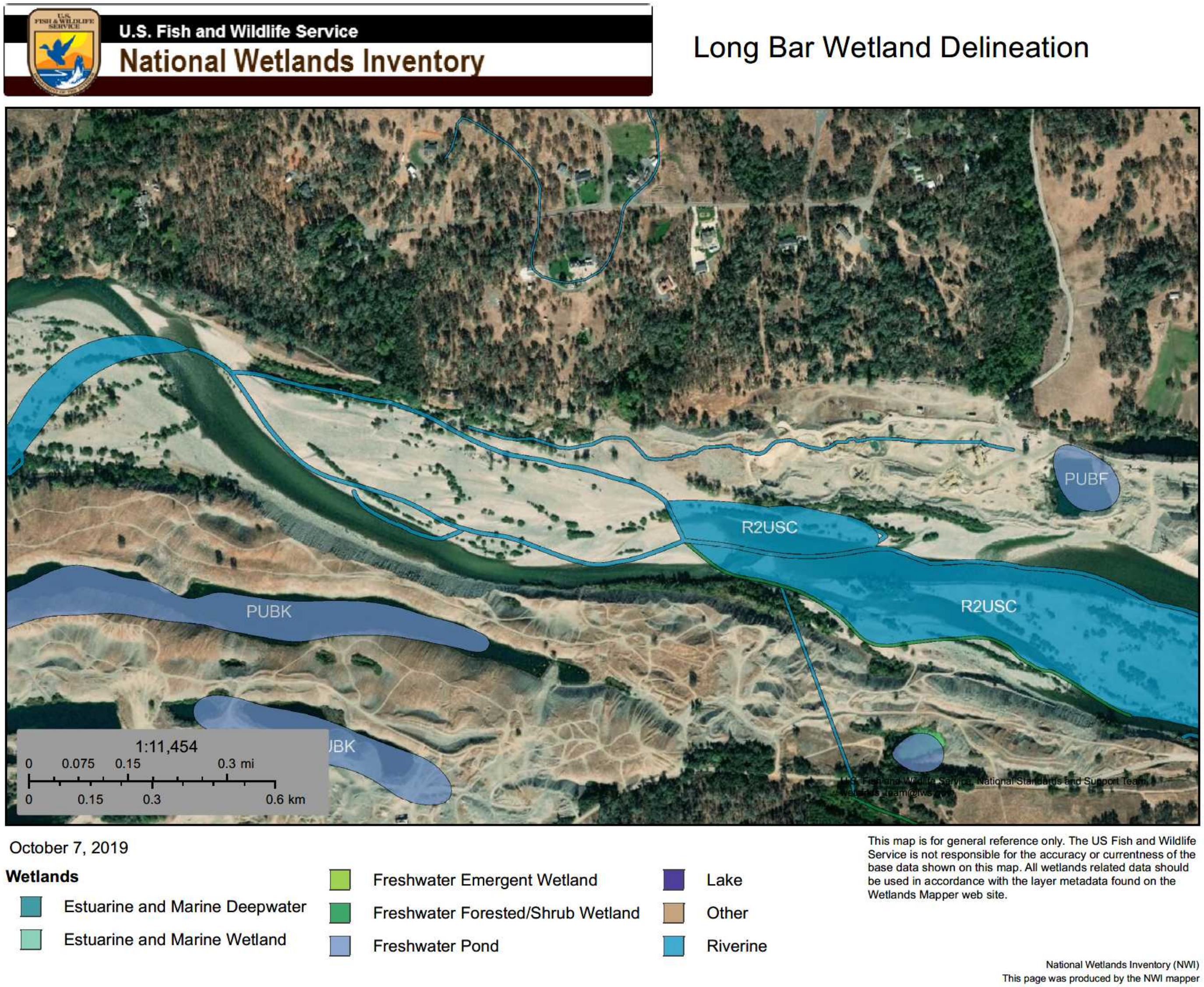

Figure 4. National Wetlands Inventory Map of the Proposed Project study area.

5.0 RESULTS

5.1 EXISTING CONDITIONS

At the time of the delineation, the large gravel bar comprising the study area shown in **Figure 5** was not inundated. Vegetation associated with the wetlands was readily identifiable to the degree necessary to determine the presence or absence of hydrophytic vegetation. All wetland vegetation was identifiable to the genus or species level. However, upland grasses (Poaceae) could not be identified past the family level due to the absence of reproductive life stages. For all sites, the vegetation observed was sufficient to determine indicator status and conduct the vegetation portion of the delineation. Normal circumstances were present within the study area. The wetland delineation data forms compiled in the field are included as **Appendix 4** and a list of plant species observed within the study area is included as **Appendix 1**. Site photos taken during the delineation are included as **Appendix 2**.

5.2 WETLANDS AND OTHER WATERS OF THE U.S. OCCURRING WITHIN THE STUDY AREA

Jurisdictional wetlands and other Waters of the U.S. observed within the study area were the main channel of the Yuba River, which has been identified previously by the NWI, isolated pools which are connected to the main channel at high flows, and areas of freshwater forested wetlands, freshwater scrub/shrub wetland, and freshwater emergent wetland (**Figures 4 and 5**). **Table 2** lists the acreage and linear feet of the Yuba River occurring in the project area grading footprint, as well as the acreage of the wetlands observed within the survey area. A detailed description of the river channel and wetlands are included below.

Table 2. Acreages of potential jurisdictional wetlands and waters of the U.S. within the project site.

Aquatic Resource Name	Cowardin	Location (lat/long)	Acreage	Linear Feet
SW-1	RP1SS6	39.22399, -121.39343	0.07	
SW-2	RP1SS6	39.22255, -121.38793	0.48	
SW-3	RP1SS6	39.22157, -121.38914	0.78	
SW-4	RP1SS6	39.22167, -121.38723	0.77	
SW-5	RP1SS6	39.22140, -121.38413	0.25	
SW-6	RP1SS6	39.22084, -121.38454	0.03	
SW-7	RP1SS6	39.22140, -121.38162	0.64	
SW-8	RP1SS6	39.22120, -121.37883	0.38	
FW-1	RP1F06	39.22363, -121.39089	3.06	
FW-2	RP1F06	39.22316, -121.38773	0.61	
FW-3	RP1F06	39.22285, -121.38740	0.82	
FW-4	RP1F06	39.22282, -121.38567	0.55	
FW-5	RP1F06	39.22160, -121.37978	2.64	
EW-1	PEM	39.22463, -121.39357	0.10	
EW-2	PEM	39.22308, -121.38803	0.01	
PD-1	R3UB1	39.22396, -121.39263	0.39	
PD-2	R3UB1	39.22369, -121.39134	0.03	
PD-3	R3UB1	39.22368, -121.39089	0.12	
PD-4	R3UB1	39.22328, -121.38894	0.01	
PD-5	R3UB1	39.22309, -121.38801	0.04	
PD-6	R3UB1	39.22307, -121.38726	0.03	
PD-7	R3UB1	39.22123, -121.37706	0.22	
PC-1	R3RB1	39.22167, -121.38662	33.64	6,402
SC-1	R3RB1	39.21981, -121.37804	3.92	1,402

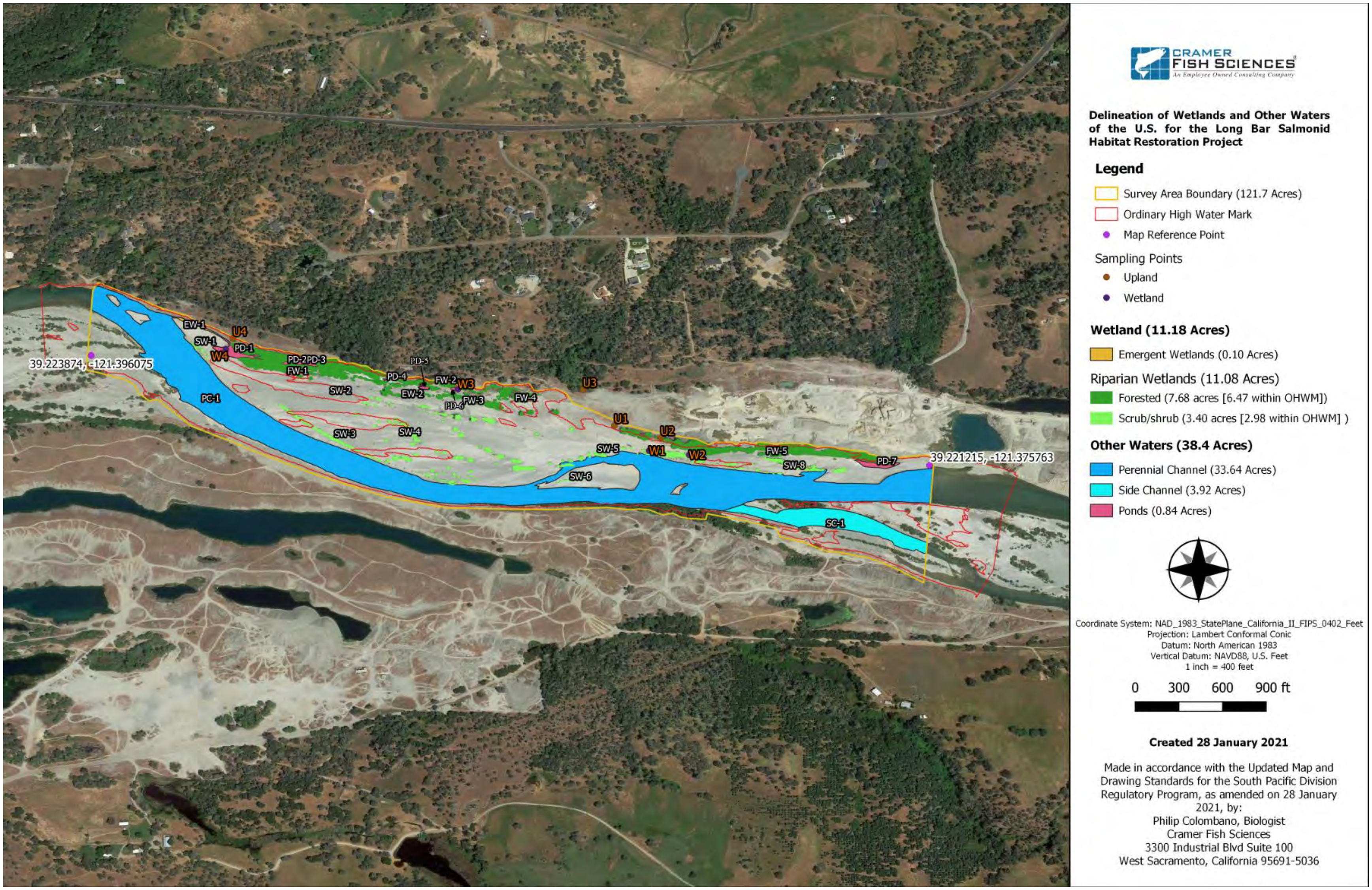

Figure 5. Delineation of wetlands and other Waters of the U.S. for the Long Bar Salmonid Habitat Restoration Project.

WETLANDS

A variety of wetlands were documented within the study area. The gravel bar/floodplain was not connected to the main channel at the flows observed during the time of the survey but showed evidence of being inundated during high flow events in winter 2019, including drift vegetation and trash trapped in tree branches. Freshwater forested wetlands (FW-1 – FW-5), comprised of a mixed riparian forest community, were primarily found along the northern edge of the study area. A few isolated pools in the northwest portion of the study area were fringed with emergent wetland (EW-1 – EW-2) consisting of cattails (*Typha* spp.). Scattered throughout the study area were stands of freshwater scrub/shrub wetlands (SW-1 – SW-8) which were dominated by willows. The OHWM has been determined to be 26,000 cfs for the lower Yuba River. The majority of the study area is below the OHWM (**Figure 5**).

A diversity of vegetation was observed within the study area. Willows were the dominant vegetation in W-1, W-2, and W-4 (**Appendix 4**). Cattails were the dominant vegetation in W-3, which lacked willows and contained parrot feather (*Myriophyllum aquaticum*; OBL; **Appendix 4**). W-1 also contained *Salvia* spp. (FACU), and *Digitaria* spp (FACU) while W-4 also contained California bulrush (*Schoenoplectus californicus*; OBL) and quack grass (*Elymus repens*; OBL; **Appendix 4**). Upland sites all contained different vegetation types. U-1 only contained foothill pine (*Pinus sabiniana*; FACU; **Appendix 4**). U-2 contained Fremont cottonwood (*Populus fremontii*; FACW) and grasses (Poaceae; UPL; **Appendix 4**), however the percent of dominant species which are OBL, FACW, or FAC were not greater than 50% (**Appendix 4**). U-3 was dominated by yellow star-thistle (*Centaurea solstitialis*; FACU) with additional vegetation comprised of grasses (UPL) and *Salvia* spp. (FACU; **Appendix 4**). The only vegetation present at U-4 were grasses (UPL; **Appendix 4**).

The primary indicators of wetland hydrology observed within wetland sampling points were variable. W-1 had the primary indicators of inundation visible on aerial imagery and water-stained leaves as well as the secondary indicators of sediment and drift deposits (**Appendix 4**). W-2 lacked any primary indicators but had the secondary indicators of water marks, drainage patterns, and sediment and drift deposits (**Appendix 4**). W-3 and W-4 both had surface water, high water table, saturation, and aquatic invertebrates as primary indicators while W-4 also had inundation visible on aerial imagery (**Appendix 4**). W-3 had the secondary indicators of water marks, sediment deposits, and drift deposits (**Appendix 4**).

The soil matrix color observed within the wetlands varied across the sites. A table listing depth, matrix colors, soil texture, and hydric soil indicators used to determine wetland hydrology for each of the wetland sampling points is included in **Table 3**. None of the paired upland soil samples corresponding to each of the wetlands satisfied the wetland hydrology, hydrophytic vegetation, or hydric soils criteria.

Table 3. Soil matrix color, texture and indicators used to delineate wetland features within study area. Color codes followed Munsell Color (2009).

Feature	Depth (inches)	Color	Texture	%	Hydric soil indicators	Hydric Soil present?
W-1	0-12	--	Sand	100	Sandy redox, Depleted matrix	Yes
W-2	0-12	--	Cobble	100	N/A	No
W-3	0-8	--	Sand	50	Sandy redox, 1 cm Muck	Yes
W-3	0-8	--	Gravel	50		Yes
W-4	0-6	--	Gravel	100	N/A	No
U-1	0-12		Organic matrix	10	N/A	No
U-1	0-12	--	Gravel/Cobble	90	N/A	No
U-2	0-12	--	Cobble	100	N/A	No
U-3	0-8	--	Cobble	100	N/A	No
U-4	0-12	--	Sand	40	N/A	No
U-4	0-12	--	Gravel	60	N/A	No

YUBA RIVER

The Yuba River has been previously identified as a jurisdictional water of the U.S. by the NWI (**Figure 4**). The river channel adjacent to the study area is relatively wide and confined by a training wall forming its southern bank. The Yuba River channel adjacent to the study area is comprised of gravel substrate. Several isolated pools, which connect with the Yuba River at high flows, were also observed along the northwest edge of the study area and are identified as ponds (PD-1 to PD-7) in the delineation map (**Figure 5**). Additionally, a perennial side channel (SC-1) on the south side of the river at the upstream end of the site was also mapped (**Figure 5**). However, this side channel is not within the proposed action footprint.

6.0 DISCUSSION AND ANALYSIS

6.1 POTENTIALLY JURISDICTIONAL AND NON-JURISDICTIONAL FEATURES

A Cramer Fish Sciences biologist conducted a delineation of potential jurisdictional Waters of the U.S. within the study area on 8 October 2019. The main channel of the Yuba River, isolated pools, freshwater forested wetlands, freshwater scrub/shrub wetlands, and emergent wetlands were identified within the study area. All these features appear to be jurisdictional under Section 404 of the CWA. A discussion of the preliminary determination of these features is presented below.

The lower section of the Yuba River downstream of Englebright Dam is considered a jurisdictional Water of the U.S. This portion of the Yuba River serves as a tributary to the Feather River which is a tributary to the Sacramento River which flows into San Francisco Bay, then into the Pacific Ocean. The Yuba River within the study area may therefore be used for international navigation, and hence constitutes a “Water of the U.S.,” under the definition presented in Section 2.0. The gravel bar/floodplain adjacent to the main channel was not inundated during the time of the survey, but is likely to connect with the main channel under relatively high flows as evidenced by debris and trash deposited in trees during high flows as well as obvious recent scour and deposition on the gravel bar. The gravel bar/floodplain supports riparian forest and scrub/shrub vegetation which are associated with wetlands as well as isolated pools; some with fringing emergent vegetation. Nearly the entire gravel bar, including the riparian and emergent wetlands and isolated pools, becomes connected to the main channel of the Yuba River during high flows as evidenced by the OHWM. The emergent wetlands, riparian wetlands below the OHWM, and the Yuba River perennial channel appear to be jurisdictional under Section 404 of the CWA. However, the final determination of jurisdictional status of these features within the study area is at the discretion of the Corps.

The Proposed Project's impacts to Waters of the U.S. are shown in the Wetland Impacts Map (**Appendix 5**). Overall, implementation of the Proposed Project would result in the enhancement of 27.2 acres of floodplain habitat, and the creation/enhancement of 10.2 acres of seasonal channel and 3.86 acres of perennial channel (**Table 4; Appendix 5**) while having temporary impacts to 5.70 acres and permanently changing the aquatic resource type of 0.95 acres (**Table 5**).

Table 4. The existing acres, project acres and associated change in acres for the aquatic resource types found within the survey area of the Proposed Project.

Aquatic Resource Type	Existing Acres	Project Acres	Change in Acres
Emergent Wetland	0.10	0.10	0
Riparian Wetland above OHWM	1.63	1.63	0
Riparian Wetland below OHWM	9.45	8.50	-0.95
Perennial Channel	37.56	41.42	3.86
Intermittent Channel (Side Channel)	0	10.2	10.2
Ponds	0.84	0.84	0
Total	49.58	62.69	13.11

Table 5. The temporary impacts, permanent conversion, and new acres with implementation of the Proposed Project for the aquatic resource types found within the survey area.

Aquatic Resource Type	Temporary Impact (Acres)	Permanent Conversion to Perennial Side Channel (Acres)	New (Acres)
Emergent Wetland	0.08	0	0
Riparian Wetland above OHWM	0.38	0	0
Riparian Wetland below OHWM	3.24	0.95	0
Perennial Channel	1.24	0	3.86
Intermittent Channel (Side Channel)	0	0	10.2
Ponds	0.76	0	0
Total	5.70	0.95	14.06

Implementation of the Proposed Project would have temporary impacts to 0.08 acres of emergent wetland, 3.62 acres of riparian wetland (3.24 acres below the OHWM), 1.24 acres of perennial channel, and 0.76 acres of ponds (**Table 5**). The Proposed Project would also create 10.2 acres of intermittent channel (side channels), and 3.86 acres of perennial channel (**Table 5**). Creation of perennial side channel would result in permanent conversion of 0.95 acres of riparian wetland below OHWM (**Table 5**).

6.2 INTERSTATE COMMERCE CONNECTION

As discussed in Section 6.1, the Yuba River is a jurisdictional aquatic resource because it is a traditional navigable waterway, and an international commerce connection is present. The adjacent floodplain is also tentatively a jurisdictional aquatic resource due to the high likelihood that it becomes connected to the Yuba River during high flow events.

7.0 CONCLUSION

Implementation of the Proposed Project would benefit salmonid species through targeted habitat restoration activities. Such activities would include juvenile salmonid rearing habitat enhancement through floodplain lowering and side channel excavation. Because the intent of the Proposed Project is to restore and enhance non-tidal open waters to increase aquatic resources, the project may be recommended as representative of projects that qualify under NWP 27: Aquatic Habitat Restoration, Establishment, and Enhancement Activities (Corps and EPA 2007).

The Yuba River, adjacent floodplain (below the OHWM), and wetlands qualify as jurisdictional aquatic resources under Section 404 of the CWA. Final determination of the status of these aquatic resources must be approved by the Corps. If the Corps concurs with the determination, it has regulatory authority over the Yuba River and floodplain containing wetlands.

Before implementation of restoration activities, a final jurisdictional determination must be approved by the Corps.

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APPENDIX 1: PLANT SPECIES OBSERVED WITHIN STUDY AREA

Scientific name	Common name	Classification
ASTERACEAE	COMPOSITE FAMILY	
*Centaurea solstitialis**	Yellow star-thistle	FAC U
CYPERACEAE	SEDGE FAMILY	
Schoenoplectus californicus	California bulrush	OBL
HALORAGACEAE	WATERMILFOIL FAMILY	
Myriophyllum aquaticum	Parrot feather	OBL
LAMIACEAE	DEADNETTLE FAMILY	
Salvia sp.	Sage	FAC U
PINACEAE	PINE FAMILY	
Pinus sabiniana	Gray pine	FAC U
POACEAE	GRASS FAMILY	
Poaceae sp.	Unidentifiable grass	UPL
Digitaria sp.*	Crabgrass	FAC U
*Elymus repens**	Couch grass	OBL
SALICACEAE	WILLOW FAMILY	
Salix exigua	Sandbar willow	FAC W
Salix gooddingii	Goodding's willow	FAC W
Salix lasiolepis	Arroyo willow	FAC W
Populus fremontii	Fremont cottonwood	FAC W
TYPHACEAE	CATTAIL FAMILY	
Typha sp.	Cattail	OBL

* indicates a non-native plant

APPENDIX 2: PHOTOS OF STUDY AREA

A1. Wetland 1 sample location.

A2. Upland 1 sample location.

A3.Wetland 2 sample location

A4. Upland 2 sample location.

A5. Wetland 3 sample location

A6. Upland 3 sample location

A7. Wetland 4 sample location

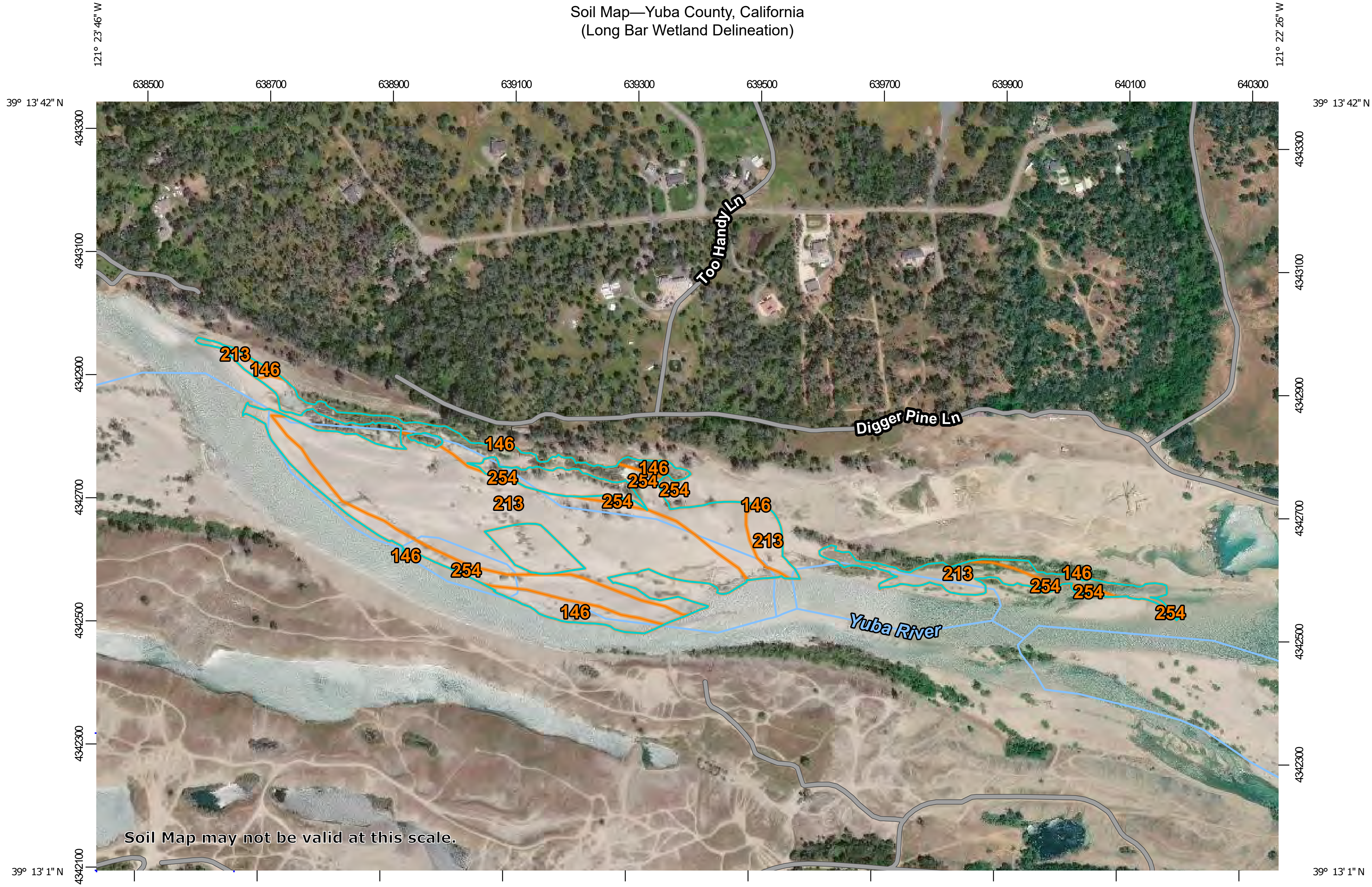
A8. Upland 4 sample location

A9. Yuba River main channel at downstream end of survey area

APPENDIX 3: NRCS SOIL SURVEY REPORT

Attachment 1

Soil Map—Yuba County, California
(Long Bar Wetland Delineation)



Map Scale: 1:8,810 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 400, 800, 1600, 2400

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Soil Map—Yuba County, California
(Long Bar Wetland Delineation)

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yuba County, California
Survey Area Data: Version 13, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 20, 2017—Aug 8, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
146	DUMPS, MINE TAILINGS	3.6	9.0%
213	RIVERWASH	24.3	60.6%
254	WATER	12.2	30.5%
Totals for Area of Interest		**40.1**	**100.0%**

APPENDIX 4: FIELD DATA SHEETS

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE, YUBA Sampling Date: 8 OCT 2019
Applicant/Owner: SYCCL / SRI State: CA Sampling Point: 1255 (W1)
Investigator(s): KIRSTEN SELLHEIM Section, Township, Range: T16N R5E
Landform (hillslope, terrace, etc.): TERRACE Local relief (concave, convex, none): CONCAVE Slope (%): 1%
Subregion (LRR): CALIFORNIA Lat: 39.22160 Long: 121.38255 Datum: WGS 84
Soil Map Unit Name: DUMPS / TAILINGS NWI classification: RIVERINE
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? Yes X No ___

Remarks: GRAVEL BAR WITH PATCHES OF SAND
PHOTOS 329-331

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. SALIX SPP.	100%	Y	FACW
2.			
3.			
4.			
Total Cover:	100%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. PH 331, SALVIA SP.	5%	N	FACU
2. DIGITARIA SP.	15%	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	20%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 80% % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	100	x 2 = 200
FAC species		x 3 =
FACU species	20	x 4 = 80
UPL species		x 5 =
Column Totals:	120 (A)	280 (B)

Prevalence Index = B/A = 2.3

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: W 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
12"		100%					SAND	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

SAND SAMPLE TAKEN

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- X Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- X Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

DRY SEASON, LOW RIVER FLOWS

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE / YUBA Sampling Date: 8 OCT 2019

Applicant/Owner: SYRCL / SRI State: CA Sampling Point: 1259 U1

Investigator(s): KIRSTEN SELLHEIM Section, Township, Range: T16 R5E

Landform (hillslope, terrace, etc.): HILLSLOPE Local relief (concave, convex, none): CONVEX Slope (%): 3%

Subregion (LRR): CALIFORNIA Lat: 39.22305 Long: 121.38416 Datum: WGS 84

Soil Map Unit Name: DUMPS / TAILINGS NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks:

PN 338-342

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. PINUS SABINIANA	80%	Y	FACU
2.			
3.			
4.			
Total Cover:	80%		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. —			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:			
Woody Vine Stratum			
1. —			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 100% % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	0	x 2 =
FAC species	0	x 3 =
FACU species	80	x 4 = 320
UPL species	0	x 5 =
Column Totals:	80 (A)	320 (B)

Prevalence Index = B/A = 4

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:

PINE NEEDLES AND CONES

SOIL

Sampling Point: U1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12		10					ORGANIC	MATRIX
0-12	—	90					GRAVEL/	COBBLE

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____________

Water Table Present? Yes ____ No X Depth (inches): ____________

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): ____________

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Attachment 1

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE / YUBA Sampling Date: 9 OCT 2019
Applicant/Owner: SYRCL / SRI State: CA Sampling Point: 1256 (W2)
Investigator(s): KIRSTEN SELLHEIM Section, Township, Range: T 16N R5E
Landform (hillslope, terrace, etc.): TERRACE Local relief (concave, convex, none): CONVEX Slope (%): 1%
Subregion (LRR): CALIFORNIA Lat: 39.22161 Long: 121.38256 Datum: WGS 84
Soil Map Unit Name: DUMPS / TAILINGS NWI classification: NA
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes X	No ___
Is the Sampled Area within a Wetland?	Yes X	No ___

Remarks:

PH. 0332-0334

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. SALIX SPP.	100%	Y	FACW
2.			
3.			
4.			
Total Cover:	100%		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. —			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:			
Woody Vine Stratum			
1. —			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	100	x 2 = 200
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	100 (A)	200 (B)

Prevalence Index = B/A = 2

Hydrophytic Vegetation Indicators:

- X Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: W2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
12"	NA -						COBBLE	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- X Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE / YUBA Sampling Date: 8 OCT 2019

Applicant/Owner: SYRCL / SRI State: CA Sampling Point: 1257 - U2

Investigator(s): KIRSTEN SELLHEIM Section, Township, Range: T 16N R5E

Landform (hillslope, terrace, etc.): TAILINGS PILE Local relief (concave, convex, none): CONCAVE Slope (%): 30%

Subregion (LRR): CALIFORNIA Lat: 39.22178 Long: 121.38229 Datum: WGS 84

Soil Map Unit Name: DUMPS, TAILINGS NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X
Is the Sampled Area within a Wetland?		X

Remarks:

PH. 336-337

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. POPULUS FREMONTII	40%	Y	FACU
2.			
3.			
4.			
Total Cover:	40%		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:	0%		
Herb Stratum			
1. POACEAE	25%	Y	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	25%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 35% % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	40	x 2 = 80
FAC species	0	x 3 =
FACU species	0	x 4 =
UPL species	25	x 5 = 125
Column Totals:	65 (A)	205 (B)

Prevalence Index = B/A = 3.15

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:

Attachment 1

SOIL

Sampling Point: U2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
12"							COBBLE	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ______

Water Table Present? Yes ____ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE / YUBA Sampling Date: OCT 2019
Applicant/Owner: SYRCL / SRI State: CA Sampling Point: 1260 / W3
Investigator(s): KIRSTEN SELLHEIM Section, Township, Range: T 16N R5E
Landform (hillslope, terrace, etc.): TERRACE / FLOODPLAIN Local relief (concave, convex, none): CONCAVE Slope (%): 3
Subregion (LRR): CALIFORNIA Lat: 39.22302 Long: 121.38418 Datum: WGS 84
Soil Map Unit Name: DUMPS / TAILINGS NWI classification: RIVERINE
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___		Is the Sampled Area within a Wetland? Yes X No ___
Hydric Soil Present? Yes X No ___		
Wetland Hydrology Present? Yes X No ___		

Remarks:

PH 0345-0347

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. TYPHA SP.	40%	Y	OBL
2. MYRIOPHYLLUM AQUATICUM	5%	N	OBL
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	45%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 55% % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	45 (A)		45 (B)

Prevalence Index = B/A = 1

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

Attachment 1

SOIL

Sampling Point: W3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8		50					SAND	
0-8		50					GRAVEL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
X 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
X Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X No __

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

X Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
__ Water Marks (B1) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
X Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Plowed Soils (C6)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

X Water Marks (B1) (**Riverine**)
X Sediment Deposits (B2) (**Riverine**)
X Drift Deposits (B3) (**Riverine**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Thin Muck Surface (C7)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No __ Depth (inches): ______

Water Table Present? Yes X No __ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes X No __ Depth (inches): ______

Wetland Hydrology Present? Yes X No __

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE/YUBA Sampling Date: 8 OCT 2019

Applicant/Owner: SYRCL/SRI State: CA Sampling Point: U3-1261

Investigator(s): KIRSTEN SELLHEIM Section, Township, Range: T16N R5E

Landform (hillslope, terrace, etc.): HILLSLOPE Local relief (concave, convex, none): CONCAVE Slope (%): 80%

Subregion (LRR): CALIFORNIA Lat: 39.22428 Long: 121.39264 Datum: WGS 84

Soil Map Unit Name: DUMPS/TAILINGS NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks:

PH 354-355

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. CENTAUREA SOLSTITIALIS	50%	Y	FACU
2. POACEAE	12%	N	UPL
3. SALVIA SP. 356-358	5%	N	FACU
4.			
5.			
6.			
7.			
8.			
Total Cover:	67%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 33 % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	0	x 3 = 0
FACU species	55	x 4 = 220
UPL species	12	x 5 = 60
Column Totals:	67 (A)	280 (B)

Prevalence Index = B/A = 4.2

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:

SOIL

Sampling Point: U3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8		100					COBBLE	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (**A11**)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Attachment 1

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE / YUBA Sampling Date: 8 OCT 2019

Applicant/Owner: SYRCL / SRI State: CA Sampling Point: 1262 - W4

Investigator(s): KIRSTEN SELLHEIM Section, Township, Range: T 16N R5E

Landform (hillslope, terrace, etc.): TERRACE / FLOODPLAIN Local relief (concave, convex, none): CONCAVE Slope (%): 0 %

Subregion (LRR): CALIFORNIA Lat: 39. 22402 Long: 121.39281 Datum: WGS84

Soil Map Unit Name: TAILINGS / DUMPS NWI classification: RIVERINE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	Is the Sampled Area within a Wetland? Yes X No ___
Hydric Soil Present?	Yes ___ No X	
Wetland Hydrology Present?	Yes X No ___	

Remarks:

PH 353, 359 - 362

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. SALIX SPP.	5	Y	FACW
2.			
3.			
4.			
Total Cover:	5		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. SCHOENOPLECTUS CALIFORNICUS	30%	Y	OBL
2. ELYMUS REPENS	60%	Y	OBL
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	90%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 10% % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	90	x 1 = 90
FACW species	5	x 2 = 10
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	95 (A)	100 (B)

Prevalence Index = B/A = 1.05

Hydrophytic Vegetation Indicators:

- X Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

SOIL

Sampling Point: W4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6		100%					GRAVEL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ______________________

Depth (inches): ______________________

Hydric Soil Present? Yes ______ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): ________

Water Table Present? Yes X No ___ Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): ________

Wetland Hydrology Present? Yes X No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: LONG BAR City/County: MARYSVILLE/YUBA Sampling Date: 8 OCT 2019

Applicant/Owner: SYRCL/SRA State: CA Sampling Point: U4-1263

Investigator(s): KRISTEN SELLHEIM Section, Township, Range: T 16N R5E

Landform (hillslope, terrace, etc.): TERRACE Local relief (concave, convex, none): NONE Slope (%): 0

Subregion (LRR): CALIFORNIA Lat: 39.22218 Long: 121.38339 Datum: WGS 84

Soil Map Unit Name: DUMPS/TAILINGS NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	Is the Sampled Area within a Wetland?	Yes ____ No X
Hydric Soil Present?	Yes ____	No X		
Wetland Hydrology Present?	Yes ____	No X		

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. POACEAE	10%	Y	UP
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	10%		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 90% % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 =
FACW species	0	x 2 =
FAC species	0	x 3 =
FACU species	0	x 4 =
UPL species	10	x 5 = 50
Column Totals:	10 (A)	50 (B)

Prevalence Index = B/A = 5

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

Attachment 1

SOIL

Sampling Point: V4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12		40					SAND	
0-12		60					GRAVEL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? Yes ___ No X

Remarks:

PN 0367 - 0370

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No ✓ Depth (inches): ______

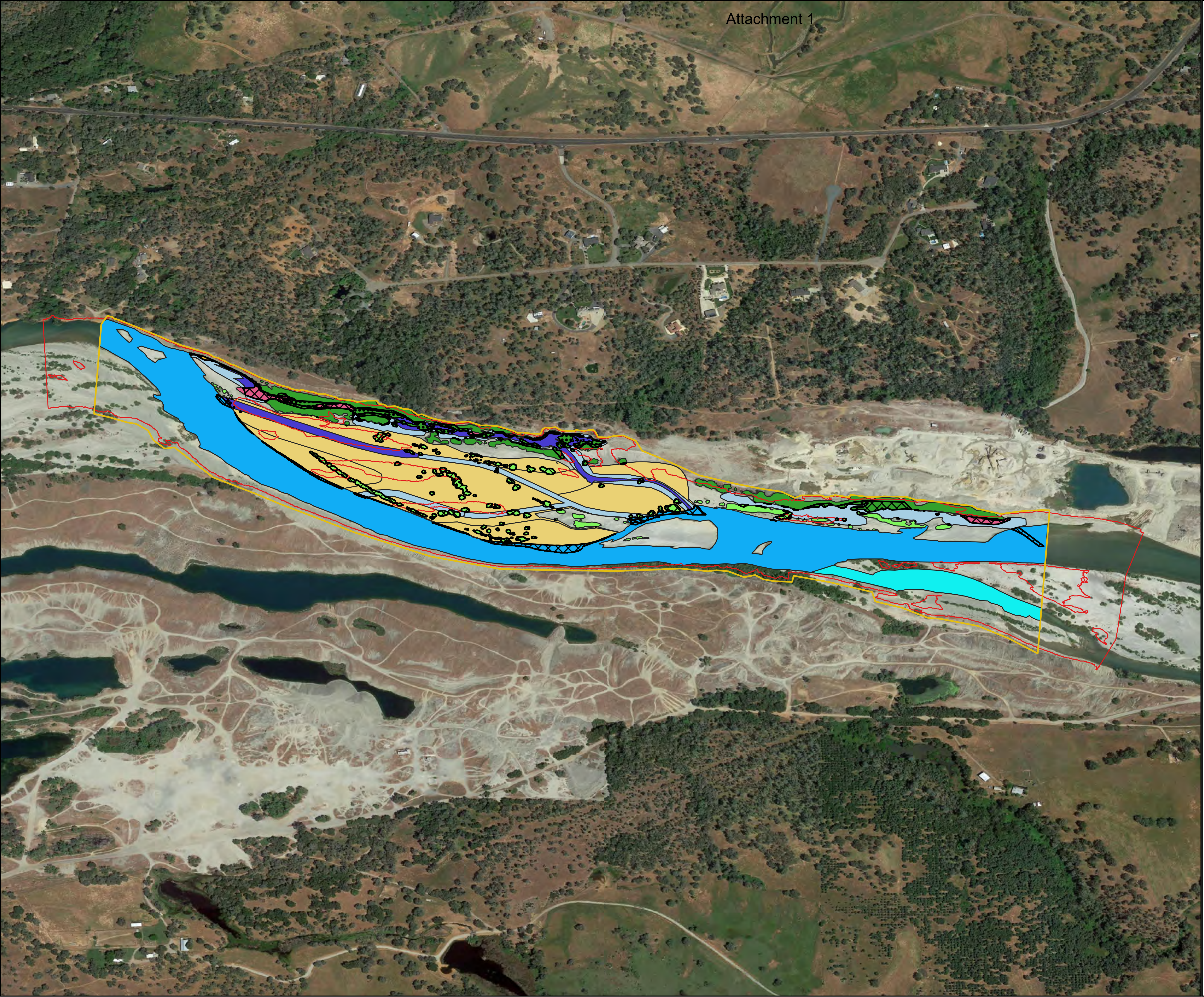
Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX 5: AQUATIC RESOURCES IMPACTS MAP



CRAMER FISH SCIENCES®
An Employee Owned Consulting Company

Impacts to Wetlands and Other Waters of the U.S. for the Long Bar Salmonid Habitat Restoration Project

Legend

- Survey Area Boundary (121.7 Acres)
- Ordinary High Water Mark (26,000 cfs)

Wetland (11.18 Acres)

- Emergent Wetlands (0.10 Acres)

Riparian Wetlands (11.08 Acres)

- Forested (7.68 Acres [6.47 within OHWM])
- Scrub/shrub (3.40 Acres [2.98 within OHWM])

Other Waters (38.4 Acres)

- Perennial Main Channel (33.64 Acres)
- Perennial Side Channel (3.92 Acres)
- Ponds (0.84 Acres)

Project Restoration Actions (42.1 Acres)

- Enhanced Floodplain (27.2 Acres)
- Perennial Channel (4.7 Acres)
- Seasonal Channel (10.2 Acres)

Impacts

- Permanent Change (0.95 Acres)
- Temporary Impacts (5.70 Acres)

Coordinate System: NAD_1983_StatePlane_California_II_FIPS_0402_Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Vertical Datum: NAVD88, U.S. Feet
1 inch = 400 feet

0 300 600 900 ft

Created 28 January 2021

Made in accordance with the Updated Map and Drawing Standards for the South Pacific Division Regulatory Program, as amended on 28 January 2021, by:
Philip Colombano, Biologist
Cramer Fish Sciences
3300 Industrial Blvd Suite 100
West Sacramento, California 95691-5036

APPENDIX H. CULTURAL RESOURCES ASSESSMENT

Technical Report—Draft

CULTURAL RESOURCES ASSESSMENT REPORT and FINDING OF EFFECTS

Long Bar Floodplain Restoration Project
Yuba County, California

March 2020

Prepared for:

Cramer Fish Sciences
3300 Industrial Blvd., Suite 100
West Sacramento, CA 95691

On behalf of:

U.S. Fish and Wildlife Service
Anadromous Fish Restoration Program
850 S. Guild Avenue, Suite 105
Lodi, CA 95240-3188

Prepared by:

Horizon Water and Environment, LLC
P.O. Box 2727
Oakland, CA 94612
Janis Offermann, MA, RPA
Cultural Resources Practice Lead

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Acronyms and Abbreviations

APE	area of potential effects
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CRHR	California Register of Historical Resources
CFR	Code of Federal Regulations
Horizon	Horizon Water and Environment, LLC
NAHC	Native American Heritage Commission
NCIC	North Central Information Center
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
PGDC	Pacific Gold Dredging Company
PRC	Public Resources Code
TCR	tribal cultural resource
UAIC	United Auburn Indian Community
USC	United States Code
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
YCGF	Yuba Consolidated Gold Fields

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Executive Summary

The U.S. Fish and Wildlife Service (USFWS) is sponsoring the Long Bar Restoration Project (project or proposed project), which proposes to restore an approximately 1-mile-long section of the Yuba River in Yuba County, California. The proposed project area is at the northeast corner of the Yuba Goldfields Historic Mining District, a large expanse of land adjacent to the Yuba River that was subject to extensive dredging for the purposes of mining gold between 1904 and the 1950s. The dredging operations realigned the Yuba River and left massive piles of cobble tailings that are currently used as gravel quarries. The objective of the project is to restore and enhance ecosystem processes with a primary focus on enhancing productive juvenile salmonid rearing habitat to increase natural production of fall-run and spring-run Chinook salmon and California Central Valley steelhead in the lower Yuba River.

Horizon Water and Environment, LLC (Horizon) was retained by Cramer Fish Sciences to complete a cultural resources assessment in support of the project pursuant to the requirements of Section 106 of the National Historic Preservation Act (NHPA) and the California Environmental Quality Act (CEQA). This report documents the cultural resources inventory methods and results as required for compliance with federal and California regulations. The study consisted of a literature review to identify any previously recorded cultural resources that could be affected by the proposed project and a field reconnaissance to locate any cultural resources that may exist but have not yet been recorded.

No archaeological resources were identified during the field survey, as the entire project area of potential effects (APE) consists of a cobble field on the north side of the Yuba River. While the cobble field is likely comprised of material resulting from the degradation and erosion of dredge tailings over the past decades, the cobble field is not a cultural resource.

The Yuba Goldfields Historic Mining District is considered eligible for listing in the National Register of Historic Places (NRHP) and California Register of Historical Resources (CRHR) (Horizon 2016; Office of Historic Preservation 2017). The APE is within the boundaries of the historic district; however, the cobble field in the APE does not represent elements of the historic district due to a lack of integrity. As a result, the proposed project will have no adverse effect on historic properties pursuant to 36 Code of Federal Regulations (CFR) 800.4(5)(b) and will not have a significant impact on historical resources under CEQA.

The archaeological inventory was performed based on information obtained at the North Central Information Center of the California Historical Resources Information System, as well as on direct observation of site conditions and other information generally applicable as of November 2019. The conclusions and recommendations herein are therefore based on information available up to that point in time. Further information may come to light in the future that could substantially change the conclusions found herein.

Information obtained from these sources in this timeframe is assumed to be correct and complete. Horizon does not assume any liability for findings or lack of findings based upon misrepresentation of information presented to Horizon or for items that are not visible, made visible, accessible, or present at the time of the project area inventory.

1 Introduction

1.1 Location and Setting

The Long Bar Restoration Project is located along the Yuba River, about 9 river miles downstream from Englebright Dam and 16 miles upstream from the City of Marysville in western Yuba County **(Figure 1)**. The entire project area is directly adjacent to the north bank of the current channel of the Yuba River. Daguerre Point Dam lies approximately 3 miles downstream of the westernmost limits of the project. The area is within the boundaries and at the northeast corner of the Yuba Goldfields Historic District. The entirety of the Yuba Goldfields covers approximately 10,000 acres of land in private, U.S. Bureau of Land Management, U.S. Army Corps of Engineers, and State of California ownership (Barnes 2003a:2) that have been entirely disturbed during more than a century of operations, first by gold dredging and then by gravel mining. Dredging activities disturbed the river channel and adjacent floodplain to depths of up to 140 feet, and the operations rerouted portions the main channel of the Yuba River downstream of the current project area in the early 1900s. The project is located on land currently owned by Long Bar Mine, LLC.

The project site is comprised entirely of a cobble field that receives overflow from the Yuba River. The project location is depicted within the Browns Valley and Smartsville U.S. Geological Survey (USGS) 7.5-minute topographic quadrangles in Sections 22, 23, 26 and 27, Township 16 North, Range 5 East **(Figure 2)**. The project area is at an elevation of approximately 160 feet above mean sea level.

As previously noted, the project area is comprised of a cobble field within the Yuba River channel. The cobble field is flooded seasonally, and backwater channels along the north edge of the field have developed. Soil is limited and confined to areas where silts have been deposited by the river. These areas are concentrated around the backwater channels and generally on the north edge of the APE. Most of the riparian vegetation present grows around the backwater channels, although willows have taken hold throughout the cobble bar. Woody vegetation consists primarily of willow, although white alder and cottonwood are also present. Grey pine and oaks dominate the uplands north of the APE. Tule, willow, blackberry, rushes, and sedges are found in the ponded areas, while sparse annual grasses cover the floodplain.

Photographs of the project area are provided in **Appendix A**.

1.2 Project Description and Area of Potential Effects

The Long Bar Restoration Project is being sponsored by the USFWS to restore and enhance the ecosystem of the lower Yuba River in order to improve habitat suitable for rearing juvenile salmonids to increase the natural production of fall-run and spring-run Chinook salmon and Central Valley steelhead. It will also test hypotheses regarding a variety of habitat enhancement techniques and assess subsequent utilization of restored floodplain and off-channel habitats by juvenile salmonids and non-native predatory species.

Figure 1
Project Vicinity

Long Bar Floodplain Restoration Project

Attachment 1

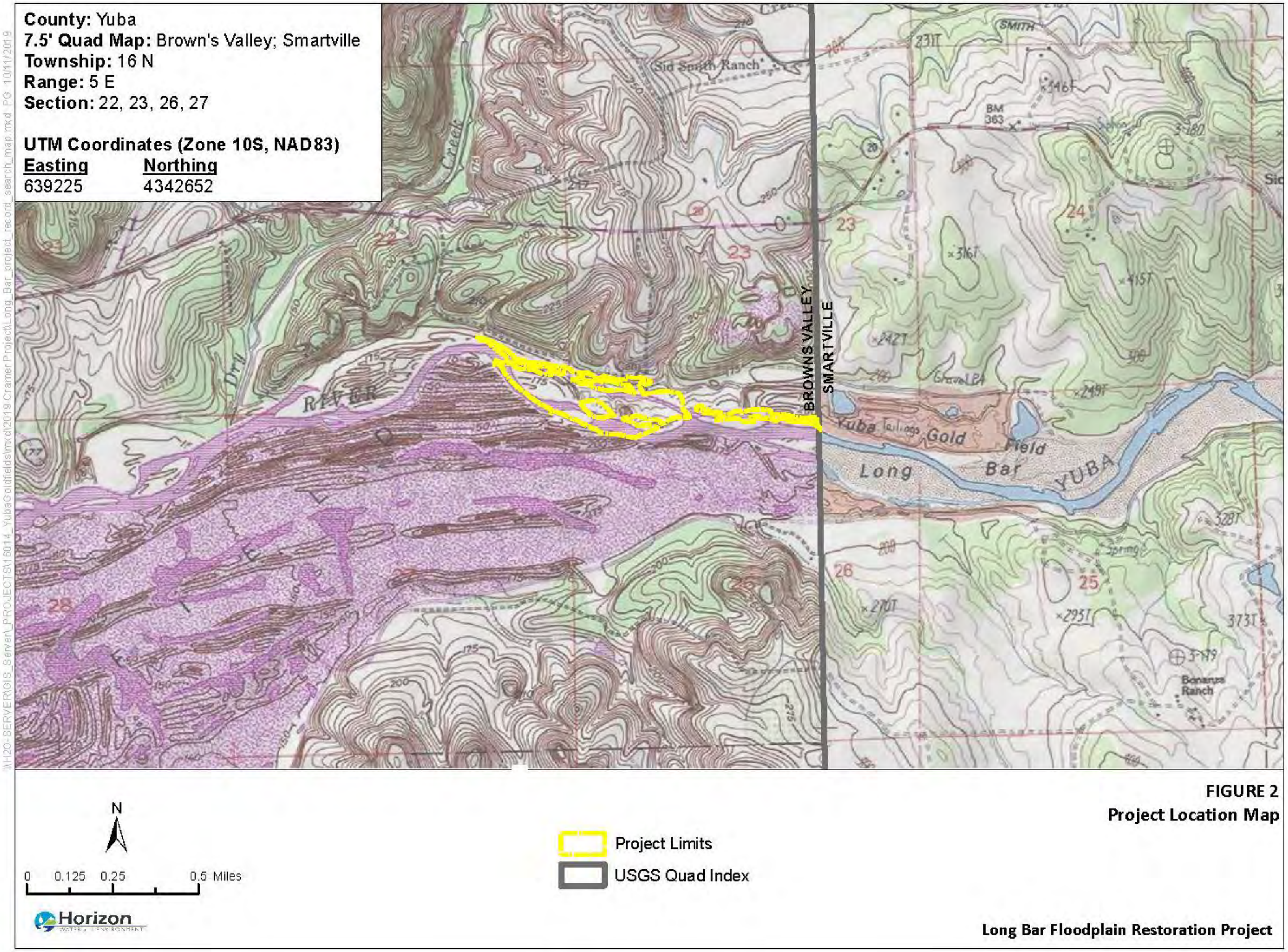


FIGURE 2
Project Location Map

Long Bar Floodplain Restoration Project

To achieve these goals, the project objectives are to:

1. Incorporate the project into an ecologically-sound, ecosystem context by designing the project to function under current water management constraints (i.e., timing, frequency, magnitude and duration of elevated flows);

2. Reestablish main channel and off-channel connectivity and complexity to restore ecological processes at the project site to increase the availability and maintenance of off-channel rearing habitats;

3. Create habitat conditions suitable for spring juvenile salmonid rearing (i.e., fry and sub-yearling smolts);

4. As possible, create habitat conditions suitable for summer holding of juvenile spring-run Chinook salmon and steelhead;

5. Reduce the abundance of invasive predators and aquatic vegetation by modifying stagnant backwater features at the downstream end of the site;

6. Create conditions suitable for natural riparian vegetation recruitment and survival (i.e., willows, cottonwood, alders, etc.);

7. To significantly increase suitable rearing habitat acreage through the restoration of natural ecosystem processes associated with a well-connected, frequently inundated floodplain.

The project aims to remove a portion of the legacy hydraulic mining substrate on Long Bar to increase floodplain connectivity and improve habitat heterogeneity, promoting riparian vegetation recruitment and salmonid rearing habitat. Proposed enhancements include grading approximately 40.1 acres on a 56.7-acre section of the gravel/cobble bar (see **Figure 3**).

Details about the proposed restoration are currently conceptual; however, the final design will likely be similar to the modifications shown in **Figure 4**. The existing backwater channel is well developed but will be modified to improve conditions for rearing juvenile salmonids. The upstream side channel currently is less defined than the backwater channel; it will be graded to enhance conditions for juvenile salmonids. Alcove and flood runner channels will be also be developed to provide high quality juvenile salmonid rearing habitat at different flow levels (low/medium and high flows, respectively), while the secondary (low flow) channel will be constructed to provide water to the backwater channel year-round. The connector channel will direct water at higher flows to the flood runner channels and floodplain.

Re-vegetation of the project area is also planned. The extent and specific species are still to be determined, but likely plant species include willow (*Salix* spp.), Fremont cottonwood (*Populus* fremontii), western sycamore (*Platanus racemosa*), elderberry (*Sambucus* spp.), and buttonbush (*Cephalanthus occidentalis*).

The APE (Figure 3) encompasses the areas involved in all phases of the proposed project. It covers approximately 56.7 acres, of which about 40 acres will be graded to achieve the proposed enhancements. No staging areas, new access roads, or utility modifications are anticipated outside of the direct APE. The vertical APE is expected to be no more than about 12 feet below the current ground surface.

Attachment 1

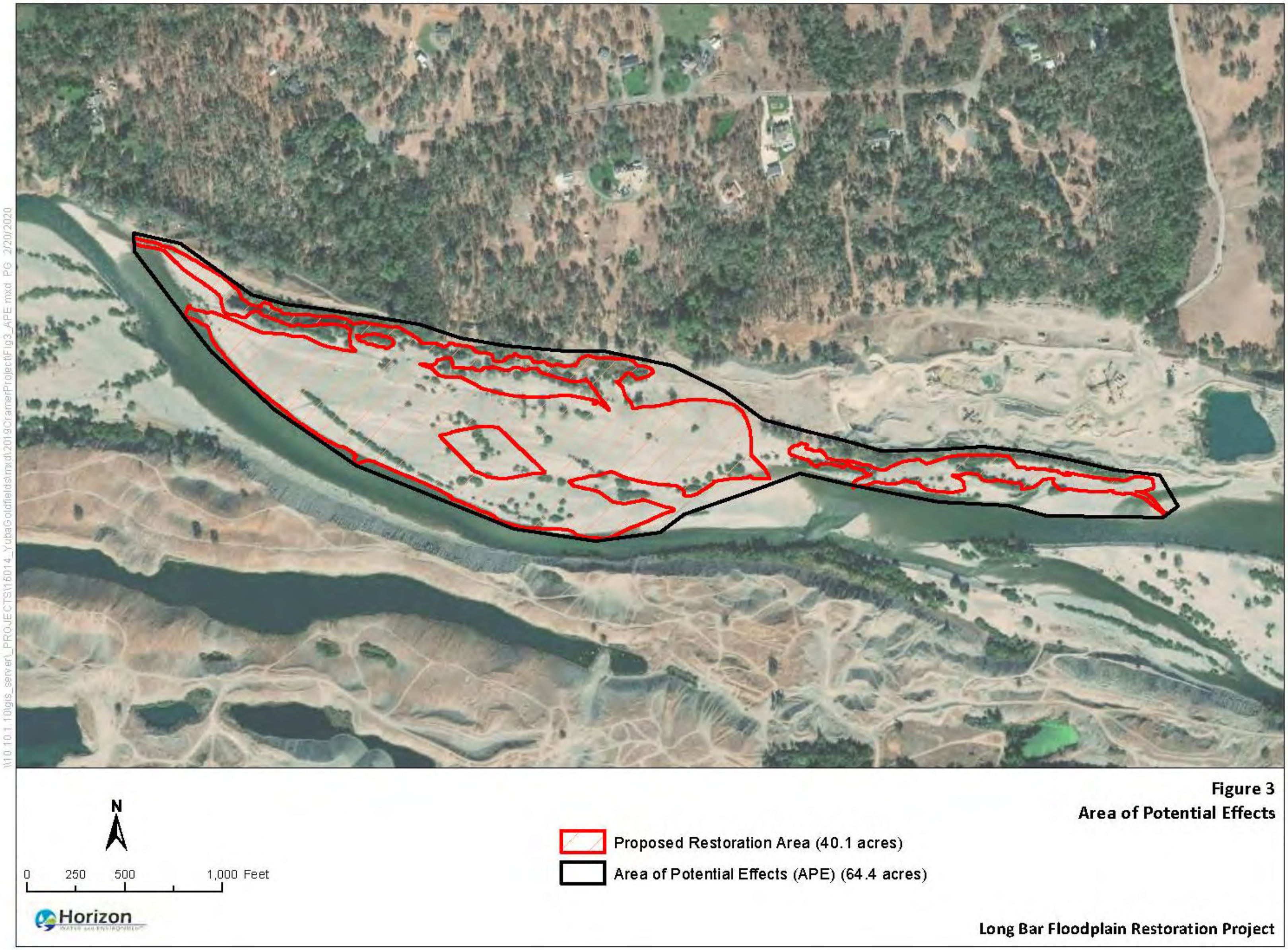
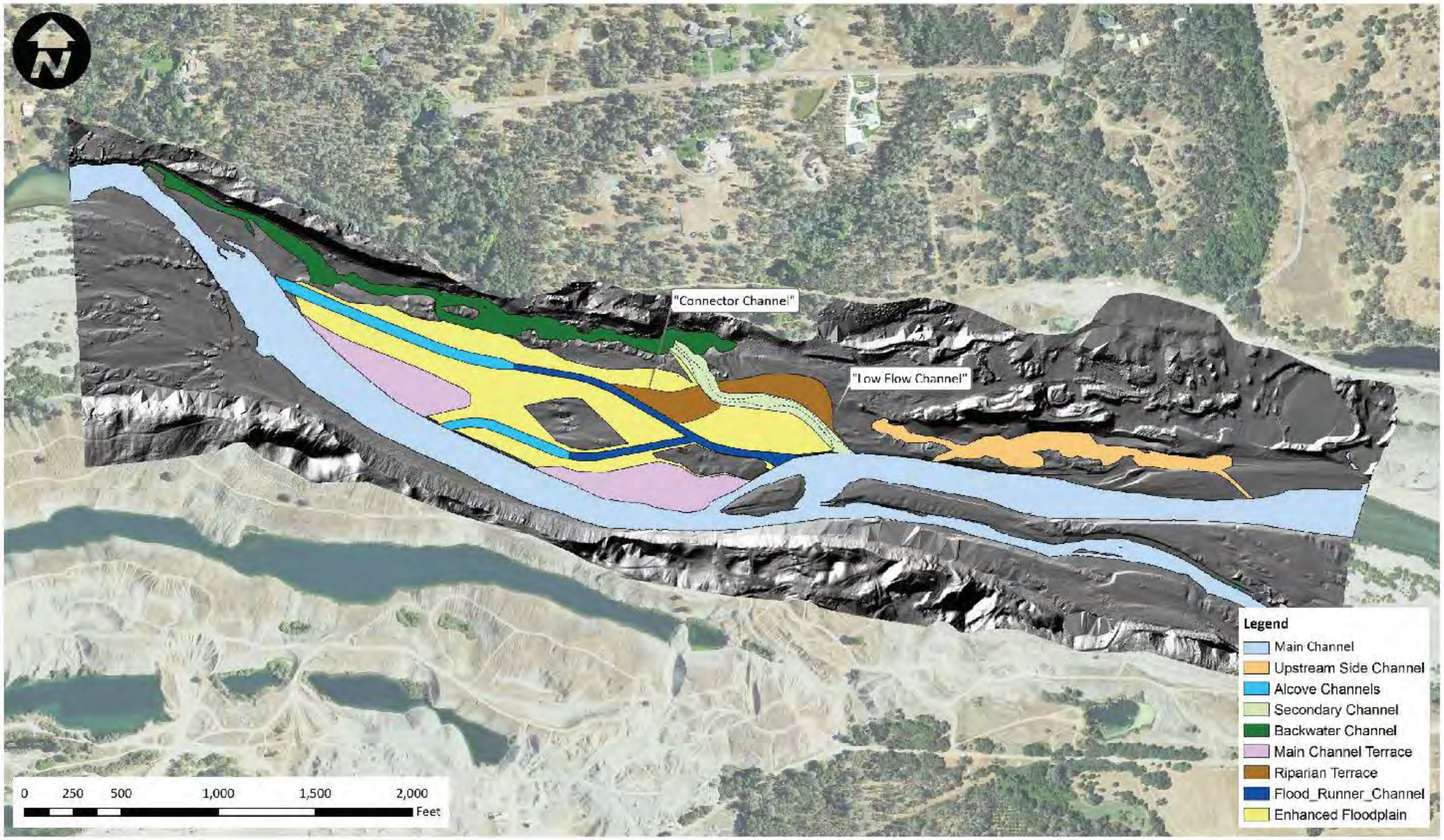


Figure 3
Area of Potential Effects

Long Bar Floodplain Restoration Project

Attachment 1



Original Figure Prepared by: Cramer Fish Sciences

Figure 4
Conceptual Project Restoration Plan

Horizon
WATER and ENVIRONMENT

Long Bar Floodplain Restoration Project

1.3 Regulatory Setting and Need for Study

1.3.1 State of California Regulations

CEQA and State CEQA Guidelines

The proposed project must comply with CEQA (Public Resources Code [PRC] 21000 et seq.) and the CEQA Guidelines (California Code of Regulations [CCR], Title 14, Chapter 3), which determine, in part, whether the project has a significant effect on a unique archaeological resource (per PRC 21083.2) or a historical resource (per PRC 21084.1).

CEQA Guidelines CCR 15064.5 notes that "a project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment." Lead agencies are required to identify potentially feasible measures or alternatives to avoid or mitigate significant adverse changes in the significance of a historical resource before such projects are approved. According to the CEQA guidelines, historical resources are:

- Listed in, or determined to be eligible for listing in, the CRHR (per PRC 5024.1);
- Included in a local register of historical resources (per PRC 5020.1) or identified as significant in a historical resource survey meeting the requirements of PRC 5024.1(g); or
- Determined by a lead state agency to be historically significant.

CEQA Guidelines CCR 15064.5 also applies to unique archaeological resources as defined in PRC 21084.1.

Assembly Bill 52, which went into effect on July 1, 2015, requires, per PRC 21080.3.1, that CEQA lead agencies consult with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of a proposed project, if so requested by the tribe, and if the agency intends to release a negative declaration, mitigated negative declaration, or environmental impact report for a project. The bill also specifies, under PRC 21084.2, that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource (TCR) is considered a project that may have a significant effect on the environment.

As defined in Section 21074(a) of the PRC, TCRs are:

(1) Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:

a. Included or determined to be eligible for inclusion in the CRHR; or

b. Included in a local register of historical resources as defined in subdivision (k) of Section 5020.1.

(2) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1. In applying the criteria set forth in subdivision (c) of Section 5024.1 for the purposes of this

paragraph, the lead agency shall consider the significance of the resource to a California Native American tribe.

TCRs are further defined under Section 21074(b) and (c) as follows:

(b) A cultural landscape that meets the criteria of subdivision (a) is a TCR to the extent that the landscape is geographically defined in terms of the size and scope of the landscape; and

(c) A historical resource described in Section 21084.1, a unique archaeological resource as defined in subdivision (g) of Section 21083.2, or a "nonunique archaeological resource" as defined in subdivision (h) of Section 21083.2 may also be a tribal cultural resource if it conforms to the criteria of subdivision (a).

Mitigation measures for TCRs must be developed in consultation with the affected California Native American tribe pursuant to the newly chaptered Section 21080.3.2 or according to Section 21084.3. Section 21084.3 identifies mitigation measures that include avoidance and preservation of TCRs and treating TCRs with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource.

The County of Yuba, as the lead State agency for the project, will consult with Native American tribes pursuant to PRC 21080.3.1. The results of that consultation are not included in this report.

California Register of Historical Resources

PRC Section 5024.1 establishes the CRHR. This register lists all California properties considered to be significant historical resources. The CRHR includes all properties listed, or determined to be eligible for listing, in the NRHP, including properties evaluated under Section 106 of the NHPA. The criteria for listing are similar to those of the NRHP. Criteria for listing in the CRHR include resources that:

(1) Are associated with the events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

(2) Are associated with the lives of persons important in our past;

(3) Embody the distinctive characteristics of a type, period, region, or method of construction, or represent the work of an important creative individual, or possess high artistic values; or

(4) Have yielded, or may be likely to yield, information important in prehistory or history.

The regulations set forth the criteria for eligibility as well as guidelines for assessing historical integrity and resources that have special considerations.

1.3.2 Federal Regulations

The USFWS is providing funding for the proposed project through the Central Valley Project Improvement Act (CVPIA). As a result, the project constitutes a federal undertaking as defined by Title 54 United States Code (USC) Section 300101 of the NHPA and mandates compliance with 54 USC Section 306108, commonly known as Section 106 of the NHPA, and its implementing regulations found under Title 36 of the CFR Section 800, as amended in 2001. To comply with Section 106 of the

NHPA, the project proponent must "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register."

The implementing regulations of the NHPA require that cultural resources be evaluated for NRHP eligibility if they cannot be avoided by an undertaking (proposed project). To determine site significance through application of NRHP criteria, several levels of potential significance that reflect different (although not necessarily mutually exclusive) values must be considered. As provided in Title 36 CFR Section 60.4, "the quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association" and must be considered within the historic context. Resources must also be at least 50 years old, except in rare cases, and, to meet eligibility criteria of the NRHP, must:

(A) Be associated with events that have made a significant contribution to the broad patterns of our history; or

(B) Be associated with the lives of persons significant in our past; or

(C) Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(D) Have yielded, or may be likely to yield, information important in prehistory or history.

For archaeological sites evaluated under Criterion (D), integrity requires that the site remain sufficiently intact to convey information necessary to address specific important research questions.

Cultural resources also may be considered separately under the National Environmental Protection Act per Title 42 USC Sections 4321 through 4327. These sections require federal agencies to consider potential environmental impacts and appropriate mitigation measures for projects with federal involvement.

1.4 Personnel

Fieldwork, analysis, and reporting were carried out by the below-listed Horizon professionals who meet the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (per Title 48 of the CFR, Section 44716, as amended in 1983). Procedures complied with NHPA Section 106 as set forth in Title 36 of the CFR, Section 800.

- Janis Offermann, MA, Registered Professional Archaeologist, acted as Principal Investigator for the project, conducted the archaeological field survey, and prepared this report. She has a bachelor's degree in anthropology from Sonoma State University in California and a master's degree in anthropology from the University of California at Davis. She has more than 40 years of experience in California archaeology and cultural resources management. Ms. Offermann is the cultural resources practice leader with Horizon.

- Judy Tordoff, Ph.D., conducted research on Long Bar and prepared the historic background description included herein. Ms. Tordoff has a bachelor's degree in humanities (Spanish, music, anthropology), a master's degree in anthropology (human osteology), and a doctorate degree in Anthropology (historical archaeology), all from Michigan State University, East Lansing. She has more than 50 years of experience in historical archaeology and has been practicing in California for 40 years. The study of dredge mining is one of Dr. Tordoff's specialties.

2 Project Context[1]

2.1 Environmental Setting

The Long Bar Restoration Project is located in the Great Valley geomorphic province in the low foothills on the west side of the Sierra Nevada mountain range, at an elevation of about 175 feet above mean sea level. As previously described, it is located along the north bank of the Yuba River. The Yuba River is one of many large perennial drainages that carry snowmelt from the Sierra Nevada peaks and, eventually, into the Sacramento River, which flows 445 miles through the Sacramento Valley before joining with the San Joaquin River and forming the Sacramento-San Joaquin Delta and entering San Francisco Bay.

The project area is dominated by a cobble field created by the erosion of dredge mine tailings in the Yuba River. The depth of the tailings is unknown, but the history of dredge mining in the immediate vicinity suggests that the cobbles are at least 60 feet deep and could be as much as 140 feet deep. As a result, there is little soil development and vegetation is riparian in nature, consisting almost entirely of willow, with some cottonwood and alder. Vegetation is concentrated along small ponds that exist in a back channel along the north edge of the APE. The ponds are filled by the high water table during low flow periods.

The current condition of the Yuba River, particularly in the project area, belies what was undoubtedly a rich riverine ecosystem that was surrounded by grassy plains and oak-studded hills. The Yuba River continues to support a fishery that includes salmon and other important food fish, and deer and other animals have found a home among the tailings; however, it is much-changed from the time before gold mining, water regulation, and other anthropogenic impacts altered the flow and condition of the river and the adjacent lands.

2.2 Prehistoric Context

Despite implications of Central California habitation dating back 10,000 years, evidence generally only supports occupation of the Sacramento Valley to approximately 3,500 years ago. It is, however, notable that White's (2003) recent work near Colusa revealed dates of up to 4,385 years before present. The apparent lack of evidence for very early dates of occupation is likely due to the frequent flooding the valley endures and the resulting sedimentation (Elsasser 1978; Moratto 2004; Wallace 1978).

During the 1930s, Sacramento Junior College and the University of California, Berkeley were the first institutions to begin systematic investigations of Sacramento Valley archaeological sites. Included in these early investigations were several sites along the Cosumnes River in the northern Delta and in Colusa County. As the result of those efforts and subsequent studies in the region, three cultural

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[1] Sections 2.2, and 2.3 are taken almost verbatim from *Cultural Resources Assessment Report Hallwood Side Channel and Floodplain Restoration Project, Yuba County, California* (Horizon 2016). Some portions of Section 2.4 are also derived from that report, although the information on Long Bar has been prepared specifically for this document.

horizons were delineated. These were the Early, the Middle and the Late horizons, with respective initial dates of 2,500 B.C., 1,500 B.C. and 500 A.D. (Elsasser 1978).

Subsequent research has yielded a refinement of dates along with the realization that basic socio-economic and technical trends or patterns occurred over a broad region. The pattern concept allows for a fluid evolution of culture through time that acknowledges the influence of local environments and economic systems, including trade networks (Fredrickson 1973; Moratto 2004). It has also been determined that these patterns could last for different lengths of time in localized areas and that they were distinguished by unique expressions of material culture. The revised cultural chronology is currently identified by the Windmiller Pattern, the Berkeley Pattern, and the Augustine Pattern.

The Windmiller Pattern dominated the region from approximately 2,000 B.C. to 500 B.C. Relative to subsequent periods, Windmiller subsistence appears to have focused largely on hunting, as evidenced by large quantities of faunal remains and projectile points in the archaeological record. However, fishing and seed procurement tools are also evident in the archaeological record. With regard to tool technology, both flaked stone and ground stone industries are well represented. Facilitating the acquisition of materials for tool and ornament production was a vast trade network, where obsidian was obtained from North Coast Range and eastern Sierran sources, shell beads from the coast, and quartz and alabaster from the Sierra foothills. The Windmiller Pattern is also characterized by distinctive burial patterns, with bodies typically buried fully extended, face down, with the head oriented toward the west, and the inclusion of funerary objects (Moratto 2004; Wallace 1978).

The Berkeley Pattern was present from approximately 500 B.C. to 500 A.D. This pattern is represented by an apparent increase in the use of pestles and mortars, which is thought indicative of an intensified reliance on acorns as a principal dietary staple. In addition, the Berkeley Pattern exemplifies a well-developed bone industry, distinctive diagonal flaking of large concave-base points, and marked forms of shell beads and ornaments. In contrast to the Windmiller Pattern, Berkeley burials are found in a flexed position with variable orientation and fewer funerary artifacts (Moratto 2004).

The Augustine Pattern occurred from approximately 500 A.D. to contact in the 1800s. This pattern is thought to reflect the southern expansion of Wintuan peoples through the Sacramento Valley. It is distinguished by large populations with complex social systems that depended heavily upon fishing, hunting, and the gathering of seeds, nuts, tubers, and other plant-based foods. Tool technology is represented by shaped pestles and mortars, bone awls, the bow and arrow, and, in some cases, pottery. There was considerable variation in mortuary practices including flexed burials, cremation, and funerary object differentiation (Moratto 2004).

2.3 Ethnohistoric Context

The proposed project area lies within the ancestral territory of the Nisenan, or Southern Maidu. The Nisenan ancestral territory includes the drainages of the Yuba, Bear, and American rivers, and the lower drainages of the Feather River, and extends from the crest of the Sierra Nevada to the banks of the Sacramento River. The northern boundary was in the vicinity of Honcut Creek, while the southern limits of the territory was just south of the American River. Although Kroeber (1925:393) identified three dialects among the Nisenan (Valley Nisenan, Northern Hill Nisenen, and Southern Hill Nisenan), Beals' (1933:338-339) study suggests that there were three dialects among the Hill Nisenan, which were defined by the major river drainages within the territory. From north to south, the dialect divisions were from the Bear River and north, between the Bear River and the Middle Fork American River, and from the American River and south. The project area is in the territory occupied by the northernmost Hill Nisenan group who spoke the Bear River dialect of the Nisenan language.

The Nisenan territory was divided into several political divisions or "tribelets," each with its own headman who resided in the larger villages. According to Kroeber (1925:831), the larger villages could have had populations in excess of 500 individuals, although small settlements consisting of 15 to 25 people and extended families were common. The village of *Yupa* was located in the northeast corner of the confluence of the Yuba and Feather rivers, at the location of present-day Marysville; the village of *Chiemwie* was in the general vicinity of the proposed project but on the south side of the Yuba River (Kroeber 1925:445, Plate 37; Wilson and Towne 1978:Figure 1).

Nisenan people followed a seasonal round of food gathering, as did most California Indians. Throughout California, various species of oak provided the most important staple food, although the black oak was apparently the most preferred. Acorn harvests in the early fall provided the region's native inhabitants with a reliable, large-scale food source that could sustain populations through the winter months. Other important botanical foodstuffs capable of being stored for long periods included nuts from the grey pine, buckeye, and hazelnuts. Various roots, nuts, wild onion, wild sweet potato, and many varieties of grasses, berries, and fruits were also gathered at various times. Many items were processed and stored for winter use, although fresh fruits, such as various berries, wild plums, grapes, and other native fruits, were likely consumed fresh (Wilson and Towne 1978).

Hunting was accomplished using various techniques and weapons, including the bow and arrow, drives, and decoys. Nets, traps, rodent hooks, and fire were all used in hunting small game. Fish could be caught with nets, gorges, hooks, and harpoons within the larger perennial drainages of the foothill regions. One technique apparently involved using soap root and turkey mullein to poison the water so fish could be easily gathered. Freshwater clams and mussels were also gathered in the larger waterways, such as the Sacramento River. Other aquatic food sources available to native populations near the project area would have included salmon and sturgeon, which would have been netted or caught with the aid of weirs.

Euro-American contact with the indigenous cultures began with infrequent excursions by Spanish explorers and Hudson's Bay Company trappers traveling through the Sacramento and San Joaquin valleys in the early 1800s. In general, indigenous lifeways remained stable for centuries until the early to middle decades of the 19th century. With the coming of Russian trappers and Spanish missionaries, cultural patterns began to be disrupted as social structures within and among groups were stressed. An estimated 75 percent of the Valley Nisenan population died in the malaria epidemic of 1833. With the influx of Europeans during the Gold Rush era, the population was further reduced as a result of disease and violent relations with the miners. However, today the Nisenan are reinvesting in their traditional culture. Through newfound political, economic, and social influence, they now constitute a growing and thriving Native American community in California.

2.4 Historic-Era Context

Present-day Yuba County was on the far northeastern frontier of Spanish, and then Mexican, California, and most of the explorers of that era largely remained in the plains west of the Feather River. Gabriel Moraga, however, in his 1808 expedition, travelled up the Sacramento River to approximately 18 miles north of the town of Colusa. From there he turned east and followed the foothills south as he returned to San Jose. It was during this expedition that Moraga applied the name

“Rio de las Plumas” to the Feather River. It is also possible that he gave the Yuba River its name, “the Rio de las Uvas” (Kyle et al. 2002:572). The fur trappers who exploited the area in the 1820s and 1830s similarly tended to stay in the plains west of the project area.

During the 1840s, the Mexican government began issuing grants of large land tracts to those willing to settle and develop the northern frontier. John Sutter initially settled on his Nueva Helvetia land grant in the Sacramento area, but he also obtained a second, very large grant to the north in what is now Sutter County. Known as the Hock Farm, Sutter claimed property north to the Yuba River and beyond. In 1842, Sutter gave Theodor Cordua a 19-year lease on lands to the north and east of the Yuba and Feather River confluence. Cordua constructed an adobe house and set up a small trading post at the site of modern-day Marysville. In 1844, he received a grant from the Mexican government for lands on the east side of the Feather River from the Yuba River north to Honcut Creek, and east to the Sierra foothills. George Patterson settled on the south side of the Yuba River, opposite Marysville, in 1845 (Thompson and West 1879:34-35).

The Yuba River quickly became a focus for gold mining after the initial discovery at Sutter’s Mill in January 1848. By June of that year, mining camps had sprung up near Timbuctoo, Parks Bar, and Rose Bar (Thompson and West 1879:61) along the Yuba River. Intensive mining occurred along the Yuba River for 10 miles upstream from Marysville, and by 1850 the town of Marysville became a major hub for transporting goods and people from Sacramento to the goldfields. This was enhanced by the fact that the Feather River was navigable up to the town (Thompson and West 1879:70).

Gold mining, while enriching Marysville economically, wreaked havoc on its citizens by depositing great volumes of silts and mining debris into the Yuba River resulting in major aggradation. As a result, the citizens of Marysville were inundated numerous times during the 1850s and 1860s, and a new levee built to protect the town was breached in several places as the result of extensive flooding in 1875 (Thompson and West 1879: 68).

The deposition of the mining debris was so great that the following was written in 1891 (Lewis Publishing Company 1891):

> The later history of Yuba County is unique above all others in that during the past twenty or thirty years she has almost completely altered her configuration, the surface level over no mean part of her superficies having changed materially. The cause of this has been hydraulic mining, chiefly, and the vast amount of "slickens," or mining debris, washed down thereby. Where prosperous orchards, gardens and farms stood in former days along the banks of the rivers, their place has been taken by an overflow of sand and mud—the "slickens" of the mining regions—fences, trees and even telegraph poles going out of sight under fifteen, twenty, or even thirty feet of this debris.
>
> The still more curious sight is to be seen in some parts, of a fresh orchard and new fields of grass appearing now upon this new and artificial surface, second layer, so to speak, of agriculture. This is only the case in some parts, however, as the deposits are not always capable of cultivation. This refers of course only to the bottom lands along the rivers.

Gold Mining in Yuba County

The evolution of mining in Yuba County followed that of other gold-bearing lands in California. As previously mentioned, after the 1848 gold discovery at Sutter's Mill in El Dorado County, hopeful miners flocked to the Yuba River, as they did to other waterways, and quickly recovered the easily reached placer gold. A placer is a deposit of sand, gravel, or other material containing particles of valuable minerals (gold being one of them) that can be recovered by washing (Wells 1966:5). The earliest methods of gold extraction were used on shallow, easily reached deposits. With each improvement on the gold pan, the original and simplest method of washing gravels, the volume of material processed was increased, more water was necessary, and the technique required more cooperation between larger numbers of miners. By 1849 the rocker, or miner's cradle, was in common use. As early as 1850 the long tom began to replace the rocker (Paul 1947). Sluice boxes, elongated rectangular troughs with riffles along the floor, were replacing both rocker and long tom by 1852 (Lindström 1988). With more organization, and the creation of hundreds of miles of ditches to provide water, ground sluicing was developed as a faster way of reaching less accessible placers and of breaking down gold-bearing deposits (Tordoff 2004).

The development of hydraulic mining—directing streams of water under high pressure against gold-bearing deposits or to remove material above such deposits—transformed the mining industry in California. First developed near Nevada City in 1852, hydraulic mining allowed miners to reach buried deposits and quickly direct material to processing equipment. Rapid developments in the industry made it the primary recovery method by the 1860s. This continued to be used for 20 years (Clark 1970), until the Sawyer Decision prohibited the dumping of billions of cubic yards of debris into the Sacramento River and its tributaries. It was estimated that almost half a billion cubic yards of hydraulic tailings were carried yearly by upland flood waters and deposited in the Yuba River valley, and that they ranged in depth from 10 to 45 feet (Aubury 1910:166; Clark 1970). Bedrock, and the gold-bearing deposits, were between 30 and 110 feet from the surface (Waring 1917:425). It remained for bucket-line dredging to be developed and make it possible to access these deep deposits.

Dredging for gold along the Yuba River began in 1904 by Wendell P. Hammon, the "Dredge King." Hammon acquired this name as the first person to use bucket-line dredges at his operations near Oroville in 1898. From initial depths of 60 feet on early bucket-line dredges, the industry evolved quickly, moving from wooden to steel hulls on its dredges, from steam power to electricity, to larger buckets, and to longer bucket lines. As these changes occurred, some areas within the Yuba Goldfields were dredged more than once since deeper gold deposits could be accessed. By the 1950s these design improvements made it profitable to rework tailings multiple times (O'Brien 1952:151). Some of the dredges were equipped with hydraulic monitors for washing material into the dredge ponds (O'Brien 1952:151). Ultimately, one of the dredges to work in the Yuba Goldfields was refurbished in the 1980s to reach 140 feet below the surface (Cal-Sierra Development Inc. n.d.).

Over the decades, the dredge mining of the Yuba Goldfields ultimately consumed at least 10,000 acres of land in along the Yuba River, primarily to the south of the current river channel, and devoured the mine company towns of Hammonton and Marigold. The region is now held under private, U.S. Bureau of Land Management, U.S. Army Corps of Engineers, and State of California ownership (Barnes 2003:2). Mining in the Yuba Goldfields, today, primarily focuses on the quarrying of the cobble and gravel mine tailings for construction projects. Long Bar Mine, LLC, who owns the land in the APE, is one of many gravel mining companies that currently operate in the region.

Long Bar

Long Bar has a history surely as deep as any mining area in the state (see **Appendix B**). Located in California's seventh highest gold-producing region, it was no doubt discovered early in the rush to the mines. Its longevity, in memory at least, is attested through the persistence of the name at its location along the Lower Yuba River, the name of a road in the vicinity, and the name of the current project area landowner, Long Bar Mine, LLC.

By 1851 Long Bar was an identified place along the Lower Yuba River, delineated on a map of the Feather and Yuba rivers that shows Long Bar along a road following the Yuba River on its north side; at this point in time, no buildings or mines are indicated on the map (Milleson and Adams 1851).

Thompson and West (1879) stated that Long Bar was settled as early as 1852, but clearly the area had been mined for some time before then as an early dredging "scheme" was hatched by the Yuba River Gold Dredging Company at that time. A steamer from back east was brought to California and outfitted with dredging machinery (little description of the machinery was provided). It was called the Phoenix (*Phenix* in Wells 2004) and worked Ousley's Bar, a short distance downstream from Long Bar. Though the Yuba River Gold Dredging Company stated that the dredge had worked "perfectly," it was determined that river banks presented greater opportunities for gold recovery and the equipment was set to work on other operations. The dredge had operated for little over a month (Thompson and West 1879:134). Wells dated the attempt at 1850 (2004:16).

The Long Bar settlement may have been something of a central place for miners in the area. Newton A. Chandler, a Vermonter, wrote letters from Long Bar to his wife back home in 1855, 1856 and 1857, before moving on to other mines in Nevada County (Online Archive of California 2020). An 1861 Official Map of Yuba County depicts a small concentration of houses north of the river at an area called Long Bar, strung out along what would become Parks Bar Road. A few buildings are also present south of the river, including one called Eureka House, possibly a boarding house for miners (Westcoatt 1861). Several reservoirs are present north of the river and would have served mining endeavors in the area. Ditches are not identified.

The original 1867 General Land Office (General Land Office 2020) plat map shows that the little settlement had developed, even though fewer buildings are depicted. By this time there are not only a few houses, but also a barn and a store, plus a vineyard, all in Sections 23 and 24 along what is now named the Parks Bar Road. South of the river along the Marysville and Nevada Road was a house with a cultivated field to the south at the dividing line between Sections 25 and 26.

During the 1860s and 1870s more of the land within the project area and the Long Bar region passed into private ownership. By the end of the 1870s, Thompson and West (1879) listed 13 businesses in Long Bar Township, including farmers, miners, teamsters, hotel keepers, and stock raisers. The Township itself extended from Honcut Creek in the north to the Yuba River in the south, and included almost all of Township 16 North/Range 5 East, plus a tiny portion of Township 17 North/ Range 5 East, reflecting the importance to the surrounding area of the community along the river.

With the enormous flow of debris from upstream mining during the mid-1800s, the river channel was fragmenting, and concerns for downstream navigation and agriculture were increasing. The 1884 Sawyer Decision curtailed hydraulic mining and by the late 1880s the settlement of Long Bar appears to have died. Lands on the north side of the river were in private ownership and only two vineyards are depicted, one north and one south of the river. The 1887 Official Map of Yuba County shows no houses in Sections 23 and 24, though the 1888 USGS 15-minute quadrangle map (USGS

2016) shows two buildings that appear to be in Section 23. The same situation existed south of the river, with the exception of large tracts of land in Sections 25 and 26 under the ownership of the Excelsior Water & Mining Company (Doyle 1887). Long Bar Township persisted, however, as well as a Long Bar School District. A school house is shown on the county map in Section 18 of Township 16 North/Range 6 East; it is situated along a road that runs to the southwest and hits the Parks Bar Road along the west side of Section 24, Township 16 North/Range 5 East.

By 1890 many of the hydraulic, drift, quartz, and placer mines of the county were idle, including the nearby Chandler Quartz Mine, west of Long Bar. One of the operating mines was the Too Handy Quartz Mine, located in Section 22 and extending north-northwest from the north bank of the Yuba River. The mine is depicted on an 1898 plat map diagram, and patented in 1901 by Peter McAulslan and John Purkiss. The location of the Too Handy mine may correspond to that of archaeological site P-58-001748.

The 20th century changed the mining landscape forever with the development of dredge mining, particularly bucket-line dredge mining. As discussed earlier, William P. Hammon inaugurated the process near Oroville, and perfected it in the Yuba Goldfields. Starting in 1904, the Yuba Goldfields became the state's most productive dredge field, and its third largest gold producer overall (Clark 1970). By 1909, the Official Map of Yuba County showed the river itself as Yuba Consolidated Gold Fields (YCGF), Hammon's company. Lands north and south of the river in Sections 22, 23, 24 and 26 were either in private ownership or owned by the Excelsior Water & Mining Company, with a small portion, mostly river, owned by the Central Pacific Railroad (Meek and Meek 1909). The YCGF general plan for 1911 shows property prospecting and dredge work in those sections (YCGF 1911). Long Bar is still known, however, as it is named on a 1914 map of Butte (sic) County in Sections 22 and 23. The same map indicates that the river has developed more new channels by this point, and a single building is shown adjacent to one of them on the western border of Section 25 (Punnett Bros. 1914).

The YCGF, plus its associated companies and those it purchased (such as the Marysville Dredging Company) was the giant of dredging concerns in Yuba County and beyond. It worked deposits along the Lower Yuba River and left tons of bucket-line dredge tailings that remain today, primarily south of the river. The history of that company and its supreme importance to the dredging industry and the economy of the United States has been discussed elsewhere (Bumback and Bowen 2015; Horizon 2016; Newland et al. 2005; and many others). One company that was *not* purchased by the YCGF was the Pacific Gold Dredging Company (PGDC), seen on a 1916 map of dredged areas (to 1915) within the Yuba River Basin (Waring 1917). The PGDC started work on the Yuba River in 1916 with one dredger at the upstream edge of the Yuba River dredging district (defined by Logan [1930:193] as extending 7.5 miles upriver from 1 mile west of Marigold, and 1 to 2 miles wide), and the 1916 map shows it on either side of the river in the eastern halves of Sections 23 and 26. The map did not extend to the east into Sections 24 and 25. This company was controlled by a Guggenheim Mining Syndicate. Its dredger Number 2 was built in 1916 at the Parks Bar Bridge and commissioned in 1917 (Hamilton 1919:428, 431). According to the state mineralogist's report, the dredge was equipped with 9-cubic-foot buckets and could dig 70 feet underwater (Logan 1921:490). It finished its work in March, 1923 (Logan 1930:193).

According to Logan, gold production from methods other than dredging had been limited since 1914 (1930:192). The Depression brought single miners and small groups to work during the summers on the river banks and gravel bars below Smartsville. Landowners here and elsewhere often worked deposits on their own property for extra income. With the rise in gold prices in 1934 (from $20.67 to

$35.00), things improved as lower-grade gravels could be worked profitably and prospecting and development increased, creating more employment opportunities.

The YCGF owned over 11,000 acres of patented land along the Yuba River, over 6,500 of which were tailings and river bars (O'Brien 1952:151). Between them and other companies, millions of tons of cobbles and other debris were created along this area of the Yuba River during the 20th century. The YCGF itself dredged until 1968 (Clark 1970). Since then, impacts from the aggregate mining industry – working over the tailings – and changing weather patterns have moved and scoured the banks of the river.

Long Bar was one of many small settlements developed during the gold rush and beyond, viable as long as gold was reachable and mining was practiced on a comparatively small scale. The county developed in tandem with the mining industry and not all settlements survived the influx of farms and ranches, the development of larger towns, and of larger scale mining efforts. During its history, Long Bar referred to a river bar, a small settlement, a school district and a township. Clearly, this was an important place along one of the most important river mining areas of the state. The fact that the settlement did not survive even the 19th century, in no way diminishes its influence on the history of this portion of Yuba County.

3 Native American Consultation and Archival Research

In accordance with the Secretary of the Interior's Standards and the Guidelines for Archaeology and Historic Preservation (Title 48 CFR Section 44716 [amended 1983]), the primary goals of this archaeological inventory were to identify and completely document the location, qualities, and condition of any potential historic properties in the project's APE. Methods employed to achieve these goals follow.

3.1 Native American Consultation

The Native American Heritage Commission (NAHC) was contacted via email on October 11, 2019, for a search of the sacred lands files for the APE and a list of individuals who might have additional knowledge about tribal resources in the project area. The NAHC responded on November 19, 2019, stating that sacred land files failed to identify any significant resources in the project area and providing a list of knowledgeable Native Americans in the region. Copies of this correspondence are in **Appendix C**.

Nine individuals who might have information about the project area were identified by the NAHC. Each of these individuals were contacted by letter, dated November 20, 2019 **(Table 1)**. The letters provided information about the project and inquired about any areas of concern within or adjacent to the study area. A project location map was included with each letter.

Table 1. Native American Consultation

Name of Contact	Organization/Tribe	Letter Date	Email Follow-up Date/Comments
Ms. Pamela Cubbler Treasurer	Colfax-Todds Valley Consolidated Tribe	November 20, 2019	Email follow-up on January 8, 2020. No reply to date.
Mr. Clyde Prout, Chairperson	Colfax-Todds Valley Consolidated Tribe	November 20, 2019	Email follow-up on January 8, 2020. No reply to date.
Ms. Glenda Nelson, Chairperson	Enterprise Rancheria – Estom Yumeka Maidu Tribe	November 20, 2019	Email follow-up on January 8, 2020. No reply to date.
Mr. Benjamin Clark, Chairperson	Mooretown Rancheria of Maidu Indians	November 20, 2019	Tribal Historic Preservation Officer responded; no known resources in project area, but would like to be informed if cultural items or human remains are discovered during construction.
Mr. Guy Taylor, Cultural Resources	Mooretown Rancheria of Maidu Indians	November 20, 2019	Tribal Historic Preservation Officer responded; no known resources in project area, but would like to be informed if cultural items or human remains are discovered during construction.
Ms. Tina Goodwin, Chairperson	Pakan'yani Maidu of Strawberry Valley Rancheria	November 20, 2019	Email follow-up on January 8, 2020. No reply to date.
Mr. Grayson Coney	Tsi Akim Maidu	November 20, 2019	Email follow-up on January 8, 2020. No reply to date.

Name of Contact	Organization/Tribe	Letter Date	Email Follow-up Date/Comments
Mr. Don Ryberg, Chairperson	Tsi Akim Maidu	November 20, 2019	Email follow-up on January 8, 2020. No reply to date.
Mr. Gene Whitehouse, Chairperson	United Auburn Indian Community of the Auburn Rancheria	November 20, 2019	Phone call from UAIC to Horizon on December 4, 2019. Horizon sent photographs to UAIC on December 6, 2019, and followed up via email on January 8, 2020. UAIC responded the same day; they did not need to conduct a field review but provided mitigation measures for the environmental document.

The Mooretown Rancheria of Maidu Indians and the United Auburn Indian Community of the Auburn Rancheria (UAIC) both responded to the November 20, 2019, letter. The Mooretown Rancheria Tribal Historic Preservation Officer responded in a letter dated November 26, 2019, stating that the tribe was not aware of any resources in the area, but that they would like to be notified if any cultural or human remains were discovered during construction. The UAIC responded via a telephone call to Horizon staff on December 4, 2019. After some discussion about the project, Horizon forwarded photographs of the project area to UAIC so that they could get a feel for what the project area looked like. Horizon followed up in an email on January 8, 2020, and UAIC responded that they did not need to conduct a field review of the project site. They did, however, provide recommended mitigation measures for inclusion in the CEQA environmental document, which Horizon passed on to Cramer Fish Sciences for inclusion in the environmental document.

Follow-up emails were sent on January 8, 2020 to all other individuals who did not respond to the November 2019 letter. No responses have been received from any of those contacted, to date. All correspondence with Native American tribes is included in Appendix C.

3.2 Archival Research

Cultural resources include prehistoric archaeological sites, historic-era archaeological sites, TCRs, and historic buildings, structures, landscapes, districts, and linear features.

A records search was conducted for the proposed project by the North Central Information Center (NCIC) of the California Historical Resources Information System at California State University, Sacramento (NCIC File No.: YUB-19-40). The purpose of the records search was to determine if the study area had previously been surveyed for cultural resources, and to identify any previously recorded cultural resources within, or within ¼ mile of, the proposed project. The record search results are presented in **Appendix D.** The archival research also included review of the California Inventory of Historic Resources, local historical inventories, historical literature, and historical maps including USGS topographic maps, General Land Office maps, and Rancho Plat Maps. In-depth research on Long Bar was conducted at the California Geological Survey library, the California Room of the California State Library, the Bureau of Land Management's online historic land records, and other online sources.

One previously conducted study (Bumback and Bowen 2015) had included nearly all of the current project's APE. Though not identified on the reports map included in the record search (see Appendix D), based on the list of resources provided, it also appears that an earlier survey, conducted in 1978 for the proposed Marysville Lake, encompassed the entire project area. Two other studies had been conducted within close proximity to the project area. One was of the Hammond Grove Park located just downstream of the APE (Decker 1997), while the other was of potential gravel mining areas on the south side of the Yuba River (Barnes 2003).

The records search indicated that no cultural resources had previously been recorded within the project APE. However, seven resources have been recorded within the ¼-mile search area; all but one was recorded during studies for the proposed Marysville Lake. Except for one bedrock mortar complex, the recorded resources are of the historic era and are related to mining activities or established communities along the Yuba River during the mid to late 1800s. These resources include a canal, mine tailings, a cemetery, and a rock wall. Site records for all of the resources are found in Appendix C.

Bumback and Bowen (2015) did not record or evaluate the Yuba Goldfields in their study, citing the limited impacts of their proposed project should the Goldfields be determined CRHR-eligible, but the region was described and discussed. Tordoff (2016), however, provided a preliminary evaluation of the historic district as part of her study on the Yuba Goldfields training walls for the Hallwood site Channel and Floodplain Restoration Project, located approximately 3.5 miles downstream of the current proposed project (Horizon 2016). In her evaluation, Tordoff found that the Yuba Goldfields appear to be significant for the NRHP/CRHR under criterion A/1 (association with events that have made a significant contribution to the broad patterns of our history) as the most productive dredge field in California, and for the contributions of the YCGF and the Yuba Manufacturing Company to the development of bucket-line dredge technology and the dredging industry as a whole. She noted that the resource might be eligible under criterion B/2 (association with the lives of persons important in our past) for its association with Wendell P. Hammon, the California Dredge King but, though Hammon was involved in all aspects of the exploitation of the Yuba Goldfields, eligibility under this criterion would rest on the degree of separation between Hammon, his dredging companies, and work in the Goldfields. Under criterion C/3 (embodiment of the distinctive characteristics of a type period, region, or method of construction, or representation of the work of an important creative individual, or possession of high artistic value), the Goldfields may be important as representative of the evolution of bucket-line dredge mining in California. Under criterion D/4 (has yielded, or may be likely to yield, information important in prehistory or history), the Goldfields may be important for insights into the evolution of dredge tailing configurations as deeper-digging machines were developed, although she noted that it is unlikely that the Goldfields will meet the requirements of this criterion, as many areas have been re-dredged more than once. In a letter dated March 9, 2017, (see **Appendix E**) the State Historic Preservation Officer did not object that the Yuba Goldfields be treated as an eligible historic district under Criteria A and C. In that same letter, the State Historic Preservation Officer also did not object to finding the north and middle training walls eligible for individual listing, as well as contributors to the Yuba Goldfields Historic Mining District.

An examination of historic USGS topographic maps from 1888, 1895, 1911, 1947, 1949, and 1973 (USGS 2020), and aerial photographs (NETROnline 2020) was undertaken as part of the archival research, the results of which are depicted in **Figure 5**. The historic maps, which date to 1888, indicate that the Yuba River below Long Bar, was very braided as it made its way toward the confluence with the Feather River. By this time, changes had undoubtedly already occurred to the river due to extensive hydraulic mining upstream. At this early date, the river in the vicinity of the APE was slightly to the south of its current location before curving to the south at the APE's western end, rather than to the north as it does today. The alignment appears unchanged in the 1895 map. However, after dredging operations began in the early 1900s, significant changes in location of the river, itself, can be seen. The Browns Valley USGS map from 1911 depicts the river moved further to the south, though a stream is present along the base of the hills in the approximate location of the current backwater channel. The next available map dates to 1947, and reflects significant dredging activity directly west of the project area, which again caused the river to slightly change course and move southerly in the project area. A map from 1949 looks identical to the 1947 map. By 1973, the Yuba River alignment matches that of today, with the main stem of the river moving northward just west of the APE to fill a channel that had been a backwater in the 1947 and 1949 maps.

Figure 5
Long Bar Historic Maps

Long Bar Floodplain Restoration Project

4 Inventory Methods and Results

4.1 Pedestrian Survey

The project APE was subjected to a reconnaissance-level pedestrian survey on October 8, 2019, by a qualified archaeologist who meets the U.S. Secretary of Interior's professional standards in archaeology (48 Federal Register 44738-44739; Appendix A to 36 CFR 61). Because there is no original ground surface within the APE, and it is currently a cobble field in the channel of the Yuba River, the field study was largely a due diligence review that focused on photographing the terrain.

4.2 Survey Results

No archaeological sites or isolated artifacts were identified during the pedestrian survey. Occasional modern debris items were extremely rare (one sandal and one aluminum soda can) and were not recorded.

5 Summary and Recommendations

A cultural resources field investigation was conducted of the proposed project's APE on October 8, 2019. No cultural resources were identified within the APE. While the region was undoubtedly used by Native Americans prior to colonization, the Yuba Goldfields area, including the current project APE, has been so extensively modified that prehistoric sites are no longer extant in mined areas, or they are deeply buried by silts and mine tailings. Similarly, historic-era sites (e.g., the towns of Marigold and Hammonton) no longer exist within the Yuba Goldfields due to the extensive dredge mining activities.

Although the project is located within the boundaries of the Yuba Goldfields Historic Mining District, there are no intact tailings or other mining features within the APE that would contribute to the eligibility of the district. Therefore, implementation of the proposed project would have a no adverse effect on the historic district pursuant to 36 CFR 800.4(d)(1) or under CEQA.

It is recommended that, ultimately, the entirety of the Yuba Goldfields Historic Mining District be recorded and formally evaluated for NRHP/CRHR eligibility, although that is beyond the scope of the current project, which is contained in a very small portion of the resource.

In the unlikely event that human remains are encountered during restoration activities, Section 7050.5 of the California Health and Safety Code states that it is a misdemeanor to knowingly disturb a human burial. If human remains are encountered, work should halt in the vicinity of the remains and, as required by law, the Yuba County coroner should be notified immediately. An archaeologist should also be contacted to evaluate the find. If human remains are of Native American origin, the coroner must notify the NAHC within 24 hours of that determination. Pursuant to California PRC Section 5097.98, the NAHC, in turn, will immediately contact an individual who is most likely descended from the remains (the "Most Likely Descendant"). The Most Likely Descendant has 48 hours to inspect the site and recommend treatment of the remains. The landowner is obligated to work with the Most Likely Descendant in good faith to find a respectful resolution to the situation and entertain all reasonable options regarding the Most Likely Descendant's preferences for treatment.

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MITIGATION MONITORING AND REPORT PROGRAM: LONG BAR SALMONID HABITAT RESTORATION PROJECT ON THE LOWER YUBA RIVER MITIGATED NEGATIVE DECLARATION

This Mitigation Monitoring and Reporting Program (MMRP) was prepared in accordance with Section 15097 of the California Environmental Quality Act (CEQA) Guidelines. Section 15097 requires that a lead agency establish a program to report on or monitor measures adopted as part of the environmental review process to mitigate or avoid significant effects on the environment. The MMRP for the Long Bar Salmonid Habitat Restoration Project is presented here as Table 1. As the Lead Agency, the U.S. Fish and Wildlife Service is responsible for enforcement of the adopted mitigation measures. This MMRP is designed to ensure that the mitigation measures necessary to reduce significant impacts identified in the Long Bar Salmonid Habitat Restoration Initial Study and Proposed Mitigated Negative Declaration (IS/MND) are implemented. The components of the MMRP Table 1 are listed below:

Mitigation Measures: The mitigation measures are taken verbatim from the Long Bar Salmonid Habitat Restoration Project IS/MND.

Timing/Milestone: Identifies a schedule for conducting each mitigation action.

Responsible Entity: Identifies the entity responsible for implementing specific mitigation measures.

Mitigation Action: Identifies the specific action or actions that must be completed to implement the mitigation measure.

Monitoring and Enforcement Responsibility: Identifies the department/agency, consultant, or other entity responsible for overseeing that mitigation occurs.

Check off Date/Initials: To be filled out when individual mitigation is complete.

MITIGATION MONITORING AND REPORTING PROGRAM: LONG BAR SALMONID HABITAT RESTORATION PROJECT					
Mitigation Measure(s)	Timing/ Milestone	Responsible Entity	Mitigation Action	Monitoring and Enforcement Responsibility	Check off Date/Initials
Reduce Dust Impacts The following dust reduction measures will be implemented during movement of materials from the construction area to the processing plant to reduce construction-related emissions: • wet materials to limit visible dust emissions using water; • provide at least 6 in (15.2 cm) of freeboard space from the top of the container; or, • cover the container. Implement the following dust reduction measure during cobble placement to reduce construction-related emissions: • limit or promptly remove any of mud or dirt on construction equipment and vehicles at the end of each workday, or once every 24 hours. Water trucks would be used to wet down construction access roads, staging areas, and restoration activity zones to minimize dust production.	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Protect Elderberry Plants and Special Status	Prior to initiation of	Project Applicant/	Implement specified	Project Applicant/	

Plants with Buffer Each year, before beginning construction activities, a pre-project special status plant survey will be conducted of the Proposed Project site. If elderberry shrubs (or other special status plants) are identified in subsequent surveys they will be avoided. Complete avoidance of elderberry plants may be assumed when there is at least a 100-ft (30.5 m) buffer around the plant. However, 20 ft buffers will be established and maintained for all elderberry plants with stems measuring 1 in or greater in diameter at ground level which will be retained in situ (83 plants). All buffer zones will be flagged and Proposed Project activities will be adjusted to ensure no activities occur in the buffer area, thereby minimizing any negative effects on valley elderberry longhorn beetle. No insecticides, herbicides, fertilizers, or other chemicals that might harm valley elderberry longhorn beetle or its host plant will be used for the Proposed Project (USFWS 1999).	restoration activities	Contractor	mitigation measures	Contractor	
Transplant Unavoidable Elderberry Plants to Suitable Locations Elderberries that were transplanted pre-project, following consultation with U.S. Fish and Wildlife Service, will be monitored in years 1, 2, and 3 and 10 with a target minimum survival rate of at least 60%. If necessary, replacement plants will be added to the restoration area to maintain survival above 60%.	Prior to initiation of restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Protect and Compensate for Native Trees Native trees, such as Fremont cottonwood (*Populus*	Prior to initiation of restoration	Project Applicant/	Implement specified mitigation	Project Applicant/ Contractor	

fremontii), willows (*Salix* spp.), and Alder (*Alnus rhombifolia*) with a diameter-at-breast-height (DBH) of 6 in (15.2 cm) or greater will be protected with 30-ft (9.1-m), 10-ft (3-m), and 10-ft (3-m) buffers, respectively. Native trees will be marked with flagging if close to the work area to prevent disturbance. To compensate for the removal of riparian shrubs and trees during Proposed Project implementation, the plans will identify tree and shrub species that will be planted, how, where, and when they will be planted, and measures to be taken to ensure a minimum performance criteria of 60% survival of planted trees for a period of three consecutive years. Irrigation will not be used, but the return of inundation to the floodplain is expected to promote growth of native riparian species. The tree plantings will be based on native tree species compensated for in the following manner: • Oaks having a DBH of 3 – 5 in (7.6 – 12.7 cm) will be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a DBH of greater than 5 in will be replaced in-kind at a ratio of 5:1. • Riparian trees (i.e., willow, cottonwood, poplar, alder, ash, etc.) and shrubs will be replaced in-kind and on site, at a ratio of 3:1, and planted in the nearest suitable location to the area where they were removed.	activities	Contractor	measures		

Construction Approach to Minimize Impacts to Fish The construction approach will allow fish to move progressively downstream and away from the impact area as construction moves from upstream to downstream through the backwater channel. The majority of the in-water work will involve the filling in and creation of a side channel through the ponds and backwater. Before in-water work starts in a section of the channel a qualified fisheries biologist will survey the area and determine whether there is a suitable egress route for fish to move downstream and away from the construction area. If a suitable downstream egress route is not present, most likely because an area is deemed too shallow, then the problem area will be altered such that it becomes suitable. An excavator would likely be used to deepen the problem area and would work from downstream to upstream to discourage fish from migrating downstream until the egress route is completed. Once suitable downstream egress has been established, in-stream construction will begin at the most upstream section of the channel and work progressively downstream and across the channel. The listed fish species most likely to be present are juvenile CCV Steelhead from 7 to 30 cm (3 – 12 in) fork length and possibly juvenile CV spring-run Chinook Salmon that are demonstrating the yearling life history strategy from 7 to 12 cm (3 – 5 in) fork length. Juvenile CCV steelhead and Chinook Salmon are highly mobile and would be expected to easily move downstream and away from the impact	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

area with a suitable egress route. Juvenile CCV steelhead and Chinook Salmon are not likely to be present in the ponds or the majority of the backwater, since they are not juvenile salmonid habitat. During pre-project surveys juvenile Chinook Salmon were only observed in the observed in the backwater in winter and spring when flows were sufficient to allow access (CFS unpublished data). Juvenile *O. mykiss* were never observed in the backwater (CFS unpublished data). Once work proceeds past an area, fish will be able to return to use the newly created habitat through upstream migration. If a qualified fisheries biologist, with input from the contractor, determines that in-stream work in an area cannot be performed using the construction approach then fish relocation will be performed to avoid fish injury and mortality and minimize disturbance.					
Fish Relocation to Minimize Impact to Fish from Construction Activities If fish relocation needs to be performed, a qualified fisheries biologist will determine which fish relocation method is most appropriate for the area. Fish relocation will most likely initially be attempted by trying to herd the fish out of the work area as this would minimize impacts to fish as they would not be handled and transported. The following guidelines will apply to fish relocation through herding. • Before fish relocation through herding begins, a qualified fisheries biologist will identify the most appropriate method and approach. Prior to beginning the fisheries	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

biologist will ensure that the location to which fish are herded contains suitable habitat. • The fish relocation through herding will be conducted under the supervision of a qualified fisheries biologist. The method that will most likely be used will be to install an exclusion screen or block-net above the upstream most work area. An appropriately sized seine that covers the width of the channel, operated by qualified personnel, will be pulled in the downstream direction until it is below the bottom of the work area. The net will then be fastened in place, blocking the entire channel until a temporary block net can be installed. The temporary block-net will be installed immediately upstream of the seine net such that fish have been herded downstream and cannot return upstream. A minimum of three seine hauls will be performed. For each haul, when the seine approaches the block-net, the block-net will be removed until the seine has passed downstream of its location and will then be re-installed immediately upstream of the seine. After the final pass, as determined by the fisheries biologist, the block-net will be left in place or replaced with an exclusion screen to prevent fish from moving upstream. • After the area has been adequately seined, based on the judgement of a qualified fish biologist, the area will once again be					

surveyed for fish. The fisheries biologist will determine the most appropriate method to survey the area for remaining fish. • If the survey results in an estimate of greater than 95% of individuals that were present prior to relocation efforts being absent after relocation efforts and no listed species are observed, the fish relocation effort will be considered successful and construction activities can commence. If initial relocation efforts are deemed unsuccessful, the fisheries biologist will determine whether further herding with a seine should be conducted until the success criteria is met or relocation using a capture method will be employed. If fish relocation using herding is not successful or the fisheries biologist decides it is not feasible, then fish capture and relocation will be used. The following guidelines will apply to fish capture and relocation. • Before fish relocation begins, a qualified fisheries biologist will identify the most appropriate release location(s). Release locations will have water temperatures within 2°C of the capture location, offer suitable habitat for released fish, and will be selected to minimize the likelihood that fish will re-enter the work area or become impinged on the exclusion net or screen. • The method used to capture fish will depend					

on the nature of the work site, and will be selected by a qualified fisheries biologist who is experienced with fish capture and handling. Areas of complex habitat may require the use of electrofishing equipment, whereas in other areas fish may be captured through seining or dip netting. Electrofishing will only be performed by properly trained personnel following NMFS guidelines (2000). Electrofishing will only be performed if seining and/or dip netting is not feasible. • Handling of salmonids will be minimized. When it is necessary, personnel will only handle fish with wet hands or nets. • Fish will be held temporarily in cool, shaded water. Overcrowding in buckets will be avoided by using at least two buckets and no more than 25 fish will be kept in a five gallon bucket. Aeration will be provided with a battery powered external bubbler. Fish will be protected from jostling and noise and will not be removed from the bucket until the time of release. The water temperature in each bucket will be monitored and partial water changes or the addition of ice will be conducted as necessary to maintain a stable water temperature (within 2°C of initial water temperature). Fish will not be held for more than 30 minutes. If water temperature reaches or exceeds NMFS limits, fish will be released and relocation operations will					

cease. • If fish are abundant, capture will cease periodically to allow release and minimize the time fish are held in containers. • Fish will not be anesthetized or measured. However, they will be visually identified to species level, and year classes will be estimated and recorded. • When feasible, initial fish relocation efforts will occur several days prior to the scheduled start of construction. The fisheries biologist will perform a final survey on the day before or the day of construction. • Reports on fish relocation activities will be submitted to CDFW and NMFS within 6 months of the relocation effort. • If mortality during relocation exceeds 2%, relocation will cease and CDFW and NMFS will be contacted as soon as possible.					
Exclusion of Fish from Construction Areas to Prevent Impacts Fish exclusion screens or nets may be used in strategic locations at various times to prevent fish from being impacted by construction activities. Exclusion will prevent fish from accessing areas from which they were relocated.	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Work Outside of Critical Periods for Sensitive	Prior to restoration	Project Applicant/	Implement specified	Project Applicant/	

Species Table 14 lists the critical periods when disturbance could result in significant impacts to individuals or populations of special status species. To avoid these impacts, all Proposed Action in-water activities will be conducted during the period 15 July through 30 September, which is outside the listed critical periods for the majority of the species. Surveys will be performed for species which have critical periods overlapping with the in-water work window or dry-ground work window (16 April to 31 October) which may be impacted by the Proposed Action activities. If special status or sensitive species are identified within the area which may be impacted by Proposed Action activities, then buffers will be established and/or CDFW and USFWS will be consulted. Nesting birds and raptors are protected under the MBTA and California Fish and Game Code, and trees and shrubs within the Action Area likely provide nesting habitat for songbirds and raptors. If tree removal is unavoidable, it will occur during the non-breeding season (mid-September). If other construction activities must occur during the potential breeding season (1 February- 31 August) surveys for active nests and/or roosts will be conducted by a qualified biologist no more than 10 days prior to the start of construction. A minimum no disturbance buffer will be delineated around active nests (note, size of buffer depends on species encountered) until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.	activities	Contractor	mitigation measures	Contractor	

Monitor for Bats to Prevent Impacts For bat species, before any ground disturbing activities, a qualified biologist will survey for the presence of associated habitat types for the bat species of concern. If bats are present, suitable avoidance and conservation measures will be implemented, including a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged.	Prior to restoration activities	Project Applicant/ Contractor	Hire qualified biologist to perform surveys; if necessary, implement specified mitigation measures	Project Applicant/ Contractor	
Use Special Transportation Routes and Work Areas Special transportation routes and work areas will be designated to avoid damaging trees and shrubs in riparian habitats, especially those sensitive species described above. Potential impacts to the riparian vegetation could occur during heavy equipment operation. These impacts will be minimized to the greatest extent practicable by selecting travel routes that avoid or minimize damage. Heritage size trees (i.e., greater than 24 in [40.6 cm] in diameter) near the work area will be identified, flagged and fenced prior to construction to prevent unintended damage. If damage cannot be avoided, these trees will be replaced at a ratio prescribed in **Mitigation Measure 5 - Protect and Compensate for Native Trees.**	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Monitor for Wildlife to Prevent Impacts Pre-construction surveys by qualified biologists will be conducted no more than 10 days prior to the start of construction. Pre-construction surveys will be conducted by qualified wildlife biologists, who will determine the	Prior to restoration activities	Project Applicant/ Contractor	Hire qualified biologist to perform surveys; if necessary, implement specified mitigation	Project Applicant/ Contractor	

use of the Action Area by American badgers; surveys will focus on identification of potential badger dens within, and a minimum 250 ft (76.2 m) buffer, around the Action Area. If badger dens are located within the construction or buffer area, prior to initiation of construction CDFW will be consulted for further instructions on methods to avoid direct impacts to this species. Protocol-level surveys will also be implemented for other state and federally-listed species such as Foothill Yellow-legged Frog, Swainson's Hawk, White-tailed Kite, Bald Eagle, Chinook Salmon, CCV steelhead, and Western Pond Turtle, which may be impacted by restoration activities (Swainson's Hawk Technical Advisory Committee 2000). This includes pre-construction surveys conducted no more than 15 days before Proposed Action construction activities by qualified wildlife and fisheries biologists. Surveys for active nests will be performed using qualified biologists no more than 10 days prior to the start of disturbance activities. A minimum no-disturbance buffer of 250 ft around active nests of non-listed bird species; a 500-ft no-disturbance buffer around migratory bird species; and a half mile buffer for nest of listed species and fully protected species (including White-tailed Kite and Bald Eagle) will be established until breeding season is over or young have fledged. If such a buffer cannot be accomplished, CDFW will be consulted. If Foothill Yellow Legged Frog or Western Pond Turtle are present in Action Areas that will be disturbed then CDFW will be consulted for further instructions on methods to avoid direct			measures		

impacts to these species.					
Monitor Water Quality and Prevent Impacts During in-water work, turbidity will be monitored with intermittent grab samples from the river, and construction curtailed if turbidity exceeds criteria established by the Regional Water Quality Control Board in its Clean Water Act §401 Water Quality Certification. Only clean native sediment from within the Action Area will be used to create riffles and perform other topographic modification. As appropriate, silt curtains will be used along the river corridor to capture floating materials or sediments mobilized during construction activities, and prevent water quality impacts. Stream bank impacts will be isolated and minimized to reduce bank sloughing. Banks will be stabilized with revegetation following Proposed Action activities, as appropriate. A Spill Prevention and Response Plan will also be developed as part of the Long Bar Best Management Practices Plan (BMP Plan), as well as a Stormwater Pollution Prevention Plan (SWPPP). All pertinent staff will be trained on and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them will be made available at the site and staff will be trained in its use. Spill prevention kits will be in close proximity to construction areas, and workers will be trained in their proper use.	Ongoing prior to, during and after restoration activities	Project Applicant/ Contractor	Use qualified QSP and implement measures	Project Applicant/ Contractor	
Monitor Mercury Levels and Mitigate for Impacts Sediment and aqueous total mercury levels will be	Ongoing prior to, during and after restoration	Project Applicant/ Contractor	Use qualified QSP and implement measures	Project Applicant/ Contractor	

measured before, during, and after restoration activities in the Action Area. Following methods in the Stillwater Sciences (2004) Mercury Assessment, total mercury from areas of Proposed Action exposed fine sediments (<63 µm) will be evaluated to determine if they are considered elevated by the Central Valley Regional Water Quality Control Board (0.10 mg/kg or greater). Aqueous raw total mercury will also be tested to ensure that it is below the California Toxics Rule for a drinking water source of 50 ng/L. It is unlikely that excavation and regrading activities may uncover mercury hot spots and or mobilize mercury in the aquatic food web; however, if samples are found with mercury levels above established standards, work will be halted in the vicinity of the elevated mercury area to assess contamination potential. If, sediment total mercury levels meet the elevated criteria then the mitigation action(s) defined in the Proposed Action 401 water quality certification will be implemented.	activities				
Use Clean Equipment and Biodegradable Lubricants All equipment will be clean and those performing in-water work will use biodegradable lubricants and hydraulic fluids. All equipment will be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs). Vehicles are to be fueled and lubricated in a designated staging area located outside the stream channel and banks. Front-end loaders will be wheeled (rubber tire) to minimize impacts. Construction specifications will require that any equipment used in or near the river is properly	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

cleaned to prevent any hazardous materials from entering the river, and containment material will be on site in case of an accident. Contracted personnel will regularly monitor contractors to ensure environmental compliance. Spill prevention kits will be located close to construction areas, with workers trained in their use.					
Prevent Spread of Aquatic Invasive Species To minimize the chance that aquatic invasive plants and invertebrates will be transported and spread to other sections of the Yuba River or other water bodies on equipment, construction specifications will require that equipment be steam cleaned immediately after the work is completed and before being used in other water bodies. An Invasive Species Risk Assessment and Planning (ISRAP) protocol will be developed, and all appropriate staff will be trained as to its purpose and implementation before construction begins. The plan will be used to prevent the spread of invasive species during construction. Additional measures may be taken at the recommendation of CDFW.	Prior to restoration activities	Project Applicant/ Contractor	Implement mitigation measures specified in ISRAP	Project Applicant/ Contractor	
Reduce Impacts from Noise To mitigate noise related impacts, the Proposed Action will require all contractors to comply with the following operational parameters: • restrict construction activities to time periods under which the aggregate plant is allowed to operate; • install and maintain sound-reducing equipment and muffled exhaust on all	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

construction equipment.					
Inadvertent Discoveries of Objects of Cultural Significance The following mitigation measure would be implemented as the Proposed Action would not have a Tribal or Archeological Monitor present during ground disturbing activities. Cultural items include darkened soil (midden), shell fragments, faunal bone fragments, fire affected rock and clay, isolated artifacts, bowl mortars, handstones and pestles, flaked stone, and human remains. Recommendations of the treatment of a Tribal Cultural Resource (TCR) will be documented in the project record. For any recommendations made by traditionally and culturally affiliated Native American Tribes that are not implemented, a justification for why the recommendation was not followed will be provided in the project record. If adverse impacts to a TCR, unique archeological, or other cultural resources occurs, then consultation with the United Auburn Indian Community of the Auburn Rancheria (UAIC) and other by traditionally and culturally affiliated Native American Tribes regarding mitigation contained in the Public Resources Code sections 21084.3(a) and (b) and CEQA guidelines section 15370 will occur. • If potentially significant TCRs, cultural or archeological resources are discovered during ground disturbing construction activities, all work will cease within 100 feet of the find. UAIC's Tribal Historic Preservation Department and Mooretown	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

Rancheria Tribal Historic Preservation Officer will be immediately contacted to assess the significance of the find, according to Section 15064.5 of the CEQA Guidelines, and make recommendations for appropriate treatment. • A qualified cultural resources specialist meeting the Secretary of the Interior's Standards and Qualifications for Archeology, may also assess the significance of the find in join consultation with Tribal Representatives from UAIC and Mooretown Rancheria to ensure that Tribal values are considered. Work will remain suspended or slowed within 100 feet of the find until the resource is evaluated, which will occur within one day, but no more than two days, of the find. • The Proposed Action applicant will coordinate with UAIC's Tribal Historic Preservation Department and Mooretown Rancheria Tribal Historic Preservation Officer all necessary investigations and treatment of the discovery under the requirements of CEQA, including AB 52. Preservation in place would be the preferred alternative under CEQA and Tribal protocols, and every effort will be made to preserve the resources in place, including through project redesign. • The contractor will implement any measures deemed by Yuba County to be necessary and					

feasible to preserve in place, avoid, or minimize impacts to the resource, including, but not limited to, the use of a paid Tribal Monitor, and facilitating the appropriate Tribal treatment of the find, as necessary. The final disposition of archaeological, historical, and paleontological resources recovered on State lands under the jurisdiction of the State Lands Commission must be approved by the Commission					
Public Safety During construction, signs will be posted upstream and downstream of the work zone to warn river users of the potential hazards created by heavy equipment and how to safely avoid the work zone. The importance of monitoring for the presence of rafters and boaters will be part of the initial construction crew safety training and this will be reiterated during weekly BMP meetings.	Prior to and ongoing during restoration activities	Project Applicant/ Contractor	Implement mitigation measure specified	Project Applicant/ Contractor	

Fisher, Ciara

From:	Benedict, Christopher
Sent:	Thursday, June 11, 2020 4:14 PM
To:	Fisher, Ciara
Subject:	RE: Long Bar Floodplain Restoration Project (EA2020-0005)

No comments

Christopher J. Benedict, REHS
Environmental Health Specialist
Yuba County Environmental Health
915 8th Street, Suite 123
Marysville, CA 95901

Phone: (530) 749-5469
Cell: (530) 822-6899
Fax: (530) 749-5454

From: Fisher, Ciara
Sent: Thursday, June 11, 2020 3:52 PM
To: Benedict, Christopher
Subject: RE: Long Bar Floodplain Restoration Project (EA2020-0005)

Hey Chris,

Did you have any comments for this project?

Ciara Fisher
Planner II
County of Yuba
530-749-5463

From: Benedict, Christopher <cbenedict@CO.YUBA.CA.US>
Sent: Wednesday, April 22, 2020 10:12 AM
To: Fisher, Ciara <cfisher@CO.YUBA.CA.US>
Subject: Automatic reply: Long Bar Floodplain Restoration Project (EA2020-0005)

Greetings,

Due to the Restricted Activities Directive issued in Yuba and Sutter Counties, Community Development and Services Agency (Department) will only be available for critical and certain essential business operations. Staff are monitoring both email and voicemail daily, and we will do our best to respond to inquiries within 24 hours (excluding weekends). For detailed information regarding the directive, please visit our website at www.bepreparedyuba.org. For general questions, please email us or leave a phone message at 749-5430, and someone will get back to you as soon as possible. We will work with you to process new projects, but our normal processing times will be longer than normal. Thank you for your understanding.

Fisher, Ciara

From:	Anna Starkey <astarkey@auburnrancheria.com>
Sent:	Tuesday, May 5, 2020 11:26 AM
To:	Fisher, Ciara
Cc:	Rebecca Allen
Subject:	RE: AB-52 Consultation for Long Bar Floodplain Restoration Project
Attachments:	3_Mitigation_Measure_CEQA_UnanticipatedDiscoveries.pdf

Hello Ciara,
Thank you for the notification to consult for the Long Bar Floodplain Restoration Project. We decline to consult for this project but wish to be immediately notified of an unanticipated discovery. We are aware of several tribal cultural resources in the vicinity so we ask that you incorporate the attached unanticipated discoveries mitigation measure into the TCRs section of the CEQA document. We ask that you share a draft copy of the CEQA document with us to review before it goes out for public comment.

Last year, the archaeological consultant for the project asked for information on tribal cultural resources for their cultural resources identification and assessment, and shared photographs and project area conditions. Based on the information provided by Janis Offerman (report author and trusted archaeologist), and a review of our database, we do not believe that the project would impact any known or unknown tribal cultural resources. The summary provided on page 21 of the report is accurate.

Additionally, I wanted to let you know that the cultural report for this project is a good example of the type of report you should be getting. There are historic maps and project area photographs. Reports should also include buried site potential/geoarchaeological conditions.

Thank you,
Anna Starkey

Anna M. Starkey, M.A., RPA
Cultural Regulatory Specialist
Tribal Historic Preservation Department| UAIC
10720 Indian Hill Road
Auburn, CA 95603
Direct line: (916) 251-1565 | Cell: (530) 863-6503
astarkey@auburnrancheria.com |www.auburnrancheria.com

From: Fisher, Ciara <cfisher@CO.YUBA.CA.US>
Sent: Monday, May 4, 2020 2:20 PM
To: Anna Starkey <astarkey@auburnrancheria.com>
Subject: AB-52 Consultation for Long Bar Floodplain Restoration Project

Hello Anna,

Please review Yuba County's invitation for Consultation, for the Long Bar Floodplain Restoration Project (EA2020-0005). The U.S. Fish and Wildlife Services (USFWS) is planning to restore an approximately 1-mile-long section of the Yuba River in Yuba County, California.

Attached is the PDF copy of the AB 52 Consultation Letter Package that includes the project Vicinity Map, Aerial, and Cultural Resource Studies. I also mailed a hard copy to your office.

Let me know if you have any questions or comments. Thanks,

Ciara Fisher
Planner II
County of Yuba
530-749-5470

Tribal Cultural Resources – Unanticipated Discoveries

The following mitigation measure[1] is intended to address the evaluation and treatment of inadvertent/unanticipated discoveries of potential tribal cultural resources (TCRs), archaeological, or cultural resources during a project's ground disturbing activities.

If any suspected TCRs are discovered during ground disturbing construction activities, all work shall cease within 100 feet of the find. A Tribal Representative from culturally affiliated tribes shall be immediately notified and shall determine if the find is a TCR (PRC §21074). The Tribal Representative will make recommendations regarding the treatment of the discovery. Preservation in place is the preferred alternative under CEQA and UAIC protocols, and every effort must be made to preserve the resources in place, including through project redesign.

Work at the discovery location cannot resume until all necessary investigation and evaluation of the discovery under the requirements of the CEQA, including AB 52, has been satisfied.

The contractor shall implement any measures deemed by the CEQA lead agency to be necessary and feasible to preserve in place, avoid, or minimize impacts to the resource, including, but not limited to, facilitating the appropriate tribal treatment of the find, as necessary.

1 Proposed Mitigation Measure includes suggested template language to assist lead CEQA agencies, and their consultants, in understanding the Tribe's policies and expectations. All measures are subject to periodic review and change by the consulting Tribe to reflect best practices and to be worded on a project scope and site specific basis.

April 15, 2021

THE SIERRA FUND
204 Providence Mine Rd
Suite 214
Nevada City, CA 95959
P: 530.265.8454
F: 530.265.8176
E: info@sierrafund.org
www.sierrafund.org

ATTN: Ciara Fisher
Planning Department, CDSA
Submitted via email to: cfisher@co.yuba.ca.us

RE: Comments on Environmental Assessment EA2020-0005
Long Bar Salmonid Habitat Restoration Project

Dear C. Fisher and Yuba County Planning Department,

The Sierra Fund is writing regarding the draft Mitigated Negative Declaration for the Environmental Assessment (EA2020-00005, SCH# 2021030284) filed on the proposed US Fish and Wildlife Service project "to restore and enhance the ecosystem of the lower Yuba River in order to improve habitat suitable for rearing juvenile salmonids to increase the natural production of fall-run and spring-run Chinook salmon and Central Valley steelhead." We would like our comments to be considered part of the decision record when the Yuba County Development Review Committee (DRC) reviews this project as part of the public hearing scheduled for Thursday, May 6, 2021 beginning at 9:00 a.m.

Summary: The Sierra Fund is very supportive of the Project goals. However, we have a serious concern about the proposed Mitigated Negative Declaration (MND) for the Environmental Assessment (EA) conducted for this Project. The Project Description is incomplete and therefore the EA is insufficient. In addition, the Project meets the criteria for requiring permitting under the Surface Mining and Reclamation Act (SMARA). SMARA's requirements apply to anyone, including government agencies, engaged in surface mining operations in California (including those on federally managed lands) which disturb more than one acre or remove more than 1,000 cubic yards of material.

Project Description Is Incomplete: The Project EA focuses almost exclusively on the fish restoration elements of this Project. However, the Project has another purpose that is only obliquely referred to in the more than 500 pages of materials submitted. **That other purpose is mining.**

The Project proposes to do gravel/sand mining as part of the fish habitat restoration activities. An estimate by one project proponent of material to be moved has been verbally presented as "maybe" 300,000 cubic yards. However, we could find no written estimate of the description or volume of material to be moved in any of the documents submitted as part of the EA.

The Project description materials provided as part of the EA mention that a mining company will be taking some of the mining products. That mining company, SRI, has the silica/sand rights on the site where this material will be mined. Apparently, SRI does plan to take, transport to their site, and sell some of the material produced as part of this Project. It is not clear if the "verbal estimate" from project proponents of the volume of material is "gross" material to be moved or just volume of the sand that SRI will be transporting and selling from their nearby facility.

SRI has a SMARA permit to mine "near" the site of this Project. This Project is not part of that permit, and therefore not part of that Reclamation Plan, nor part of the financial assurance mechanism associated with that permit. As you know, any amendment to this existing SMARA permit or consideration of new mining activities on this site is under the jurisdiction of the State Mining and Geology Board (SMGB).

This is a mining project *because it will move an estimated 300 times the legal trigger for SMARA*. Project proponents are aware that SMARA should apply to this Project. One partner made a presentation to the SMGB last month in preparation for asking for an exemption from SMARA for this Project (see Attachment 1: SMGB Public Agenda Thursday March 18, 2021, Item 15b, *Long Bar Floodplain Construction Project, Yuba County.)* Despite this acknowledgment that SMARA applies to this Project, neither mining nor SMARA are mentioned in the EA. The pending request for an exemption from SMARA is also not mentioned in the EA.

This project requires a SMARA permit: Instead of issuing a Mitigated Negative Declaration the County should require that the Project obtain a SMARA permit from the SMGB (which would include creation of a Reclamation Plan, development of a financial assurance mechanism, and regular inspections). Yuba County cannot waive SMARA. Yuba County cannot be lead agency for CEQA review of a mining project permitted under SMARA.

If the Project is successful at persuading the SMGB to waive SMARA for this Project it may then be appropriate for Yuba County to process a MND for an EA for both the fish restoration and mining activities. In that case, the existing EA would need to be amended to include language describing the mitigation measures pertaining to the mining activities proposed for the project.

I would be happy to discuss these concerns with your staff. We have raised our concerns about this project with SYRCL staff as well. Thank you for this opportunity to share our observations with you.

Sincerely,

Elizabeth "Izzy" Martin
CEO

Attachment: State Mining & Geology Board Agenda March 18, 2021

Cc: Paul Cadrett, U.S. Fish & Wildlife Service Project Applicant
Kirsten Sellheim, Cramer Fish Sciences, Consulting Firm
Melinda Booth, SYRCL, Project Partner

Attachment 3

California
Department of Conservation
State Mining and Geology Board

Gavin Newsom, Governor
David Shabazian, Director
Jeffrey Schmidt, Executive Officer

Publication Date: Friday, March 5, 2021

OFFICIAL NOTICE OF PUBLIC MEETING

THE STATE MINING AND GEOLOGY BOARD

Will Conduct a Regular Business Meeting on:

Thursday, March 18th, 2021 at 1:00 p.m.

This meeting will be held via video conference and will be recorded.

To avoid any background noises while the meeting is in session, we ask that you mute your device. To join the meeting, please download the latest version of MS Teams by visiting their website at https://aka.ms/getteams or install the MS Teams app on your phone. After installing MS Teams on your device click on the Microsoft Teams Meeting link to join the meeting. You may also join us by phone by dialing (916) 318-8892 and entering the Conference ID Number: **883 299 547#**.

The executive session will be held via an alternate MS Teams line, which will be provided to Board members prior to the meeting. The primary conference line will remain open during the executive session and members of the public may remain on the line. Board members will re-join the main teleconference after the conclusion of the executive session.

For questions or comments regarding this Agenda, please contact the Board by email at smgb@conservation.ca.gov. This Notice, the agenda, and all associated staff reports can be accessed at the SMGB's web site at: https://www.conservation.ca.gov/smgb.

PUBLIC MEETING AGENDA

1. **Call to Order (Sheingold)**

2. **Pledge of Allegiance**

3. **Roll Call and Declaration of a Quorum**

4. **Review of the Agenda (Sheingold)**

5. **Department Reports**
   - **Department of Conservation Report (Shabazian)**
   - **Division of Mine Reclamation Report (Haas)**
   - **California Geological Survey Report (Bohlen)**

6. **Chair Report (Sheingold)**

7. **Executive Officer Report (Schmidt)**

8. **Senior Geologist Report (Fry)**

9. **Senior Policy Analyst Report (Livers)**

10. **Board Committee Reports**
    - Policy and Administration (Chair Landregan)
    - Geohazards and Mineral Conservation (Chair Zafir)
    - SMARA Compliance (Chair Anderson)

11. **Ex-Parte Communication Disclosure**
    Board Members will identify any discussions they may have had requiring disclosure pursuant to Public Resources Code Sections 663.1 and 663.2.

12. **Public Comment Period**
    This time is scheduled to provide the public with an opportunity to address non-agenda items. Those wishing to speak should do so at this time. All persons wishing to address the Board are encouraged to complete a virtual speaker card via chat on the MS Teams platform. Speaker testimony is limited to three minutes except by special consent of the Chair.

13. **Consent Items**
    All the items appearing under this section will be acted upon by the Board by one motion and without discussion; however, any Board member wishing to discuss any item may request the Chair to remove the item from the Consent Calendar and consider it separately.

    A. Consideration and Approval of Minutes for the Regular Business Meeting held on:

    January 21st, 2021

14. **Regular Business Items**

    A. Consideration and Adoption of the 2020 Annual Mine Fee Schedule, Subject to the Surface Mining and Reclamation Act of 1975 (PRC Sections 2710 et seq. and 2207).

B. Consideration and Approval of Non-substantive Regulatory Changes to Seismic Hazard Mapping Regulation (Title 14, California Code of Regulation (CCR), Sections 3720-3722, 3724, 3725), Pursuant to 1 CCR 100 (Section 100).

15. Presentations, Reports, and Informational Items

A. Presentation: *Bagley-Keene Update* (Nicole Rinke, Esq., DAG, Attorney General's Office). This presentation is a refresher on the provisions of the Bagley-Keene Open Meeting Act.

B. Presentation: *Long Bar Floodplain Construction Project, Yuba County* (Aaron Zettler-Mann, South Yuba River Citizens League). This presentation will provide preliminary information to the Board for future consideration of an exemption from the Surface Mining and Reclamation Act.

16. Executive Session (Closed to the Public)

The Board will discuss information from its legal counsel on personnel matters and pending litigation and may take appropriate actions based on this information. This session is being held under Government Code, Section 11126.

The executive session will be held via an alternate MS Teams line, which will be provided to Board members prior to the meeting. The primary conference line will remain open during the executive session and members of the public may remain on the line. Board members will re-join the main teleconference after the conclusion of the executive session.

A. To discuss potential litigation involving the Board pursuant to Government Code Section 11126(e)(2).

Re-open Regular Business Meeting, Announce Results of Executive Session

17. Announcements and Future Meetings

18. Adjournment

THE STATE MINING AND GEOLOGY BOARD

THE BOARD

The State Mining and Geology Board (Board) serves as a regulatory, policy, and hearing body representing the State's interests in the reclamation of mined lands, geology, geologic and seismologic hazards, and the conservation of mineral resources.

The Board was established in 1885 as the Board of Trustees to oversee the activities of the State Mineralogist and the California Division of Mines and Geology (now the California Geological Survey). It is the second oldest Board in California. Today's Board has nine members appointed by the Governor and confirmed by the State Senate, for four-year terms. By statute, Board members must have specific professional backgrounds in geology, mining engineering, environmental protection, groundwater hydrology and rock chemistry, urban planning, landscape architecture, mineral resource conservation, and seismology, with one member representing the general public.

SPECIALTY	MEMBER NAME	TERM
Non-specialized public member	Larry Sheingold, Chair	2018-2022
Mining Engineer with background and experience in mining in California	George Kenline, Vice-Chair	2017-2021
Mineral resource conservation, development, or utilization	Brian Anderson	2019-2023
Environmental protection or the study of ecosystems	Vacant	2017-2021
Registered Geologist with background and experience in mining geology	Janet Kappmeyer	2017-2021
Landscape Architect	Stephanie Landregan	2018-2022
Registered Geologist, Geophysicist, or Civil Engineer with background and experience in seismology	Zia Zafir	2020-2024
Groundwater hydrology, water quality, or rock chemistry	Vacant	2016-2020
Representative of local government with background and experience in urban planning	Vacant	2019-2023

*Board member terms effectively terminate January 15 of the term-ending year.

Mission Statement

The mission of the Board is to provide professional expertise and guidance, and to represent the State's interest in the development, utilization, and conservation of mineral resources, the reclamation of mined lands and the development and dissemination of geologic and seismic hazard information to protect the health and welfare of the people of California.

STATUTORY AND REGULATORY AUTHORITY

The Board operates within Department of Conservation under the Natural Resources Agency and is granted responsibilities and obligations under the following acts:

Surface Mining and Reclamation Act of 1975

Under this Act, *Public Resources Code Sections 2710 et seq. and its regulations at 14 California Code of Regulations Section 3500 et seq*., the Board provides a comprehensive surface mining and reclamation policy to assure that adverse environmental impacts are minimized, and mined lands are reclaimed. SMARA also encourages the production, conservation, and protection of the State's mineral resources.

Alquist-Priolo Earthquake Fault Zoning Act

Under this Act, *Public Resources Code Section 2621 through Section 2630, and its regulations at 14 California Code Regulations Section 3600 et seq*., the Board is authorized to represent the State's interests in establishing guidelines and standards for geological and geophysical investigations and reports produced by the California Geological Survey, public sector agencies, and private practitioners. The Board is also authorized to develop specific criteria through regulations to be used by Lead Agencies in complying with the provisions of the Act to protect the health, safety and welfare of the public.

Seismic Hazards Mapping Act

Under this Act, *Public Resources Code Section 2690 through Section 2699.6 and its regulations at 14 California Code of Regulations Section 3720 et seq.* the Board is authorized to provide policy and guidance through regulations for a statewide seismic hazard mapping and technical advisory program to assist cities, counties, and State agencies in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction or other ground failure, landslides and other seismic hazards caused by earthquakes, including tsunami and seiche threats.

GENERAL PROCEDURAL INFORMATION ABOUT BOARD MEETINGS

The Board is governed by the Bagley-Keene Open Meeting Act that requires the Board to:

(1) Publish an Agenda at least ten days in advance of any meeting
(2) Describe in the Agenda specific items to be transacted or discussed
(3) Refuse to add an item no later than ten days prior to any meeting and republishing of the Agenda
(4) Call a closed session by the Chair to discuss litigation and other matters
(5) Make all testimony, files, and documents are made a part of the administrative record

Other Agenda material and reports will be available approximately one week prior to the scheduled Board meeting. All Board related information is available at http://www.conservation.ca.gov/smgb.

The Board encourages the submittal of comments, written material, or technical reports thirty days prior to the applicable Board meeting. All such material concerning any matters on the Agenda can be submitted to: smgb@conservation.ca.gov or addressed to:

State Mining and Geology Board
801 K Street, MS 20-15
Sacramento, CA 95814

Fisher, Ciara

From:	Fisher, Ciara
Sent:	Thursday, April 29, 2021 8:51 AM
To:	Fisher, Ciara
Subject:	RE: Long Bar comment response

From: Aaron Zettler-Mann <aaron@yubariver.org>
Sent: Wednesday, April 28, 2021 10:27 AM
To: Carrie Monohan <carrie.monohan@sierrafund.org>; Izzy Martin <izzy.martin@sierrafund.org>
Cc: Melinda Booth <Melinda@yubariver.org>; Kirsten Sellheim <kirstens@fishsciences.net>; Perkins, Kevin <kperkins@CO.YUBA.CA.US>
Subject: Long Bar comment response

Izzy and Carrie,

We received your comment letter on the Long Bar project. I certainly appreciate your concern for the Yuba River and desire to ensure that restoration actions have the best intentions of the environment at their core. Attached, please find a copy of the response letter Yuba County, as the CEQA lead agency, will be filing in response.

If you would like to have a conversation regarding the decision that we made regarding SMARA and our response letter prior to the public CEQA hearing May 6, we will do our best to find a time. I can make time in the afternoon of Monday, Tuesday, or Wednesday next week (5/3-5). Based on the discussions outlined in the letter, it is unclear if I will be making a presentation to the State Mining and Geology Board in May. If I do, it will be an informative presentation without any request of the Board.

Best,
Aaron

Aaron Zettler-Mann Ph.D.
Watershed Science Director
South Yuba River Citizens League
313 Railroad Ave. #101, Nevada City, CA 95959
530.265.5961 x221 | aaron@yubariver.org

"There's nothing – absolutely nothing – half so much worth doing as messing about in boats."
-Kenneth Grahame

April 28, 2021

ATTN: Ciara Fisher
Planning Department, CDSA

RE: Response to Comments on Environmental Assessment EA2020-0005
Long Bar Salmonid Habitat Restoration Project
(SCH# 2021030284)

Dear C. Fisher and the Yuba County Planning Department,

The South Yuba River Citizens League (SYRCL) is writing on behalf of, and in collaboration with, the U.S. Fish and Wildlife Service Long Bar Salmonid Habitat Restoration Project (Project) team, which includes Cramer Fish Sciences and cbec eco engineering. We are writing to address concerns laid out in written comment by The Sierra Fund related to the above Project as part of the California Environmental Quality Act (CEQA) environmental review process. The Sierra Fund expressed concerns regarding the proposed Mitigated Negative Declaration (MND) for the Project's joint Initial Study/Environmental Assessment (IS/EA). Summarizing the concerns of The Sierra Fund, they feel that this is a mining project based on the volume of material moved. And, because they feel the project is a mining project, they believe that it should require a Surface Mining and Reclamation Act of 1975 (SMARA) permit. The Project Team, in collaboration with the California State Mining and Geology Board (SMGB) and Yuba County asserts that the project is a floodplain restoration project. The sole goal of this Project is restoring habitat that is degraded as a result of historic dredge mining into much-needed rearing habitat for threatened salmonids. As such, SYRCL and the Project Team believe that the CEQA MND/IS should be granted without the need to acquire the SMARA permit. Below, we address the concerns as laid out by The Sierra Fund. Where appropriate, we include additional clarifying information into the IS/EA document.

Project Classification as Restoration: SYRCL, the Project Team, the SMGB, and Yuba County do not believe that the Project is a mining project and therefore it is not subject to SMARA. As described in detail in the Project IS/EA, the sole Project objective is restoring approximately 42 acres of Yuba River floodplain from its degraded state as a result of decades of hydraulic and dredge mining. In February 2018, then-project manager and former SYRCL River Science Director Rachel Hutchinson initiated communication with Kevin Perkins about Yuba County being the lead agency for the CEQA process. Subsequent meetings discussed the specific proposed project restoration actions, strategies, and location and the IS/EA was drafted following these discussions. Based on the proposed Project actions, Yuba County determined that the project did not qualify as a surface mining operation but instead was a restoration project. Pursuant to the CEQA process, relevant entities had the opportunity to make comment on the Project during the public review period. In fact, as mentioned in The Sierra Fund's letter, the Project was presented to the SMGB prior to the CEQA public review period to ensure that the SMGB were aware of the Project's proposed actions. Had the SMGB felt that this Project qualified as a mining operation they would have indicated this during the briefing meeting and or submitted a comment letter indicating this during the CEQA public review period.

Long Bar Mine LLC is facilitating this project in a cost-efficient manner by allowing the Project to dispose of the excavated material onto their site. This reduces environmental and fiscal impacts associated with hauling and permanently storing excavated material away from the Project site. Saleable silica or sand resources excavated as part of this grading will be sold to help offset Project costs. Without the cost offset associated with this partnership, restoration implementation costs would be considerably higher and the restoration actions may not be financially viable to implement.

To address The Sierra Fund's request to explicitly include excavation amounts, we have added Addendum A as a table in the IS/EA and also added the following language to the document (p. 31):

"The total amount of material proposed for removal to reconnect off-channel rearing habitat at a higher frequency and duration is estimated to be approximately 380,000 yd^3. A summary of cut and fill volumes by restoration feature is provided in Table 2."

As mentioned in TSF's letter, these approximate volumes were provided to SMGB prior to the CEQA public review period.

In summary, communication about this project between SYRCL and Yuba County over the last three years, the stated objectives and reclamation actions described in detail in the Project IS/EA, the lack of comment from the SMGB and other State agencies on the land use classification of the project during the public review period, and the nature of the relationship between the Project and Long Bar Mine LLC support the assertion that the Project does not qualify as a mining operation.

SMARA permit requirement: The Sierra Fund believes that the Project should be required to obtain a SMARA permit requiring the creation of a reclamation plan, development of a financial assurance mechanism, and regular inspections. SYRCL and the Project Team do not agree with this statement.

Under SMARA, "*the Board provides a comprehensive surface mining and reclamation policy to assure that adverse environmental impacts are minimized and mined lands are reclaimed. SMARA also encourages the production, conservation, and protection of the State's mineral resources.*" The goal of SMARA is to ensure that there is a detailed plan and funding mechanism for reclamation of previously mined lands. It is not, itself, an environmental regulation. The Project Team has applied for and will secure all applicable environmental permits prior to construction to ensure that the project does not result in any undue environmental harm and meets all State and Federal environmental quality regulations. To that end, we are in the process of securing the following permits: NMFS and USFWS Section 7 Biological Opinions, NEPA (FONSI issued), CEQA (NOD), Section 106 – cultural impacts, USACE Section 404 Letter of Permission, Section 401 Water Quality Certification, and approval of Storm Water Pollution Prevention Plan (Addendum B). As such, the Project will comply with all relevant environmental regulations.

If required to secure a SMARA permit, this project would be required to submit a reclamation plan for the floodplain restoration project. The goal of a reclamation plan is to describe in detail how the site will be reclaimed to achieve a post-mining landscape. The Project Team asserts that the Project *is* the execution of what, under SMARA requirements, would be a reclamation plan if the project was part of a mining operation. Which it is not. No actions (mining or otherwise) would occur within the project area without this USFWS funded restoration project. The Project site would remain in its current degraded state as a result of historic hydraulic and dredge mining. This project is a reclamation project to correct the "... *adverse environmental impacts [and ensure] mined lands are reclaimed."*

The financial assurance mechanism as required by SMARA is designed to assure the people of California that environmental degradation as a result of mining will be restored through secured money available to execute the reclamation plan. Project construction, which consists solely of habitat reclamation designed to improve juvenile salmonid habitat, is funded by the U.S. Fish and Wildlife Service through a contract with SYRCL. As such, the application of the financial assurance mechanism is not relevant to the project. For the above reasons, we also believe that SMARA does not apply to this project.

The Project Team added the following language to the IS/EA to document communication with the Mining and Geology Board and explicitly state the reasons that the Project is not subject to SMARA (p. 22):
"*Surface Mining and Reclamation Act*

The Surface Mining and Reclamation Act of 1975 (SMARA) provides a comprehensive surface mining and reclamation policy with the regulation of surface mining operations to assure that adverse environmental impacts are minimized and mined lands are reclaimed to a usable condition. The State Mining and Geology Board provides oversight for implementation of SMARA. The Proposed Action goals are to rehabilitate habitat that was subject to historic mining, but it is not a mining action. The Proposed Action was presented to the State Mining and Geology Board on 15 March 2021 as a courtesy to ensure that the State Mining and Geology Board was aware of the Proposed Action prior to the CEQA public review period."

SYRCL and the Project Team appreciate the concern that The Sierra Fund has for the Yuba River watershed and appreciate their interest in assuring the best outcomes for restoration projects. However, this Project is a reclamation project, not a mining project, as has been clear in communication with Yuba County and permitting agencies beginning in February 2018. In addition, SMARA, which is intended to secure funding such that subsequent to mining activity, reclamation actions can occur, is not applicable to this project because the sole purpose of the project *is* reclamation.

Please do not hesitate to reach out for further clarification or if there are additional concerns.

Sincerely,
Aaron Zettler-Mann
Watershed Scienced Director
South Yuba River Citizens League

Attachment 4

Addendum A
Cut and Fill Volumes by Project Element

Project Total	Cut (CY)	Fill (CY)
	380,513	1,420

Project Element	Cut (CY)	Fill (CY)
Main Channel	-	-
Upstream Side Channel	53,528	575
Alcove Channels	68,833	0
Backwater Channel	30,386	785
Main Channel Terrace	85,631	0
Riparian Terrace	15,339	0
Flood Runner Channel	52,819	10
Enhanced Floodplain	73,977	50

Addendum B
State and Federal Permits and Current Status (4/22/2021)

Permit	Status
NMFS Section 7 - Biological Opinion (BO)	In review - application submitted January 2021
USFWS Section 7 - Biological Opinion (BO)	USFWS BiOp issued in January 2021
NEPA (FONSI)	To be finalized after NMFS BiOp is issued
CEQA (NOD)	Public review period ended April 2021; NOD anticipated May 2021
Sec. 106 SHPO - cultural resources	Completed June 2020
USACE Sec. 404 – LOP	Application submitted March 2021
CVFPB Encroachment Permit	Exempt
Sec. 401 - Water Quality Certification	Application submitted March 2021, certification anticipated July 2021
CDFW 1600 streambed alteration agreement	Exempt
SWPPP	In review – will be submitted to SMARTS site following issuance of 401 Certification
State Lands Lease	Application submitted March 2021
USACE Sec. 408	Exempt
SCP	Approved
4(d)	Approved